CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**MANUFACTURING DATA BOOK** **H2 STORAGE VESSEL**	Sheet 1 of 1016 Date: 28/02/2025 Rev: 03

Base Load Power Hub (BLPH)

MANUFACTURING DATA BOOK

H2 STORAGE VESSEL

Document Number: 1723001756-QC-DB-00017

ITEM V25001 A

Document Class: 2

03	28/02/2025	Accepted for Construction (AFC)	M.Rampazzo	P.Franzolin	M.Galli
02	10/12/2024	Issue for Review (IFR)	M.Rampazzo	P.Franzolin	M.Galli
01	02/12/2024	Issue for Review (IFR)	M.Rampazzo	P.Franzolin	M.Galli
00	16/10/2024	Issue for Review (IFR)	M.Rampazzo	P.Franzolin	M.Galli
Rev.	Date	Description	Prepared	Reviewed	Approved

BREMBANA&ROLLE

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**MANUFACTURING DATA BOOK** **H2 STORAGE VESSEL**	Sheet 2 of 1016 Date: 28/02/2025 Rev: 03

Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
01	Issued for Review(IFR)
02	Issued for Review(IFR)
03	Accepted for Construction (AFC)

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1	
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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**MANUFACTURER RECORD BOOK (FINAL DOSSIER) INDEX ITEM V25001 A - F H2 STORAGE VESSELS**	Sheet 1 of 4 Date: 26/06/2024 Rev: 02

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
ROSETTI MARINO S.p.A. Quality Control Dept.	06/08/2024

Base Load Power Hub (BLPH)

MANUFACTURER RECORD BOOK (FINAL DOSSIER) INDEX ITEM V25001 A - F

H2 STORAGE VESSEL

Document Number: 1723001756-QC-LIS-00016

Document Class: 2

02	26/06/2024	Accepted for Construction (AFC)	P. Franzolin	M. Galli	M. Galli
01	06/05/2024	Accepted for Construction (AFC)	P. Franzolin	M. Galli	M. Galli
00	17/01/2024	Issue for Review (IFR)	P. Franzolin	M. Galli	M. Galli
Rev.	**Date**	**Description**	**Prepared**	**Reviewed**	**Approved**

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**MANUFACTURER RECORD BOOK (FINAL DOSSIER) INDEX ITEM V25001 A - F H2 STORAGE VESSELS**	Sheet 2 of 4 Date: 26/06/2024 Rev: 02

Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
01	Accepted for Construction (AFC)
02	Accepted for Construction (AFC)

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO

MANUFACTURER RECORD BOOK (FINAL DOSSIER) INDEX

CLIENT:	**ROSETTI MARINO**	**Contract Nº:**	**CW-I-WP4-2023-05**
PROJECT NAME:	**HOLLANDSE KUST NOORD WIND PARK Project**	**Doc. No. :**	**1723001756-QC-DB-00017**
EQUIPMENT:	**ITEM V25001 A-F**	**COMPANY REFER:**	**23096-QBDI**

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3	General Arrangement Drawings c/w Foundation Loading Diagram (doc. no. 1723001756-MAC-DA-00004)	26 - 27
4	Detail Drawings (doc. no. 1723001756-MAC-DD-00005)	28 - 29
5	Name Plate Drawing (doc. no. 1723001756-MAC-DD-00006)	30 - 31
6	Pressure Vessel Mechanical Calculation (doc. no. 1723001756-MAC-CAL-00003)	32 - 247
7	Transportation / Lifting Arrangement Drawing (doc. no. 1723001756-TI-DD-00021)	248 - 249
8	Shipping, Packing, Handling and Storage and Preservation Procedure (doc. no. 1723001756-QC-PRO-00020)	250 - 258

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PAGE 6/1002

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTIMARINO

MANUFACTURER RECORD BOOK (FINAL DOSSIER) INDEX

CLIENT:	ROSETTI MARINO	Contract Nº:	CW-I-WP4-2023-05
PROJECT NAME:	HOLLANDSE KUST NOORD WIND PARK Project	Doc. No. :	1723001756-QC-DB-00017
EQUIPMENT:	ITEM V25001 A-F	COMPANY REFER:	23096-QBDI

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6	List of utilized materials / PMA / Material certificates and test coupon certificate, including welding material certificates	315 - 505
7	Copies of Company approved waivers to Vendor requirements.	506 - 507
8	All Non Conformity Reports and Repairs reports with final disposition and resolutions.	508 - 509
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12	Manufacturing & NDE procedures (NDE, PMI,forming ,...) / NDE Operators List & Qualifications (doc. no. 1723001756-NDT-PRO-00009) (doc. no. 1723001756-NDT-LIS-00010)	682 - 815
13	Non Destructive Tests Certificates (RX, UT, PM, LP, Hardness, etc.)	816 - 853
14	PWHT Procedure / Certificate of Heat Treatment and Graphs (doc. no. 1723001756-WC-PRO-00011)	854 - 866
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PART 1

DESIGN DOSSIER

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTI MARINO

MANUFACTURER RECORD BOOK (FINAL DOSSIER) INDEX

CLIENT:	ROSETTI MARINO	Contract Nº:	CW-I-WP4-2023-05
PROJECT NAME:	HOLLANDSE KUST NOORD WIND PARK Project	Doc. No. :	1723001756-QC-DB-00017
EQUIPMENT:	ITEM V25001 A-F	COMPANY REFER:	23096-QBDI

PART 1 – DESIGN DOSSIER

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8	Shipping, Packing, Handling and Storage and Preservation Procedure (doc. no. 1723001756-QC-PRO-00020)	250 - 258

PART 1 - SECTION 1

Document Register
(doc. no. 1723001756-MD-LIS-00001)

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTI MARINO
Document Title:	SUPPLIER MASTER INFORMATION REGISTER	Sh. 1 of 6 Date: 28/02/2025 Rev. 01

Base Load Power Hub (BLPH)

H2 STORAGE VESSEL

SUPPLIER MASTER INFORMATION REGISTER

Document Number: 1723001756-MD-LIS-00001

Document Class: 3

01	28/02/2025	AFC	R.Magagnato	R.Magagnato	M.Galli
00	10/11/2023	Issue for Information (IFI)	R.Magagnato	R.Magagnato	M.Galli
Rev.	Date	Description	Prepared	Reviewed	Approved

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTI MARINO
Document Title:	SUPPLIER MASTER INFORMATION REGISTER	Sh. 2 of 6 Date: 28/02/2025 Rev. 01

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1	Cover	X							
2	Table of Contents	X							
3	Revision / Change Log / Hold List	X							
4	References	X							
5	SMIR	X							

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTI MARINO
Document Title:	SUPPLIER MASTER INFORMATION REGISTER	Sh. 3 of 6 Date: 28/02/2025 Rev. 00

Revision / Change Log

Rev.	Description

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No.	Description
1.	
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SMIR - REGISTRO DOCUMENTI / *SMIR - SUPPLIER MASTER INFORMATION REGISTER*

	Ordine n°/*order nr.*	1723001756		Fornitore/*Supplier* :	BREMBANA & ROLLE								
	data / *dated:*			Codice F./ *S. Code:*									
	Commessa / *Job:*			Indirizzo/ *address* :									
Descrizione / *Description*		PRESSURE VESSEL		Persona di riferim./ *contact person:*									
	Macrofase / *Phase*												

Pos.	Document nr. Client (1)	Doc Client Rev. (1)	Document nr. Internal	Document nr. Internal Rev. (2)	Document nr. Supplier (3)	Doc Supplier Rev. (3)	Titolo Documento / *Document title* *PRESSURE VESSEL*	Disciplina / *Discipline*	Blocco Classe / *Class Block (6)*	Docum. Format (7)	first issue date (8)	Third Party Approval (I/A)	Design KEY Document	Document Approval (I/A)
							CONTROL DOCUMENTS							
1	1723001756-MD-LIS-00001	00	1723001756-MD-LIS-00001	00	n.a.	00	SUPPLIER MASTER INDEX REGISTER (SMIR)	MAC			10/11/2023			A
							QUALITY DOCUMENTS							
2	1723001756-QC-ITP-00002	00	1723001756-QC-ITP 00002	00	23096-01-QCPA	04	INSPECTION AND TEST PLAN	QUA		A4	04/12/2023			A
							ENGINEERING DOCUMENTS							
3	1723001756-MAC-CAL-00003	00	1723001756-MAC-CAL-00003	00	23096-01-EMC1	03	PRESSURE VESSEL MECHANICAL CALCULATION	MAC			20/11/2023		Y	I
4	1723001756-MAC-DA-00004	00	1723001756-MAC-DA-00004	00	23096-01-EGA1	05	GENERAL ARRANGEMENTS DRAWINGS AND FOUNDATION LOADING DIAGRAM AND SUPPORT DETAILS (INCL NOZZLE LOADS)	MAC			20/11/2023		Y	A
5	1723001756-MAC-DD-00005	00	1723001756-MAC-DD-00005	00	23096-01-ED01	02	DETAILED DRAWING INCLUDING CROSS SECTION/EXPLODED VIEW DRAWING WITH PART LIST	MAC			18/12/2023			I
6	1723001756-MAC-DD-00006	00	1723001756-MAC-DD-00006	00	23096-01-ENP1	03	NAMEPLATE DRAWING	MAC			18/12/2023			A
7	1723001756-MAC-DS-00007	00	1723001756-MAC-DS-00007	00	23096-01-EDS1	03	EQUIPMENT DATA SHEETS INCLUDING WEIGHT DATA SHEETS	MAC			18/12/2023			A
8	1723001756-MAT-PRO-00008	00	1723001756-MAT-PRO-00008	00	23096-QSP	02	PAINTING PROCEDURE (including surface preparation)	MAC			10/01/2024			A
							PROCEDURES							
9	1723001756-NDT-PRO-00009	00	1723001756-NDT-PRO-00009	00	23096-QNDE	03	NON-DESTRUCTIVE EXAMINATIONS PROCEDURES (NDE)	MAC			09/01/2024			A
10	1723001756-NDT-LIS-00010	00	1723001756-NDT-LIS-00010	00	23096-QNDEPQ	03	NDE OPERATORS LIST AND QUALIFICATIONS				09/01/2024			A
11	1723001756-QC-PRO-00011	00	1723001756-QC-PRO-00011	00	23096-01-TPWF	02	HEAT TREATMENT PROCEDURES (inc. PWHT)				10/01/2024			A
12	1723001756-QC-PRO-00012	00	1723001756-QC-PRO-00012	00	23096-QHT	03	HYDROSTATIC TEST PROCEDURES (FAT PROCEDURE)	MAC			10/01/2024			A
13	1723001756-WEL-PRO-00013	00	1723001756-WEL-PRO-00013	00	23096-01-TWB1	04	WELDING PROCEDURE SPECIFICATION (WPS) AND QUALIFICATIONS (PQR) RECORDS	WEL			18/12/2023			A
14	1723001756-WEL-DD-00014	00	1723001756-WEL-DD-00014	00	23096-01-EWM1	03	WELDING DETAIL DRAWINGS				18/12/2023			A
15	1723001756-WEL-LIS-00015	00	1723001756-WEL-LIS-00015	00	23096-01-TWPQ	02	WELDING OPERATORS LIST and WELDER QUALIFICATIONS RECORDS (WPQ)	WEL			18/12/2023			A
16	1723001756-QC-LIS-00016	00	1723001756-QC-LIS 00016	00	23096-MDBI	03	EQUIPMENT MANUFACTURERS RECORD BOOK (FINAL DOSSIER) - INDEX	QUA			10/01/2024			A
							CERTIFICATES (ref. to notes in the RDDS)							
17	1723001756-QC-DB-00017 - V25001A	00	1723001756-QC-DB 00017 - V25001A	00	23096-01-MDBA	03	EQUIPMENT MANUFACTURERS RECORD BOOK – COMPLETE	CERT			30/11/2024			A
17	1723001756-QC-DB-00017 - V25001B	00	1723001756-QC-DB 00017 - V25001B	00	23096-01-MDBB	02	EQUIPMENT MANUFACTURERS RECORD BOOK – COMPLETE	CERT			30/11/2024			A
17	1723001756-QC-DB-00017 - V25001C	00	1723001756-QC-DB 00017 - V25001C	00	23096-01-MDBC	02	EQUIPMENT MANUFACTURERS RECORD BOOK – COMPLETE	CERT			30/11/2024			A
17	1723001756-QC-DB-00017 - V25001D	00	1723001756-QC-DB 00017 - V25001D	00	23096-01-MDBD	02	EQUIPMENT MANUFACTURERS RECORD BOOK – COMPLETE	CERT			30/11/2024			A
17	1723001756-QC-DB-00017 - V25001E	00	1723001756-QC-DB 00017 - V25001E	00	23096-01-MDBE	02	EQUIPMENT MANUFACTURERS RECORD BOOK – COMPLETE	CERT			30/11/2024			A
17	1723001756-QC-DB-00017 - V25001F	00	1723001756-QC-DB 00017 - V25001F	00	23096-01-MDBF	02	EQUIPMENT MANUFACTURERS RECORD BOOK – COMPLETE	CERT			30/11/2024			A
SPA														
18	1723001756-COM-LIS-00018	00	1723001756-COM-LIS-00018	00	23096-LSP1	01	SPARE PART INDEX REGISTER (COMMISSIONING, OPERATION)	COM			28/02/2024			I
19	1723001756-MAC-MAN-00019	00	1723001756-MAC-MAN-00019	00	23096-EIM1	01	INSTALLATION AND OPERATING MAINTENANCE MANUAL (PED)	MAC			28/02/2024			I
HAN														
20	1723001756-QC-PRO-00020	00	1723001756-QC-PRO-00020	00	23096-EIM2	03	SHIPPING, PACKING, HANDLING AND STORAGE and PRESERVATIONS, PROCEDURES	LOG			15/05/2024			I
21	1723001756-TI-DD-00021	00	1723001756-TI-DD-00021	00	23096-01-ESH1	04	TRANSPORTATION DRAWINGS	METODI			01/07/2024			I

22	1723001756MAC-DD-00022	00	1723001756MAC-DD-00022	00	n.a.	00	LIFTING ARRANGEMENT DRAWINGS	METODI			01/07/2024			I

Notes:

(1) Numero documento Cliente — 00

Document number assigned by final Client — 00

(2) Numero documento interno — 00

Document number internal

(3) Numero documento Fornitore (assegnato dal Fornitore)

Document number assigned by Supplier

(4) Assegnare il Titolo del documento (assegnato dal Fornitore)

Fill in the document title (to be assigned by Vendor)

(5) Specific are la disciplina (compilato da Rosetti)

Process, Piping; Electrical, Expediting, Inspection, Commissioning, Quality, ecc (to be filled by Rosetti)

(6) Blocco Classe: Specifica, Disegno, Report, Data Sheet, etc. (compilato da Rosetti)

Procedure, list, drawing, data sheet, etc. (to be filled by Rosetti)

(7) A4, A3, A1 (compilato dal Fornitore)

A4, A3, A1 (Supplier)

(8) Data prevista per l'emissione del documento (compilato dal Fornitore)

Foreseen date for the first issue (Supplier)

PART 1 - SECTION 2

Equipment Data Sheet Including Weight Data Sheet
(doc. no. 1723001756 MAC-DDL-MAC-DS-00007)

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**Technical Data Sheet for H2 Storage Vessel - V-25001 A-F**	Sheet 1 of 9 Date: 12/09/2024 Rev: 03

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

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Sign	Date
	04-11-2024

Base Load Power Hub (BLPH)

Technical Data Sheet for H2 Storage Vessels - V-25001 A-F

Document Number: 1723001756-DDL-MAC-DS-00007

Document Class: 2

03	12/09/2024	Approved for Construction (AFC)	MT	DP	DP
02	27/08/2024	Approved for Construction (AFC)	MT	DP	DP
01	14/06/2024	Approved for Construction (AFC)	MT	DP	DP
00	03/05/2024	Issue for Review (IFR)	MT	DP	DP
Rev.	Date	Description	Prepared	Reviewed	Approved

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**Technical Data Sheet for H2 Storage Vessel - V-25001 A-F**	Sheet 2 of 9 Date: 12/09/2024 Rev: 03

Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
01	Approved for Construction (AFC)
02	Approved for Construction (AFC)
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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**Technical Data Sheet for H2 Storage Vessel - V-25001 A-F**	Sheet 3 of 9 Date: 12/09/2024 Rev: 03

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**Technical Data Sheet for H2 Storage Vessel - V-25001 A-F**	Sheet 4 of 9 Date: 12/09/2024 Rev: 03

Rev	**DESIGN DATA**							
	Design Conditions	Internal	40	Bar (g)	at	-10 / 80	°C	
		..External	FV	Bar	at	-10 / 80	°C	
		Volume	101.2	m^3				
	Dimension (Nominal)		2.8 ID x 15.5 T/T	m				
	Minimum Design Metal Temp		-29	°C (MDMT)	at	0	Bar (g)	
	Operating Conditions	Internal	30	Bar (g)	at	20	°C	
	Corrosion Allowance		0	mm				
	Liquid Specific Gravity		Negligible					
	PWHT Required		Per ASME Sect VIII Div 2	☑ Service PWHT	Yes			
	Radiography Requirements		Full (100%)					
	Shop Hydrotest Pressure		57.2 Bar (g) per Code and Pressure Equipment Directive 2014/68/UE					
	Field Hydrotest Pressure		57.2 Bar (g) per Code and Pressure Equipment Directive 2014/68/UE					
	Painting Per		123A90-DDL-MAT-SP-60006					
	Insulation		N/A	mm				
	Fireproofing		N/A	mm				
	Erection Weight		58700	Kg				
	Empty Weight		58700	Kg (Start-Up Ready) - Estimated				
	Operating Weight		58900	Kg - Estimated				
	Test Weight		160400	Kg				
	Vessel Designed For Wind		1 Year Return, 3 sec. gust = 35 m/sec, 100 Year Return, 3 sec. gust = 45 m/sec					
	Vessel Designed For Earthquake		N/A					
	Moment At POS	Wind:	132800/45000	N-M (Transverse/Longitudinal)				
	Shear Force At POS	Wind:	77000/26000	N (Transverse/Longitudinal)				
	Moment At POS	Earthquake:	0	N-M (Operating)	0	N-M (Empty)		
	Shear Force At POS	Earthquake:	0	N (Operating)	0	N (Empty)		

Rev	**DESIGN CODE & MATERIAL SPECIFICATIONS**				
	Construction Code	**2021 ASME Section VIII Div.2 class 2**	Code Stamp ☑ Yes	National Board Registration ☑ Yes	
	Materials for Pressure Components and Parts Welded to Pressure Components,				
	Shell and Heads	SA-516 60 (HIC)			
	Standard ANSI Weld Neck and LWN Flanges	SA-350 LF2 CL.1			
	Fittings	(n.a.) General Note VM-8			
	Self Reinforcing & Special Forgings	SA-350 LF2 CL.1			
	Nozzle Necks	(if any) SA-333 6			
	Shell Attachments — Plate (Including Wear Plate)	SA-516-60			
	Pipe	(if any) SA-333 6			
	Structural Shapes	(if any) S275 J2			
	Materials for Parts Not Welded to Pressure Components:				
	Saddles	A/SA-516 60			
	Plate	A/SA-516-60			
	Pipe	(if any) SA-333 6			
	Pressure Bolting	SA-193-B7 / SA-194-2H			
	Internal Bolting	(if any) A-193 Gr B6 / A-194 Gr 6			
	Internal Piping	Carbon Steel			
	Other Internals	Carbon Steel			
	Gaskets — **Pressure Gaskets**	SW 316 S.S. Graphite filled C/W 316 S.S. Inner Ring & Epoxy Coated C.S. outer ring			
	Non-pressure Gaskets	n.a.			

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**Technical Data Sheet for H2 Storage Vessel - V-25001 A-F**	Sheet 5 of 9 Date: 12/09/2024 Rev: 03

Rev	GENERAL NOTES

VM-1. All materials shown on this data sheet are to be furnished and installed by the Vessel Supplier unless otherwise noted.

VM-2. Substitutions of materials will not be allowed without ROSETTI MARINO prior approval. This approval can only be obtained at the time Vessel Supplier submits his quotation.

VM-3. The inside diameter of manholes shall be equal to the size specified in the table of connections for 18" (450 mm) and smaller size manholes. Manholes size 20" (500 mm) and larger may have a minimum inside diameter 25 mm less than the nominal size listed in the table of connections.

VM-4. Manholes and handholes shall be furnished with blind flange, bolts and gasket. Each manhole shall be provided with a davit or hinge and internal manhole grip.

VM-5. Internal ladder rungs shall be provided below the manway.

VM-6. Vessel Supplier to provide vessel grounding lugs .

VM-8. In addition to meeting Code requirements for fittings, piping fittings shall be made from a material specification listed for plate, forging, or pipe pressure components on page 1 of this data sheet.

VM-9 Regarding pressure retaining parts, vendor is allowed to propose equivalent/similar material, according to other international Codes, i.e. DIN/EN or other internationally recognized CODE, provided that Carbon Equivalent value (CEQ) is 0,35.max

VM-10 Total number of vessels is 6 (six) – V-25001 A/B/C/D/E/F

VM-11 For hydrogen vessel fatigue design, Contractor should expect that the number of full charge/discharge cycles (from full to empty) will be 180 during the year. In other words, it is expected that:
Fuel cell will utilise the full hydrogen inventory from the storage vessels 180 times per year (full discharge).
Electrolyser will fully recharge the hydrogen vessels (from empty to full) 180 times per year (full charge)

WM-13 Max hardness in base metal shall be 235 HV10
Steel shall be HIC resistant to ISO 15156-2
Impact testing shall be at -46°C for base metal and weld metal in H2 service regardless of MDMT
Phosphorus maximum to be 0.015% (from EIGA 121/14)
Max strength 355Mpa yield
max CE of 0.35 should ideally be by product analysis not ladle analysis

VM-14 H2 physical properties at 15°C and 30 barg

Pressure	30	Bar (g)
Temperature	15	°C
Inlet Density	2.58	Kg/m³
Compressibility factor (Z)	1.01	
Viscosity	0.0086	cP
Specific heats Ratio (Cp/Cv)	1.42	
Molecular Weight	2	

VM-15 Area Classification Zone 1 IIB T1 + H2

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**Technical Data Sheet for H2 Storage Vessel - V-25001 A-F**	Sheet 6 of 9 Date: 12/09/2024 Rev: 03

TABLE OF CONNECTIONS

General Notes for Table of Connections:

A. Connections shown in sketch are diagrammatic only. For true location see plan view, end view or orientation below.
B. Unless otherwise noted the dimensions from the face of flange to inside of the vessel shall comply with Table 4 of doc. no. 123A90-DDL-MAC-50026:
C. All pressure connections are to be flanged.
D. Elevations in the table are reference T.L. to the centre of the nozzles.
E. Dimension "A" is the distance from the reference tangent line to the face of flange for nozzles on heads.
F. Flanges over 24" shall be per ASME B16.47 Series B.
G. All flange faces shall have a smooth finish.
H For specific notes to TABLE OF CONNECTIONS see next page.

Mark	Size	Rating	Type/Face	Service	Elevation	Dim"A"	Specific Notes
1N	1"	300#	LWN/RF	Hydrogen Inlet	700		
2N	1"	300#	LWN/RF	Hydrogen Outlet	15100		
3N	1"	300#	LWN/RF	Drain with Blind	1000		1
4N	4"	300#	LWN-SR/RF	PSV Connection	13900		
5N	1"	300#	LWN/RF	Nitrogen Purging	400		
K1	1"	300#	LWN/RF	Pressure Transmitter (ESD)	14300		
K2	1"	300#	LWN/RF	Pressure Transmitter (CTRL)	14700		
M1	24"	300#	LWN SR/RF	Manhole C/W Davit		1050	1 See general note VM3
M2	24"	300#	LWN SR/RF	Manhole C/W Davit		1050	1 See general note VM3

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**Technical Data Sheet for H2 Storage Vessel - V-25001 A-F**	Sheet 7 of 9 Date: 12/09/2024 Rev: 03

Rev	SPECIFIC NOTES TO TABLE OF CONNECTIONS (All Notes Listed Hereunder Shall Apply Only If Called For By Number In The Table Of Connections)
	1 Supply blind flange, bolts and gasket. 2 Elevation is given to the face of flange. 3 Nozzle size listed is minimum inside diameter of nozzle neck. 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

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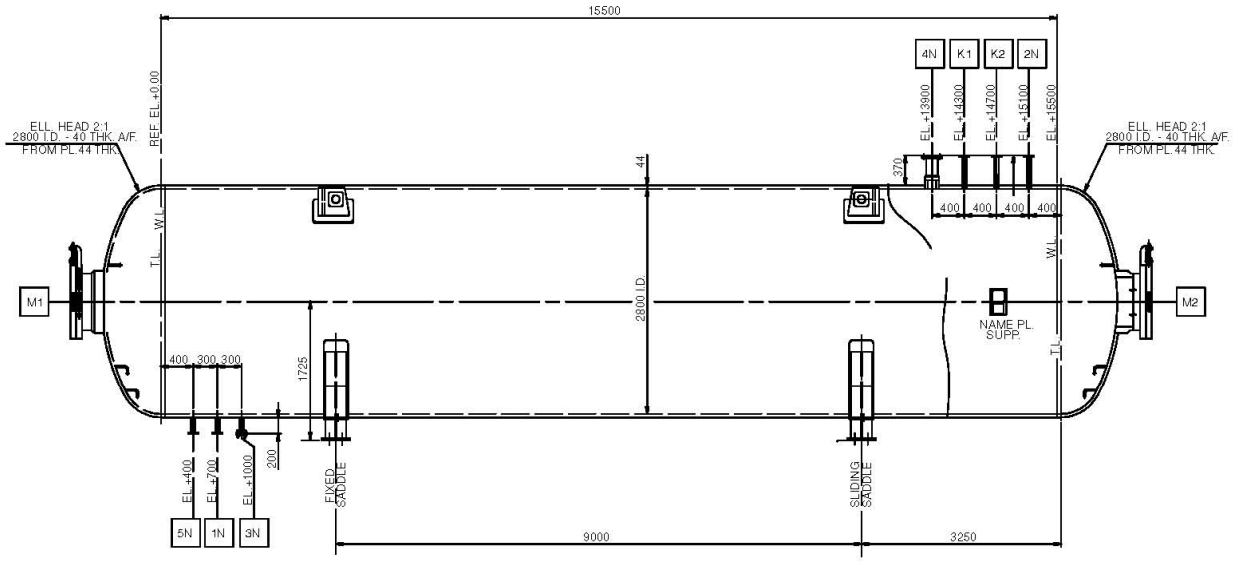
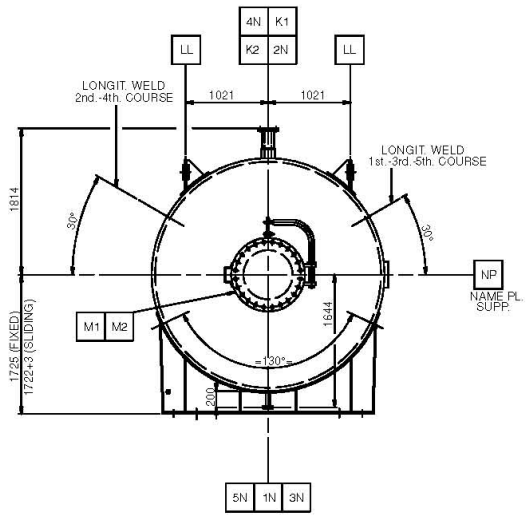
CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**Technical Data Sheet for H2 Storage Vessel - V-25001 A-F**	Sheet 8 of 9 Date: 12/09/2024 Rev: 03

Rev	VESSEL SKETCH





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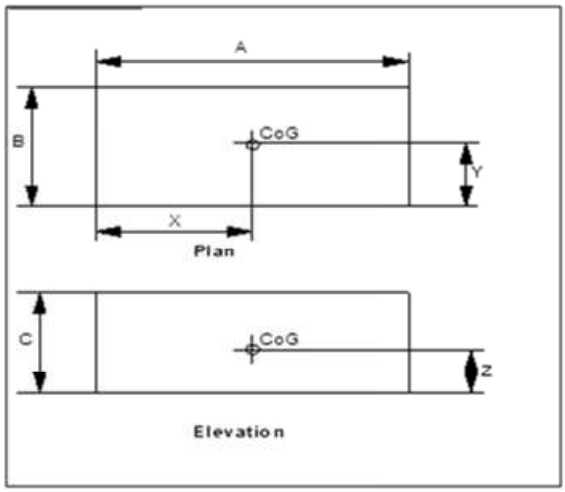
CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**Technical Data Sheet for H2 Storage Vessel - V-25001 A-F**	Sheet 9 of 9 Date: 12/09/2024 Rev: 03

WEIGHT DATA (kg)

			Areas for Input by Supplier	
Dry Weight	(I)	58620	Kg
Content	(II)	260	Kg
Operating Weight	(I+II)	58880	Kg
Auxiliaries' weight, included in (I) (specify under notes)			Kg
Test weight, i.e. filled with water			Kg
Transport Weight			

CENTRE OF GRAVITY (CoG) DATA FOR INSTALLED DRY CONDITION



Overall dimensions		
A =	17600	mm
B =	2940	mm
C =	3605	mm

CoG location		
X =	8850	mm
Y =	1444	mm
Z =	1690	mm

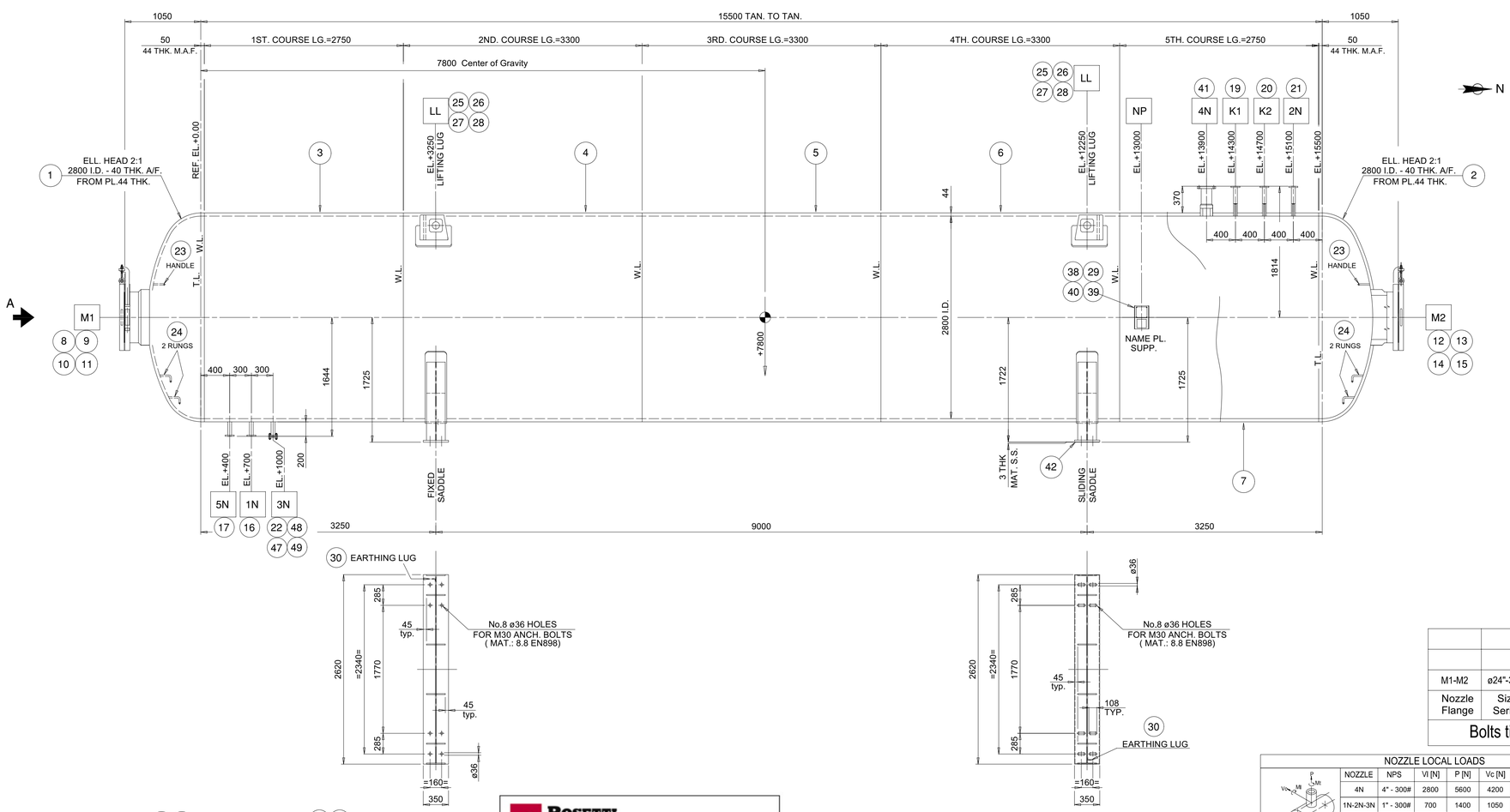
NOTES

WEIGHTS AND CoG STATUS (TICK OFF AS APPROPRIATE)

☐ Estimated	☑ Calculated
☐ Catalogue data	☐ Weighed

PART 1 - SECTION 3

General Arrangement Drawings c/w Foundation Loading Diagram (doc. no. 1723001756-MAC-DA-00004)



M1-M2	ø24"-300#	Min.: 2003 Max.: 2754
Nozzle Flange	Size Series	Bolt Torque Value (Nxm)

Bolts tightening

NOZZLE LOCAL LOADS							
NOZZLE	NPS	Vl [N]	P [N]	Vc [N]	Mc [Nm]	Mt [Nm]	Ml [Nm]
4N	4" - 300#	2800	5600	4200	1120	1680	1456
1N-2N-3N	1" - 300#	700	1400	1050	18	105	18
5N	1" - 300#	700	1400	1050	18	105	18

FOUNDATION LOADS					
CONDITION			ERECTION	OPERATING	HY-TEST
WEIGHT		[kg]	58700	58900	160400
WIND	LONG. SHEAR LOAD	[kN]	26	26	7
	TRANS. SHEAR LOAD	[kN]	77	77	20
	LONG. MOMENT	[kNm]	45	45	12.1
	TRASVERSAL MOMENT	[kNm]	132.8	132.8	34.5
EARTHQUAKE	LONG. SHEAR LOAD	[kN]	-	-	-
	TRANS. SHEAR LOAD	[kN]	-	-	-
	LONG. MOMENT	[kNm]	-	-	-
	TRASVERSAL MOMENT	[kNm]	-	-	-

UNFACTORED LOAD

- LONGIT. WIND SHEAR ACTING ON FIXED SADDLE
- TRANSV. WIND SHEAR IS THE GLOBAL VALUE ACTING ON THE EQUIPMENT. TO BE DIVIDED BY TWO FOR SHEAR ACTING ON THE SINGLE SADDLE

SHELL	SA 516 Gr.60 HIC
ELLIPTICAL HEAD	SA 516 Gr.60 HIC
SADDLE	SA 516 Gr.60
EXT. WELDED	SA 516 Gr.60
INT. WELDED	SA 516 Gr.60
INTERNALS REMOV.	-
FORGINGS (1N-2N-3N-4N-5N-K1-K2)	SA 350 LF2 CL.1
FORGINGS (M1-M2)	SA 350 LF2 CL.1
PIPES	SA 333 GR.6
BLIND FLANGES (M1-M2)	SA 350 LF2 CL.1
STUD BOLTS & NUTS	SA 193 GR.B7 / SA 194 GR.2H
INT. BOLTING	SA 193 GR.B6 / SA 194 GR.6
GASKET	
FLANGE GASKETS	S.W. 316 S.S. GRAPHITE FILLED WITH 316 S.S. INNER RING & EPOXY-COATED C.S. OUTER RINGS

MATERIALS LIST FOR MAIN COMPONENTS

TITLE	Project Doc. No.	B&R Doc. No.
Mechanical Calculation	1723001756-MAC-CAL-00003	23096-01-EMC1
Shipping Drawing	1723001756-TI-DD-00021	23096-01-ESH1
Name Plates Drawing	1723001756-MAC-DD-00006	23096-01-ENP1
Welding map Drawing	1723001756-WEL-DD-00014	23096-01-EWM1
Bill of Material & Notes	1723001756-MAC-DD-00024	23096-01-EBM1
Details Drawing - 2	1723001756-MAC-DD-00023	23096-01-ED02
Details Drawing - 1	1723001756-MAC-DD-00005	23096-01-ED01
General Arrangement	1723001756-MAC-DA-00004	23096-01-EGA1

LIST OF DRAWINGS

MK.	Q.TY	DIA.	RATING	TYPE FLANGE	THK.	I.D.	SELFREINF. THK.	PROJECTION	SERVICE
M2	1	24"	300#	LWN-RF Spec. + BL.	46.05	609.6	80.0	SEE DWG	MANHOLE C/W DAVIT
M1	1	24"	300#	LWN-RF Spec. + BL.	46.05	609.6	80.0	SEE DWG	MANHOLE C/W DAVIT
K2	1	1"	300#	LWN-RF	14.3	25.4	-	1814	PRESS. TRASM. (CTRL)
K1	1	1"	300#	LWN-RF	14.3	25.4	-	1814	PRESS. TRASM. (ESD)
5N	1	1"	300#	LWN-RF	14.3	25.4	-	1644	NITROGEN PURGING
4N	1	4"	300#	LWN-RF	22.2	101.6	35.0	1814	PSV CONNECTION
3N	1	1"	300#	LWN-RF + BL.	14.3	25.4	-	1644	DRAIN WITH BLIND
2N	1	1"	300#	LWN-RF	14.3	25.4	-	1814	HYDROGEN OUTLET
1N	1	1"	300#	LWN-RF	14.3	25.4	-	1644	HYDROGEN INLET

NOZZLES TABLE

ROSETTI MARINO	
1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
	14-05-2024

NOTES

1) No.6 PIECES REQUIRED
2) FOR BILL OF MATERIALS AND GENERAL NOTES SEE DRAWING 23096-01-EBM1
3) FOR WELDING DETAIL SEE DRAWING 23096-01-EWM1
4) BOLT HOLES OF THE NOZZLES SHALL ALWAYS STRADDLE THE PRINCIPAL CENTERLINES OF THE VESSELS OR THEIR PARALLEL LINES.
5) NOZZLES PROJECTIONS REFERRED FROM VESSEL CENTERLINE TO FACE FLANGE.
6) REINFORCING PADS SHALL BE PROVIDED WITH ONE ¼" NPT TELL TALE HOLE (B1.20.1)
7) MAWP SET EQUAL TO DESIGN PRESSURE TO ASME VIII DIV.2 PART.2 PARA 2.2.3.1 (d) (1)

NORME DI COSTRUZIONE		ASME VIII Div.2 CLASS 2 2021 ED. PED 2014/68/EU
CODE OF CONSTRUCTION		
USER CLASSIFICATION OF INSTALLATION AREA		ZONE 1 IIB T1+H2
CLASSIF. UTENTE AREA DI INSTALLAZIONE		
MARCATURA		CERTIFICATION MARK "U2" + NBR CE
MARKING		
ENTE NOTIFICATO		LRQA INSPECTION IBERIA SA. No.0094
NOTIFIED BODY		
ANTINCENDIO (ESCLUSO DALLA NS. FORNITURA)	mm	NO
FIREPROOFING (NOT INCLUDED IN OUR SCOPE OF SUPPLY)		
ISOLAMENTO (ESCLUSO DALLA NS. FORNITURA)	mm	NO
INSULATION (NOT INCLUDED IN OUR SCOPE OF SUPPLY)		
PESO PIENO D'ACQUA (IN SHOP)	Kg	160400
TOTAL WEIGHT FULL WATER		
CAPACITÀ	m^3	101.2 (101200 L)
CAPACITY (V)		
PESO IN ESERCIZIO	Kg	58900
OPERATING WEIGHT		
PESO A VUOTO ASSIEMATO	Kg	58700
EMPTY WEIGHT		
PESO DI FABBRICAZIONE	Kg	58700
FABRICATED WEIGHT		
PESO DI SOLLEVAMENTO	Kg	58700
LIFTING WEIGHT		
CONTROLLI NON DISTRUTTIVI		SEE "INSPECTION TEST PLAN" 1723001756-QC-ITP-00002
N.D.T.		
PARTICOLARI DI SALDATURA		SEE "WELDING BOOK" 1723001756-WEL-PRO-00014
WELDING DETAIL		
MASSIMA OVALIZZAZIONE SUL DIAMETRO	%	1
MAX. OVALIZATION OF DIAMETER		
VENTO		NEN - EN 1991-1-4
WIND		
TERREMOTO		N/A
EARTHQUAKE		
NEVE		NEN - EN 1991-1-3
SNOW		
EFFICIENZA GIUNTI		1
JOINT EFFICIENCY		
RADIOGRAFIA / UT		100%
RADIOGRAPHY / UT		
RICOTTURA		YES
P.W.H.T.		
PED MODULE		G
MODULO PED		
CATEGORY		IV
CATEGORIA		
PED FLUID GROUP		1
GRUPPO FLUIDO PED		
TALLONE DI SALDATURA		NO (5)
WELDING COUPON		
COLLAUDO / GRUPPO ISPEZIONE		1B
EXAMINATION / EXAMINATION GROUP		
CORROSIONE AMMISSIBILE	mm	NO
CORROSION ALLOWANCE		
NOME DEL FLUIDO		HYDROGEN
FLUID NAME		
PRESSIONE DI PROVA IDRAULICA	barg	57.2
HYDRAULIC TEST PRESSURE (PT)		
M.D.M.T.	°C	-29
M.D.M.T. (TM)		
SURFACE TREATMENT		1723001756-MAC-PRO-00008
TRATT. SUPERF.		
TEMPERATURA DI ESERCIZIO	°C	20
OPERATING TEMPERATURE		
MASS. PRESS. AMM. DI LAVORO EXT.	barg	F.V. @ 80°C
MAX. ALLOW. WORKING PRESS. EXT.		
PRESSIONE DI ESERCIZIO	barg	30
OPERATING PRESSURE		
TEMPERATURA DI PROGETTO	°C	-29 / 80
DESIGN TEMPERATURE (TS)		
PRESSIONE DI PROGETTO	barg	40
DESIGN PRESSURE (MAWP) (PS) (7)		
	barg	

DESCRIPTION

DESIGN DATA TABLE

BREMBANA&ROLLE — VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.

PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK

PURCHASE ORDER No.: 1723001756 123A90A

LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.

B&R CAD FILE No: 23096-01-EGA1.dwg | MFR'S S.N. 23096-01-SNA/F | B&R DRAWING No. 23096-01-EGA1

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
5	14/05/2024	AFO	MAT	DP	ACCEPTED FOR CONSTRUCTION (AFC)
4	18/03/2024	AFO	MAT	DP	ACCEPTED FOR CONSTRUCTION (AFC)
3	21/02/2024	AFO	MAT	DP	ACCEPTED FOR CONSTRUCTION (AFC)
2	16/02/2024	AFO	MAT	DP	ISSUE FOR REVIEW (IFR)
1	21/12/2023	AFO	MAT	DP	ISSUE FOR REVIEW (IFR)
0	16/11/2023	AFO	MAT	DP	ISSUE FOR REVIEW (IFR)

CROSSWIND — ROSETTI MARINO

GENERAL ARRANGEMENT DRAWING AND FOUNDATION LOADING DIAGRAM
HYDROGEN STORAGE VESSEL ITEM : V-25001A/F

CONTRACT NO. CW-I-WP4-2023-05 / H2 STORAGE | SCALE 1:35

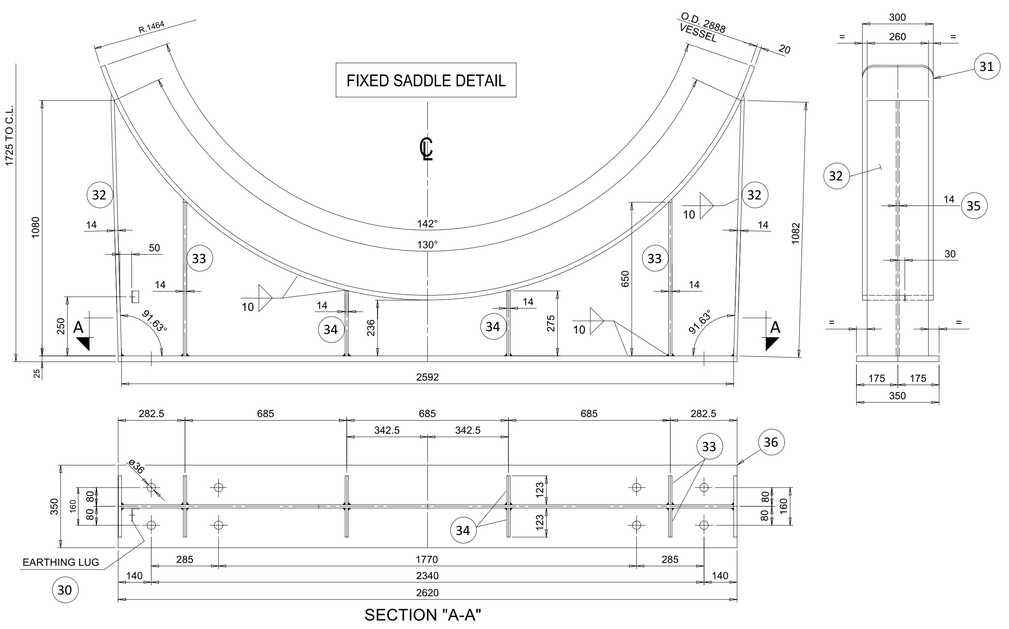
DRAWN A.FRANCO | CHECKED M.TONIOLO | APPROVED D.PASSERINI | DATE 14/05/24

A1 | DRAWING NO. 1723001756-MAC-DA-00004 | SHEET 1 | REV. 4

File Name : 1723001756-MAC-DA-00004.DWG

PART 1 - SECTION 4

Detail Drawings
(doc. no. 1723001756-MAC-DD-00005)



1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

ROSETTI MARINO

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign | Date

03-04-2024

23096-01-EWM1	Welding map Drawing
23096-01-EBM1	Bill of material and General Notes
23096-01-ED02	Manhole Davit Detail
23096-01-EGA1	General Arrangement
Manufacturer Dwg. No.	Description

Reference documents/belong to drawing

BREMBANA&ROLLE — VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.

PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK

PURCHASE ORDER No.: 1723001756 123A90A

LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.

B&R CAD FILE No: 23096-01-EGA1.DWG | MFR'S S.N. 23096-01-SNA/F | B&R DRAWING No. 23096-01-ED01

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
2	21/03/2024				ISSUE FOR INFORMATION (IFI)
1	07/02/2024				ISSUE FOR INFORMATION (IFI)
0	23/11/2023				ISSUE FOR INFORMATION (IFI)

CROSSWIND — ROSETTI MARINO

DETAILED DRAWING INCLUDING CROSS SECTION–EXPLODED VIEW DRAWING
H2 STORAGE VESSEL ITEM : V–25001A/F

CONTRACT NO. CW–I–WP4–2023–05 / H2 STORAGE | SCALE 1:10

DRAWN D.ADELINI | CHECKED M.TONIOLO | APPROVED D.PASSERINI | DATE 23/11/23

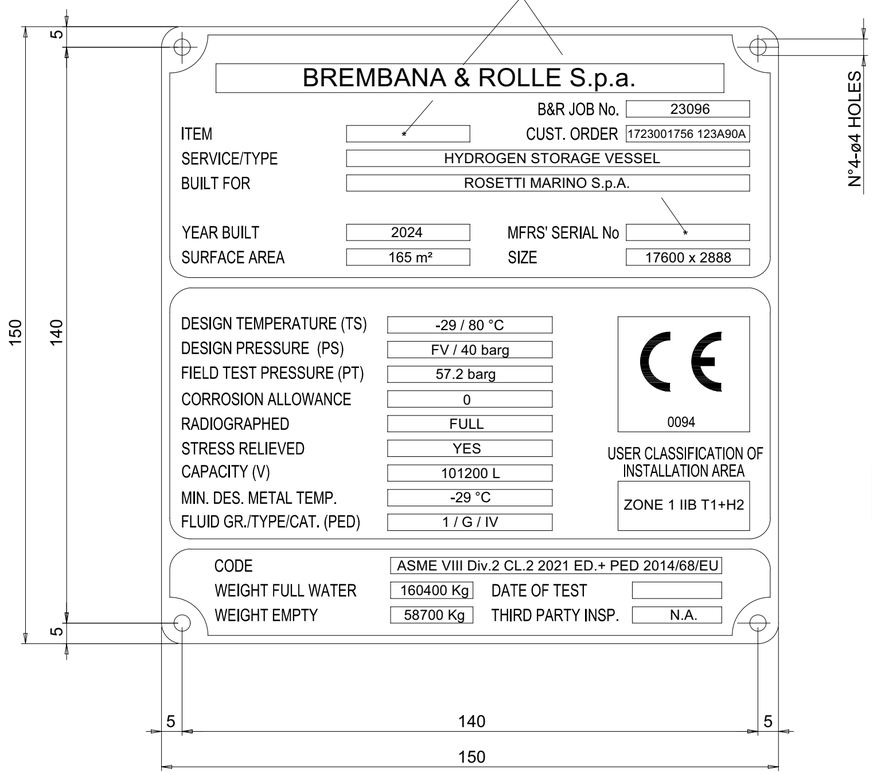
A1 | DRAWING NO. 1723001756–MAC–DD–00005 | SHEET 1 | REV. 2

File Name : 1723001756-MAC-DD-00005.DWG

PART 1 - SECTION 5

Name Plate Drawing
(doc. no. 1723001756-MAC-DD-00006)

ITEM	MFRS' SERIAL No
V-25001A	23096-01-SNA
V-25001B	23096-01-SNB
V-25001C	23096-01-SNC
V-25001D	23096-01-SND
V-25001E	23096-01-SNE
V-25001F	23096-01-SNF



39 CLIENT NAME PLATE

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

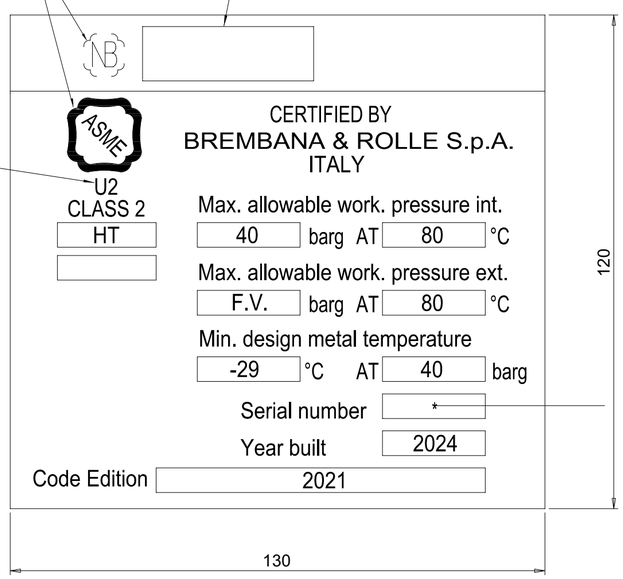
NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
	19-06-2024

STAMPIGLIATO IN OFFICINA DA BREMBANA&ROLLE
STAMPED IN SHOP BY BREMBANA&ROLLE

ESEGUITO DAL FORNITORE DELLA TARGA
TO BE PERFORMED BY NAME PLATE SUPPLIER

ESEGUITO DAL FORNITORE DELLA TARGA
TO BE PERFORMED BY NAME PLATE SUPPLIER



40 ASME NAME PLATE

MFRS' SERIAL No
23096-01-SNA
23096-01-SNB
23096-01-SNC
23096-01-SND
23096-01-SNE
23096-01-SNF

23096-01-EBM1	Bill of material and General Notes
23096-01-ED01	Detail Drawing (NP support)
23096-01-EGA1	General Arrangement
Manufacturer Dwg. No.	Description

Reference documents/belong to drawing

NOTE-NOTES

1) TUTTE LE LETTERE E I NUMERI SONO INCISI CHIMICAMENTE
ALL LETTERS AND NUMBER ARE CHEMICALLY ETCHED
2) LA TARGA SARA' IN MATERIALE S.S. 316L CON Sp. 2 mm
NAME PLATE SHALL BE IN S.S. 316L MATERIAL WITH 2 mm THK
3) ALTEZZA MINIMA DELLE LETTERE 4 mm
MINIMUM HEIGHT OF LETTERS 5/32"
4) CARATTERI SONO INCISI O IN RILIEVO MINIMO 0.004 INC. (O.10mm)
CHARACTERS EITHER INDENTED OR RAISED MIN 0.004 INC. (O.10mm)
5) PER ASSIEME APPARECCHIO, VEDI DISEGNO 23096-01-EGA1
FOR GENERAL ASSEMBLY , SEE DWG 23096-01-EGA1

BREMBANA&ROLLE

VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.

PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK

PURCHASE ORDER No.: 1723001756 123A90A

LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.

B&R CAD FILE No: 23096-01-EGA1.dwg

MFR'S S.N. 23096-01-SNA/F

B&R DRAWING No. 23096-01-ENP1

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
3	14/06/2024	AFG	MAT	DSA	ACCEPTED FOR CONSTRUCTION (AFC)
2	18/03/2024	AFG	MAT	DSA	ACCEPTED FOR CONSTRUCTION (AFC)
1	16/02/2024	AFG	MAT	DSA	ACCEPTED FOR CONSTRUCTION (AFC)
0	30/11/2023	AFG	MAT	DSA	ISSUE FOR INFORMATION (IFI)

CROSSWIND

ROSETTI MARINO

NAME PLATE DRAWING
H2 STORAGE VESSEL ITEM : V-25001A/F

CONTRACT NO. CW-I-WP4-2023-05 / H2 STORAGE

SCALE 1:1

DRAWN A.FRANCO | CHECKED M.TONIOLO | APPROVED D.PASSERINI | DATE 14/06/24

A2

DRAWING NO. 1723001756-MAC-DD-00006

SHEET 1

REV. 3

File Name : 1723001756-MAC-DD-00006

PART 1 - SECTION 6

Pressure Vessel Mechanical Calculation
(doc. no. 1723001756-MAC-CAL-00003)

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**PRESSURE VESSEL MECHANICAL CALCULATION – H2 STORAGE VESSEL**	Sheet 1 of 215 Date: 14/05/2024 Rev: 3

Base Load Power Hub (BLPH)

PRESSURE VESSEL MECHANICAL CALCULATION
H2 STORAGE VESSEL

Document Number: 1723001756-MAC-CAL-00003

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	[illegible] WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
[signature]	14-02-2024

Document Class: 3

Rev.	Date	Description	Prepared	Reviewed	Approved
3	14/05/2024	Issue For Information (IFI)	M. Toniolo	D. Passerini	D. Passerini
2	22/03/2024	Issue For Information (IFI)	M. Toniolo	D. Passerini	D. Passerini
1	19/02/2024	Issue For Information (IFI)	M. Toniolo	D. Passerini	D. Passerini
0	17/11/2023	Issue for Information (IFI)	M. Toniolo	D. Passerini	D. Passerini

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**PRESSURE VESSEL MECHANICAL CALCULATION – H2 STORAGE VESSEL**	Sheet 2 of 215 Date: 14/05/2024 Rev: 3

Revision / Change Log

Rev.	Description
0	Issue for Information (IFI)
1	MAWP set equal to Design Pressure to ASME VIII-2 Part .2 § 2.2.3.1(d)(1); Nozzles 1N, 5N moved ffrom head to cylindrical shell ; Saddles each calculated with 8 x M30 dia bolts 8.8 material; Nozle 4N changed from 2 NPS 300# to 4 NPS 300#; Allowable Nozzle loads to 4 NPS and 1 NPS nozzles considered; Top Platform initially considered have been removed; H2 Weight 260 kg considered in operating condition; Anchor bolts check in ocean transport condition added. SS. under sliding saddle considered (friction coefficient used 0.3) Height of Base moved to 35 m. Wind pressure updated.
2	Edititorial changes
3	Nozzles K1 and K2 reconciled with GA drawing

HOLDS LIST

No.	Description
1	
2	
3	
4	

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		JOB	23096		
		ITEM	V-25001 A÷F		

CLIENT:	**ROSETTI MARINO**
PURCHASE ORDER No.:	**1723001756 123A90A**
END USER:	**CROSSWIND**
ENGINEERING	**ROSETTI MARINO**
PROJECT:	**BLPH PLATFORM**
SITE:	**HOLLANDSE KUST NOORD SITE V**
ITEM:	**V-25001 A÷F**
EQUIPMENT TYPE:	**HORIZONTAL EQUIPMENT**
SERVICE:	**H2 STORAGE VESSEL**
MANUFACTURER	**BREMBANA & ROLLE S.p.A.**
JOB NOMBER:	**23096**
SERIAL NUMBER	**23096-01-SNA**

REV.	DESCRIPTION	DATE	ORIGINATOR [Project Eng.]	CHECK [Project Tech.Mng.]	APPROVAL [Engineering Mgr.]
3	Emesso Per Approvazione	14/05/2024	M. TONIOLO	D. PASSERINI	D.PASSERINI
2	Emesso Per Approvazione	22/03/2024	M. TONIOLO	D. PASSERINI	D.PASSERINI
1	Emesso Per Approvazione	15/02/2024	M. TONIOLO	D. PASSERINI	D.PASSERINI
0	Emesso Per Approvazione	16/11/2023	M. TONIOLO	D. PASSERINI	D. PASSERINI

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DESIGN NOTES:

DESIGN DATA:

ITEM TAG: V-25001 A÷F

Design calculation in accordante with **ASME Sezione VIII div. 2 Class 2 2021 Edition.**
Software: Intergraph PV Elit, Release SP25.
For partS not covered by the Code, Manufacturer's calculation sheets are used.

Equipment Not in lethal service

Unità System: SI
Pressure expressed in: barg
Flange according to: ASME B16.5: 2017; ASME B16.47:2017

EQUIPMENT	Note	*DESIGN CODE*		**ASME VIII Div.2 Class 2 2021 Ed.**	***Rev***
INTERNAL DESIGN PRESSURE		40	barg		
MAWP	① 1	① 40	barg		
EXTERNAL DESIGN PRESSURE		FV@ 80 °C			
TEMPERATURE @ INTERNAL DESIGN PRESSURE		80	°C		
M.D.M.T.		-29	°C		
CORROSION ALLOWANCE		0	mm		
TYE OF FLUID	① 2	HYDROGEN			
JOINT EFFICIENCY / NDE		1 / 100%			
POST WELD HEAT TREATMENT		YES			

1. MAWP set equal to design pressure to ASME VIII – 2, Part 2 §.2.2.3.1(d)(1);
2. Hydrogen weight 260 Kg in operating condition included;

TEST PRESSURE CALCULATION:

Material Stress Ratio (SR) St/S
(St = allowable stress @ design temperature, Sa = allowable stress @ ambient temperature)

allowable stress per ASME Sezione IIA Tabella 5A (in N/mm²):

Material	St (N/mm²)	Sa (N/mm²)	SR
SA-516 60	136.38	147	1.078
SA-350 LF2 Cl.1	153.7	165.5	1.078

Test pressure at highest point based on the Design Code ond on PED 2014/68/EU Directive requirements:
Test Pressure to PED 2014/68/UE:
Higher between:
Pt = 1.43*Des Pressure = 57.2 barg
Pt = 1.25*Des Pressure*SR = 53.9 barg

Test Pressure to ASME VIII div.2
① Pt = 1.25*Des Pressure*SR = 53.9 bar g

Test pressure at highest point: = 57.2 barg

DESIGN LOADS:

Loads here below listed have been considered in the condition specified by the following symbols:
E = Erection;
O = Operating;
T = HydroTesting;
A = All teh above condition;
L = Lifting.

(a) Internal / External design Pressure
- See Fabrication Drawings (O)

(b) weight of the vessel and normal contents under operating and test conditions.
- Fluid Density and height as shown on the reference drawing:

Fluid Density in operating condition:	260 kg total considered; (O)	①
Height of fluid in operating condition:	260 kg total considered; (O)	①
Fluid Density in test condition:	1 kg/dm³; (T)	
Height of fluid in test condition:	Full; (T)	

(c) Superimposed static reactions from the weight of attached equipment, such as motors, machinery, other vessels, piping, linings and insulation.

NOZZLE LOADS:
Nozzle loads calculated in accordante with Project Specification:
123A90-DDL-MAC-SP-50026 Appendix 1 - Forces and Moments:

Loads have been verified according to WRC 107/507 Bulletin(O)

- Where applicable, le flange Rating have been checked against nozzle loads according to ASME VIII-div.4.16.12. or, when not staisfactory, by formula according to Equivalent Pressure Method. (O).

OTHER LOADS:

DESCRIPTION	QUANTITY	LOAD	CONDITION	Note
Insulation	n/a	200 Kg/m³ ①	E, O, L	
Fireproofing	n/a	2100 Kg/m³	O	
Internal Lining	n/a	7850 klg/m³	A	
Weight of Internals	n/a		O	
Ladders and Platforms	① n/a	250 kg/m²	E, O	
External Attachments	n/a		E, O	
Miscellaneous weight	500 kg		A	
	n.a.			

Note:
NOne

(b) Cyclic and dynamic reactions due to pressure or thermal variations, or from equipment mounted on a vessel, and mechanical loading.

– Not Applicable

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WIND & SEISMIC ACTIONS:

WIND LOADS:
to EN-1991 Part 1-4 and Project Specification CWHKN-INN-BPH-DTS-00005
Wind Speed considered: 45 m/s
25% of wind loads considered during testing.
① Elevation of Bse plate 35 .
(E)(O)(T).

Calculation of wind pressure in accordance with EUROCODE 1 - Part 1-4

Fundamental value basic wind Vb,0 = 45 m/s <-- 162 Km/h
Air density = r = 1.25 N/m³ <-- ("1.25" unless otherwise noted in National Annexes)
Equipment height from basement= z1 = 3.4 m <--
Height of basement = Z2 = 35.1 m <--
Equipment height from ground= Z = 38.5 m (Z1+Z2)
Importance factor = I = 1 <-- ("1" unless specified by client specification)
Vessel OD (including insulation) b = 2.9 m <--

Terrain category 0 <--
Zo = 1.000 m
Z min = 10.000 m
Zmax = 200.000 m

Terrain Cat.	Zo	Zmin
0	0.003	1
I	0.010	1
II	0.050	2
III	0.300	5
IV	1.000	10

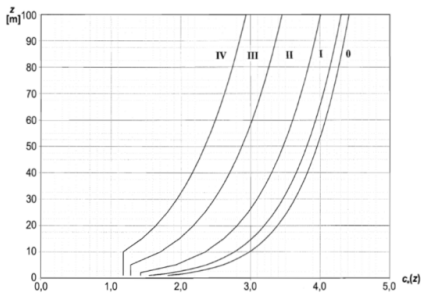
Assumed Coefficients

Cp = 1.000 <-- Pressure coefficient (or shape factor)
Co(z) = 1.000 <-- Orographic coefficient ("1" unless otherwise noted in National Annexes)
Ki = 1.000 <-- Turbolence factor ("1" unless otherwise noted in National Annexes)
Zo,II = 0.050 Coefficient for terrain category 2
Cdir = 1.000 <-- Directional factor ("1" unless otherwise noted in National Annexes)
C season = 1.000 <-- Season factor ("1" unless otherwise noted in National Annexes)

Basic wind velocity Vb = Cdir * C season * Vb,0 = 45 m/s
Basic velocity Pressure qb = 0.5 * r * vb² = 1265.625 Pa (= dynamic wind pressure)

Mean Wind velocity

Kr = 0.19 * (Zo / Zo,II)^0.07= 0.234
cr(Z) = Kr * Ln(Z/Zo) = 0.855 (@Z see summary table)
cr(Zmin) = Kr * Ln(Zmin/Zo)= 0.540 (@Z see summary table)
Vm (Z) = cr(z) * Co(z) * Vb = 38.495 (@Z see summary table)



Turbolence Intensity

Iv = Ki / LN(Z/Zo) = 0.274 (@Z see summary table)

Peak velocity pressure *exposure factor ce(z) for co=1, ki=4*

qp(Z) = [1 +7*Iv(z)] * (1/2)*1.25*Vm(Z)² = 2702.117 N/m² (valid for a peak factor 3.5)

Wind Pressure

p = cp * qp(z) = 2702.117

Summary table

	Heigth m	Cr(Z)	Vm(z) m/s	Iv	qp(z) N/m²	Wind Pressure Kpa (*)
	10.0	0.540	24.28	0.434	1488.6	1.489
-->	15.0	0.635	28.56	0.369	1827.0	1.827
-->	20.0	0.702	31.59	0.334	2081.0	2.081
-->	35.0	0.833	37.49	0.281	2608.0	2.608
-->	40.0	0.864	38.90	0.271	2740.2	2.740
-->	45.0	0.892	40.14	0.263	2858.9	2.859
-->	50.0	0.917	41.25	0.256	2966.6	2.967

(*) multiplied by the Importance factor, if specified

Determination of Force Coefficient

k = Surface roughness for new surfaces
k= 0.05 Bright steel <--

v = kinematic viscosity of the air =
v = 0.00015 m²/s <--

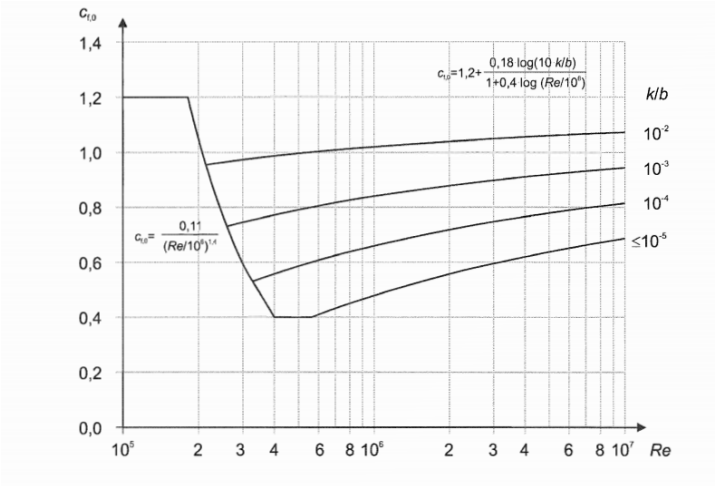
k/b = 1.72E-05

$c_{f,0} = 1.2 + (0.18*\log(10*k/b)/(1+0.4*\log(Re/10^6)$

	Heigth m	v(Ze)	Re	Cf,0	Wind Pressure Kpa (*)
	10.0	48.80	9435276	0.7126152	1.0608
-->	15.0	54.07	10452961	0.7187759	1.3132
-->	20.0	57.70	11155878	0.7226101	1.5038
-->	35.0	64.60	12488846	0.7291166	1.9016
-->	40.0	66.21	12801424	0.7305181	2.0018
-->	45.0	67.63	13075639	0.731713	2.0919
-->	50.0	68.90	13319818	0.7327512	2.1738

these values are entered in the software input data

(*) multiplied by the force coefficient



SEISMIC LOADS

NOT APPLICABLE (O)

IMPACT TEST REQUIREMENTS AND EXEMPTION:

Minimum Design Metal temperature: -29°C
Post Weld Heat Treatment : YES

MATERIAL	CODE REQUIREMENTS
SA-516 60	Impact test exempted up to ③ 44 mm @ -29°C (ASME VIII Div. 2 – FIG 3.8M and ③ Table 3.15 for material in Curve D. Material to be Impact tested for thickness greater than ③ 44 mm (see note 1)
SA-350 LF2 CL.1	Impact test exempted down to -48°C for all thickness (ASME VIII Div. 2 para 3.11.2.4 (b). (see note 1)
SA 193 B7 / SA-194 Gr."H	Impact test exempted down to -48°C for bolt size 2 ½" and less (ASME VIII Div.2 Table 3.4) (see note 1)

Note 1)
Despite Code Impact Test Exemptions all materials have been subjected to impact test in accordance with PED 2014/68/EU Directive and Project requirements.

Nozzle Calculation Summary (bar & mm):

Description	MAWP	Ext	MAPNC	Tbl 4.5.2	Weld	Pass/Fail
M1	42.9	OK	...	...	OK	Passed
1N	42.2	OK	...	OK	OK	Passed
5N	42.2	OK	...	OK	OK	Passed
3N	42.2	OK	...	OK	OK	Passed
2N	42.2	OK	...	OK	OK	Passed
K2	42.2	OK	...	OK	OK	Passed
K1	42.2	OK	...	OK	OK	Passed
4N	42.2	OK	...	OK	OK	Passed
M2	42.9	OK	...	...	OK	Passed

Nozzle MAWP Summary:

Minimum MAWP Nozzles	:	42.2 Nozzle	: 4N
Minimum MAWP Shells/Flanges	:	40 Element	: Shell#5
Minimum MAPnc Shells/Flanges	:	45.5 Element	: Shell#5
Computed Vessel M.A.W.P.	:	40 bar	

VIII-2 Nozzle to Gross Structural Discontinuity Check:
No Nozzles were too close to any gross structural discontinuities per 4.5.13.1

Multiple output lines for the same nozzle indicates required Code calculations in both the longitudinal and circumferential planes of reinforcement where applicable.

Check the Spatial Relationship between the Nozzles:

From Node	Nozzle Description	X Coordinate mm	Layout Angle deg	Inside Radius mm
10	M1	0.000	0.000	304.800
20	1N	750.000	180.000	12.700
20	5N	450.000	180.000	12.700
20	3N	1050.000	180.000	12.700
60	2N	15100.001	0.000	12.700
60	K2	14700.000	0.000	25.400
60	K1	14300.000	0.000	25.400
60	4N	13900.001	0.000	50.800
70	M2	0.000	0.000	304.800

The nozzle spacing is computed by the following:

$= \mathrm{sqrt}(ll^2 + lc^2)$ where

ll - Arc length along the inside vessel surface in the long. direction.
lc - Arc length along the inside vessel surface in the circ. direction

If any interferences/violations are found, they will be noted below.

No interference violations have been detected!

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Nozzle Schedule:

Description	Nominal or Actual Size	Schd or FVC Type	Flg Type	Nozzle O/Dia mm	Wall Thk mm	Reinforcing Pad Diameter	Reinforcing Pad Thk mm	Cut Length mm	Flg Class
1N	25 mm	Actual	LWN	54.0	14.300	...	...	244	300
5N	25 mm	Actual	LWN	54.0	14.300	...	...	245	300
3N	25 mm	Actual	LWN	54.0	14.300	...	...	245	300
2N	25 mm	Actual	LWN	54.0	14.300	...	...	414	300
K2	25 mm	Actual	LWN	54.0	14.300	...	...	414	300
K1	25 mm	Actual	LWN	54.0	14.300	...	...	414	300
4N	101 mm	Actual	LWN	146.0	22.200	...	...	416	300
M1	609 mm	Actual	LWN	701.7	46.050	...	...	369	300
M2	609 mm	Actual	LWN	701.7	46.050	...	...	369	300

General Notes for the above table:

The cut length is the outside projection + inside projection + drop + in-plane shell thickness. This value does not include weld gaps, nor does it account for shrinkage.

In the case of oblique nozzles, the outside diameter must be increased. The re-pad width around the nozzle is calculated as follows:
Width of Pad = (Pad Outside Dia. (per above) - Nozzle Outside Dia.)/2

For hub nozzles, the thickness and diameter shown are those of the smaller and thinner section.

Nozzle Material and Weld Fillet Leg Size Details (mm):

Description	Material	Shl Grve Weld	Noz Shl/Pad Weld	Pad OD Weld	Pad Grve Weld	Inside Weld
1N	SA-350 LF2	40.000	10.000	...	...	...
5N	SA-350 LF2	40.000	10.000	...	...	...
3N	SA-350 LF2	40.000	10.000	...	...	...
2N	SA-350 LF2	44.000	10.000	...	...	...
K2	SA-350 LF2	44.000	10.000	...	...	...
K1	SA-350 LF2	44.000	10.000	...	...	...
4N	SA-350 LF2	44.000	10.000	...	...	...
M1	SA-350 LF2	40.000	10.000	...	...	...
M2	SA-350 LF2	40.000	10.000	...	...	...

Note: The Outside projections below do not include the flange thickness.

Nozzle Miscellaneous Data:

Description	Elev/Distance From Datum mm	Layout Angle deg	Proj Outside mm	Proj Inside mm	Installed in Component
1N	750.000	180.0	200.00	0.00	Shell#1
5N	450.000	180.0	201.46	0.00	Shell#1
3N	1050.000	180.0	201.46	0.00	Shell#1
2N	15100.000	0.0	370.00	0.00	Shell#5
K2	14700.000	0.0	370.00	0.00	Shell#5
K1	14300.000	0.0	370.00	0.00	Shell#5
4N	13900.000	0.0	370.00	0.00	Shell#5
M1	...	0.0	300.00	0.00	Head 1
M2	...	0.0	300.00	0.00	Head2

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Units used in this Analysis (User_SI_bars):

Name	System Unit	Constant	User Unit
Length	Feet	304.8000	mm
Force	Pounds	4.4480	N
Mass	Pounds	0.4536	kg
Area	sq. inches	645.1600	mm^2
Moment	ft. lbs.	1.3563	N-m
Stress	lbs./sq.in.	0.0069	N/mm^2
Temperature	Degrees F	0.5556	°C
Pressure	psig	0.0689	bar
Elast. Modulus	lbs./sq.in.	0.0069	MPa
Pipe Density	lbs./cu.in.	27680.0000	kg/m^3
Ins. Density	lbs./cu.ft.	16.0183	kg/m^3
Fluid Density	lbs./cu.ft.	0.0160	kg/dm^3
Wind Speed	miles/hr	0.4470	m/sec
Tray Weight	lbs./sq.ft.	0.0005	kgs/cm^2
Inertia	in.^4	416231.0000	mm^4
G Load	G's	1.0000	g's
Wind Load	lbs./sq.ft.	0.0479	kPa
Elevation	Feet	304.8000	mm
Volume	in.^3	0.1600E-04	m^3
Diameter	inches	25.4000	mm
Thickness	inches	25.4000	mm

PV Elite Vessel Analysis Program: Input Data

Design Internal Pressure (for Hydrotest)	40	bar
Design Internal Temperature	80.0	°C
Projection of Nozzle from Vessel Top	0	mm
Projection of Nozzle from Vessel Bottom	0	mm
Minimum Design Metal Temperature	-46.0	°C
Type of Construction	Welded	
Special Service	None	
Use Higher Longitudinal Stresses (Flag)	N	
Select t for Internal Pressure (Flag)	N	
Select t for External Pressure (Flag)	N	
Select t for Axial Stress (Flag)	N	
Select Location for Stiff. Rings (Flag)	N	
Consider Vortex Shedding	N	

Shop Pressure Test:

Type of Pressure Test	User Defined Hydro
Pressure Test Position	Horizontal
Test Performed in Corroded Condition	No

Load Case 1	NP+EW+WI+FW+BW
Load Case 2	NP+EW+EE+FS+BS
Load Case 3	NP+OW+WI+FW+BW
Load Case 4	NP+OW+EQ+FS+BS
Load Case 5	NP+HW+HI
Load Case 6	NP+HW+HE
Load Case 7	IP+OW+WI+FW+BW
Load Case 8	IP+OW+EQ+FS+BS
Load Case 9	EP+OW+WI+FW+BW
Load Case 10	EP+OW+EQ+FS+BS
Load Case 11	HP+HW+HI
Load Case 12	HP+HW+HE
Load Case 13	IP+WE+EW
Load Case 14	IP+WF+CW

Load Case 15	IP+VO+OW
Load Case 16	IP+VE+EW
Load Case 17	NP+VO+OW
Load Case 18	FS+BS+IP+OW
Load Case 19	FS+BS+EP+OW
Load Case 20	BL+IP+OW
Wind Design Code	User Defined

Wind Profile Height mm	Pressure kPa
5000.0000	2.7400
0.0000	0.0000
0.0000	0.0000
0.0000	0.0000
0.0000	0.0000
0.0000	0.0000
0.0000	0.0000
0.0000	0.0000

Damping Factor (Beta) for Wind (Ope)	0.0100
Damping Factor (Beta) for Wind (Empty)	0.0000
Damping Factor (Beta) for Wind (Filled)	0.0000
Seismic Design Code	No Seismic
M.A.W.P + Static Head to Nozzle	Y
Consider MAP New and Cold in Noz. Design	N
Consider External Loads for Nozzle Des.	Y
Use ASME VIII-1 Appendix 1-9	N
Perform Blast Load Analysis	No
Material Database Year	Current w/Addenda or Code Year

Complete Listing of Vessel Elements and Details:

Element From Node	10	
Element To Node	20	
Element Type	Elliptical	
Description	Head 1	
Distance "FROM" to "TO"	50	mm
Inside Diameter	2800	mm
Element Thickness	40	mm
Internal Corrosion Allowance	0	mm
Nominal Thickness	45	mm
External Corrosion Allowance	0	mm
Design Internal Pressure	40	bar
Design Temperature Internal Pressure	80	°C
Design External Pressure	1.03	bar
Design Temperature External Pressure	80	°C
Effective Diameter Multiplier	1.2	
Material Name	SA-516 60	[Impact Tested]
Allowable Stress, Ambient	147	N/mm²
Allowable Stress, Operating	136.28	N/mm²
Allowable Stress, Hydrotest	209	N/mm²
Material Density	7750.4	kg/m³
P Number Thickness	0	mm
Yield Stress, Operating	205	N/mm²
MDMT Curve	Impact Tested	
External Pressure Chart Name	CS-2	
UNS Number	K02100	
Product Form	Plate	
Efficiency, Longitudinal Seam	1.0	
Efficiency, Circumferential Seam	1.0	
Elliptical Head Factor	2.0	

Weld is pre-Heated	No	
Element From Node	10	
Detail Type	Nozzle	
Detail ID	M1	
Dist. from "FROM" Node / Offset dist	0	mm
Nozzle Diameter	609.6	mm
Nozzle Schedule	None	
Nozzle Class	300	
Layout Angle	0.0	
Blind Flange (Y/N)	Y	
Weight of Nozzle (Used if > 0)	9282.5	N
Grade of Attached Flange	GR 1.1	
Nozzle Matl	SA-350 LF2 [Impact Tested]	

Element From Node	20	
Element To Node	30	
Element Type	Cylinder	
Description	Shell#1	
Distance "FROM" to "TO"	2750	mm
Inside Diameter	2800	mm
Element Thickness	44	mm
Internal Corrosion Allowance	0	mm
Nominal Thickness	44	mm
External Corrosion Allowance	0	mm
Design Internal Pressure	40	bar
Design Temperature Internal Pressure	80	°C
Design External Pressure	1.03	bar
Design Temperature External Pressure	80	°C
Effective Diameter Multiplier	1.0	
Material Name	SA-516 60 [Impact Tested]	
Efficiency, Longitudinal Seam	1.0	
Efficiency, Circumferential Seam	1.0	
Weld is pre-Heated	No	
Element From Node	20	
Detail Type	Nozzle	
Detail ID	1N	
Dist. from "FROM" Node / Offset dist	700	mm
Nozzle Diameter	25.4	mm
Nozzle Schedule	None	
Nozzle Class	300	
Layout Angle	180.0	
Blind Flange (Y/N)	N	
Weight of Nozzle (Used if > 0)	154.24	N
Grade of Attached Flange	GR 1.1	
Nozzle Matl	SA-350 LF2 [Impact Tested]	
Element From Node	20	
Detail Type	Nozzle	
Detail ID	5N	
Dist. from "FROM" Node / Offset dist	400	mm
Nozzle Diameter	25.4	mm
Nozzle Schedule	None	
Nozzle Class	300	
Layout Angle	180.0	
Blind Flange (Y/N)	N	
Weight of Nozzle (Used if > 0)	154.63	N
Grade of Attached Flange	GR 1.1	
Nozzle Matl	SA-350 LF2 [Impact Tested]	

Element From Node	20	
Detail Type	Nozzle	
Detail ID	3N	
Dist. from "FROM" Node / Offset dist	1000	mm
Nozzle Diameter	25.4	mm
Nozzle Schedule	None	
Nozzle Class	300	
Layout Angle	180.0	
Blind Flange (Y/N)	N	
Weight of Nozzle (Used if > 0)	0	N
Grade of Attached Flange	GR 1.1	
Nozzle Matl	SA-350 LF2 [Impact Tested]	

Element From Node	30	
Element To Node	40	
Element Type	Cylinder	
Description	Shell#2	
Distance "FROM" to "TO"	3350	mm
Inside Diameter	2800	mm
Element Thickness	44	mm
Internal Corrosion Allowance	0	mm
Nominal Thickness	44	mm
External Corrosion Allowance	0	mm
Design Internal Pressure	40	bar
Design Temperature Internal Pressure	80	°C
Design External Pressure	1.03	bar
Design Temperature External Pressure	80	°C
Effective Diameter Multiplier	1.2	
Material Name	SA-516 60 [Impact Tested]	
Efficiency, Longitudinal Seam	1.0	
Efficiency, Circumferential Seam	1.0	
Weld is pre-Heated	No	

Element From Node	30	
Detail Type	Saddle	
Detail ID	Saddle Left	
Dist. from "FROM" Node / Offset dist	450	mm
Width of Saddle	300	mm
Height of Saddle at Bottom	1725	mm
Saddle Contact Angle	130.0	
Height of Composite Ring Stiffener	0	mm
Width of Wear Plate	350	mm
Thickness of Wear Plate	20	mm
Contact Angle, Wear Plate (degrees)	142.0	
Friction coefficient	0.5	
Moment Factor	3.0	
Dimension E at base (optional)	0	mm
Circumferential Eff. over Saddle	1.0	
Circumferential Eff. at Midspan	1.0	
Tangent to Tangent dist. (optional)	0	mm

Element From Node	30	
Detail Type	Weight	
Detail ID	LIFTING LUG1	
Dist. from "FROM" Node / Offset dist	450	mm
Miscellaneous Weight	1470.9	N
Offset from Element Centerline	0	mm

Element From Node	40	

Element To Node	50	
Element Type	Cylinder	
Description	Shell#3	
Distance "FROM" to "TO"	3300	mm
Inside Diameter	2800	mm
Element Thickness	44	mm
Internal Corrosion Allowance	0	mm
Nominal Thickness	44	mm
External Corrosion Allowance	0	mm
Design Internal Pressure	40	bar
Design Temperature Internal Pressure	80	°C
Design External Pressure	1.03	bar
Design Temperature External Pressure	80	°C
Effective Diameter Multiplier	1.2	
Material Name	SA-516 60 [Impact Tested]	
Efficiency, Longitudinal Seam	1.0	
Efficiency, Circumferential Seam	1.0	
Weld is pre-Heated	No	
Element From Node	40	
Detail Type	Weight	
Detail ID	MISC	
Dist. from "FROM" Node / Offset dist	1650	mm
Miscellaneous Weight	4903	N
Offset from Element Centerline	0	mm
Element From Node	40	
Detail Type	Weight	
Detail ID	H2 WEIGHT	
Dist. from "FROM" Node / Offset dist	1650	mm
Miscellaneous Weight	2549.6	N
Offset from Element Centerline	0	mm

Element From Node	50	
Element To Node	60	
Element Type	Cylinder	
Description	Shell#4	
Distance "FROM" to "TO"	3350	mm
Inside Diameter	2800	mm
Element Thickness	44	mm
Internal Corrosion Allowance	0	mm
Nominal Thickness	44	mm
External Corrosion Allowance	0	mm
Design Internal Pressure	40	bar
Design Temperature Internal Pressure	80	°C
Design External Pressure	1.03	bar
Design Temperature External Pressure	80	°C
Effective Diameter Multiplier	1.2	
Material Name	SA-516 60 [Impact Tested]	
Efficiency, Longitudinal Seam	1.0	
Efficiency, Circumferential Seam	1.0	
Weld is pre-Heated	No	
Element From Node	50	
Detail Type	Saddle	
Detail ID	Saddle Right	
Dist. from "FROM" Node / Offset dist	2800	mm
Width of Saddle	300	mm
Height of Saddle at Bottom	1725	mm
Saddle Contact Angle	130.0	
Height of Composite Ring Stiffener	0	mm

Width of Wear Plate	350	mm
Thickness of Wear Plate	20	mm
Contact Angle, Wear Plate (degrees)	142.0	
Friction coefficient	0.30000001	
Moment Factor	3.0	
Dimension E at base (optional)	0	mm
Circumferential Eff. over Saddle	1.0	
Circumferential Eff. at Midspan	1.0	
Tangent to Tangent dist. (optional)	0	mm
Element From Node	50	
Detail Type	Weight	
Detail ID	LIFTING LUG2	
Dist. from "FROM" Node / Offset dist	2800	mm
Miscellaneous Weight	1961.2	N
Offset from Element Centerline	0	mm

Element From Node	60	
Element To Node	70	
Element Type	Cylinder	
Description	Shell#5	
Distance "FROM" to "TO"	2750	mm
Inside Diameter	2800	mm
Element Thickness	44	mm
Internal Corrosion Allowance	0	mm
Nominal Thickness	44	mm
External Corrosion Allowance	0	mm
Design Internal Pressure	40	bar
Design Temperature Internal Pressure	80	°C
Design External Pressure	1.03	bar
Design Temperature External Pressure	80	°C
Effective Diameter Multiplier	1.2	
Material Name	SA-516 60 [Impact Tested]	
Efficiency, Longitudinal Seam	1.0	
Efficiency, Circumferential Seam	1.0	
Weld is pre-Heated	No	
Element From Node	60	
Detail Type	Nozzle	
Detail ID	2N	
Dist. from "FROM" Node / Offset dist	2300	mm
Nozzle Diameter	25.4	mm
Nozzle Schedule	None	
Nozzle Class	300	
Layout Angle	0.0	
Blind Flange (Y/N)	N	
Weight of Nozzle (Used if > 0)	77.717	N
Grade of Attached Flange	GR 1.1	
Nozzle Matl	SA-350 LF2 [Impact Tested]	
Element From Node	60	
Detail Type	Nozzle	
Detail ID	K2	
Dist. from "FROM" Node / Offset dist	1900	mm
Nozzle Diameter	25.4	mm
Nozzle Schedule	None	
Nozzle Class	300	
Layout Angle	0.0	
Blind Flange (Y/N)	N	
Weight of Nozzle (Used if > 0)	155.53	N
Grade of Attached Flange	GR 1.1	

Nozzle Matl	SA-350 LF2 [Impact Tested]	
Element From Node	60	
Detail Type	Nozzle	
Detail ID	K1	
Dist. from "FROM" Node / Offset dist	1500	mm
Nozzle Diameter	25.4	mm
Nozzle Schedule	None	
Nozzle Class	300	
Layout Angle	0.0	
Blind Flange (Y/N)	N	
Weight of Nozzle (Used if > 0)	155.53	N
Grade of Attached Flange	GR 1.1	
Nozzle Matl	SA-350 LF2 [Impact Tested]	
Element From Node	60	
Detail Type	Nozzle	
Detail ID	4N	
Dist. from "FROM" Node / Offset dist	1100	mm
Nozzle Diameter	101.6	mm
Nozzle Schedule	None	
Nozzle Class	300	
Layout Angle	0.0	
Blind Flange (Y/N)	N	
Weight of Nozzle (Used if > 0)	155.53	N
Grade of Attached Flange	GR 1.1	
Nozzle Matl	SA-350 LF2 [Impact Tested]	

Element From Node	70	
Element To Node	80	
Element Type	Elliptical	
Description	Head2	
Distance "FROM" to "TO"	50	mm
Inside Diameter	2800	mm
Element Thickness	40	mm
Internal Corrosion Allowance	0	mm
Nominal Thickness	45	mm
External Corrosion Allowance	0	mm
Design Internal Pressure	40	bar
Design Temperature Internal Pressure	80	°C
Design External Pressure	1.03	bar
Design Temperature External Pressure	80	°C
Effective Diameter Multiplier	1.2	
Material Name	SA-516 60 [Impact Tested]	
Efficiency, Longitudinal Seam	1.0	
Efficiency, Circumferential Seam	1.0	
Elliptical Head Factor	2.0	
Weld is pre-Heated	No	
Element From Node	70	
Detail Type	Nozzle	
Detail ID	M2	
Dist. from "FROM" Node / Offset dist	0	mm
Nozzle Diameter	609.6	mm
Nozzle Schedule	None	
Nozzle Class	300	
Layout Angle	0.0	
Blind Flange (Y/N)	Y	
Weight of Nozzle (Used if > 0)	9282.5	N
Grade of Attached Flange	GR 1.1	
Nozzle Matl	SA-350 LF2 [Impact Tested]	

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Internal Pressure Results Summary:

Element Thickness, Pressure, Diameter and Allowable Stress :

From	To	Int. Press + Liq. Hd bar	Nominal Thickness mm	Total Corr Allowance mm	Element Diameter mm	Allowable Stress(SE) N/mm²
Head 1		40	45	...	2800	136.28
Shell#1		40	44	...	2800	136.28
Shell#2		40	44	...	2800	136.28
Shell#3		40	44	...	2800	136.28
Shell#4		40	44	...	2800	136.28
Shell#5		40	44	...	2800	136.28
Head2		40	45	...	2800	136.28

Element Required Thickness and MAWP :

From	To	Design Pressure bar	M.A.W.P. Corroded bar	M.A.P. New & Cold bar	Minimum Thickness mm	Required Thickness mm
Head 1		40	42.9	46.3	40	37.2604
Shell#1		40	42.2	45.5	44	41.7057
Shell#2		40	42.2	45.5	44	41.7057
Shell#3		40	42.2	45.5	44	41.7057
Shell#4		40	42.2	45.5	44	41.7057
Shell#5		40	42.2	45.5	44	41.7057
Head2		40	42.9	46.3	40	37.2604
Minimum			40	45.5		

MAWP: 40 bar, limited by: DESIGN (user specified)

Elements Suitable for Design Internal Pressure.

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Internal Pressure Calculation Results:

ASME Code, Section VIII Division 2 Class 2, 2021



Internal Pressure Results for: Head 1

Elliptical Head Design Information:			
Design Pressure P	40.000 bar	Int. Design Temperature	80 °C
Material	SA-516 60	Ext. Design Temperature	80 °C
Length	50.000 mm	External Pressure Chart	CS-2
		UNS Number	K02100
Int. Corr. All. c	0.0000 mm	Allowable Stress (ope) S	136.3 N/mm²
Ext. Corr. All. ce	0.0000 mm	Allowable Stress (amb) Sa	147.0 N/mm²
Inside Diameter Di	2800.000 mm	Actual Stress	127.0 N/mm²
Spec. Min. Thk t or e	40.0000 mm	Spec. Nominal Thk.	45.000 mm
Surface Area	9507514.0 mm^2	SG of Contents	0.000
Element Volume	3.1 m³	Weight of Contents	0.0 N
Empty Weight	65523.3 N	Operating Weight	65523.3 N
		Comp. All. Ope. Stress	114.4 N/mm²
		Aspect Ratio	2.00

Radiography Information:			
User Defined		User Defined	
Circ. Joint Efficiency	100 %	Long. Joint Efficiency E	100 %

Tolerance for Formed Heads per 4.3.2.2:

```
Head inner surface maximum deviation outside the specified shape,  1.25% of D: 35.000 mm
Head inner surface maximum deviation inside the specified shape,  0.625% of D: 17.500 mm
```

Head Calculation - Section 4.3.6 (and Section 4.3.7 for Ellipsoidal Head)

Computed Minimum Required Thickness [t]:
tr = 37.3 mm

```
t  = tr + ci + co
   = 37.3 + 0 + 0
   = 37.3 mm - see below for the derivation
```

For Elliptical heads: Compute [h, k, r,] per 4.3.7.1

```
h = D/(2 * Aspect Ratio)
  = 2800/(2 * 2 )
  = 700.000 mm

k = D/(2 * h)
  = 2800/(2 * 700 )
  = 2.000

r = D( 0.5/k - 0.08 ) + ca
  = 2800 ( 0.5/2 - 0.08 ) + 0
  = 476.000 mm
```

```
  L = D(0.44 * k + 0.02 ) + ca
    = 2800 (0.44 *2 + 0.02) + 0
    = 2520.000 mm

Step 3: Geometric Constants [BetaTh, PhiTh, Rth]:
```

Equations 4.3.8 to 4.3.11 as appropriate
t (corroded) and P for the calc.: t = 37.3 mm, P = 40 bar

Angle [BetaTh]:

```
  = acos[(0.5 * D - r)/(L - r)]
  = acos[(0.5 * 2800 - 476 )/(2520 - 476 )]
  = 1.1 radians - Equation 4.3.8

  PhiTh = sqrt( L * t ) / r
        = sqrt( 2520 * 37.3 )/476
        = 0.64 radians - Equation 4.3.9

 PhiTh < BetaTh, Thus:

  Rth = ( 0.5 * D - r ) / cos( BetaTh - PhiTh ) + r
      = ( 0.5 * 2800 - 476 )/cos( 1.1 - 0.64 ) + 476
      = 1506 mm - Equation 4.3.10
```

Step 4: Coefficients: Equations 4.3.12 to 4.3.15 [C1 and C2]:

```
  r/D > 0.08, Thus:
  C1 = 0.692( r / D ) + 0.605
     = 0.692( 476/2800 ) + 0.605
     = 0.72 - Equation 4.3.13

  C2 = 1.46 - 2.6( r/D ) = 1.46 - 2.6( 476/2800 )
     = 1.02, Equation 4.3.15
```

Step 5: Pressure to produce knuckle elastic buckling [Peth]:

```
  = C1 * Et * t² / ( C2 * Rth( 0.5 * Rth - r ))
  = 0.72 * 199340 * 37.3²/( 1.02 * 1506 ( 0.5 * 1506 - 476 ))
  = 4707 bar, Equation 4.3.16
```

Step 6: Internal Pressure for max stress in knuckle equals yield [Py]:
C3 = Sy = 205 N/mm², Not in the creep range - 4.3.6.1(f)

```
  Py = C3 * t / ( C2 * Rth( 0.5 * Rth / r - 1 ) )
     = 205 * 37.3/(1.02 * 1506 ( 0.5 * 1506/476 - 1 ))
     = 85.6 bar, Equation 4.3.17
```

Step 7: Value of Internal Press. resulting in buckling of knuckle [G and Pck]:
G = Peth/Py = 4707/85.6 = 55

G > 1, Thus:

Buckling Pressure [Pck]:

```
  = ( ( 0.77508*G - 0.20354*G²  + 0.019274*G³ ) /
    ( 1 + 0.19014*G - 0.089534*G² + 0.0093965*G³ ) )Py
  = ( ( 0.77508*55 -0.20354*55²+0.019274*55³ )/
    ( 1 + 0.19014*55 - 0.089534*55² + 0.0093965*55³ ))*85.6
  = 173 bar, Equation 4.3.19
```

Step 8: Compute Allowable Pressure base on buckling of knuckle [Pak]:

```
  = Pck/1.5 = 173/1.5 = 115 bar - Equation 4.3.21
```

Step 9: Compute allowable pressure based on rupture of crown [Pac]:

```
  = 2 * S * E / (L / t + 0.5 )
  = 2 * 136 * 1/(2520/37.3 + 0.5 )
```

= 40 bar, Equation 4.3.22

Step 10: Compute final pressure [Pa]:
= min(Pak, Pac) = min(115, 40)
= 40 bar, Equation 4.3.23: (same as original design pressure)

Allowable pressure in Crown at given thickness [Pac]:
= 2 * S * E / (L / t + 0.5)
= 2 * 136 * 1/(2520/40 + 0.5)
= 42.918 bar

Computed Maximum Allowable Pressure [MAWP]:
= MaxPressure - Pliq = 42.9 - 0 = 42.9 bar

Computed Maximum Allowable Pressure New and Cold [MAPnc]:
= 46.3 bar

Computed Membrane Stress Intensity at Design Pressure [Sm]:
= 127.0 N/mm²

Required Thickness of Straight Flange = 41.706 mm

Percent Fiber Elongation per Table 6.1

For Heads formed from Segments	(75*tnom/Rf)*(1-Rf/Ro)	6.770 %
For one Piece doubly Curved Heads	100*ln(Db/(Df-2t))	21.720 %

Where Db is the blank diameter for one piece doubly curved surfaces [Db]:
= square root(4 * Head Surface Area / 3.14159)
= square root(4 * 9507514/3.14159)
= 3479.273 mm

MDMT Calculations in the Knuckle Portion:

Note: This Element/Detail was specified as being Impact Tested.

MDMT Calculations in the Head Straight Flange:

Note: This Element/Detail was specified as being Impact Tested.

Note:
Post Weld Heat Treatment is required for this Element/Joint and it was specified as being heat treated.

Tolerance for Formed Heads per 4.3.2.2:

Head inner surface maximum deviation outside the specified shape,	1.25% of D:	35.000 mm
Head inner surface maximum deviation inside the specified shape,	0.625% of D:	17.500 mm

External Pressure Results for: Head 1

Elliptical Head From 10 to 20 Ext. Chart: CS-2 at 80 ◦C

Maximum External Pressure per ASME Division 2 Section 4.4:

Elastic Hoop Compressive Membrane Failure Stress [Fhe]:
= 0.075 * Ey(t / Ro)
= 0.075 * 199340 (40/2524)
= 236.906 N/mm²

Ratio of Elastic Hoop Compressive Membrane Failure Stress to Yield [Fr]:
= Fhe / Sy

= 236.9 / 205.0
= 1.156

Engineering Yield to Tensile Stress ratio [R]:
= sigma_ys / sigma_uts
= 205/414
= 0.496

Ratio [AE]:
= Fhe / E
= 237/199340
= 0.001188

Factor [m1]:
= (ln(r) + (eps_p - eps_ys)) / ln(ln(1 + eps_p)/ ln(1 + eps_ys))
= (ln(0.5) + (0.20000E-04 - 0.002))/ln(ln(1 + 0.20000E-04)/ln(1 + 0.002))
= 0.153

Curve Fitting Constant for the Elastic Region of the Stress-Strain Curve [A1]:
= sigma_ys(1 + eps_ys) / ln(1 + eps_ys)^{m1}
= 205 (1 + 0.0020)/ln(1 + 0.0020)$^{0.15293092}$
= 531.422 N/mm²

Curve Fitting Exponent for, Ferritic Steel [m2]:
= m2f(m2f2 - R)
= 0.6 (1 - 0.5)
= 0.303

Curve Fitting Constant [A2]:
= (sigma_uts * exp(m2)) / (m2 ^{m2})
= (414 * exp(0.3))/(0.3 $^{0.3}$)
= 803.964 N/mm²

Material Parameter for Stress-Strain Curve Model [K]:
= 1.5 * R$^{1.5}$ - 0.5 * R$^{2.5}$ - R$^{3.5}$
= 1.5 * 0.5$^{1.5}$ - 0.5 * 0.5$^{2.5}$ - 0.5$^{3.5}$
= 0.351

Compute the Allowable Stress per 4.4.3

	Fic	H	D1	D2	D3	D4	Tangent Modulus	Iteration Diff
1	206	-1.949	0.228E-06	0.204E-06	0.621E-06	-0.514E-06	0.120E+05	0.160E-01
2	103	-4.772	0.490E-08	0.490E-08	0.126E-06	-0.126E-06	0.155E+06	0.522E-03
3	155	-3.361	0.463E-07	0.461E-07	0.320E-06	-0.317E-06	0.532E+05	0.173E-02
4	129	-4.066	0.169E-07	0.169E-07	0.210E-06	-0.210E-06	0.100E+06	0.997E-04
5	116	-4.419	0.941E-08	0.941E-08	0.165E-06	-0.165E-06	0.129E+06	0.285E-03
6	122	-4.243	0.127E-07	0.127E-07	0.187E-06	-0.187E-06	0.115E+06	0.116E-03
7	126	-4.155	0.147E-07	0.147E-07	0.198E-06	-0.198E-06	0.107E+06	0.147E-04
8	127	-4.110	0.157E-07	0.157E-07	0.204E-06	-0.204E-06	0.104E+06	0.408E-04
9	126	-4.132	0.152E-07	0.152E-07	0.201E-06	-0.201E-06	0.106E+06	0.126E-04
10	126	-4.144	0.149E-07	0.149E-07	0.200E-06	-0.200E-06	0.107E+06	0.111E-05
11	126	-4.138	0.151E-07	0.150E-07	0.201E-06	-0.200E-06	0.106E+06	0.575E-05
12	126	-4.141	0.150E-07	0.150E-07	0.200E-06	-0.200E-06	0.106E+06	0.231E-05
13	126	-4.142	0.150E-07	0.149E-07	0.200E-06	-0.200E-06	0.106E+06	0.602E-06
14	126	-4.143	0.149E-07	0.149E-07	0.200E-06	-0.200E-06	0.106E+06	0.253E-06
15	126	-4.142	0.150E-07	0.149E-07	0.200E-06	-0.200E-06	0.106E+06	0.174E-06
16	126	-4.143	0.149E-07	0.149E-07	0.200E-06	-0.200E-06	0.106E+06	0.392E-07

Factor of Safety [FS]:
Since Fic > 0.55 Fy and Fic < Fy
= 2.407 - 0.741 * Fic / Fy

```
= 2.407 - 0.741 * 126/205
= 1.950
```

Allowable Circumferential Compressive Stress [Fha]:

```
= Fic/FS
= 126/1.95
= 64.871 N/mm²
```

Allowable External Pressure at the given Thickness [Pa]:

```
= 2 * Fha[t/Ro]
= 2 * 64.9 [40/2524 ]
= 20.556 bar
```

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Internal Pressure Calculation Results:

ASME Code, Section VIII Division 2 Class 2, 2021



Internal Pressure Results for: Shell#1

Cylindrical Shell Design Information:			
Design Pressure P	40.000 bar	Int. Design Temperature	80 °C
Material	SA-516 60	Ext. Design Temperature	80 °C
Length	2750.000 mm	External Pressure Chart	CS-2
		UNS Number	K02100
Int. Corr. All. c	0.0000 mm	Allowable Stress (ope) S	136.3 N/mm²
Ext. Corr. All. ce	0.0000 mm	Allowable Stress (amb) Sa	147.0 N/mm²
Inside Diameter Di	2800.000 mm	Actual Stress	127.3 N/mm²
Spec. Min. Thk t or e	44.0000 mm	Spec. Nominal Thk.	44.000 mm
Surface Area	24950532.0 mm^2	SG of Contents	0.000
Element Volume	16.5 m³	Weight of Contents	0.0 N
Empty Weight	65523.3 N	Operating Weight	65523.3 N
		Comp. All. Ope. Stress	115.8 N/mm²

Radiography Information:			
User Defined Circ. Joint Efficiency	100 %	User Defined Long. Joint Efficiency E	100 %

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:
= 0.5*D*(exp(P/(S*E))-1)+ci+co
= 0.5*2800 *(exp(40/(136 *1))-1) + 0 + 0
= 41.7 + 0 + 0 = 41.7 mm Equation 4.3.1

Computed Maximum Allowable Working Pressure [MAWP]:
= S * E * Ln((2*t + D) / D) - Pliq
= 136 * 1 * Ln((2*44 + 2800)/2800) - 0
= 42.2 - 0 = 42.2 bar

Computed Maximum Allowable Pressure New & Cold [MAPnc]:
= S * E * Ln((2*t + D) / D)
= 147 * 1 * Ln((2*44 + 2800)/2800)
= 45.5 bar

Computed Stress Intensity at Design Pressure [Si]:
= P * D / (E(Do - D))
= 40 * 2800/(1 (2888 - 2800))
= 127.2911 N/mm²

Computed Membrane Stress at Design Pressure [Sm]:
= P / (E * Ln((2*t + D) / D))
= 40/(1 * Ln((2*44 + 2800)/2800))
= 129.2811 N/mm²

Percent Fiber Elongation per Table 6.1

```
Cylinders formed from Plate     (50*tnom/Rf)*(1-Rf/Ro)      1.547 %
```

Minimum Design Metal Temperature Results:

Note: This Element/Detail was specified as being Impact Tested.

Note:
Post Weld Heat Treatment is required for this Element/Joint and it was specified as being heat treated.

External Pressure Results for: Shell#1

Cylindrical Shell From 20 to 30 Ext. Chart: CS-2 at 80 °C

Maximum External Pressure per ASME Division 2 Section 4.4:

Determine Parameter [Mx]:
```
= L / sqrt( Ro * t )
= 16067/sqrt( 1444 * 44 )
= 63.741
```

Compute the Factor [Ch]:
Since Mx > 13 and Mx < 2 * $(Do/t)^{0.94}$, Ch = 1.12 * $Mx^{-1.058}$
```
= 1.12 * 63.7^-1.058
= 0.0138
```

Elastic Hoop Compressive Membrane Failure Stress [Fhe]:
```
= 1.6 * Ch * Ey( t / Do )
= 1.6 * 0.014 * 199340 ( 44/2888 )
= 67.099 N/mm²
```

Ratio of Elastic Hoop Compressive Membrane Failure Stress to Yield [Fr]:
```
= Fhe / Fy
= 67.1/205.0
= 0.327
```

Predicted Buckling Stress [Fic]:

Engineering Yield to Tensile Stress ratio [R]:
```
= sigma_ys / sigma_uts
= 205/414
= 0.496
```

Ratio [AE]:
```
= Fhe / E
= 67.1/199340
= 0.000337
```

Factor [m1]:
```
= ( ln( r ) + ( eps_p - eps_ys )) / ln( ln( 1 + eps_p )/ ln( 1 + eps_ys ))
= ( ln( 0.5 ) + ( 0.20000E-04 - 0.002 ))/ln( ln( 1 + 0.20000E-04 )/ln( 1 + 0.002 ))
= 0.153
```

Curve Fitting Constant for the Elastic Region of the Stress-Strain Curve [A1]:
```
= sigma_ys( 1 + eps_ys ) / ln( 1 + eps_ys )^m1
= 205 ( 1 + 0.0020 )/ln( 1 + 0.0020 )^0.15293092
= 531.422 N/mm²
```

Curve Fitting Exponent for, Ferritic Steel [m2]:

= m2f(m2f2 - R)
= 0.6 (1 - 0.5)
= 0.303

Curve Fitting Constant [A2]:
= (sigma_uts * exp(m2)) / ($m2^{m2}$)
= (414 * exp(0.3))/($0.3^{0.3}$)
= 803.964 N/mm²

Material Parameter for Stress-Strain Curve Model [K]:
= 1.5 * $R^{1.5}$ - 0.5 * $R^{2.5}$ - $R^{3.5}$
= 1.5 * $0.5^{1.5}$ - 0.5 * $0.5^{2.5}$ - $0.5^{3.5}$
= 0.351

Compute the Allowable Stress per 4.4.3

	Fic	H	D1	D2	D3	D4	Tangent Modulus	Iteration Diff
1	206	-1.949	0.228E-06	0.204E-06	0.621E-06	-0.514E-06	0.120E+05	0.169E-01
2	103	-4.772	0.490E-08	0.490E-08	0.126E-06	-0.126E-06	0.155E+06	0.330E-03
3	51	-6.183	0.105E-09	0.105E-09	0.255E-07	-0.255E-07	0.198E+06	0.756E-04
4	77	-5.478	0.996E-09	0.996E-09	0.648E-07	-0.648E-07	0.188E+06	0.750E-04
5	64	-5.830	0.363E-09	0.363E-09	0.426E-07	-0.426E-07	0.195E+06	0.551E-05
6	71	-5.654	0.615E-09	0.615E-09	0.530E-07	-0.530E-07	0.192E+06	0.328E-04
7	67	-5.742	0.476E-09	0.476E-09	0.477E-07	-0.477E-07	0.194E+06	0.133E-04
8	66	-5.786	0.416E-09	0.416E-09	0.451E-07	-0.451E-07	0.195E+06	0.379E-05
9	65	-5.808	0.389E-09	0.389E-09	0.438E-07	-0.438E-07	0.195E+06	0.883E-06
10	65	-5.797	0.402E-09	0.402E-09	0.445E-07	-0.444E-07	0.195E+06	0.145E-05
11	65	-5.803	0.395E-09	0.395E-09	0.441E-07	-0.441E-07	0.195E+06	0.281E-06
12	65	-5.806	0.392E-09	0.392E-09	0.440E-07	-0.440E-07	0.195E+06	0.301E-06
13	65	-5.804	0.394E-09	0.394E-09	0.441E-07	-0.441E-07	0.195E+06	0.101E-07

Factor of Safety [FS]:
Since Fic [65.6] < 0.55 * 205, FS = 2

Allowable Circumferential Compressive Stress [Fha]:
= Fic/FS
= 65.6/2
= 32.800 N/mm²

Allowable External Pressure at the given Thickness [Pa]:
= 2 * Fha(t / Do)
= 2 * 328 (44/2888)
= 9.993 bar

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Internal Pressure Calculation Results:

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Internal Pressure Results for: Shell#2

Cylindrical Shell Design Information:			
Design Pressure P	40.000 bar	Int. Design Temperature	80 °C
Material	SA-516 60	Ext. Design Temperature	80 °C
Length	3350.000 mm	External Pressure Chart	CS-2
		UNS Number	K02100
Int. Corr. All. c	0.0000 mm	Allowable Stress (ope) S	136.3 N/mm²
Ext. Corr. All. ce	0.0000 mm	Allowable Stress (amb) Sa	147.0 N/mm²
Inside Diameter Di	2800.000 mm	Actual Stress	127.3 N/mm²
Spec. Min. Thk t or e	44.0000 mm	Spec. Nominal Thk.	44.000 mm
Surface Area	30394282.0 mm^2	SG of Contents	0.000
Element Volume	20.1 m³	Weight of Contents	0.0 N
Empty Weight	65523.3 N	Operating Weight	65523.3 N
		Comp. All. Ope. Stress	115.8 N/mm²

Radiography Information:			
User Defined Circ. Joint Efficiency	100 %	User Defined Long. Joint Efficiency E	100 %

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:
= 0.5*D*(exp(P/(S*E))-1)+ci+co
= 0.5*2800 *(exp(40/(136 *1))-1) + 0 + 0
= 41.7 + 0 + 0 = 41.7 mm Equation 4.3.1

Computed Maximum Allowable Working Pressure [MAWP]:
= S * E * Ln((2*t + D) / D) - Pliq
= 136 * 1 * Ln((2*44 + 2800)/2800) - 0
= 42.2 - 0 = 42.2 bar

Computed Maximum Allowable Pressure New & Cold [MAPnc]:
= S * E * Ln((2*t + D) / D)
= 147 * 1 * Ln((2*44 + 2800)/2800)
= 45.5 bar

Computed Stress Intensity at Design Pressure [Si]:
= P * D / (E(Do - D))
= 40 * 2800/(1 (2888 - 2800))
= 127.2911 N/mm²

Computed Membrane Stress at Design Pressure [Sm]:
= P / (E * Ln((2*t + D) / D))
= 40/(1 * Ln((2*44 + 2800)/2800))
= 129.2811 N/mm²

Percent Fiber Elongation per Table 6.1

```
Cylinders formed from Plate     (50*tnom/Rf)*(1-Rf/Ro)      1.547 %
```

Minimum Design Metal Temperature Results:

Note: This Element/Detail was specified as being Impact Tested.

```
Note:
```
Post Weld Heat Treatment is required for this Element/Joint and it was specified as being heat treated.

External Pressure Results for: Shell#2

Cylindrical Shell From 30 to 40 Ext. Chart: CS-2 at 80 °C

Maximum External Pressure per ASME Division 2 Section 4.4:

Determine Parameter [Mx]:

```
  = L / sqrt( Ro * t )
  = 16067/sqrt( 1444 * 44 )
  = 63.741
```

Compute the Factor [Ch]:

Since Mx > 13 and Mx < 2 * $(Do/t)^{0.94}$, Ch = 1.12 * $Mx^{-1.058}$

```
  = 1.12 * 63.7^-1.058
  = 0.0138
```

Elastic Hoop Compressive Membrane Failure Stress [Fhe]:

```
  = 1.6 * Ch * Ey( t / Do )
  = 1.6 * 0.014 * 199340 ( 44/2888 )
  = 67.099 N/mm²
```

Ratio of Elastic Hoop Compressive Membrane Failure Stress to Yield [Fr]:

```
  = Fhe / Fy
  = 67.1/205.0
  = 0.327
```

Predicted Buckling Stress [Fic]:

Engineering Yield to Tensile Stress ratio [R]:

```
  = sigma_ys / sigma_uts
  = 205/414
  = 0.496
```

Ratio [AE]:

```
  = Fhe / E
  = 67.1/199340
  = 0.000337
```

Factor [m1]:

```
  = ( ln( r ) + ( eps_p - eps_ys )) / ln( ln( 1 + eps_p )/ ln( 1 + eps_ys ))
  = ( ln( 0.5 ) + ( 0.20000E-04 - 0.002 ))/ln( ln( 1 + 0.20000E-04 )/ln( 1 + 0.002 ))
  = 0.153
```

Curve Fitting Constant for the Elastic Region of the Stress-Strain Curve [A1]:

```
  = sigma_ys( 1 + eps_ys ) / ln( 1 + eps_ys )^m1
  = 205 ( 1 + 0.0020 )/ln( 1 + 0.0020 )^0.15293092
  = 531.422 N/mm²
```

Curve Fitting Exponent for, Ferritic Steel [m2]:

= m2f(m2f2 - R)
= 0.6 (1 - 0.5)
= 0.303

Curve Fitting Constant [A2]:
= (sigma_uts * exp(m2)) / ($m2^{m2}$)
= (414 * exp(0.3))/($0.3^{0.3}$)
= 803.964 N/mm²

Material Parameter for Stress-Strain Curve Model [K]:
= 1.5 * $R^{1.5}$ - 0.5 * $R^{2.5}$ - $R^{3.5}$
= 1.5 * $0.5^{1.5}$ - 0.5 * $0.5^{2.5}$ - $0.5^{3.5}$
= 0.351

Compute the Allowable Stress per 4.4.3

	Fic	H	D1	D2	D3	D4	Tangent Modulus	Iteration Diff
1	206	-1.949	0.228E-06	0.204E-06	0.621E-06	-0.514E-06	0.120E+05	0.169E-01
2	103	-4.772	0.490E-08	0.490E-08	0.126E-06	-0.126E-06	0.155E+06	0.330E-03
3	51	-6.183	0.105E-09	0.105E-09	0.255E-07	-0.255E-07	0.198E+06	0.756E-04
4	77	-5.478	0.996E-09	0.996E-09	0.648E-07	-0.648E-07	0.188E+06	0.750E-04
5	64	-5.830	0.363E-09	0.363E-09	0.426E-07	-0.426E-07	0.195E+06	0.551E-05
6	71	-5.654	0.615E-09	0.615E-09	0.530E-07	-0.530E-07	0.192E+06	0.328E-04
7	67	-5.742	0.476E-09	0.476E-09	0.477E-07	-0.477E-07	0.194E+06	0.133E-04
8	66	-5.786	0.416E-09	0.416E-09	0.451E-07	-0.451E-07	0.195E+06	0.379E-05
9	65	-5.808	0.389E-09	0.389E-09	0.438E-07	-0.438E-07	0.195E+06	0.883E-06
10	65	-5.797	0.402E-09	0.402E-09	0.445E-07	-0.444E-07	0.195E+06	0.145E-05
11	65	-5.803	0.395E-09	0.395E-09	0.441E-07	-0.441E-07	0.195E+06	0.281E-06
12	65	-5.806	0.392E-09	0.392E-09	0.440E-07	-0.440E-07	0.195E+06	0.301E-06
13	65	-5.804	0.394E-09	0.394E-09	0.441E-07	-0.441E-07	0.195E+06	0.101E-07

Factor of Safety [FS]:
Since Fic [65.6] < 0.55 * 205, FS = 2

Allowable Circumferential Compressive Stress [Fha]:
= Fic/FS
= 65.6/2
= 32.800 N/mm²

Allowable External Pressure at the given Thickness [Pa]:
= 2 * Fha(t / Do)
= 2 * 328 (44/2888)
= 9.993 bar

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Internal Pressure Calculation Results:

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Internal Pressure Results for: Shell#3

Cylindrical Shell Design Information:			
Design Pressure P	40.000 bar	Int. Design Temperature	80 °C
Material	SA-516 60	Ext. Design Temperature	80 °C
Length	3300.000 mm	External Pressure Chart	CS-2
		UNS Number	K02100
Int. Corr. All. c	0.0000 mm	Allowable Stress (ope) S	136.3 N/mm²
Ext. Corr. All. ce	0.0000 mm	Allowable Stress (amb) Sa	147.0 N/mm²
Inside Diameter Di	2800.000 mm	Actual Stress	127.3 N/mm²
Spec. Min. Thk t or e	44.0000 mm	Spec. Nominal Thk.	44.000 mm
Surface Area	29940634.0 mm^2	SG of Contents	0.000
Element Volume	19.8 m³	Weight of Contents	0.0 N
Empty Weight	65523.3 N	Operating Weight	65523.3 N
		Comp. All. Ope. Stress	115.8 N/mm²

Radiography Information:			
User Defined Circ. Joint Efficiency	100 %	User Defined Long. Joint Efficiency E	100 %

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:
= 0.5*D*(exp(P/(S*E))-1)+ci+co
= 0.5*2800 *(exp(40/(136 *1))-1) + 0 + 0
= 41.7 + 0 + 0 = 41.7 mm Equation 4.3.1

Computed Maximum Allowable Working Pressure [MAWP]:
= S * E * Ln((2*t + D) / D) - Pliq
= 136 * 1 * Ln((2*44 + 2800)/2800) - 0
= 42.2 - 0 = 42.2 bar

Computed Maximum Allowable Pressure New & Cold [MAPnc]:
= S * E * Ln((2*t + D) / D)
= 147 * 1 * Ln((2*44 + 2800)/2800)
= 45.5 bar

Computed Stress Intensity at Design Pressure [Si]:
= P * D / (E(Do - D))
= 40 * 2800/(1 (2888 - 2800))
= 127.2911 N/mm²

Computed Membrane Stress at Design Pressure [Sm]:
= P / (E * Ln((2*t + D) / D))
= 40/(1 * Ln((2*44 + 2800)/2800))
= 129.2811 N/mm²

Percent Fiber Elongation per Table 6.1

```
Cylinders formed from Plate     (50*tnom/Rf)*(1-Rf/Ro)      1.547 %
```

Minimum Design Metal Temperature Results:

Note: This Element/Detail was specified as being Impact Tested.

```
Note:
```
Post Weld Heat Treatment is required for this Element/Joint and it was specified as being heat treated.

External Pressure Results for: Shell#3

Cylindrical Shell From 40 to 50 Ext. Chart: CS-2 at 80 °C

Maximum External Pressure per ASME Division 2 Section 4.4:

Determine Parameter [Mx]:

```
  = L / sqrt( Ro * t )
  = 16067/sqrt( 1444 * 44 )
  = 63.741
```

Compute the Factor [Ch]:

Since Mx > 13 and Mx < 2 * $(Do/t)^{0.94}$, Ch = 1.12 * $Mx^{-1.058}$

```
  = 1.12 * 63.7^-1.058
  = 0.0138
```

Elastic Hoop Compressive Membrane Failure Stress [Fhe]:

```
  = 1.6 * Ch * Ey( t / Do )
  = 1.6 * 0.014 * 199340 ( 44/2888 )
  = 67.099 N/mm²
```

Ratio of Elastic Hoop Compressive Membrane Failure Stress to Yield [Fr]:

```
  = Fhe / Fy
  = 67.1/205.0
  = 0.327
```

Predicted Buckling Stress [Fic]:

Engineering Yield to Tensile Stress ratio [R]:

```
  = sigma_ys / sigma_uts
  = 205/414
  = 0.496
```

Ratio [AE]:

```
  = Fhe / E
  = 67.1/199340
  = 0.000337
```

Factor [m1]:

```
  = ( ln( r ) + ( eps_p - eps_ys )) / ln( ln( 1 + eps_p )/ ln( 1 + eps_ys ))
  = ( ln( 0.5 ) + ( 0.20000E-04 - 0.002 ))/ln( ln( 1 + 0.20000E-04 )/ln( 1 + 0.002 ))
  = 0.153
```

Curve Fitting Constant for the Elastic Region of the Stress-Strain Curve [A1]:

```
  = sigma_ys( 1 + eps_ys ) / ln( 1 + eps_ys )^m1
  = 205 ( 1 + 0.0020 )/ln( 1 + 0.0020 )^0.15293092
  = 531.422 N/mm²
```

Curve Fitting Exponent for, Ferritic Steel [m2]:

= m2f(m2f2 - R)
= 0.6 (1 - 0.5)
= 0.303

Curve Fitting Constant [A2]:
= (sigma_uts * exp(m2)) / ($m2^{m2}$)
= (414 * exp(0.3))/($0.3^{0.3}$)
= 803.964 N/mm²

Material Parameter for Stress-Strain Curve Model [K]:
= 1.5 * $R^{1.5}$ - 0.5 * $R^{2.5}$ - $R^{3.5}$
= 1.5 * $0.5^{1.5}$ - 0.5 * $0.5^{2.5}$ - $0.5^{3.5}$
= 0.351

Compute the Allowable Stress per 4.4.3

	Fic	H	D1	D2	D3	D4	Tangent Modulus	Iteration Diff
1	206	-1.949	0.228E-06	0.204E-06	0.621E-06	-0.514E-06	0.120E+05	0.169E-01
2	103	-4.772	0.490E-08	0.490E-08	0.126E-06	-0.126E-06	0.155E+06	0.330E-03
3	51	-6.183	0.105E-09	0.105E-09	0.255E-07	-0.255E-07	0.198E+06	0.756E-04
4	77	-5.478	0.996E-09	0.996E-09	0.648E-07	-0.648E-07	0.188E+06	0.750E-04
5	64	-5.830	0.363E-09	0.363E-09	0.426E-07	-0.426E-07	0.195E+06	0.551E-05
6	71	-5.654	0.615E-09	0.615E-09	0.530E-07	-0.530E-07	0.192E+06	0.328E-04
7	67	-5.742	0.476E-09	0.476E-09	0.477E-07	-0.477E-07	0.194E+06	0.133E-04
8	66	-5.786	0.416E-09	0.416E-09	0.451E-07	-0.451E-07	0.195E+06	0.379E-05
9	65	-5.808	0.389E-09	0.389E-09	0.438E-07	-0.438E-07	0.195E+06	0.883E-06
10	65	-5.797	0.402E-09	0.402E-09	0.445E-07	-0.444E-07	0.195E+06	0.145E-05
11	65	-5.803	0.395E-09	0.395E-09	0.441E-07	-0.441E-07	0.195E+06	0.281E-06
12	65	-5.806	0.392E-09	0.392E-09	0.440E-07	-0.440E-07	0.195E+06	0.301E-06
13	65	-5.804	0.394E-09	0.394E-09	0.441E-07	-0.441E-07	0.195E+06	0.101E-07

Factor of Safety [FS]:
Since Fic [65.6] < 0.55 * 205, FS = 2

Allowable Circumferential Compressive Stress [Fha]:
= Fic/FS
= 65.6/2
= 32.800 N/mm²

Allowable External Pressure at the given Thickness [Pa]:
= 2 * Fha(t / Do)
= 2 * 328 (44/2888)
= 9.993 bar

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Internal Pressure Calculation Results:

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Internal Pressure Results for: Shell#4

Cylindrical Shell Design Information:			
Design Pressure P	40.000 bar	Int. Design Temperature	80 °C
Material	SA-516 60	Ext. Design Temperature	80 °C
Length	3350.000 mm	External Pressure Chart	CS-2
		UNS Number	K02100
Int. Corr. All. c	0.0000 mm	Allowable Stress (ope) S	136.3 N/mm²
Ext. Corr. All. ce	0.0000 mm	Allowable Stress (amb) Sa	147.0 N/mm²
Inside Diameter Di	2800.000 mm	Actual Stress	127.3 N/mm²
Spec. Min. Thk t or e	44.0000 mm	Spec. Nominal Thk.	44.000 mm
Surface Area	30394282.0 mm^2	SG of Contents	0.000
Element Volume	20.1 m³	Weight of Contents	0.0 N
Empty Weight	65523.3 N	Operating Weight	65523.3 N
		Comp. All. Ope. Stress	115.8 N/mm²

Radiography Information:			
User Defined Circ. Joint Efficiency	100 %	User Defined Long. Joint Efficiency E	100 %

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:
= 0.5*D*(exp(P/(S*E))-1)+ci+co
= 0.5*2800 *(exp(40/(136 *1))-1) + 0 + 0
= 41.7 + 0 + 0 = 41.7 mm Equation 4.3.1

Computed Maximum Allowable Working Pressure [MAWP]:
= S * E * Ln((2*t + D) / D) - Pliq
= 136 * 1 * Ln((2*44 + 2800)/2800) - 0
= 42.2 - 0 = 42.2 bar

Computed Maximum Allowable Pressure New & Cold [MAPnc]:
= S * E * Ln((2*t + D) / D)
= 147 * 1 * Ln((2*44 + 2800)/2800)
= 45.5 bar

Computed Stress Intensity at Design Pressure [Si]:
= P * D / (E(Do - D))
= 40 * 2800/(1 (2888 - 2800))
= 127.2911 N/mm²

Computed Membrane Stress at Design Pressure [Sm]:
= P / (E * Ln((2*t + D) / D))
= 40/(1 * Ln((2*44 + 2800)/2800))
= 129.2811 N/mm²

Percent Fiber Elongation per Table 6.1

```
Cylinders formed from Plate     (50*tnom/Rf)*(1-Rf/Ro)      1.547 %
```

Minimum Design Metal Temperature Results:

Note: This Element/Detail was specified as being Impact Tested.

Note:
Post Weld Heat Treatment is required for this Element/Joint and it was specified as being heat treated.

External Pressure Results for: Shell#4

Cylindrical Shell From 50 to 60 Ext. Chart: CS-2 at 80 °C

Maximum External Pressure per ASME Division 2 Section 4.4:

Determine Parameter [Mx]:
```
= L / sqrt( Ro * t )
= 16067/sqrt( 1444 * 44 )
= 63.741
```

Compute the Factor [Ch]:
Since Mx > 13 and Mx < 2 * $(Do/t)^{0.94}$, Ch = 1.12 * $Mx^{-1.058}$
```
= 1.12 * 63.7^-1.058
= 0.0138
```

Elastic Hoop Compressive Membrane Failure Stress [Fhe]:
```
= 1.6 * Ch * Ey( t / Do )
= 1.6 * 0.014 * 199340 ( 44/2888 )
= 67.099 N/mm²
```

Ratio of Elastic Hoop Compressive Membrane Failure Stress to Yield [Fr]:
```
= Fhe / Fy
= 67.1/205.0
= 0.327
```

Predicted Buckling Stress [Fic]:

Engineering Yield to Tensile Stress ratio [R]:
```
= sigma_ys / sigma_uts
= 205/414
= 0.496
```

Ratio [AE]:
```
= Fhe / E
= 67.1/199340
= 0.000337
```

Factor [m1]:
```
= ( ln( r ) + ( eps_p - eps_ys )) / ln( ln( 1 + eps_p )/ ln( 1 + eps_ys ))
= ( ln( 0.5 ) + ( 0.20000E-04 - 0.002 ))/ln( ln( 1 + 0.20000E-04 )/ln( 1 + 0.002 ))
= 0.153
```

Curve Fitting Constant for the Elastic Region of the Stress-Strain Curve [A1]:
```
= sigma_ys( 1 + eps_ys ) / ln( 1 + eps_ys )^m1
= 205 ( 1 + 0.0020 )/ln( 1 + 0.0020 )^0.15293092
= 531.422 N/mm²
```

Curve Fitting Exponent for, Ferritic Steel [m2]:

= m2f(m2f2 - R)
= 0.6 (1 - 0.5)
= 0.303

Curve Fitting Constant [A2]:
= (sigma_uts * exp(m2)) / ($m2^{m2}$)
= (414 * exp(0.3))/($0.3^{0.3}$)
= 803.964 N/mm²

Material Parameter for Stress-Strain Curve Model [K]:
= 1.5 * $R^{1.5}$ - 0.5 * $R^{2.5}$ - $R^{3.5}$
= 1.5 * $0.5^{1.5}$ - 0.5 * $0.5^{2.5}$ - $0.5^{3.5}$
= 0.351

Compute the Allowable Stress per 4.4.3

	Fic	H	D1	D2	D3	D4	Tangent Modulus	Iteration Diff
1	206	-1.949	0.228E-06	0.204E-06	0.621E-06	-0.514E-06	0.120E+05	0.169E-01
2	103	-4.772	0.490E-08	0.490E-08	0.126E-06	-0.126E-06	0.155E+06	0.330E-03
3	51	-6.183	0.105E-09	0.105E-09	0.255E-07	-0.255E-07	0.198E+06	0.756E-04
4	77	-5.478	0.996E-09	0.996E-09	0.648E-07	-0.648E-07	0.188E+06	0.750E-04
5	64	-5.830	0.363E-09	0.363E-09	0.426E-07	-0.426E-07	0.195E+06	0.551E-05
6	71	-5.654	0.615E-09	0.615E-09	0.530E-07	-0.530E-07	0.192E+06	0.328E-04
7	67	-5.742	0.476E-09	0.476E-09	0.477E-07	-0.477E-07	0.194E+06	0.133E-04
8	66	-5.786	0.416E-09	0.416E-09	0.451E-07	-0.451E-07	0.195E+06	0.379E-05
9	65	-5.808	0.389E-09	0.389E-09	0.438E-07	-0.438E-07	0.195E+06	0.883E-06
10	65	-5.797	0.402E-09	0.402E-09	0.445E-07	-0.444E-07	0.195E+06	0.145E-05
11	65	-5.803	0.395E-09	0.395E-09	0.441E-07	-0.441E-07	0.195E+06	0.281E-06
12	65	-5.806	0.392E-09	0.392E-09	0.440E-07	-0.440E-07	0.195E+06	0.301E-06
13	65	-5.804	0.394E-09	0.394E-09	0.441E-07	-0.441E-07	0.195E+06	0.101E-07

Factor of Safety [FS]:
Since Fic [65.6] < 0.55 * 205, FS = 2

Allowable Circumferential Compressive Stress [Fha]:
= Fic/FS
= 65.6/2
= 32.800 N/mm²

Allowable External Pressure at the given Thickness [Pa]:
= 2 * Fha(t / Do)
= 2 * 328 (44/2888)
= 9.993 bar

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Internal Pressure Calculation Results:

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Internal Pressure Results for: Shell#5

Cylindrical Shell Design Information:			
Design Pressure P	40.000 bar	Int. Design Temperature	80 °C
Material	SA-516 60	Ext. Design Temperature	80 °C
Length	2750.000 mm	External Pressure Chart	CS-2
		UNS Number	K02100
Int. Corr. All. c	0.0000 mm	Allowable Stress (ope) S	136.3 N/mm²
Ext. Corr. All. ce	0.0000 mm	Allowable Stress (amb) Sa	147.0 N/mm²
Inside Diameter Di	2800.000 mm	Actual Stress	127.3 N/mm²
Spec. Min. Thk t or e	44.0000 mm	Spec. Nominal Thk.	44.000 mm
Surface Area	24950532.0 mm^2	SG of Contents	0.000
Element Volume	16.5 m³	Weight of Contents	0.0 N
Empty Weight	65523.3 N	Operating Weight	65523.3 N
		Comp. All. Ope. Stress	115.8 N/mm²

Radiography Information:			
User Defined Circ. Joint Efficiency	100 %	User Defined Long. Joint Efficiency E	100 %

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:
= 0.5*D*(exp(P/(S*E))-1)+ci+co
= 0.5*2800 *(exp(40/(136 *1))-1) + 0 + 0
= 41.7 + 0 + 0 = 41.7 mm Equation 4.3.1

Computed Maximum Allowable Working Pressure [MAWP]:
= S * E * Ln((2*t + D) / D) - Pliq
= 136 * 1 * Ln((2*44 + 2800)/2800) - 0
= 42.2 - 0 = 42.2 bar

Computed Maximum Allowable Pressure New & Cold [MAPnc]:
= S * E * Ln((2*t + D) / D)
= 147 * 1 * Ln((2*44 + 2800)/2800)
= 45.5 bar

Computed Stress Intensity at Design Pressure [Si]:
= P * D / (E(Do - D))
= 40 * 2800/(1 (2888 - 2800))
= 127.2911 N/mm²

Computed Membrane Stress at Design Pressure [Sm]:
= P / (E * Ln((2*t + D) / D))
= 40/(1 * Ln((2*44 + 2800)/2800))
= 129.2811 N/mm²

Percent Fiber Elongation per Table 6.1

```
Cylinders formed from Plate     (50*tnom/Rf)*(1-Rf/Ro)      1.547 %
```

Minimum Design Metal Temperature Results:

Note: This Element/Detail was specified as being Impact Tested.

```
Note:
```
Post Weld Heat Treatment is required for this Element/Joint and it was specified as being heat treated.

External Pressure Results for: Shell#5

Cylindrical Shell From 60 to 70 Ext. Chart: CS-2 at 80 °C

Maximum External Pressure per ASME Division 2 Section 4.4:

Determine Parameter [Mx]:
```
  = L / sqrt( Ro * t )
  = 16067/sqrt( 1444 * 44 )
  = 63.741
```

Compute the Factor [Ch]:
Since Mx > 13 and Mx < 2 * $(Do/t)^{0.94}$, Ch = 1.12 * $Mx^{-1.058}$
```
  = 1.12 * 63.7^-1.058
  = 0.0138
```

Elastic Hoop Compressive Membrane Failure Stress [Fhe]:
```
  = 1.6 * Ch * Ey( t / Do )
  = 1.6 * 0.014 * 199340 ( 44/2888 )
  = 67.099 N/mm²
```

Ratio of Elastic Hoop Compressive Membrane Failure Stress to Yield [Fr]:
```
  = Fhe / Fy
  = 67.1/205.0
  = 0.327
```

Predicted Buckling Stress [Fic]:

Engineering Yield to Tensile Stress ratio [R]:
```
  = sigma_ys / sigma_uts
  = 205/414
  = 0.496
```

Ratio [AE]:
```
  = Fhe / E
  = 67.1/199340
  = 0.000337
```

Factor [m1]:
```
  = ( ln( r ) + ( eps_p - eps_ys )) / ln( ln( 1 + eps_p )/ ln( 1 + eps_ys ))
  = ( ln( 0.5 ) + ( 0.20000E-04 - 0.002 ))/ln( ln( 1 + 0.20000E-04 )/ln( 1 + 0.002 ))
  = 0.153
```

Curve Fitting Constant for the Elastic Region of the Stress-Strain Curve [A1]:
```
  = sigma_ys( 1 + eps_ys ) / ln( 1 + eps_ys )^m1
  = 205 ( 1 + 0.0020 )/ln( 1 + 0.0020 )^0.15293092
  = 531.422 N/mm²
```

Curve Fitting Exponent for, Ferritic Steel [m2]:

= m2f(m2f2 - R)
= 0.6 (1 - 0.5)
= 0.303

Curve Fitting Constant [A2]:
= (sigma_uts * exp(m2)) / ($m2^{m2}$)
= (414 * exp(0.3))/($0.3^{0.3}$)
= 803.964 N/mm²

Material Parameter for Stress-Strain Curve Model [K]:
= $1.5 * R^{1.5} - 0.5 * R^{2.5} - R^{3.5}$
= $1.5 * 0.5^{1.5} - 0.5 * 0.5^{2.5} - 0.5^{3.5}$
= 0.351

Compute the Allowable Stress per 4.4.3

	Fic	H	D1	D2	D3	D4	Tangent Modulus	Iteration Diff
1	206	-1.949	0.228E-06	0.204E-06	0.621E-06	-0.514E-06	0.120E+05	0.169E-01
2	103	-4.772	0.490E-08	0.490E-08	0.126E-06	-0.126E-06	0.155E+06	0.330E-03
3	51	-6.183	0.105E-09	0.105E-09	0.255E-07	-0.255E-07	0.198E+06	0.756E-04
4	77	-5.478	0.996E-09	0.996E-09	0.648E-07	-0.648E-07	0.188E+06	0.750E-04
5	64	-5.830	0.363E-09	0.363E-09	0.426E-07	-0.426E-07	0.195E+06	0.551E-05
6	71	-5.654	0.615E-09	0.615E-09	0.530E-07	-0.530E-07	0.192E+06	0.328E-04
7	67	-5.742	0.476E-09	0.476E-09	0.477E-07	-0.477E-07	0.194E+06	0.133E-04
8	66	-5.786	0.416E-09	0.416E-09	0.451E-07	-0.451E-07	0.195E+06	0.379E-05
9	65	-5.808	0.389E-09	0.389E-09	0.438E-07	-0.438E-07	0.195E+06	0.883E-06
10	65	-5.797	0.402E-09	0.402E-09	0.445E-07	-0.444E-07	0.195E+06	0.145E-05
11	65	-5.803	0.395E-09	0.395E-09	0.441E-07	-0.441E-07	0.195E+06	0.281E-06
12	65	-5.806	0.392E-09	0.392E-09	0.440E-07	-0.440E-07	0.195E+06	0.301E-06
13	65	-5.804	0.394E-09	0.394E-09	0.441E-07	-0.441E-07	0.195E+06	0.101E-07

Factor of Safety [FS]:
Since Fic [65.6] < 0.55 * 205, FS = 2

Allowable Circumferential Compressive Stress [Fha]:
= Fic/FS
= 65.6/2
= 32.800 N/mm²

Allowable External Pressure at the given Thickness [Pa]:
= 2 * Fha(t / Do)
= 2 * 328 (44/2888)
= 9.993 bar

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Internal Pressure Calculation Results:

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Internal Pressure Results for: Head2

Elliptical Head Design Information:			
Design Pressure P	40.000 bar	Int. Design Temperature	80 °C
Material	SA-516 60	Ext. Design Temperature	80 °C
Length	50.000 mm	External Pressure Chart	CS-2
		UNS Number	K02100
Int. Corr. All. c	0.0000 mm	Allowable Stress (ope) S	136.3 N/mm²
Ext. Corr. All. ce	0.0000 mm	Allowable Stress (amb) Sa	147.0 N/mm²
Inside Diameter Di	2800.000 mm	Actual Stress	127.0 N/mm²
Spec. Min. Thk t or e	40.0000 mm	Spec. Nominal Thk.	45.000 mm
Surface Area	9507514.0 mm^2	SG of Contents	0.000
Element Volume	3.1 m³	Weight of Contents	0.0 N
Empty Weight	65523.3 N	Operating Weight	65523.3 N
		Comp. All. Ope. Stress	115.8 N/mm²
		Aspect Ratio	2.00

Radiography Information:			
User Defined		User Defined	
Circ. Joint Efficiency	100 %	Long. Joint Efficiency E	100 %

Tolerance for Formed Heads per 4.3.2.2:

```
Head inner surface maximum deviation outside the specified shape,  1.25% of D: 35.000 mm
Head inner surface maximum deviation inside the specified shape,  0.625% of D: 17.500 mm
```

Head Calculation - Section 4.3.6 (and Section 4.3.7 for Ellipsoidal Head)

Computed Minimum Required Thickness [t]:
tr = 37.3 mm

```
t  = tr + ci + co
   = 37.3 + 0 + 0
   = 37.3 mm - see below for the derivation
```

For Elliptical heads: Compute [h, k, r,] per 4.3.7.1

```
h = D/(2 * Aspect Ratio)
  = 2800/(2 * 2 )
  = 700.000 mm

k = D/(2 * h)
  = 2800/(2 * 700 )
  = 2.000

r = D( 0.5/k - 0.08 ) + ca
  = 2800 ( 0.5/2 - 0.08 ) + 0
  = 476.000 mm
```

```
  L = D(0.44 * k + 0.02 ) + ca
    = 2800 (0.44 *2 + 0.02) + 0
    = 2520.000 mm

Step 3: Geometric Constants [BetaTh, PhiTh, Rth]:
```
Equations 4.3.8 to 4.3.11 as appropriate
t (corroded) and P for the calc.: t = 37.3 mm, P = 40 bar

Angle [BetaTh]:
```
  = acos[(0.5 * D - r)/(L - r)]
  = acos[(0.5 * 2800 - 476 )/(2520 - 476 )]
  = 1.1 radians - Equation 4.3.8

  PhiTh = sqrt( L * t ) / r
        = sqrt( 2520 * 37.3 )/476
        = 0.64 radians - Equation 4.3.9

 PhiTh < BetaTh, Thus:

  Rth = ( 0.5 * D - r ) / cos( BetaTh - PhiTh ) + r
      = ( 0.5 * 2800 - 476 )/cos( 1.1 - 0.64 ) + 476
      = 1506 mm - Equation 4.3.10

Step 4: Coefficients: Equations 4.3.12 to 4.3.15 [C1 and C2]:
  r/D > 0.08, Thus:
  C1 = 0.692( r / D ) + 0.605
     = 0.692( 476/2800 ) + 0.605
     = 0.72 - Equation 4.3.13

  C2 = 1.46 - 2.6( r/D ) = 1.46 - 2.6( 476/2800 )
     = 1.02, Equation 4.3.15

Step 5: Pressure to produce knuckle elastic buckling [Peth]:
  = C1 * Et * t² / ( C2 * Rth( 0.5 * Rth - r ))
  = 0.72 * 199340 * 37.3²/( 1.02 * 1506 ( 0.5 * 1506 - 476 ))
  = 4707 bar, Equation 4.3.16

Step 6: Internal Pressure for max stress in knuckle equals yield [Py]:
```
C3 = Sy = 205 N/mm², Not in the creep range - 4.3.6.1(f)

```
  Py = C3 * t / ( C2 * Rth( 0.5 * Rth / r - 1 ) )
     = 205 * 37.3/(1.02 * 1506 ( 0.5 * 1506/476 - 1 ))
     = 85.6 bar, Equation 4.3.17

Step 7: Value of Internal Press. resulting in buckling of knuckle [G and Pck]:
```
G = Peth/Py = 4707/85.6 = 55

G > 1, Thus:

Buckling Pressure [Pck]:
```
  = ( ( 0.77508*G - 0.20354*G²  + 0.019274*G³ ) /
    ( 1 + 0.19014*G - 0.089534*G² + 0.0093965*G³ ) )Py
  = ( ( 0.77508*55 -0.20354*55²+0.019274*55³ )/
    ( 1 + 0.19014*55 - 0.089534*55² + 0.0093965*55³ ))*85.6
  = 173 bar, Equation 4.3.19

Step 8: Compute Allowable Pressure base on buckling of knuckle [Pak]:
  = Pck/1.5 = 173/1.5 = 115 bar - Equation 4.3.21

Step 9: Compute allowable pressure based on rupture of crown [Pac]:
  = 2 * S * E / (L / t + 0.5 )
  = 2 * 136 * 1/(2520/37.3 + 0.5 )
```

= 40 bar, Equation 4.3.22

Step 10: Compute final pressure [Pa]:
= min(Pak, Pac) = min(115, 40)
= 40 bar, Equation 4.3.23: (same as original design pressure)

Allowable pressure in Crown at given thickness [Pac]:
= 2 * S * E / (L / t + 0.5)
= 2 * 136 * 1/(2520/40 + 0.5)
= 42.918 bar

Computed Maximum Allowable Pressure [MAWP]:
= MaxPressure - Pliq = 42.9 - 0 = 42.9 bar

Computed Maximum Allowable Pressure New and Cold [MAPnc]:
= 46.3 bar

Computed Membrane Stress Intensity at Design Pressure [Sm]:
= 127.0 N/mm²

Required Thickness of Straight Flange = 41.706 mm

Percent Fiber Elongation per Table 6.1

For Heads formed from Segments	(75*tnom/Rf)*(1-Rf/Ro)	6.770 %
For one Piece doubly Curved Heads	100*ln(Db/(Df-2t))	21.720 %

Where Db is the blank diameter for one piece doubly curved surfaces [Db]:
= square root(4 * Head Surface Area / 3.14159)
= square root(4 * 9507514/3.14159)
= 3479.273 mm

MDMT Calculations in the Knuckle Portion:

Note: This Element/Detail was specified as being Impact Tested.

MDMT Calculations in the Head Straight Flange:

Note: This Element/Detail was specified as being Impact Tested.

Note:
Post Weld Heat Treatment is required for this Element/Joint and it was specified as being heat treated.

Tolerance for Formed Heads per 4.3.2.2:

Head inner surface maximum deviation outside the specified shape,	1.25% of D:	35.000 mm
Head inner surface maximum deviation inside the specified shape,	0.625% of D:	17.500 mm

External Pressure Results for: Head2

Elliptical Head From 70 to 80 Ext. Chart: CS-2 at 80 °C

Maximum External Pressure per ASME Division 2 Section 4.4:

Elastic Hoop Compressive Membrane Failure Stress [Fhe]:
= 0.075 * Ey(t / Ro)
= 0.075 * 199340 (40/2524)
= 236.906 N/mm²

Ratio of Elastic Hoop Compressive Membrane Failure Stress to Yield [Fr]:
= Fhe / Sy

= 236.9 / 205.0
= 1.156

Engineering Yield to Tensile Stress ratio [R]:
= sigma_ys / sigma_uts
= 205/414
= 0.496

Ratio [AE]:
= Fhe / E
= 237/199340
= 0.001188

Factor [m1]:
= (ln(r) + (eps_p - eps_ys)) / ln(ln(1 + eps_p)/ ln(1 + eps_ys))
= (ln(0.5) + (0.20000E-04 - 0.002))/ln(ln(1 + 0.20000E-04)/ln(1 + 0.002))
= 0.153

Curve Fitting Constant for the Elastic Region of the Stress-Strain Curve [A1]:
= sigma_ys(1 + eps_ys) / ln(1 + eps_ys)^{m1}
= 205 (1 + 0.0020)/ln(1 + 0.0020)$^{0.15293092}$
= 531.422 N/mm²

Curve Fitting Exponent for, Ferritic Steel [m2]:
= m2f(m2f2 - R)
= 0.6 (1 - 0.5)
= 0.303

Curve Fitting Constant [A2]:
= (sigma_uts * exp(m2)) / (m2 ^{m2})
= (414 * exp(0.3))/(0.3 $^{0.3}$)
= 803.964 N/mm²

Material Parameter for Stress-Strain Curve Model [K]:
= 1.5 * $R^{1.5}$ - 0.5 * $R^{2.5}$ - $R^{3.5}$
= 1.5 * $0.5^{1.5}$ - 0.5 * $0.5^{2.5}$ - $0.5^{3.5}$
= 0.351

Compute the Allowable Stress per 4.4.3

	Fic	H	D1	D2	D3	D4	Tangent Modulus	Iteration Diff
1	206	-1.949	0.228E-06	0.204E-06	0.621E-06	-0.514E-06	0.120E+05	0.160E-01
2	103	-4.772	0.490E-08	0.490E-08	0.126E-06	-0.126E-06	0.155E+06	0.522E-03
3	155	-3.361	0.463E-07	0.461E-07	0.320E-06	-0.317E-06	0.532E+05	0.173E-02
4	129	-4.066	0.169E-07	0.169E-07	0.210E-06	-0.210E-06	0.100E+06	0.997E-04
5	116	-4.419	0.941E-08	0.941E-08	0.165E-06	-0.165E-06	0.129E+06	0.285E-03
6	122	-4.243	0.127E-07	0.127E-07	0.187E-06	-0.187E-06	0.115E+06	0.116E-03
7	126	-4.155	0.147E-07	0.147E-07	0.198E-06	-0.198E-06	0.107E+06	0.147E-04
8	127	-4.110	0.157E-07	0.157E-07	0.204E-06	-0.204E-06	0.104E+06	0.408E-04
9	126	-4.132	0.152E-07	0.152E-07	0.201E-06	-0.201E-06	0.106E+06	0.126E-04
10	126	-4.144	0.149E-07	0.149E-07	0.200E-06	-0.200E-06	0.107E+06	0.111E-05
11	126	-4.138	0.151E-07	0.150E-07	0.201E-06	-0.200E-06	0.106E+06	0.575E-05
12	126	-4.141	0.150E-07	0.150E-07	0.200E-06	-0.200E-06	0.106E+06	0.231E-05
13	126	-4.142	0.150E-07	0.149E-07	0.200E-06	-0.200E-06	0.106E+06	0.602E-06
14	126	-4.143	0.149E-07	0.149E-07	0.200E-06	-0.200E-06	0.106E+06	0.253E-06
15	126	-4.142	0.150E-07	0.149E-07	0.200E-06	-0.200E-06	0.106E+06	0.174E-06
16	126	-4.143	0.149E-07	0.149E-07	0.200E-06	-0.200E-06	0.106E+06	0.392E-07

Factor of Safety [FS]:
Since Fic > 0.55 Fy and Fic < Fy
= 2.407 - 0.741 * Fic / Fy

= 2.407 – 0.741 * 126/205
= 1.950

Allowable Circumferential Compressive Stress [Fha]:
= Fic/FS
= 126/1.95
= 64.871 N/mm²

Allowable External Pressure at the given Thickness [Pa]:
= 2 * Fha[t/Ro]
= 2 * 64.9 [40/2524]
= 20.556 bar

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Hydrostatic Test Pressure Results:

User Defined Hydrostatic Test Pressure at High Point 57.200 bar

Horizontal Test performed per: User Hydro Pressure

Please note that Nozzle, Shell, Head, Flange, etc MAWPs are all considered when determining the hydrotest pressure for those test types that are based on the MAWP of the vessel.

Stresses on Elements due to Test Pressure (N/mm² & bar):

From To	Stress	Allowable	Ratio	Pressure
Head 1	182.5	209.0	0.873	57.47
Shell#1	185.8	209.0	0.889	57.47
Shell#2	185.8	209.0	0.889	57.47
Shell#3	185.8	209.0	0.889	57.47
Shell#4	185.8	209.0	0.889	57.47
Shell#5	185.8	209.0	0.889	57.47
Head2	182.5	209.0	0.873	57.47

Stress ratios for Nozzle and Pad Materials (N/mm²):

Description	Pad/Nozzle	Ambient	Operating	Ratio
N1	Nozzle	165.00	153.86	1.072
M1	Nozzle	165.00	153.86	1.072
N5	Nozzle	165.00	153.86	1.072
2N	Nozzle	165.00	153.86	1.072
K2	Nozzle	165.00	153.86	1.072
K1	Nozzle	165.00	153.86	1.072
4N	Nozzle	165.00	153.86	1.072
3N	Nozzle	165.00	153.86	1.072
M2	Nozzle	165.00	153.86	1.072
Minimum				1.072

Stress ratios for Pressurized Vessel Elements (N/mm²):

Description	Ambient	Operating	Ratio
Head 1	147.00	136.28	1.079
Shell#1	147.00	136.28	1.079
Shell#2	147.00	136.28	1.079
Shell#3	147.00	136.28	1.079
Shell#4	147.00	136.28	1.079
Shell#5	147.00	136.28	1.079
Head2	147.00	136.28	1.079
Minimum			1.079

Hoop Stress in Nozzle Wall during Pressure Test (N/mm²):

Description	Ambient	Operating	Ratio
M1	40.85	237.50	0.172
1N	7.62	237.50	0.032
5N	7.62	237.50	0.032
3N	7.62	237.50	0.032

2N	7.62	237.50	0.032
K2	7.62	237.50	0.032
K1	7.62	237.50	0.032
4N	15.85	237.50	0.067
M2	40.85	237.50	0.172

Elements Suitable for Test Pressure.

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External Pressure Results Summary:

External Pressure Calculation Results:

ASME Code, Section VIII Division 2 Class 2, 2021

External Pressure Calculations:

From	To	Section Length mm	Outside Diameter mm	Corroded Thickness mm	Factor A	Factor B N/mm²
10	20	No Calc	2880	40	No Calc	No Calc
20	30	16066.7	2888	44	No Calc	No Calc
30	40	16066.7	2888	44	No Calc	No Calc
40	50	16066.7	2888	44	No Calc	No Calc
50	60	16066.7	2888	44	No Calc	No Calc
60	70	16066.7	2888	44	No Calc	No Calc
70	80	No Calc	2880	40	No Calc	No Calc

External Pressure Calculations:

From	To	External Actual T. mm	External Required T. mm	External Design Pressure bar	External M.A.W.P. bar
10	20	40	6.63016	1.03	20.6
20	30	44	17.7521	1.03	9.99
30	40	44	17.7521	1.03	9.99
40	50	44	17.7521	1.03	9.99
50	60	44	17.7521	1.03	9.99
60	70	44	17.7521	1.03	9.99
70	80	40	6.63016	1.03	20.6
Minimum					9.99

External Pressure Calculations:

From	To	Actual Length Bet. Stiffeners mm	Allowable Length Bet. Stiffeners mm	Ring Inertia Required mm^4	Ring Inertia Available mm^4
10	20	No Calc	No Calc	No Calc	No Calc
20	30	16066.7	25399974	No Calc	No Calc
30	40	16066.7	25399974	No Calc	No Calc
40	50	16066.7	25399974	No Calc	No Calc
50	60	16066.7	25399974	No Calc	No Calc
60	70	16066.7	25399974	No Calc	No Calc
70	80	No Calc	No Calc	No Calc	No Calc

Elements Suitable for External Pressure.

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Element and Detail Weights:

From	To	Element Metal Wgt. kg	Element ID Volume m³	Corroded Metal Wgt. kg	Corroded ID Volume m³	Extra due Misc % kg
10	20	3534.55	3.10624	3534.55	3.10624	...
20	30	8379.07	16.5332	8379.07	16.5332	...
30	40	10207.2	20.1405	10207.2	20.1405	...
40	50	10054.9	19.8399	10054.9	19.8399	...
50	60	10207.2	20.1405	10207.2	20.1405	...
60	70	8379.07	16.5332	8379.07	16.5332	...
70	80	3534.55	3.10624	3534.55	3.10624	...
Total		54296	99.40	54296	99.40	0

Weight of Details:

From	Type	Weight of Detail kg	X Offset, Dtl. Cent. mm	Y Offset, Dtl. Cent. mm	Z Offset Dtl. Cent. mm	Description
10	Nozl	946.614	-700	...	...	M1
20	Nozl	15.7293	700	-1412.7	...	1N
20	Nozl	15.7691	400	-1412.7	...	5N
20	Nozl	5.5955	1000	-1412.7	...	3N
30	Sadl	718.225	450	1530.5	...	Saddle Left
30	Wght	150	450	...	...	LIFTING LUG1
30	Clip	50.2318	450	26.5165	26.5165	Lifting Lugs
40	Wght	500	1650	...	...	MISC
40	Wght	260	1650	...	...	H2 WEIGHT
50	Sadl	718.225	2800	1530.5	...	Saddle Right
50	Wght	200	2800	...	...	LIFTING LUG2
60	Nozl	7.92543	2300	1412.7	...	2N
60	Nozl	15.8604	1900	1425.4	...	K2
60	Nozl	15.8604	1500	1425.4	...	K1
60	Nozl	15.8604	1100	1450.8	...	4N
70	Nozl	946.614	750	...	...	M2

Total Weight of Each Detail Type:

Saddles	1436.5	
Nozzles	1985.8	
Weights	1110.0	
Clips	50.2	
Sum of the Detail Weights	4582.5	kg

Weight Summation Results: (kg)

	Fabricated	Shop Test	Shipping	Erected	Empty	Operating
Main Elements	54296.5	54296.5	54296.5	54296.5	54296.5	54296.5
Saddles	1436.5	1436.5	1436.5	1436.5	1436.5	1436.5
Nozzles	1985.8	1985.8	1985.8	1985.8	1985.8	1985.8
Wld Weights	850.0	850.0	850.0	850.0	850.0	850.0
Clips	50.2	50.2	50.2	50.2	50.2	50.2
Ope Weights	...	...	...	...	...	260.0
Test Liquid	...	101760.5	...	...	...	...

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Totals	58619.1	160379.5	58619.1	58619.1	58619.1	58879.1

Weight Summary:

Fabricated Wt.	- Bare Weight without Removable Internals	58619.1 kg
Shop Test Wt.	- Fabricated Weight + Water (Full)	160379.5 kg
Shipping Wt.	- Fab. Weight + removable Intls.+ Shipping App.	58619.1 kg
Erected Wt.	- Fab. Wt + or - loose items (trays,platforms etc.)	58619.1 kg
Ope. Wt. no Liq	- Fab. Weight + Internals. + Details + Weights	58619.1 kg
Operating Wt.	- Empty Weight + Operating Liq. Uncorroded	58879.1 kg
Oper. Wt. + CA	- Corr Wt. + Operating Liquid	58879.1 kg
Field Test Wt.	- Empty Weight + Water (Full)	160379.5 kg

The Corroded Weight and thickness are used in the Horizontal Vessel Analysis (Ope Case) and Earthquake Load Calculations.

Surface Areas of Elements:

From	To	Outside Surface Area mm^2	Inside Surface Area mm^2
10	20	9507514	8938267
20	30	24950532	24190266
30	40	30394282	29468140
40	50	29940634	29028318
50	60	30394282	29468140
60	70	24950532	24190266
70	80	9507514	8938267
Total		159645296.0	154221664.0 mm^2
Total		159.6	154.2 m²

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Nozzle Flange MAWP Results: (bar & °C)

Nozzle Description	Flange Rating Ope.	Flange Rating Ambient	Design Temp	Class	Grade/ Group	Equiv. Press	Max Pressure UG-44(b)	Max Pressure 50%	Max Pressure DNV
M1	48.00	51.10	80	300	GR 1.1	...	...	...	...
1N	48.00	51.10	80	300	GR 1.1	31.911	40.083	47.996	40.08
5N	48.00	51.10	80	300	GR 1.1	31.911	40.083	47.996	40.08
3N	48.00	51.10	80	300	GR 1.1	31.911	40.083	47.996	40.08
2N	48.00	51.10	80	300	GR 1.1	31.911	40.083	47.996	40.08
K2	48.00	51.10	80	300	GR 1.1	...	...	...	...
K1	48.00	51.10	80	300	GR 1.1	...	...	...	...
4N	48.00	51.10	80	300	GR 1.1	...	...	...	...
M2	48.00	51.10	80	300	GR 1.1	...	...	...	...
Min Rating	40.083	51.096, [for Core Elements]				...	...	...	...

Selected Method for Derating ASME B16.5 Flange MAWP: ASME 4.16.12

The 4.16.12 Method is based on the paper PVP 2013-97814. PV Elite uses the maximum loads from each load category to determine ME and FE. In many cases, the computed maximum allowable pressure will be greater than the flange rating. In these cases, the minimum of the rating from the table and the 4.16.12 method will be used. SA-193 B8 Cl. 2 bolts or ones with higher allowable stresses at the specified bolt size shall be used.

The axial force FE must put the nozzle in tension (-P for 107/297; +Fr for PD 5500 AnnexG) to be considered.

Nozzle Description	Gasket Dimension G mm	Fm Value	Resolved Moment ME N-m	Axial Force FE N	MAWP PD bar	Maximum Pressure Pmax bar	Pass Fail
1N	39.751	0.50	25	1400	40.000	40.083	Pass
5N	39.751	0.50	25	1400	40.000	40.083	Pass
3N	39.751	0.50	25	1400	40.000	40.083	Pass
2N	39.751	0.50	25	1400	40.000	40.083	Pass

Evaluating Flange on Nozzle [1N]:

```
= 16*ME + 4*FE*G <= pi*G^3[((PR - PD) + FM * PR)]
= 16(25)+4*abs(1400)39.751 < pi*39.751^3[(47.996-40.000)+.500*47.996]
= 0.62999+03 <= 0.63163+03  Check Passes
```

Maximum Pressure for Flange on Nozzle 1N [Pmax]:

```
= min( PR, FM * PR + PR - (16*ME + 4*FE * G) / ( pi * G^3 ))
= min( 47.996, 0.500 * 47.996 + 47.996 - 630.0/(pi * 39.751^3)
= min( 47.996, 40.083 )
= 40.083 bar
```

Evaluating Flange on Nozzle [5N]:

```
= 16*ME + 4*FE*G <= pi*G^3[((PR - PD) + FM * PR)]
= 16(25)+4*abs(1400)39.751 < pi*39.751^3[(47.996-40.000)+.500*47.996]
= 0.62999+03 <= 0.63163+03  Check Passes
```

Maximum Pressure for Flange on Nozzle 5N [Pmax]:

```
= min( PR, FM * PR + PR - (16*ME + 4*FE * G) / ( pi * G^3 ))
= min( 47.996, 0.500 * 47.996 + 47.996 - 630.0/(pi * 39.751^3)
= min( 47.996, 40.083 )
= 40.083 bar
```

Evaluating Flange on Nozzle [3N]:

```
= 16*ME + 4*FE*G <= pi*G^3[((PR - PD) + FM * PR)]
= 16(25)+4*abs(1400)39.751 < pi*39.751^3[(47.996-40.000)+.500*47.996]
= 0.62999+03 <= 0.63163+03  Check Passes
```

Maximum Pressure for Flange on Nozzle 3N [Pmax]:

```
= min( PR, FM * PR + PR - (16*ME + 4*FE * G) / ( pi * G^3 ))
= min( 47.996, 0.500 * 47.996 + 47.996 - 630.0/(pi * 39.751^3)
= min( 47.996, 40.083 )
= 40.083 bar
```

Evaluating Flange on Nozzle [2N]:

```
= 16*ME + 4*FE*G <= pi*G^3[((PR - PD) + FM * PR)]
= 16(25)+4*abs(1400)39.751 < pi*39.751^3[(47.996-40.000)+.500*47.996]
= 0.62999+03 <= 0.63163+03  Check Passes
```

Maximum Pressure for Flange on Nozzle 2N [Pmax]:

```
= min( PR, FM * PR + PR - (16*ME + 4*FE * G) / ( pi * G^3 ))
= min( 47.996, 0.500 * 47.996 + 47.996 - 630.0/(pi * 39.751^3)
= min( 47.996, 40.083 )
= 40.083 bar
```

Pressure Ratings are per ASME B16.5 2017 Metric Edition

Large Diameter Flange ratings per ASME B16.47 2017 edition.

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Wind Load Calculation Results:

Note: Using the User Defined Wind Profile ...

Wind Loads on Masses/Equipment/Piping

ID	Wind Area mm^2	Elevation mm	Pressure kPa	Force N
LIFTING LUG1	0.00	1725.00	2.74	0.00
MISC	0.00	1725.00	2.74	0.00
H2 WEIGHT	0.00	1725.00	2.74	0.00
LIFTING LUG2	0.00	1725.00	2.74	0.00

Wind Load Calculation:

From	To	Wind Height mm	Wind Diameter mm	Wind Area mm^2	Wind Pressure kPa	Element Wind Load N
10	20	1725	3456	1846640	2.74	5059.68
20	30	1725	2888	7942000	2.74	21760.6
30	40	1725	3465.6	11609760	2.74	31810
40	50	1725	3465.6	11436480	2.74	31335.2
50	60	1725	3465.6	11609760	2.74	31810
60	70	1725	3465.6	9530400	2.74	26112.7
70	80	1725	3456	1846640	2.74	5059.68

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Shop/Field Installation Options :

Platform(s) installed in the Field before being lifted.

Note : The CG is computed from the first Element From Node

Center of Gravity of the Saddles	7750.000 mm
Center of Gravity of the Nozzles	7851.651 mm
Center of Gravity of the Added Weights (Operating)	7986.937 mm
Center of Gravity of the Added Weights (Empty)	8044.117 mm
Center of Gravity of Bare Shell New and Cold	7800.000 mm
Center of Gravity of Bare Shell Corroded	7800.000 mm
Vessel CG in the Operating Condition	7804.049 mm
Vessel CG in the Fabricated (Shop/Empty) Condition	7804.067 mm
Vessel CG in the Test Condition	7801.486 mm

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ASME VIII Division 2 Horizontal Vessel Analysis, Left Saddle:

Horizontal Vessel Stress Calculations : Operating Case

Note:
Wear Pad Width (350.00) is less than 1.56*sqrt(rm*t)
and less than 2a. The wear plate will be ignored.

Minimum Wear Plate Width to be considered in analysis [b1]:

```
= min( b + 1.56*sqrt( Rm * t ), 2a )
= min( 300 + 1.56*sqrt( 1422 * 44 ), 2 * 3250 )
= 690.2121 mm
```

Input and Calculated Values:

Vessel Mean Radius	Rm	1422.00	mm
Shell Thickness used in this Case	t	44.000	mm
Stiffened Vessel Length per 4.15.6	L	15600.00	mm
Distance from Saddle to Vessel tangent	a1 or a	3250.00	mm
Saddle Width	b1 or b	300.00	mm
Saddle Bearing Angle	delta or theta	130.00	degrees
Inside or Mean Depth of Head	Hi or hm	720.00	mm
Shell Allowable Stress used in Calculation		136.28	N/mm²
Head Allowable Stress used in Calculation		136.28	N/mm²
Circumferential Efficiency in Plane of Saddle		1.00	
Circumferential Efficiency at Mid-Span		1.00	
Distance from Saddle Base to Centerline	B	1725.00	mm
Coefficient of Friction	mu	0.50	
Saddle Force Q, Operating Case		429473.38	N
Pressure used in Analysis	P	40.000	bar

Horizontal Vessel Analysis Results:	Actual N/mm²	Allowable N/mm²
Long. Stress at Top of Midspan	63.92	136.28
Long. Stress at Bottom of Midspan	65.37	136.28
Long. Stress at Top of Saddles	74.39	136.28
Long. Stress at Bottom of Saddles	59.18	136.28
Tangential Shear in Shell	3.86	109.03
Circ. Stress at Horn of Saddle	18.48	170.36
Circ. Compressive Stress in Shell	1.03	136.28

Intermediate Results: Saddle Reaction Q due to Wind or Seismic:

Transverse Saddle Reaction Force [Fwt]:

```
= Ftr( Ft/Num of Saddles + Z Force Load ) * B / E
= 3 ( 152948/2 + 0 ) * 1725/2620
= 151050.6 N
```

Longitudinal Saddle Reaction Force [Fwl]:

```
= max( Fl, Sum of X Forces) * B / Ls
= max( 25846, 0 ) * 1725/9000
= 4953.7 N
```

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Load Combination Results for Q + Wind or Seismic [Q]:
= Saddle Load + max(Fwl, Fwt, Fsl, Fst)
= 278423 + max(4954, 151051, 0, 0)
= 429473.4 N

Longitudinal Wind Force [Fl]:
= WindScalar * WindPress(Platform Area + (pi/4(OD * WindDiaMult)^2))
= 1 * 2740 (0 + pi/4(2.89 * 1.2)^2)
= 25846.967 N

Summary of Loads at the Base of this Saddle:

Vertical Load (including saddle weight)	436516.28	N
Transverse Shear Load	76473.91	N
Longitudinal Shear Load	25845.63	N

Formulas and Substitutions for Horizontal Vessel Analysis:

Note: Wear Plate is Welded to the Shell, k = 0.1

Saddle Dimension [E]:
= Baseplate Length
= 2620.000 mm

The Computed K values from Table 4.15.1:

K1 = 0.1231	K2 = 1.0222	K3 = 0.7217	K4 = 0.3619
K5 = 0.7258	K6 = 0.0449	K7 = 0.0449	K8 = 0.3296
K9 = 0.2551	K10 = 0.0508	K1* = 0.2196	

Note: Dimension a is greater than or equal to Rm/2.

Moment per Equation 4.15.1 [M1]:
= −Q*a [1 − (1− a/L + (Rm²−hm²)/(2a*L))/(1+(4hm²)/3L)]
= −429473*3250[1−(1−3250/15600+(1422²−720²)/
(2*3250*15600))/(1+(4*720)/(3*15600))]
= −335484.7 N−m

Moment per Equation 4.15.2 [M2]:
= Q*L/4(1+2(Rm²−hm²)/(L²))/(1+(4hm²)/(3L))−4a/L
= 429473*15600/4(1+2(1422²−720²)/(15600²))/(1+(4*720)/
(3*15600))−4*3250/15600
= 201639.6 N−m

Longitudinal Stress at Top of Shell (4.15.4) [sigma1]:
= P * Rm/(2t) − M2/(pi*Rm²t)
= 40 * 1422/(2*44) − 201640/(pi*1422²*44)
= 63.92 N/mm²

Longitudinal Stress at Bottom of Shell (4.15.5) [sigma2]:
= P * Rm/(2t) + M2/(pi * Rm² * t)
= 40 * 1422/(2 * 44) + 201640/(pi * 1422² * 44)
= 65.37 N/mm²

Longitudinal Stress at Top of Shell at Support (4.15.8) [sigma✱3]:
= P * Rm/(2t) − M1/(K1*pi*Rm²t)
= 40*1422/(2*44)−−335485/(0.12*pi*1422²*44)
= 74.39 N/mm²

Longitudinal Stress at Bottom of Shell at Support (4.15.9) [sigma✱4]:
= P * Rm/(2t) + M1/(K1✱ * pi * Rm² * t)
= 40*1422/(2*44)+−335485/(0.22*pi*1422²*44)
= 59.18 N/mm²

Maximum Shear Force in the Saddle (4.15.3) [T]:

```
= Q(L-2a)/(L+(4*hm/3))
= 429473 ( 15600 - 2 * 3250 )/(15600 + ( 4 * 720/3))
= 236002.9 N
```

Shear Stress in the shell no rings, not stiffened (4.15.12) [tau2]:

```
= K2 * T / ( Rm * t )
= 1.02 * 236003/( 1422 * 44 )
= 3.86 N/mm²
```

Decay Length (4.15.20) [x1,x2]:

```
= 0.78 * sqrt( Rm * t )
= 0.78 * sqrt( 1422 * 44 )
= 195.106 mm
```

Circumferential Stress in shell, no rings (4.15.21) [sigma6]:

```
= -K5 * Q * k / ( t( b + X1 + X2 ) )
= -0.73 * 429473 * 0.1/( 44 ( 300 + 195 + 195 ) )
= -1.03 N/mm²
```

Circ. Comp. Stress at Horn of Saddle, L>=8Rm (4.15.22) [sigma7]:

```
= -Q/(4*t(b+X1+X2)) - 3*K7*Q/(2*t²)
= -429473/(4 * 44 (300 + 195 + 195 )) -
   3 * 0.045 * 429473/(2*44²)
= -18.48 N/mm²
```

Effective reinforcing plate width (4.15.24) [B1]:

```
= min( b + 1.56 * sqrt( Rm * t ), 2a  )
= min( 300 + 1.56 * sqrt( 1422 * 44 ), 2 * 3250 )
= 690.21 mm
```

Distance between Saddle Supports [Ls]:

```
= 9000.0 mm
```

Free Un-Restrained Thermal Expansion between the Saddles [Exp]:

```
= Alpha * Ls( Design Temperature - Ambient Temperature )
= 0.11973E-04 * 9000 ( 80 - 21.1 )
= 6.345 mm
```

Results for Vessel Ribs, Web and Base:

Baseplate Length	Bplen	2619.9998	mm
Baseplate Thickness	Bpthk	25.0000	mm
Baseplate Width	Bpwid	350.0000	mm
Number of Ribs (inc. outside ribs)	Nribs	6	
Rib Thickness	Ribtk	14.0000	mm
Web Thickness	Webtk	14.0000	mm
Web Location	Webloc	Center	
Saddle Yield Stress	Sy	205.0	N/m
Height of Web at Center	Hw,c	235.0	mm
Friction Coefficient	mu	0.500	

Moment of Inertia of Saddle - Transverse Direction (90 degrees to long axis)

Inertia of Shell [ShellInertia]:

```
= (( 1.56 * sqrt( R * t ) + WearPlateWidth )t^3 )/12
= (( 1.56 * sqrt( 1400 * 44 ) + 350 )44^3 )/12
= 5233003.000 mm^4
```

Resolved Inertia for the Shell [I,shell]:

```
= ShellInertia + AShell( C1 - Y )^2
= 5233003 + 32436 ( 86 - 22 )^2
= 138022576.000 mm^4
```

BREMBANA&ROLLE	PRESSURE VESSEL MECHANICAL CALCULATION H2 STORAGE VESSEL	DOC.	23096-01-EMC1	REV.	3
		Sheet	62	of	215
		JOB	23096		
		ITEM	V-25001 A÷F		

	B mm	D mm	Y mm	A mm^2	AY mm³	I + AD² mm^4
Shell	737.2	44.0	22.0	32436.0	713592.0	0.138E+09
Wearplate	350.0	20.0	54.0	7000.0	378000.0	0.739E+07
Web	14.0	236.0	182.0	3304.0	601327.8	0.458E+08
BasePlate	350.0	25.0	312.5	8750.0	2734374.5	0.449E+09
Totals	...	...	...	51490.0	4427294.5	0.641E+09

Distance to Centroid [C1]:
= AY / A
= 4427294/51490
= 85.984 mm

Angle [beta]:
= 180 - Saddle Angle/2
= 180 - 130/2
= 115.0

Saddle Splitting Coefficient [K1]:
= (1 + cos(beta) - 0.5*sin(beta)²)/(pi - beta + sin(beta)cos(beta))
= (1 + cos(115) - 0.5*sin(115)²)/(pi - 2.01 + sin(115)cos(115))
= 0.2218

Saddle Splitting Force [Fh]:
= K1 * Q
= 0.22 * 429473
= 95265.7891 N

Tension Stress, St = (Fh/As) = 5.0002 N/mm²
Allowed Stress, Sa = 0.6 * Yield Str = 123.0000 N/mm²

Saddle Splitting Dimension [d]:
= B - R * sin(theta/2)/(theta/2 in radians)
= 1725 - 1400 * sin(130/2)/1.13
= 606.559 mm

Bending Moment, M = Fh * d = 57807.7461 N-m

Bending Stress, Sb = (M * C1 / I) = 7.7563 N/mm²
Allowed Stress, Sa = 2/3 * Yield Str = 136.6667 N/mm²

Minimum Thickness of Baseplate per Moss:
= sqrt(3(Q + Saddle_Wt)BasePlateWidth / (4 * BasePlateLength * AllStress))
= sqrt(3(429473 + 7043)350/(4 * 2620 * 137))
= 17.890 mm

Calculation of Axial Load, Intermediate Values and Compressive Stress:

Web Length Dimension [Web Length]:
= 2 * cos(90 - Saddle Angle/2)(Inside Radius + Shell Thk + Wear Plate Thk)
= 2 * cos(90 - 130/2)(1400 + 44 + 20)
= 2653.669 mm

Distance between Ribs [e]:
= Web Length / (Nribs - 1)
= 2654/(6 - 1)
= 530.734 mm

Baseplate Pressure Area [Ap]:
= e * Bpwid / 2
= 531 * 350/2
= 92878.422 mm^2

Bearing Pressure [Bp]:
= Q / (BasePlateLength * BasePlateWidth)
= 429473/(2620 * 350)
= 0.468 N/mm^2

Axial Load [P]:
= Ap * Bp
= 92878 * 0.47
= 43499.250 N

Area of the Rib and Web [Ar]:
= Rib Area + Web Area
= 4004 + 3715
= 7719.137 mm^2

Compressive Stress [Sc]:
= P/Ar
= 43499/7719
= 5.636 N/mm²

Check of Outside Ribs:

Inertia of Saddle, Outer Ribs - Longitudinal Direction

	B	D	Y	A	AY	Io
Rib+Web	14.0	300.0	...	4200.0	...	0.315E+08

Rib dimension [D]:
= Saddle Width - Web Thickness
= 300 - 14
= 286.000 mm

Distance to Centroid from Datum [ytot]:
= AY / A
= 0/7719
= 0.000 mm

Distance to Centroid [C1]:
= Saddle Width / 2
= 300/2
= 150.000 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31499968/7719)
= 63.881 mm

Length of Outer Rib, step 1, [Lw]:
= 2 * sin(saddle bearing angle / 2)(radius + shlthk + wpdthk)
= 2 * sin(130/2)(1400 + 44 + 20)
= 2653.669 mm

Length of Outer Rib, step 2, [Bd]:
= Baseplate length - clearance
= 2620 - 50.8
= 2569.200 mm

Length of Outer Rib, step 3, [Dd]:
= (Lw - Bd)/2
= (2654 - 2569)/2

= 42.235 mm

Length of Outer Rib [L]:
= sqrt(Rl^2 + Dd^2)
= sqrt(1082^2 + 42.2^2)
= 1082.111 mm

Intermediate Term [Cc]:
= sqrt(2 * pi² * Elastic Modulus / Yield Stress)
= sqrt(2 * pi² * 199955/205)
= 138.757

Slenderness ratio [KL/r]:
= KL/r
= 1 * 1082/63.9
= 16.940

Bending Moment [Rm]:
= Fl /(2 * Bplen) * e * L / 2
= 25846/(2 * 2620) * 531 * 1082/2
= 1416.937 N-m

Compressive Allowable, KL/r < Cc (16.9 < 139) per AISC E2-1 [Sca]:
= (1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= (1-(16.9)²/(2 * 139²))205/
(5/3+3*(16.9)/(8* 139)-(16.9³)/(8*139³)
= 118.8 N/mm²

AISC Unity Check of Outside Ribs (must be <= 1)
= Sc/Sca + (Rm * C1 / I)/Sba
= 5.64/119 + (1417 * 150/31500000)/137
= 0.097

Check of Inside Ribs:

Inertia of Saddle, Inner Ribs - Axial Direction

	B	D	Y	A	AY	Io
Rib	14.0	286.0	0.0	4004.0	0.0	0.315E+08
Web	530.7	14.0	0.0	7430.3	0.0	0.121E+06
Totals	...	...	...	11434.3	...	0.316E+08

Distance to Centroid from Datum [ytot]:
= AY / A
= 0/11434
= 0.000 mm

Distance to Centroid [C1]:
= Saddle Width / 2
= 300/2
= 150.000 mm

Length of Inner Rib [L]:
= Saddle Height - sqrt((Ro + Wpdthk)^2 - (Pitch/2)^2) - Bpthk
= 1725 - sqrt((1464 + 20)^2 - (531/2)^2) - 25
= 260.251 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31618128/11434)
= 52.585 mm

Slenderness ratio [KL/r]:

```
= KL/r
= 1 * 260/52.6
= 4.949
```

Unit Force [Force,u]:

```
= Fl / ( 2 * Baseplate Length )
= 25846/( 2 * 2620 )
= 4.932 N/mm
```

Moment at base of inner Rib [Mbase,c]:

```
= Unit Force * e * L
= 4.93 * 531 * 260
= 681.556 N-m
```

Bending Stress due to Transverse Force and Weight Load [SigmaB,base,c]:

```
= Bending Moment / Section Modulus
= 682/210788
= 3.232 N/mm²
```

Compressive Allowable, KL/r < Cc (4.95 < 139) per AISC E2-1 [Sca]:

```
= ( 1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= ( 1-( 4.95 )²/(2 * 139² ))205/
  ( 5/3+3*(4.95 )/(8* 139 )-( 4.95³)/(8*139³)
= 121.9 N/mm²
```

AISC Unity Check of Inside Ribs (must be <= 1)

```
= Sc/Sca + ( Mbase,c * C1/I )/Sba
= 7.39/122 + ( 682 * 150/31618128 )/137
= 0.084
```

Input Data for Base Plate Bolting Calculations:

Total Number of Bolts per BasePlate	Nbolts	8	
Total Number of Bolts in Tension/Baseplate	Nbt	4	
Bolt Material Specification		8.8	
Bolt Allowable Stress	Stba	373.00	N/mm²
Bolt Corrosion Allowance	Bca	0.0	mm
Distance from Bolts to Edge	Edgedis	282.5	mm
Nominal Bolt Diameter	Bnd	24.0000	mm
Thread Series	Series	TEMA Metric	
BasePlate Allowable Stress	S	136.30	N/mm²
Area Available in a Single Bolt	BltArea	312.7480	mm^2
Saddle Load QO (Weight)	QO	285465.7	N
Saddle Load QL (Wind/Seismic contribution)	QL	4953.7	N
Maximum Transverse Force	Ft	76473.9	N
Maximum Longitudinal Force	Fl	25845.6	N
Saddle Bolted to Steel Foundation		Yes	

Shear Stress in a Single Bolt, Longitudinal Direction [taub,l]:

```
= Fl / ( Bolt Area * Number of Bolts )
= 25846/( 313 * 8 )
= 10.3 N/mm².  Must be less than 264.0 N/mm².
```

Shear Stress in a Single Bolt, Transverse Direction [taub,t]:

```
= Ft / ( Bolt Area * Number of Bolts )
= 76474/( 313 * 8 )
= 30.6 N/mm².  Must be less than 264.0 N/mm².
```

Bolt Area Calculation per Dennis R. Moss

Bolt Area Requirement Due to Longitudinal Load [Bltarearl]:

```
= 0.0 (QO > QL --> No Uplift in Longitudinal direction)
```

Bolt Area due to Shear Load [Bltarears]:
```
= Fl / ( BoltShearAllowable * Nbolts )
= 25846/(264 * 8 )
= 12.2386 mm^2
```

Bolt Area due to Transverse Load:

Moment on Baseplate Due to Transverse Load [Rmom]:
```
= B * Ft + Sum of X Moments
= 1725 * 76474 + 0
= 131970.97 N-m
```

Eccentricity (e):
```
= Rmom / QO
= 131971/285466
= 462.11 mm > Bplen/6 --> Uplift in Transverse direction

f = Bplen / 2 - Edgedis
  = 2620/2 - 283
  = 1027.50 mm

K1 = 3 (e - 0.5 * Bplen)
   = 3 (462 - 0.5*2620 )
   = -2543.66 mm

K2 = 6 * n1 * At / Bpwid * (f + e)
   = 6 * 1 * 1251/350 * (1027 + 462 )
   = 31945.61 mm ²

K3 = -K2 * (0.5 * Bplen + f)
   = -31946 * (0.5 * 2620 + 1027 )
   = -74672846.01 mm ³
```

Iteratively Solving for the Effective Bearing Length:
```
Y³ + K1 * Y² + K2 * Y + K3 = 0
Y³ + -2544 * Y² + 31946 * Y + -74672840 = 0
Y  = 2542.65 mm

Num = (Bplen / 2 - Y / 3 - e)
    = (2620/2 - 2543/3 - 462 )
    = 0.34

Denom = (Bplen / 2 - Y / 3 + f)
      = (2620/2 - 2543/3 + 1027 )
      = 1489.95
```

Total Bolt Tension Force [Tforce]:
```
= - QO * Num / Denom
= - 285466 * 0.34/1490
= -64.73 N
```

Bolt Area Required due to Transverse Load [Bltareart]:
```
= Tforce / (Stba * Nbt)
= -64.7/( 373 * 4 )
= -0.0434 mm^2
```

Required Area of a Single Bolt [Bltarear]:
```
= max[Bltarearl, Bltarears, Bltareart]
= max[0, 12.2, -0.043 ]
= 12.2386 mm^2
```

Baseplate Thickness Calculation per D. Moss:

Bearing Pressure (fc)
= 2(QO + Tforce) / (Y * Bpwid)
= 2(285466 + -64.7)/(2543 * 350)
= 6.41 bar

Distance from Baseplate Edge to the Web [ADIST]:
= (Bplen - Weblngth) / 2
= (2620 - 2569)/2
= 25.4000 mm

Overturning Moment due To Bolt Tension [Mt]:
= Tforce * Adist
= -64.7 * 25.4
= -1.64 N-m

Equivalent Bearing Pressure (f1):
= fc * (Y - Adist) / Y
= 6.41 * (2543 - 25.4)/2543
= 6.35 bar

Overturning Moment due to Bearing Pressure [Mc]:
= (Adist² * Bpwid / 6) * (f1 + 2 * fc)
= (25.4 ² * 350/6) * (6.35 + 2 * 6.41)
= 72.20 N-m

Baseplate Required Thickness [Treq]:
= sqrt(6 * max(Mt,Mc) / (Bpwid * Sba))
= sqrt(6 * max(-1.64,72.2)/(350 * 204))
= 2.4601 mm

Note: Saddle and wear plate material are both specifed as impact tested.

ASME VIII Division 2 Horizontal Vessel Analysis, Right Saddle:

Note:
Wear Pad Width (350.00) is less than 1.56*sqrt(rm*t)
and less than 2a. The wear plate will be ignored.

Minimum Wear Plate Width to be considered in analysis [b1]:
= min(b + 1.56*sqrt(Rm * t), 2a)
= min(300 + 1.56*sqrt(1422 * 44), 2 * 3250)
= 690.2121 mm

Input and Calculated Values:

Vessel Mean Radius	Rm	1422.00	mm
Shell Thickness used in this Case	t	44.000	mm
Stiffened Vessel Length per 4.15.6	L	15600.00	mm
Distance from Saddle to Vessel tangent	a1 or a	3250.00	mm
Saddle Width	b1 or b	300.00	mm
Saddle Bearing Angle	delta or theta	130.00	degrees
Inside or Mean Depth of Head	Hi or hm	720.00	mm
Shell Allowable Stress used in Calculation		136.28	N/mm²
Head Allowable Stress used in Calculation		136.28	N/mm²
Circumferential Efficiency in Plane of Saddle		1.00	

```
Circumferential Efficiency at Mid-Span                    1.00

Distance from Saddle Base to Centerline        B      1725.00  mm
Coefficient of Friction                       mu         0.30

Saddle Force Q, Operating Case                      435909.69  N

Pressure used in Analysis                      P       40.000  bar
```

Horizontal Vessel Analysis Results:	Actual N/mm²	Allowable N/mm²
Long. Stress at Top of Midspan	63.91	136.28
Long. Stress at Bottom of Midspan	65.38	136.28
Long. Stress at Top of Saddles	74.54	136.28
Long. Stress at Bottom of Saddles	59.10	136.28
Tangential Shear in Shell	3.91	109.03
Circ. Stress at Horn of Saddle	18.76	170.36
Circ. Compressive Stress in Shell	1.04	136.28

Intermediate Results: Saddle Reaction Q due to Wind or Seismic:

Transverse Saddle Reaction Force [Fwt]:

```
  = Ftr( Ft/Num of Saddles + Z Force Load ) * B / E
  = 3 ( 152948/2 + 0 ) * 1725/2620
  = 151050.6 N
```

Longitudinal Saddle Reaction Force [Fwl]:

```
  = max( Fl, Sum of X Forces) * B / Ls
  = max( 25846, 0 ) * 1725/9000
  = 4953.7 N
```

Load Combination Results for Q + Wind or Seismic [Q]:

```
  = Saddle Load + max( Fwl, Fwt, Fsl, Fst )
  = 284859 + max( 4954, 151051, 0, 0 )
  = 435909.7 N
```

Longitudinal Wind Force [Fl]:

$$= \text{WindScalar} * \text{WindPress}(\text{Platform Area} + (\pi/4(\text{OD} * \text{WindDiaMult})^2))$$
$$= 1 * 2740 (0 + \pi/4(2.89 * 1.2)^2)$$
$$= 25846.967 \text{ N}$$

Summary of Loads at the Base of this Saddle:

```
Vertical Load (including saddle weight)          442952.62  N
Transverse Shear Load                             76473.91  N
Longitudinal Shear Load                           25845.63  N
```

Formulas and Substitutions for Horizontal Vessel Analysis:

Note: Wear Plate is Welded to the Shell, k = 0.1

Saddle Dimension [E]:

```
  = Baseplate Length
  = 2620.000 mm
```

The Computed K values from Table 4.15.1:

```
K1  = 0.1231     K2  = 1.0222     K3  = 0.7217     K4  = 0.3619
K5  = 0.7258     K6  = 0.0449     K7  = 0.0449     K8  = 0.3296
K9  = 0.2551     K10 = 0.0508     K1* = 0.2196
```

Note: Dimension a is greater than or equal to Rm/2.

Moment per Equation 4.15.1 [M1]:

```
= -Q*a [1 - (1- a/L + (Rm²-hm²)/(2a*L))/(1+(4hm²)/3L)]
= -435910*3250[1-(1-3250/15600+(1422²-720²)/
  (2*3250*15600))/(1+(4*720)/(3*15600))]
= -340512.5 N-m
```

Moment per Equation 4.15.2 [M2]:

```
= Q*L/4(1+2(Rm²-hm²)/(L²))/(1+(4hm²)/( 3L))-4a/L
= 435910*15600/4(1+2(1422²-720²)/(15600²))/(1+(4*720)/
  (3*15600))-4*3250/15600
= 204661.5 N-m
```

Longitudinal Stress at Top of Shell (4.15.4) [sigma1]:

```
= P * Rm/(2t) - M2/(pi*Rm²t)
= 40 * 1422/(2*44 ) - 204662/(pi*1422²*44 )
= 63.91 N/mm²
```

Longitudinal Stress at Bottom of Shell (4.15.5) [sigma2]:

```
= P * Rm/(2t) + M2/(pi * Rm² * t)
= 40 * 1422/(2 * 44 ) + 204662/(pi * 1422² * 44 )
= 65.38 N/mm²
```

Longitudinal Stress at Top of Shell at Support (4.15.8) [sigma✱3]:

```
= P * Rm/(2t) - M1/(K1*pi*Rm²t)
= 40*1422/(2*44)--340512/(0.12*pi*1422²*44)
= 74.54 N/mm²
```

Longitudinal Stress at Bottom of Shell at Support (4.15.9) [sigma✱4]:

```
= P * Rm/(2t) + M1/(K1✱ * pi * Rm² * t)
= 40*1422/(2*44)+-340512/(0.22*pi*1422²*44)
= 59.10 N/mm²
```

Maximum Shear Force in the Saddle (4.15.3) [T]:

```
= Q(L-2a)/(L+(4*hm/3))
= 435910 ( 15600 - 2 * 3250 )/(15600 + ( 4 * 720/3))
= 239539.8 N
```

Shear Stress in the shell no rings, not stiffened (4.15.12) [tau2]:

```
= K2 * T / ( Rm * t )
= 1.02 * 239540/( 1422 * 44 )
= 3.91 N/mm²
```

Decay Length (4.15.20) [x1,x2]:

```
= 0.78 * sqrt( Rm * t )
= 0.78 * sqrt( 1422 * 44 )
= 195.106 mm
```

Circumferential Stress in shell, no rings (4.15.21) [sigma6]:

```
= -K5 * Q * k / ( t( b + X1 + X2 ) )
= -0.73 * 435910 * 0.1/( 44 ( 300 + 195 + 195 ) )
= -1.04 N/mm²
```

Circ. Comp. Stress at Horn of Saddle, L>=8Rm (4.15.22) [sigma7]:

```
= -Q/(4*t(b+X1+X2)) - 3*K7*Q/(2*t²)
= -435910/(4 * 44 (300 + 195 + 195 )) -
   3 * 0.045 * 435910/(2*44²)
= -18.76 N/mm²
```

Effective reinforcing plate width (4.15.24) [B1]:

```
= min( b + 1.56 * sqrt( Rm * t ), 2a  )
= min( 300 + 1.56 * sqrt( 1422 * 44 ), 2 * 3250 )
```

= 690.21 mm

Results for Vessel Ribs, Web and Base:

Baseplate Length	Bplen	2619.9998	mm
Baseplate Thickness	Bpthk	25.0000	mm
Baseplate Width	Bpwid	350.0000	mm
Number of Ribs (inc. outside ribs)	Nribs	6	
Rib Thickness	Ribtk	14.0000	mm
Web Thickness	Webtk	14.0000	mm
Web Location	Webloc	Center	
Saddle Yield Stress	Sy	205.0	N/m
Height of Web at Center	Hw,c	235.0	mm
Friction Coefficient	mu	0.300	

Moment of Inertia of Saddle - Transverse Direction (90 degrees to long axis)

Inertia of Shell [ShellInertia]:
= ((1.56 * sqrt(R * t) + WearPlateWidth)t^3)/12
= ((1.56 * sqrt(1400 * 44) + 350)44^3)/12
= 5233003.000 mm^4

Resolved Inertia for the Shell [I,shell]:
= ShellInertia + AShell(C1 - Y)^2
= 5233003 + 32436 (86 - 22)^2
= 138022576.000 mm^4

	B mm	D mm	Y mm	A mm^2	AY mm^3	I + AD^2 mm^4
Shell	737.2	44.0	22.0	32436.0	713592.0	0.138E+09
Wearplate	350.0	20.0	54.0	7000.0	378000.0	0.739E+07
Web	14.0	236.0	182.0	3304.0	601327.8	0.458E+08
BasePlate	350.0	25.0	312.5	8750.0	2734374.5	0.449E+09
Totals	...	...	...	51490.0	4427294.5	0.641E+09

Distance to Centroid [C1]:
= AY / A
= 4427294/51490
= 85.984 mm

Angle [beta]:
= 180 - Saddle Angle/2
= 180 - 130/2
= 115.0

Saddle Splitting Coefficient [K1]:
= (1 + cos(beta) - 0.5*sin(beta)^2)/(pi - beta + sin(beta)cos(beta))
= (1 + cos(115) - 0.5*sin(115)^2)/(pi - 2.01 + sin(115)cos(115))
= 0.2218

Saddle Splitting Force [Fh]:
= K1 * Q
= 0.22 * 435910
= 96693.4922 N

Tension Stress, St = (Fh/As) =	5.0751	N/mm^2
Allowed Stress, Sa = 0.6 * Yield Str =	123.0000	N/mm^2

Saddle Splitting Dimension [d]:
= B - R * sin(theta/2)/(theta/2 in radians)
= 1725 - 1400 * sin(130/2)/1.13
= 606.559 mm

```
Bending Moment, M  = Fh * d          =      58674.0820  N-m

Bending Stress, Sb = ( M * C1 / I  ) =          7.8726  N/mm²
Allowed Stress, Sa = 2/3 * Yield Str =        136.6667  N/mm²
```

Minimum Thickness of Baseplate per Moss:

```
= sqrt( 3( Q + Saddle_Wt )BasePlateWidth / ( 4 * BasePlateLength * AllStress ))
= sqrt( 3(435910 + 7043 )350/( 4 * 2620 * 137 ))
= 18.021 mm
```

Calculation of Axial Load, Intermediate Values and Compressive Stress:

Web Length Dimension [Web Length]:

```
= 2 * cos( 90 - Saddle Angle/2 )( Inside Radius + Shell Thk + Wear Plate Thk )
= 2 * cos( 90 - 130/2 )( 1400 + 44 + 20 )
= 2653.669 mm
```

Distance between Ribs [e]:

```
= Web Length / ( Nribs - 1 )
= 2654/( 6 - 1 )
= 530.734 mm
```

Baseplate Pressure Area [Ap]:

```
= e * Bpwid / 2
= 531 * 350/2
= 92878.422 mm^2
```

Bearing Pressure [Bp]:

```
= Q / ( BasePlateLength * BasePlateWidth )
= 435910/( 2620 * 350 )
= 0.475 N/mm^2
```

Axial Load [P]:

```
= Ap * Bp
= 92878 * 0.48
= 44151.156 N
```

Area of the Rib and Web [Ar]:

```
= Rib Area + Web Area
= 4004 + 3715
= 7719.137 mm^2
```

Compressive Stress [Sc]:

```
= P/Ar
= 44151/7719
= 5.720 N/mm²
```

Check of Outside Ribs:

Inertia of Saddle, Outer Ribs - Longitudinal Direction

	B	D	Y	A	AY	Io
Rib+Web	14.0	300.0	...	4200.0	...	0.315E+08

Rib dimension [D]:

```
= Saddle Width - Web Thickness
= 300 - 14
= 286.000 mm
```

Distance to Centroid from Datum [ytot]:

= AY / A
= 0/7719
= 0.000 mm

Distance to Centroid [C1]:
= Saddle Width / 2
= 300/2
= 150.000 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31499968/7719)
= 63.881 mm

Length of Outer Rib, step 1, [Lw]:
= 2 * sin(saddle bearing angle / 2)(radius + shlthk + wpdthk)
= 2 * sin(130/2)(1400 + 44 + 20)
= 2653.669 mm

Length of Outer Rib, step 2, [Bd]:
= Baseplate length - clearance
= 2620 - 50.8
= 2569.200 mm

Length of Outer Rib, step 3, [Dd]:
= (Lw - Bd)/2
= (2654 - 2569)/2
= 42.235 mm

Length of Outer Rib [L]:
= sqrt(Rl^2 + Dd^2)
= sqrt(1082^2 + 42.2^2)
= 1082.111 mm

Intermediate Term [Cc]:
= sqrt(2 * pi² * Elastic Modulus / Yield Stress)
= sqrt(2 * pi² * 199955/205)
= 138.757

Slenderness ratio [KL/r]:
= KL/r
= 1 * 1082/63.9
= 16.940

Bending Moment [Rm]:
= Fl /(2 * Bplen) * e * L / 2
= 25846/(2 * 2620) * 531 * 1082/2
= 1416.937 N-m

Compressive Allowable, KL/r < Cc (16.9 < 139) per AISC E2-1 [Sca]:
= (1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= (1-(16.9)²/(2 * 139²))205/
(5/3+3*(16.9)/(8* 139)-(16.9³)/(8*139³)
= 118.8 N/mm²

AISC Unity Check of Outside Ribs (must be <= 1)
= Sc/Sca + (Rm * C1 / I)/Sba
= 5.72/119 + (1417 * 150/31500000)/137
= 0.097

Check of Inside Ribs:

Inertia of Saddle, Inner Ribs - Axial Direction

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	B	D	Y	A	AY	Io
Rib	14.0	286.0	0.0	4004.0	0.0	0.315E+08
Web	530.7	14.0	0.0	7430.3	0.0	0.121E+06
Totals	...	...	...	11434.3	...	0.316E+08

Distance to Centroid from Datum [ytot]:
= AY / A
= 0/11434
= 0.000 mm

Distance to Centroid [C1]:
= Saddle Width / 2
= 300/2
= 150.000 mm

Length of Inner Rib [L]:
= Saddle Height - sqrt((Ro + Wpdthk)^2 - (Pitch/2)^2) - Bpthk
= 1725 - sqrt((1464 + 20)^2 - (531/2)^2) - 25
= 260.251 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31618128/11434)
= 52.585 mm

Slenderness ratio [KL/r]:
= KL/r
= 1 * 260/52.6
= 4.949

Unit Force [Force,u]:
= Fl / (2 * Baseplate Length)
= 25846/(2 * 2620)
= 4.932 N/mm

Moment at base of inner Rib [Mbase,c]:
= Unit Force * e * L
= 4.93 * 531 * 260
= 681.556 N-m

Bending Stress due to Transverse Force and Weight Load [SigmaB,base,c]:
= Bending Moment / Section Modulus
= 682/210788
= 3.232 N/mm²

Compressive Allowable, KL/r < Cc (4.95 < 139) per AISC E2-1 [Sca]:
= (1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= (1-(4.95)²/(2 * 139²))205/
(5/3+3*(4.95)/(8* 139)-(4.95³)/(8*139³)
= 121.9 N/mm²

AISC Unity Check of Inside Ribs (must be <= 1)
= Sc/Sca + (Mbase,c * C1/I)/Sba
= 7.5/122 + (682 * 150/31618128)/137
= 0.085

Input Data for Base Plate Bolting Calculations:

Total Number of Bolts per BasePlate	Nbolts	8	
Total Number of Bolts in Tension/Baseplate	Nbt	4	
Bolt Material Specification		8.8	
Bolt Allowable Stress	Stba	373.00	N/mm²

Bolt Corrosion Allowance	Bca	0.0	mm
Distance from Bolts to Edge	Edgedis	282.5	mm
Nominal Bolt Diameter	Bnd	24.0000	mm
Thread Series	Series	TEMA Metric	
BasePlate Allowable Stress	S	136.30	N/mm²
Area Available in a Single Bolt	BltArea	312.7480	mm^2
Saddle Load QO (Weight)	QO	291902.1	N
Saddle Load QL (Wind/Seismic contribution)	QL	4953.7	N
Maximum Transverse Force	Ft	76473.9	N
Maximum Longitudinal Force	Fl	25845.6	N
Saddle Bolted to Steel Foundation		Yes	

Shear Stress in a Single Bolt, Longitudinal Direction [taub,l]:
= Fl / (Bolt Area * Number of Bolts)
= 25846/(313 * 8)
= 10.3 N/mm². Must be less than 264.0 N/mm².

Shear Stress in a Single Bolt, Transverse Direction [taub,t]:
= Ft / (Bolt Area * Number of Bolts)
= 76474/(313 * 8)
= 30.6 N/mm². Must be less than 264.0 N/mm².

Bolt Area Calculation per Dennis R. Moss

Bolt Area Requirement Due to Longitudinal Load [Bltarearl]:
= 0.0 (QO > QL --> No Uplift in Longitudinal direction)

Bolt Area due to Shear Load [Bltarears]:
= Fl / (BoltShearAllowable * Nbolts)
= 25846/(264 * 8)
= 12.2386 mm^2

Bolt Area due to Transverse Load:

Moment on Baseplate Due to Transverse Load [Rmom]:
= B * Ft + Sum of X Moments
= 1725 * 76474 + 0
= 131970.97 N-m

Eccentricity (e):
= Rmom / QO
= 131971/291902
= 451.92 mm > Bplen/6 --> Uplift in Transverse direction

f = Bplen / 2 - Edgedis
= 2620/2 - 283
= 1027.50 mm

K1 = 3 (e - 0.5 * Bplen)
= 3 (452 - 0.5*2620)
= -2574.23 mm

K2 = 6 * n1 * At / Bpwid * (f + e)
= 6 * 1 * 1251/350 * (1027 + 452)
= 31727.09 mm ²

K3 = -K2 * (0.5 * Bplen + f)
= -31727 * (0.5 * 2620 + 1027)
= -74162060.96 mm ³

Iteratively Solving for the Effective Bearing Length:
$Y^3 + K1 * Y^2 + K2 * Y + K3 = 0$

$Y^3 + -2574 * Y^2 + 31727 * Y + -74162056 = 0$
$Y = 2573.10$ mm

Num = (Bplen / 2 – Y / 3 – e)
= (2620/2 – 2573/3 – 452)
= 0.38

Denom = (Bplen / 2 – Y / 3 + f)
= (2620/2 – 2573/3 + 1027)
= 1479.80

Total Bolt Tension Force [Tforce]:
= – QO * Num / Denom
= – 291902 * 0.38/1480
= -74.23 N

Bolt Area Required due to Transverse Load [Bltareart]:
= Tforce / (Stba * Nbt)
= -74.2/(373 * 4)
= -0.0498 mm^2

Required Area of a Single Bolt [Bltarear]:
= max[Bltarearl, Bltarears, Bltareart]
= max[0, 12.2, -0.05]
= 12.2386 mm^2

Baseplate Thickness Calculation per D. Moss:

Bearing Pressure (fc)
= 2(QO + Tforce) / (Y * Bpwid)
= 2(291902 + -74.2)/(2573 * 350)
= 6.48 bar

Distance from Baseplate Edge to the Web [ADIST]:
= (Bplen – Weblngth) / 2
= (2620 – 2569)/2
= 25.4000 mm

Overturning Moment due To Bolt Tension [Mt]:
= Tforce * Adist
= -74.2 * 25.4
= -1.89 N-m

Equivalent Bearing Pressure (f1):
= fc * (Y – Adist) / Y
= 6.48 * (2573 – 25.4)/2573
= 6.42 bar

Overturning Moment due to Bearing Pressure [Mc]:
= (Adist² * Bpwid / 6) * (f1 + 2 * fc)
= (25.4 ² * 350/6) * (6.42 + 2 * 6.48)
= 72.96 N-m

Baseplate Required Thickness [Treq]:
= sqrt(6 * max(Mt,Mc) / (Bpwid * Sba))
= sqrt(6 * max(-1.89,73)/(350 * 204))
= 2.4730 mm

Note: Saddle and wear plate material are both specifed as impact tested.

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Review notes about nozzle loadings and supports in the Warnings report.

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ASME VIII Division 2 Horizontal Vessel Analysis, Left Saddle:

Horizontal Vessel Stress Calculations : Test Case

Note:
Wear Pad Width (350.00) is less than 1.56*sqrt(rm*t)
and less than 2a. The wear plate will be ignored.

Minimum Wear Plate Width to be considered in analysis [b1]:

```
= min( b + 1.56*sqrt( Rm * t ), 2a )
= min( 300 + 1.56*sqrt( 1422 * 44 ), 2 * 3250 )
= 690.2121 mm
```

Input and Calculated Values:

Vessel Mean Radius	Rm	1422.00	mm
Shell Thickness used in this Case	t	44.000	mm
Stiffened Vessel Length per 4.15.6	L	15600.00	mm
Distance from Saddle to Vessel tangent	a1 or a	3250.00	mm
Saddle Width	b1 or b	300.00	mm
Saddle Bearing Angle	delta or theta	130.00	degrees
Inside or Mean Depth of Head	Hi or hm	720.00	mm
Shell Allowable Stress used in Calculation		209.01	N/mm²
Head Allowable Stress used in Calculation		209.01	N/mm²
Circumferential Efficiency in Plane of Saddle		1.00	
Circumferential Efficiency at Mid-Span		1.00	
Distance from Saddle Base to Centerline	B	1725.00	mm
Coefficient of Friction	mu	0.50	
Saddle Force Q, Test Case, no Ext. Forces		808312.38	N
Pressure used in Analysis	P	57.339	bar

Horizontal Vessel Analysis Results:	Actual N/mm²	Allowable N/mm²
Long. Stress at Top of Midspan	91.31	209.01
Long. Stress at Bottom of Midspan	94.03	209.01
Long. Stress at Top of Saddles	111.01	209.01
Long. Stress at Bottom of Saddles	82.38	209.01
Tangential Shear in Shell	7.26	117.26
Circ. Stress at Horn of Saddle	34.79	313.51
Circ. Compressive Stress in Shell	1.93	209.01

Intermediate Results: Saddle Reaction Q due to Wind or Seismic:

Transverse Saddle Reaction Force [Fwt]:

```
= Ftr( Ft/Num of Saddles + Z Force Load ) * B / E
= 3 ( 38237/2 + 0 ) * 1725/2620
= 37762.6 N
```

Longitudinal Saddle Reaction Force [Fwl]:

```
= max( Fl, Sum of X Forces) * B / Ls
= max( 6461, 0 ) * 1725/9000
= 1238.4 N
```

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Load Combination Results for Q + Wind or Seismic [Q]:
= Saddle Load + max(Fwl, Fwt, Fsl, Fst)
= 770550 + max(1238, 37763, 0, 0)
= 808312.4 N

Longitudinal Wind Force [Fl]:
= WindScalar * WindPress(Platform Area + (pi/4(OD * WindDiaMult)^2))
= 1 * 2740 (0 + pi/4(2.89 * 1.2)^2)
= 25846.967 N

Summary of Loads at the Base of this Saddle:

Vertical Load (including saddle weight)	815355.31	N
Transverse Shear Load	19118.48	N
Longitudinal Shear Load	6461.41	N

Formulas and Substitutions for Horizontal Vessel Analysis:

Note: Wear Plate is Welded to the Shell, k = 0.1

Saddle Dimension [E]:
= Baseplate Length
= 2620.000 mm

The Computed K values from Table 4.15.1:

K1 = 0.1231	K2 = 1.0222	K3 = 0.7217	K4 = 0.3619
K5 = 0.7258	K6 = 0.0449	K7 = 0.0449	K8 = 0.3296
K9 = 0.2551	K10 = 0.0508	K1* = 0.2196	

Note: Dimension a is greater than or equal to Rm/2.

Moment per Equation 4.15.1 [M1]:
= −Q*a [1 − (1− a/L + (Rm²−hm²)/(2a*L))/(1+(4hm²)/3L)]
= −808312*3250[1−(1−3250/15600+(1422²−720²)/
(2*3250*15600))/(1+(4*720)/(3*15600))]
= −631416.2 N−m

Moment per Equation 4.15.2 [M2]:
= Q*L/4(1+2(Rm²−hm²)/(L²))/(1+(4hm²)/(3L))−4a/L
= 808312*15600/4(1+2(1422²−720²)/(15600²))/(1+(4*720)/
(3*15600))−4*3250/15600
= 379506.2 N−m

Longitudinal Stress at Top of Shell (4.15.4) [sigma1]:
= P * Rm/(2t) − M2/(pi*Rm²t)
= 57.3 * 1422/(2*44) − 379506/(pi*1422²*44)
= 91.31 N/mm²

Longitudinal Stress at Bottom of Shell (4.15.5) [sigma2]:
= P * Rm/(2t) + M2/(pi * Rm² * t)
= 57.3 * 1422/(2 * 44) + 379506/(pi * 1422² * 44)
= 94.03 N/mm²

Longitudinal Stress at Top of Shell at Support (4.15.8) [sigma✱3]:
= P * Rm/(2t) − M1/(K1*pi*Rm²t)
= 57.3*1422/(2*44)−−631416/(0.12*pi*1422²*44)
= 111.01 N/mm²

Longitudinal Stress at Bottom of Shell at Support (4.15.9) [sigma✱4]:
= P * Rm/(2t) + M1/(K1✱ * pi * Rm² * t)
= 57.3*1422/(2*44)+−631416/(0.22*pi*1422²*44)
= 82.38 N/mm²

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Maximum Shear Force in the Saddle (4.15.3) [T]:
= Q(L-2a)/(L+(4*hm/3))
= 808312 (15600 - 2 * 3250)/(15600 + (4 * 720/3))
= 444181.3 N

Shear Stress in the shell no rings, not stiffened (4.15.12) [tau2]:
= K2 * T / (Rm * t)
= 1.02 * 444181/(1422 * 44)
= 7.26 N/mm²

Decay Length (4.15.20) [x1,x2]:
= 0.78 * sqrt(Rm * t)
= 0.78 * sqrt(1422 * 44)
= 195.106 mm

Circumferential Stress in shell, no rings (4.15.21) [sigma6]:
= -K5 * Q * k / (t(b + X1 + X2))
= -0.73 * 808312 * 0.1/(44 (300 + 195 + 195))
= -1.93 N/mm²

Circ. Comp. Stress at Horn of Saddle, L>=8Rm (4.15.22) [sigma7]:
= -Q/(4*t(b+X1+X2)) - 3*K7*Q/(2*t²)
= -808312/(4 * 44 (300 + 195 + 195)) -
3 * 0.045 * 808312/(2*44²)
= -34.79 N/mm²

Effective reinforcing plate width (4.15.24) [B1]:
= min(b + 1.56 * sqrt(Rm * t), 2a)
= min(300 + 1.56 * sqrt(1422 * 44), 2 * 3250)
= 690.21 mm

Results for Vessel Ribs, Web and Base:

Baseplate Length	Bplen	2619.9998	mm
Baseplate Thickness	Bpthk	25.0000	mm
Baseplate Width	Bpwid	350.0000	mm
Number of Ribs (inc. outside ribs)	Nribs	6	
Rib Thickness	Ribtk	14.0000	mm
Web Thickness	Webtk	14.0000	mm
Web Location	Webloc	Center	
Saddle Yield Stress	Sy	205.0	N/m
Height of Web at Center	Hw,c	235.0	mm
Friction Coefficient	mu	0.500	

Moment of Inertia of Saddle - Transverse Direction (90 degrees to long axis)

Inertia of Shell [ShellInertia]:
= ((1.56 * sqrt(R * t) + WearPlateWidth)t³)/12
= ((1.56 * sqrt(1400 * 44) + 350)44³)/12
= 5233003.000 mm^4

Resolved Inertia for the Shell [I,shell]:
= ShellInertia + AShell(C1 - Y)²
= 5233003 + 32436 (86 - 22)²
= 138022576.000 mm^4

	B mm	D mm	Y mm	A mm^2	AY mm³	I + AD² mm^4
Shell	737.2	44.0	22.0	32436.0	713592.0	0.138E+09
Wearplate	350.0	20.0	54.0	7000.0	378000.0	0.739E+07
Web	14.0	236.0	182.0	3304.0	601327.8	0.458E+08
BasePlate	350.0	25.0	312.5	8750.0	2734374.5	0.449E+09
Totals	...	...	...	51490.0	4427294.5	0.641E+09

Distance to Centroid [C1]:
= AY / A
= 4427294/51490
= 85.984 mm

Angle [beta]:
= 180 – Saddle Angle/2
= 180 – 130/2
= 115.0

Saddle Splitting Coefficient [K1]:
= (1 + cos(beta) – 0.5*sin(beta)²)/(pi – beta + sin(beta)cos(beta))
= (1 + cos(115) – 0.5*sin(115)²)/(pi – 2.01 + sin(115)cos(115))
= 0.2218

Saddle Splitting Force [Fh]:
= K1 * Q
= 0.22 * 808312
= 179299.8750 N

Tension Stress, St = (Fh/As) = 9.4109 N/mm²
Allowed Stress, Sa = 0.6 * Yield Str = 123.0000 N/mm²

Saddle Splitting Dimension [d]:
= B – R * sin(theta/2)/(theta/2 in radians)
= 1725 – 1400 * sin(130/2)/1.13
= 606.559 mm

Bending Moment, M = Fh * d = 108800.0469 N–m

Bending Stress, Sb = (M * C1 / I) = 14.5982 N/mm²
Allowed Stress, Sa = 2/3 * Yield Str = 136.6667 N/mm²

Minimum Thickness of Baseplate per Moss:
= sqrt(3(Q + Saddle_Wt)BasePlateWidth / (4 * BasePlateLength * AllStress))
= sqrt(3(808312 + 7043)350/(4 * 2620 * 137))
= 24.450 mm

Calculation of Axial Load, Intermediate Values and Compressive Stress:

Web Length Dimension [Web Length]:
= 2 * cos(90 – Saddle Angle/2)(Inside Radius + Shell Thk + Wear Plate Thk)
= 2 * cos(90 – 130/2)(1400 + 44 + 20)
= 2653.669 mm

Distance between Ribs [e]:
= Web Length / (Nribs – 1)
= 2654/(6 – 1)
= 530.734 mm

Baseplate Pressure Area [Ap]:
= e * Bpwid / 2
= 531 * 350/2
= 92878.422 mm^2

Bearing Pressure [Bp]:
= Q / (BasePlateLength * BasePlateWidth)
= 808312/(2620 * 350)
= 0.881 N/mm^2

Axial Load [P]:
= Ap * Bp

= 92878 * 0.88
= 81870.000 N

Area of the Rib and Web [Ar]:
= Rib Area + Web Area
= 4004 + 3715
= 7719.137 mm^2

Compressive Stress [Sc]:
= P/Ar
= 81870/7719
= 10.607 N/mm²

Check of Outside Ribs:

Inertia of Saddle, Outer Ribs - Longitudinal Direction

	B	D	Y	A	AY	Io
Rib+Web	14.0	300.0	...	4200.0	...	0.315E+08

Rib dimension [D]:
= Saddle Width - Web Thickness
= 300 - 14
= 286.000 mm

Distance to Centroid from Datum [ytot]:
= AY / A
= 0/7719
= 0.000 mm

Distance to Centroid [C1]:
= Saddle Width / 2
= 300/2
= 150.000 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31499968/7719)
= 63.881 mm

Length of Outer Rib, step 1, [Lw]:
= 2 * sin(saddle bearing angle / 2)(radius + shlthk + wpdthk)
= 2 * sin(130/2)(1400 + 44 + 20)
= 2653.669 mm

Length of Outer Rib, step 2, [Bd]:
= Baseplate length - clearance
= 2620 - 50.8
= 2569.200 mm

Length of Outer Rib, step 3, [Dd]:
= (Lw - Bd)/2
= (2654 - 2569)/2
= 42.235 mm

Length of Outer Rib [L]:
= sqrt(Rl^2 + Dd^2)
= sqrt(1082^2 + 42.2^2)
= 1082.111 mm

Intermediate Term [Cc]:

```
= sqrt( 2 * pi² * Elastic Modulus / Yield Stress )
= sqrt( 2 * pi² * 199955/205 )
= 138.757
```

Slenderness ratio [KL/r]:

```
= KL/r
= 1 * 1082/63.9
= 16.940
```

Bending Moment [Rm]:

```
= Fl /( 2 * Bplen ) * e * L / 2
= 6461/( 2 * 2620 ) * 531 * 1082/2
= 354.234 N-m
```

Compressive Allowable, KL/r < Cc (16.9 < 139) per AISC E2-1 [Sca]:

```
= ( 1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= ( 1-( 16.9 )²/(2 * 139² ))205/
  ( 5/3+3*(16.9 )/(8* 139 )-( 16.9³)/(8*139³)
= 118.8 N/mm²
```

AISC Unity Check of Outside Ribs (must be <= 1)

```
= Sc/Sca + ( Rm * C1 / I )/Sba
= 10.6/119 + ( 354 * 150/31500000 )/137
= 0.102
```

Check of Inside Ribs:

Inertia of Saddle, Inner Ribs - Axial Direction

	B	D	Y	A	AY	Io
Rib	14.0	286.0	0.0	4004.0	0.0	0.315E+08
Web	530.7	14.0	0.0	7430.3	0.0	0.121E+06
Totals	...	...	...	11434.3	...	0.316E+08

Distance to Centroid from Datum [ytot]:

```
= AY / A
= 0/11434
= 0.000 mm
```

Distance to Centroid [C1]:

```
= Saddle Width / 2
= 300/2
= 150.000 mm
```

Length of Inner Rib [L]:

```
= Saddle Height - sqrt( (Ro + Wpdthk)^2 - (Pitch/2)^2 ) - Bpthk
= 1725 - sqrt( (1464 + 20 )^2 - (531/2)^2 ) - 25
= 260.251 mm
```

Radius of Gyration [r]:

```
= sqrt( Total Inertia / Total Area )
= sqrt( 31618128/11434 )
= 52.585 mm
```

Slenderness ratio [KL/r]:

```
= KL/r
= 1 * 260/52.6
= 4.949
```

Unit Force [Force,u]:

```
= Fl / ( 2 * Baseplate Length )
= 6461/( 2 * 2620 )
= 1.233 N/mm
```

Moment at base of inner Rib [Mbase,c]:
= Unit Force * e * L
= 1.23 * 531 * 260
= 170.389 N-m

Bending Stress due to Transverse Force and Weight Load [SigmaB,base,c]:
= Bending Moment / Section Modulus
= 170/210788
= 0.808 N/mm²

Compressive Allowable, KL/r < Cc (4.95 < 139) per AISC E2-1 [Sca]:
= (1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= (1-(4.95)²/(2 * 139²))205/
(5/3+3*(4.95)/(8* 139)-(4.95³)/(8*139³)
= 121.9 N/mm²

AISC Unity Check of Inside Ribs (must be <= 1)
= Sc/Sca + (Mbase,c * C1/I)/Sba
= 13.9/122 + (170 * 150/31618128)/137
= 0.120

Input Data for Base Plate Bolting Calculations:

Total Number of Bolts per BasePlate	Nbolts	8	
Total Number of Bolts in Tension/Baseplate	Nbt	4	
Bolt Material Specification		8.8	
Bolt Allowable Stress	Stba	373.00	N/mm²
Bolt Corrosion Allowance	Bca	0.0	mm
Distance from Bolts to Edge	Edgedis	282.5	mm
Nominal Bolt Diameter	Bnd	24.0000	mm
Thread Series	Series	TEMA Metric	
BasePlate Allowable Stress	S	136.30	N/mm²
Area Available in a Single Bolt	BltArea	312.7480	mm^2
Saddle Load QO (Weight)	QO	777592.7	N
Saddle Load QL (Wind/Seismic contribution)	QL	1238.4	N
Maximum Transverse Force	Ft	19118.5	N
Maximum Longitudinal Force	Fl	6461.4	N
Saddle Bolted to Steel Foundation		Yes	

Shear Stress in a Single Bolt, Longitudinal Direction [taub,l]:
= Fl / (Bolt Area * Number of Bolts)
= 6461/(313 * 8)
= 2.6 N/mm². Must be less than 264.0 N/mm².

Shear Stress in a Single Bolt, Transverse Direction [taub,t]:
= Ft / (Bolt Area * Number of Bolts)
= 19118/(313 * 8)
= 7.6 N/mm². Must be less than 264.0 N/mm².

Bolt Area Calculation per Dennis R. Moss

Bolt Area Requirement Due to Longitudinal Load [Bltarearl]:
= 0.0 (QO > QL --> No Uplift in Longitudinal direction)

Bolt Area due to Shear Load [Bltarears]:
= Fl / (BoltShearAllowable * Nbolts)
= 6461/(264 * 8)
= 3.0596 mm^2

Bolt Area due to Transverse Load:

Moment on Baseplate Due to Transverse Load [Rmom]:
```
= B * Ft + Sum of X Moments
= 1725 * 19118 + 0
= 32992.74 N-m
```

Eccentricity (e):
```
= Rmom / QO
= 32993/777593
= 42.41 mm < Bplen/6 --> No Uplift in Transverse direction
```

Bolt Area due to Transverse Load [Bltareart]:
```
= 0 (No Uplift)
```

Required Area of a Single Bolt [Bltarear]:
```
= max[Bltarearl, Bltarears, Bltareart]
= max[0, 3.06, 0 ]
= 3.0596 mm^2
```

ASME VIII Division 2 Horizontal Vessel Analysis, Right Saddle:

Note:
Wear Pad Width (350.00) is less than 1.56*sqrt(rm*t)
and less than 2a. The wear plate will be ignored.

Minimum Wear Plate Width to be considered in analysis [b1]:
```
= min( b + 1.56*sqrt( Rm * t ), 2a )
= min( 300 + 1.56*sqrt( 1422 * 44 ), 2 * 3250 )
= 690.2121 mm
```

Input and Calculated Values:

Vessel Mean Radius	Rm	1422.00	mm
Shell Thickness used in this Case	t	44.000	mm
Stiffened Vessel Length per 4.15.6	L	15600.00	mm
Distance from Saddle to Vessel tangent	a1 or a	3250.00	mm
Saddle Width	b1 or b	300.00	mm
Saddle Bearing Angle	delta or theta	130.00	degrees
Inside or Mean Depth of Head	Hi or hm	720.00	mm
Shell Allowable Stress used in Calculation		209.01	N/mm²
Head Allowable Stress used in Calculation		209.01	N/mm²
Circumferential Efficiency in Plane of Saddle		1.00	
Circumferential Efficiency at Mid-Span		1.00	
Distance from Saddle Base to Centerline	B	1725.00	mm
Coefficient of Friction	mu	0.30	
Saddle Force Q, Test Case, no Ext. Forces		825807.88	N
Pressure used in Analysis	P	57.339	bar

Horizontal Vessel Analysis Results:	Actual N/mm²	Allowable N/mm²
Long. Stress at Top of Midspan	91.28	209.01
Long. Stress at Bottom of Midspan	94.06	209.01
Long. Stress at Top of Saddles	111.40	209.01
Long. Stress at Bottom of Saddles	82.16	209.01

Tangential Shear in Shell	7.41	117.26
Circ. Stress at Horn of Saddle	35.54	313.51
Circ. Compressive Stress in Shell	1.97	209.01

Intermediate Results: Saddle Reaction Q due to Wind or Seismic:

Transverse Saddle Reaction Force [Fwt]:
= Ftr(Ft/Num of Saddles + Z Force Load) * B / E
= 3 (38237/2 + 0) * 1725/2620
= 37762.6 N

Longitudinal Saddle Reaction Force [Fwl]:
= max(Fl, Sum of X Forces) * B / Ls
= max(6461, 0) * 1725/9000
= 1238.4 N

Load Combination Results for Q + Wind or Seismic [Q]:
= Saddle Load + max(Fwl, Fwt, Fsl, Fst)
= 788045 + max(1238, 37763, 0, 0)
= 825807.9 N

Longitudinal Wind Force [Fl]:
= WindScalar * WindPress(Platform Area + (pi/4(OD * WindDiaMult)^2))
= 1 * 2740 (0 + pi/4(2.89 * 1.2)^2)
= 25846.967 N

Summary of Loads at the Base of this Saddle:

Vertical Load (including saddle weight)	832850.81	N
Transverse Shear Load	19118.48	N
Longitudinal Shear Load	6461.41	N

Formulas and Substitutions for Horizontal Vessel Analysis:

Note: Wear Plate is Welded to the Shell, k = 0.1

Saddle Dimension [E]:
= Baseplate Length
= 2620.000 mm

The Computed K values from Table 4.15.1:

K1 = 0.1231	K2 = 1.0222	K3 = 0.7217	K4 = 0.3619
K5 = 0.7258	K6 = 0.0449	K7 = 0.0449	K8 = 0.3296
K9 = 0.2551	K10 = 0.0508	K1* = 0.2196	

Note: Dimension a is greater than or equal to Rm/2.

Moment per Equation 4.15.1 [M1]:
= -Q*a [1 - (1- a/L + (Rm²-hm²)/(2a*L))/(1+(4hm²)/3L)]
= -825808*3250[1-(1-3250/15600+(1422²-720²)/
(2*3250*15600))/(1+(4*720)/(3*15600))]
= -645082.9 N-m

Moment per Equation 4.15.2 [M2]:
= Q*L/4(1+2(Rm²-hm²)/(L²))/(1+(4hm²)/(3L))-4a/L
= 825808*15600/4(1+2(1422²-720²)/(15600²))/(1+(4*720)/
(3*15600))-4*3250/15600
= 387720.4 N-m

Longitudinal Stress at Top of Shell (4.15.4) [sigma1]:
= P * Rm/(2t) - M2/(pi*Rm²t)
= 57.3 * 1422/(2*44) - 387720/(pi*1422²*44)

= 91.28 N/mm²

Longitudinal Stress at Bottom of Shell (4.15.5) [sigma2]:
= P * Rm/(2t) + M2/(pi * Rm² * t)
= 57.3 * 1422/(2 * 44) + 387720/(pi * 1422² * 44)
= 94.06 N/mm²

Longitudinal Stress at Top of Shell at Support (4.15.8) [sigma✱3]:
= P * Rm/(2t) - M1/(K1*pi*Rm²t)
= 57.3*1422/(2*44)--645083/(0.12*pi*1422²*44)
= 111.40 N/mm²

Longitudinal Stress at Bottom of Shell at Support (4.15.9) [sigma✱4]:
= P * Rm/(2t) + M1/(K1✱ * pi * Rm² * t)
= 57.3*1422/(2*44)+-645083/(0.22*pi*1422²*44)
= 82.16 N/mm²

Maximum Shear Force in the Saddle (4.15.3) [T]:
= Q(L-2a)/(L+(4*hm/3))
= 825808 (15600 - 2 * 3250)/(15600 + (4 * 720/3))
= 453795.4 N

Shear Stress in the shell no rings, not stiffened (4.15.12) [tau2]:
= K2 * T / (Rm * t)
= 1.02 * 453795/(1422 * 44)
= 7.41 N/mm²

Decay Length (4.15.20) [x1,x2]:
= 0.78 * sqrt(Rm * t)
= 0.78 * sqrt(1422 * 44)
= 195.106 mm

Circumferential Stress in shell, no rings (4.15.21) [sigma6]:
= -K5 * Q * k / (t(b + X1 + X2))
= -0.73 * 825808 * 0.1/(44 (300 + 195 + 195))
= -1.97 N/mm²

Circ. Comp. Stress at Horn of Saddle, L>=8Rm (4.15.22) [sigma7]:
= -Q/(4*t(b+X1+X2)) - 3*K7*Q/(2*t²)
= -825808/(4 * 44 (300 + 195 + 195)) -
3 * 0.045 * 825808/(2*44²)
= -35.54 N/mm²

Effective reinforcing plate width (4.15.24) [B1]:
= min(b + 1.56 * sqrt(Rm * t), 2a)
= min(300 + 1.56 * sqrt(1422 * 44), 2 * 3250)
= 690.21 mm

Results for Vessel Ribs, Web and Base:

Baseplate Length	Bplen	2619.9998	mm
Baseplate Thickness	Bpthk	25.0000	mm
Baseplate Width	Bpwid	350.0000	mm
Number of Ribs (inc. outside ribs)	Nribs	6	
Rib Thickness	Ribtk	14.0000	mm
Web Thickness	Webtk	14.0000	mm
Web Location	Webloc	Center	
Saddle Yield Stress	Sy	205.0	N/m
Height of Web at Center	Hw,c	235.0	mm
Friction Coefficient	mu	0.300	

Moment of Inertia of Saddle - Transverse Direction (90 degrees to long axis)

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Inertia of Shell [ShellInertia]:
= ((1.56 * sqrt(R * t) + WearPlateWidth)t^3)/12
= ((1.56 * sqrt(1400 * 44) + 350)44^3)/12
= 5233003.000 mm^4

Resolved Inertia for the Shell [I,shell]:
= ShellInertia + AShell(C1 - Y)^2
= 5233003 + 32436 (86 - 22)^2
= 138022576.000 mm^4

	B mm	D mm	Y mm	A mm^2	AY mm^3	I + AD^2 mm^4
Shell	737.2	44.0	22.0	32436.0	713592.0	0.138E+09
Wearplate	350.0	20.0	54.0	7000.0	378000.0	0.739E+07
Web	14.0	236.0	182.0	3304.0	601327.8	0.458E+08
BasePlate	350.0	25.0	312.5	8750.0	2734374.5	0.449E+09
Totals	...	...	...	51490.0	4427294.5	0.641E+09

Distance to Centroid [C1]:
= AY / A
= 4427294/51490
= 85.984 mm

Angle [beta]:
= 180 - Saddle Angle/2
= 180 - 130/2
= 115.0

Saddle Splitting Coefficient [K1]:
= (1 + cos(beta) - 0.5*sin(beta)^2)/(pi - beta + sin(beta)cos(beta))
= (1 + cos(115) - 0.5*sin(115)^2)/(pi - 2.01 + sin(115)cos(115))
= 0.2218

Saddle Splitting Force [Fh]:
= K1 * Q
= 0.22 * 825808
= 183180.7188 N

Tension Stress, St = (Fh/As) = 9.6146 N/mm²
Allowed Stress, Sa = 0.6 * Yield Str = 123.0000 N/mm²

Saddle Splitting Dimension [d]:
= B - R * sin(theta/2)/(theta/2 in radians)
= 1725 - 1400 * sin(130/2)/1.13
= 606.559 mm

Bending Moment, M = Fh * d = 111154.9531 N-m

Bending Stress, Sb = (M * C1 / I) = 14.9142 N/mm²
Allowed Stress, Sa = 2/3 * Yield Str = 136.6667 N/mm²

Minimum Thickness of Baseplate per Moss:
= sqrt(3(Q + Saddle_Wt)BasePlateWidth / (4 * BasePlateLength * AllStress))
= sqrt(3(825808 + 7043)350/(4 * 2620 * 137))
= 24.711 mm

Calculation of Axial Load, Intermediate Values and Compressive Stress:

Web Length Dimension [Web Length]:
= 2 * cos(90 - Saddle Angle/2)(Inside Radius + Shell Thk + Wear Plate Thk)
= 2 * cos(90 - 130/2)(1400 + 44 + 20)

= 2653.669 mm

Distance between Ribs [e]:
= Web Length / (Nribs - 1)
= 2654/(6 - 1)
= 530.734 mm

Baseplate Pressure Area [Ap]:
= e * Bpwid / 2
= 531 * 350/2
= 92878.422 mm^2

Bearing Pressure [Bp]:
= Q / (BasePlateLength * BasePlateWidth)
= 825808/(2620 * 350)
= 0.901 N/mm^2

Axial Load [P]:
= Ap * Bp
= 92878 * 0.9
= 83642.023 N

Area of the Rib and Web [Ar]:
= Rib Area + Web Area
= 4004 + 3715
= 7719.137 mm^2

Compressive Stress [Sc]:
= P/Ar
= 83642/7719
= 10.837 N/mm²

Check of Outside Ribs:

Inertia of Saddle, Outer Ribs - Longitudinal Direction

	B	D	Y	A	AY	Io
Rib+Web	14.0	300.0	...	4200.0	...	0.315E+08

Rib dimension [D]:
= Saddle Width - Web Thickness
= 300 - 14
= 286.000 mm

Distance to Centroid from Datum [ytot]:
= AY / A
= 0/7719
= 0.000 mm

Distance to Centroid [C1]:
= Saddle Width / 2
= 300/2
= 150.000 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31499968/7719)
= 63.881 mm

Length of Outer Rib, step 1, [Lw]:
= 2 * sin(saddle bearing angle / 2)(radius + shlthk + wpdthk)

= 2 * sin(130/2)(1400 + 44 + 20)
= 2653.669 mm

Length of Outer Rib, step 2, [Bd]:
= Baseplate length - clearance
= 2620 - 50.8
= 2569.200 mm

Length of Outer Rib, step 3, [Dd]:
= (Lw - Bd)/2
= (2654 - 2569)/2
= 42.235 mm

Length of Outer Rib [L]:
= sqrt(Rl^2 + Dd^2)
= sqrt(1082^2 + 42.2^2)
= 1082.111 mm

Intermediate Term [Cc]:
= sqrt(2 * pi² * Elastic Modulus / Yield Stress)
= sqrt(2 * pi² * 199955/205)
= 138.757

Slenderness ratio [KL/r]:
= KL/r
= 1 * 1082/63.9
= 16.940

Bending Moment [Rm]:
= Fl /(2 * Bplen) * e * L / 2
= 6461/(2 * 2620) * 531 * 1082/2
= 354.234 N-m

Compressive Allowable, KL/r < Cc (16.9 < 139) per AISC E2-1 [Sca]:
= (1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= (1-(16.9)²/(2 * 139²))205/
(5/3+3*(16.9)/(8* 139)-(16.9³)/(8*139³)
= 118.8 N/mm²

AISC Unity Check of Outside Ribs (must be <= 1)
= Sc/Sca + (Rm * C1 / I)/Sba
= 10.8/119 + (354 * 150/31500000)/137
= 0.104

Check of Inside Ribs:

Inertia of Saddle, Inner Ribs - Axial Direction

	B	D	Y	A	AY	Io
Rib	14.0	286.0	0.0	4004.0	0.0	0.315E+08
Web	530.7	14.0	0.0	7430.3	0.0	0.121E+06
Totals	...	...	...	11434.3	...	0.316E+08

Distance to Centroid from Datum [ytot]:
= AY / A
= 0/11434
= 0.000 mm

Distance to Centroid [C1]:
= Saddle Width / 2
= 300/2
= 150.000 mm

Length of Inner Rib [L]:
= Saddle Height - sqrt((Ro + Wpdthk)^2 - (Pitch/2)^2) - Bpthk
= 1725 - sqrt((1464 + 20)^2 - (531/2)^2) - 25
= 260.251 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31618128/11434)
= 52.585 mm

Slenderness ratio [KL/r]:
= KL/r
= 1 * 260/52.6
= 4.949

Unit Force [Force,u]:
= Fl / (2 * Baseplate Length)
= 6461/(2 * 2620)
= 1.233 N/mm

Moment at base of inner Rib [Mbase,c]:
= Unit Force * e * L
= 1.23 * 531 * 260
= 170.389 N-m

Bending Stress due to Transverse Force and Weight Load [SigmaB,base,c]:
= Bending Moment / Section Modulus
= 170/210788
= 0.808 N/mm²

Compressive Allowable, KL/r < Cc (4.95 < 139) per AISC E2-1 [Sca]:
= (1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= (1-(4.95)²/(2 * 139²))205/
(5/3+3*(4.95)/(8* 139)-(4.95³)/(8*139³)
= 121.9 N/mm²

AISC Unity Check of Inside Ribs (must be <= 1)
= Sc/Sca + (Mbase,c * C1/I)/Sba
= 14.2/122 + (170 * 150/31618128)/137
= 0.122

Input Data for Base Plate Bolting Calculations:

Total Number of Bolts per BasePlate	Nbolts	8	
Total Number of Bolts in Tension/Baseplate	Nbt	4	
Bolt Material Specification		8.8	
Bolt Allowable Stress	Stba	373.00	N/mm²
Bolt Corrosion Allowance	Bca	0.0	mm
Distance from Bolts to Edge	Edgedis	282.5	mm
Nominal Bolt Diameter	Bnd	24.0000	mm
Thread Series	Series	TEMA Metric	
BasePlate Allowable Stress	S	136.30	N/mm²
Area Available in a Single Bolt	BltArea	312.7480	mm^2
Saddle Load QO (Weight)	QO	795088.2	N
Saddle Load QL (Wind/Seismic contribution)	QL	1238.4	N
Maximum Transverse Force	Ft	19118.5	N
Maximum Longitudinal Force	Fl	6461.4	N
Saddle Bolted to Steel Foundation		Yes	

Shear Stress in a Single Bolt, Longitudinal Direction [taub,l]:
= Fl / (Bolt Area * Number of Bolts)
= 6461/(313 * 8)
= 2.6 N/mm². Must be less than 264.0 N/mm².

Shear Stress in a Single Bolt, Transverse Direction [taub,t]:
= Ft / (Bolt Area * Number of Bolts)
= 19118/(313 * 8)
= 7.6 N/mm². Must be less than 264.0 N/mm².

Bolt Area Calculation per Dennis R. Moss

Bolt Area Requirement Due to Longitudinal Load [Bltarearl]:
= 0.0 (QO > QL --> No Uplift in Longitudinal direction)

Bolt Area due to Shear Load [Bltarears]:
= Fl / (BoltShearAllowable * Nbolts)
= 6461/(264 * 8)
= 3.0596 mm^2

Bolt Area due to Transverse Load:

Moment on Baseplate Due to Transverse Load [Rmom]:
= B * Ft + Sum of X Moments
= 1725 * 19118 + 0
= 32992.74 N-m

Eccentricity (e):
= Rmom / QO
= 32993/795088
= 41.48 mm < Bplen/6 --> No Uplift in Transverse direction

Bolt Area due to Transverse Load [Bltareart]:
= 0 (No Uplift)

Required Area of a Single Bolt [Bltarear]:
= max[Bltarearl, Bltarears, Bltareart]
= max[0, 3.06, 0]
= 3.0596 mm^2

Review notes about nozzle loadings and supports in the Warnings report.

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ASME VIII Division 2 Horizontal Vessel Analysis, Left Saddle:

Horizontal Vessel Stress Calculations : External Pressure

Note:
Wear Pad Width (350.00) is less than 1.56*sqrt(rm*t)
and less than 2a. The wear plate will be ignored.

Minimum Wear Plate Width to be considered in analysis [b1]:

```
= min( b + 1.56*sqrt( Rm * t ), 2a )
= min( 300 + 1.56*sqrt( 1422 * 44 ), 2 * 3250 )
= 690.2121 mm
```

Input and Calculated Values:

Vessel Mean Radius	Rm	1422.00	mm
Shell Thickness used in this Case	t	44.000	mm
Stiffened Vessel Length per 4.15.6	L	15600.00	mm
Distance from Saddle to Vessel tangent	a1 or a	3250.00	mm
Saddle Width	b1 or b	300.00	mm
Saddle Bearing Angle	delta or theta	130.00	degrees
Inside or Mean Depth of Head	Hi or hm	720.00	mm
Shell Allowable Stress used in Calculation		136.28	N/mm²
Head Allowable Stress used in Calculation		136.28	N/mm²
Circumferential Efficiency in Plane of Saddle		1.00	
Circumferential Efficiency at Mid-Span		1.00	
Distance from Saddle Base to Centerline	B	1725.00	mm
Coefficient of Friction	mu	0.50	
Saddle Force Q, External Pressure Case		429473.38	N
Pressure used in Analysis	P	-1.030	bar

Horizontal Vessel Analysis Results:	Actual N/mm²	Allowable N/mm²
Long. Stress at Top of Midspan	-2.39	-184.50
Long. Stress at Top of Midspan	2.39	136.28
Long. Stress at Bottom of Midspan	-0.94	-184.50
Long. Stress at Bottom of Midspan	0.94	136.28
Long. Stress at Top of Saddles	8.08	136.28
Long. Stress at Bottom of Saddles	-7.13	-184.50
Long. Stress at Bottom of Saddles	7.13	136.28
Tangential Shear in Shell	3.86	109.03
Circ. Stress at Horn of Saddle	18.48	170.36
Circ. Compressive Stress in Shell	1.03	136.28

Intermediate Results: Saddle Reaction Q due to Wind or Seismic:

Transverse Saddle Reaction Force [Fwt]:

```
= Ftr( Ft/Num of Saddles + Z Force Load ) * B / E
= 3 ( 152948/2 + 0 ) * 1725/2620
= 151050.6 N
```

Longitudinal Saddle Reaction Force [Fwl]:

```
= max( Fl, Sum of X Forces) * B / Ls
```

= max(25846, 0) * 1725/9000
= 4953.7 N

Load Combination Results for Q + Wind or Seismic [Q]:
= Saddle Load + max(Fwl, Fwt, Fsl, Fst)
= 278423 + max(4954, 151051, 0, 0)
= 429473.4 N

Longitudinal Wind Force [Fl]:
= WindScalar * WindPress(Platform Area + (pi/4(OD * WindDiaMult)^2))
= 1 * 2740 (0 + pi/4(2.89 * 1.2)^2)
= 25846.967 N

Summary of Loads at the Base of this Saddle:

Vertical Load (including saddle weight)	436516.28	N
Transverse Shear Load	76473.91	N
Longitudinal Shear Load	25845.63	N

Formulas and Substitutions for Horizontal Vessel Analysis:

Note: Wear Plate is Welded to the Shell, k = 0.1

Saddle Dimension [E]:
= Baseplate Length
= 2620.000 mm

The Computed K values from Table 4.15.1:

K1 = 0.1231	K2 = 1.0222	K3 = 0.7217	K4 = 0.3619
K5 = 0.7258	K6 = 0.0449	K7 = 0.0449	K8 = 0.3296
K9 = 0.2551	K10 = 0.0508	K1* = 0.2196	

Note: Dimension a is greater than or equal to Rm/2.

Moment per Equation 4.15.1 [M1]:
= -Q*a [1 - (1- a/L + (Rm²-hm²)/(2a*L))/(1+(4hm²)/3L)]
= -429473*3250[1-(1-3250/15600+(1422²-720²)/
(2*3250*15600))/(1+(4*720)/(3*15600))]
= -335484.7 N-m

Moment per Equation 4.15.2 [M2]:
= Q*L/4(1+2(Rm²-hm²)/(L²))/(1+(4hm²)/(3L))-4a/L
= 429473*15600/4(1+2(1422²-720²)/(15600²))/(1+(4*720)/
(3*15600))-4*3250/15600
= 201639.6 N-m

Longitudinal Stress at Top of Shell (4.15.4) [sigma1]:
= P * Rm/(2t) - M2/(pi*Rm²t)
= -1.03 * 1422/(2*44) - 201640/(pi*1422²*44)
= -2.39 N/mm²

Longitudinal Stress at Bottom of Shell (4.15.5) [sigma2]:
= P * Rm/(2t) + M2/(pi * Rm² * t)
= -1.03 * 1422/(2 * 44) + 201640/(pi * 1422² * 44)
= -0.94 N/mm²

Longitudinal Stress at Top of Shell at Support (4.15.8) [sigma*3]:
= P * Rm/(2t) - M1/(K1*pi*Rm²t)
= -1.03*1422/(2*44)--335485/(0.12*pi*1422²*44)
= 8.08 N/mm²

Longitudinal Stress at Bottom of Shell at Support (4.15.9) [sigma*4]:
= P * Rm/(2t) + M1/(K1* * pi * Rm² * t)

= −1.03*1422/(2*44)+−335485/(0.22*pi*1422²*44)
= −7.13 N/mm²

Maximum Shear Force in the Saddle (4.15.3) [T]:
= Q(L−2a)/(L+(4*hm/3))
= 429473 (15600 − 2 * 3250)/(15600 + (4 * 720/3))
= 236002.9 N

Shear Stress in the shell no rings, not stiffened (4.15.12) [tau2]:
= K2 * T / (Rm * t)
= 1.02 * 236003/(1422 * 44)
= 3.86 N/mm²

Decay Length (4.15.20) [x1,x2]:
= 0.78 * sqrt(Rm * t)
= 0.78 * sqrt(1422 * 44)
= 195.106 mm

Circumferential Stress in shell, no rings (4.15.21) [sigma6]:
= −K5 * Q * k / (t(b + X1 + X2))
= −0.73 * 429473 * 0.1/(44 (300 + 195 + 195))
= −1.03 N/mm²

Circ. Comp. Stress at Horn of Saddle, L>=8Rm (4.15.22) [sigma7]:
= −Q/(4*t(b+X1+X2)) − 3*K7*Q/(2*t²)
= −429473/(4 * 44 (300 + 195 + 195)) −
3 * 0.045 * 429473/(2*44²)
= −18.48 N/mm²

Effective reinforcing plate width (4.15.24) [B1]:
= min(b + 1.56 * sqrt(Rm * t), 2a)
= min(300 + 1.56 * sqrt(1422 * 44), 2 * 3250)
= 690.21 mm

Results for Vessel Ribs, Web and Base:

Baseplate Length	Bplen	2619.9998	mm
Baseplate Thickness	Bpthk	25.0000	mm
Baseplate Width	Bpwid	350.0000	mm
Number of Ribs (inc. outside ribs)	Nribs	6	
Rib Thickness	Ribtk	14.0000	mm
Web Thickness	Webtk	14.0000	mm
Web Location	Webloc	Center	
Saddle Yield Stress	Sy	205.0	N/m
Height of Web at Center	Hw,c	235.0	mm
Friction Coefficient	mu	0.500	

Moment of Inertia of Saddle - Transverse Direction (90 degrees to long axis)

Inertia of Shell [ShellInertia]:
= ((1.56 * sqrt(R * t) + WearPlateWidth)t³)/12
= ((1.56 * sqrt(1400 * 44) + 350)44³)/12
= 5233003.000 mm^4

Resolved Inertia for the Shell [I,shell]:
= ShellInertia + AShell(C1 − Y)²
= 5233003 + 32436 (86 − 22)²
= 138022576.000 mm^4

	B mm	D mm	Y mm	A mm^2	AY mm³	I + AD² mm^4
Shell	737.2	44.0	22.0	32436.0	713592.0	0.138E+09
Wearplate	350.0	20.0	54.0	7000.0	378000.0	0.739E+07

Web	14.0	236.0	182.0	3304.0	601327.8	0.458E+08
BasePlate	350.0	25.0	312.5	8750.0	2734374.5	0.449E+09
Totals	...	...	...	51490.0	4427294.5	0.641E+09

Distance to Centroid [C1]:
= AY / A
= 4427294/51490
= 85.984 mm

Angle [beta]:
= 180 – Saddle Angle/2
= 180 – 130/2
= 115.0

Saddle Splitting Coefficient [K1]:
= (1 + cos(beta) – 0.5*sin(beta)²)/(pi – beta + sin(beta)cos(beta))
= (1 + cos(115) – 0.5*sin(115)²)/(pi – 2.01 + sin(115)cos(115))
= 0.2218

Saddle Splitting Force [Fh]:
= K1 * Q
= 0.22 * 429473
= 95265.7891 N

Tension Stress, St = (Fh/As) = 5.0002 N/mm²
Allowed Stress, Sa = 0.6 * Yield Str = 123.0000 N/mm²

Saddle Splitting Dimension [d]:
= B – R * sin(theta/2)/(theta/2 in radians)
= 1725 – 1400 * sin(130/2)/1.13
= 606.559 mm

Bending Moment, M = Fh * d = 57807.7461 N–m

Bending Stress, Sb = (M * C1 / I) = 7.7563 N/mm²
Allowed Stress, Sa = 2/3 * Yield Str = 136.6667 N/mm²

Minimum Thickness of Baseplate per Moss:
= sqrt(3(Q + Saddle_Wt)BasePlateWidth / (4 * BasePlateLength * AllStress))
= sqrt(3(429473 + 7043)350/(4 * 2620 * 137))
= 17.890 mm

Calculation of Axial Load, Intermediate Values and Compressive Stress:

Web Length Dimension [Web Length]:
= 2 * cos(90 – Saddle Angle/2)(Inside Radius + Shell Thk + Wear Plate Thk)
= 2 * cos(90 – 130/2)(1400 + 44 + 20)
= 2653.669 mm

Distance between Ribs [e]:
= Web Length / (Nribs – 1)
= 2654/(6 – 1)
= 530.734 mm

Baseplate Pressure Area [Ap]:
= e * Bpwid / 2
= 531 * 350/2
= 92878.422 mm^2

Bearing Pressure [Bp]:
= Q / (BasePlateLength * BasePlateWidth)
= 429473/(2620 * 350)
= 0.468 N/mm^2

Axial Load [P]:
= Ap * Bp
= 92878 * 0.47
= 43499.250 N

Area of the Rib and Web [Ar]:
= Rib Area + Web Area
= 4004 + 3715
= 7719.137 mm^2

Compressive Stress [Sc]:
= P/Ar
= 43499/7719
= 5.636 N/mm²

Check of Outside Ribs:

Inertia of Saddle, Outer Ribs - Longitudinal Direction

	B	D	Y	A	AY	Io
Rib+Web	14.0	300.0	...	4200.0	...	0.315E+08

Rib dimension [D]:
= Saddle Width - Web Thickness
= 300 - 14
= 286.000 mm

Distance to Centroid from Datum [ytot]:
= AY / A
= 0/7719
= 0.000 mm

Distance to Centroid [C1]:
= Saddle Width / 2
= 300/2
= 150.000 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31499968/7719)
= 63.881 mm

Length of Outer Rib, step 1, [Lw]:
= 2 * sin(saddle bearing angle / 2)(radius + shlthk + wpdthk)
= 2 * sin(130/2)(1400 + 44 + 20)
= 2653.669 mm

Length of Outer Rib, step 2, [Bd]:
= Baseplate length - clearance
= 2620 - 50.8
= 2569.200 mm

Length of Outer Rib, step 3, [Dd]:
= (Lw - Bd)/2
= (2654 - 2569)/2
= 42.235 mm

Length of Outer Rib [L]:
= sqrt(Rl^2 + Dd^2)
= sqrt(1082^2 + 42.2^2)

= 1082.111 mm

Intermediate Term [Cc]:
= sqrt(2 * pi² * Elastic Modulus / Yield Stress)
= sqrt(2 * pi² * 199955/205)
= 138.757

Slenderness ratio [KL/r]:
= KL/r
= 1 * 1082/63.9
= 16.940

Bending Moment [Rm]:
= Fl /(2 * Bplen) * e * L / 2
= 25846/(2 * 2620) * 531 * 1082/2
= 1416.937 N-m

Compressive Allowable, KL/r < Cc (16.9 < 139) per AISC E2-1 [Sca]:
= (1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= (1-(16.9)²/(2 * 139²))205/
(5/3+3*(16.9)/(8* 139)-(16.9³)/(8*139³)
= 118.8 N/mm²

AISC Unity Check of Outside Ribs (must be <= 1)
= Sc/Sca + (Rm * C1 / I)/Sba
= 5.64/119 + (1417 * 150/31500000)/137
= 0.097

Check of Inside Ribs:

Inertia of Saddle, Inner Ribs - Axial Direction

	B	D	Y	A	AY	Io
Rib	14.0	286.0	0.0	4004.0	0.0	0.315E+08
Web	530.7	14.0	0.0	7430.3	0.0	0.121E+06
Totals	...	...	...	11434.3	...	0.316E+08

Distance to Centroid from Datum [ytot]:
= AY / A
= 0/11434
= 0.000 mm

Distance to Centroid [C1]:
= Saddle Width / 2
= 300/2
= 150.000 mm

Length of Inner Rib [L]:
= Saddle Height - sqrt((Ro + Wpdthk)^2 - (Pitch/2)^2) - Bpthk
= 1725 - sqrt((1464 + 20)^2 - (531/2)^2) - 25
= 260.251 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31618128/11434)
= 52.585 mm

Slenderness ratio [KL/r]:
= KL/r
= 1 * 260/52.6
= 4.949

Unit Force [Force,u]:

```
= Fl / ( 2 * Baseplate Length )
= 25846/( 2 * 2620 )
= 4.932 N/mm
```

Moment at base of inner Rib [Mbase,c]:

```
= Unit Force * e * L
= 4.93 * 531 * 260
= 681.556 N-m
```

Bending Stress due to Transverse Force and Weight Load [SigmaB,base,c]:

```
= Bending Moment / Section Modulus
= 682/210788
= 3.232 N/mm²
```

Compressive Allowable, KL/r < Cc (4.95 < 139) per AISC E2-1 [Sca]:

```
= ( 1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= ( 1-( 4.95 )²/(2 * 139² ))205/
  ( 5/3+3*(4.95 )/(8* 139 )-( 4.95³)/(8*139³)
= 121.9 N/mm²
```

AISC Unity Check of Inside Ribs (must be <= 1)

```
= Sc/Sca + ( Mbase,c * C1/I )/Sba
= 7.39/122 + ( 682 * 150/31618128 )/137
= 0.084
```

ASME VIII Division 2 Horizontal Vessel Analysis, Right Saddle:

Note:
Wear Pad Width (350.00) is less than 1.56*sqrt(rm*t)
and less than 2a. The wear plate will be ignored.

Minimum Wear Plate Width to be considered in analysis [b1]:

```
= min( b + 1.56*sqrt( Rm * t ), 2a )
= min( 300 + 1.56*sqrt( 1422 * 44 ), 2 * 3250 )
= 690.2121 mm
```

Input and Calculated Values:

Vessel Mean Radius	Rm	1422.00	mm
Shell Thickness used in this Case	t	44.000	mm
Stiffened Vessel Length per 4.15.6	L	15600.00	mm
Distance from Saddle to Vessel tangent	a1 or a	3250.00	mm
Saddle Width	b1 or b	300.00	mm
Saddle Bearing Angle	delta or theta	130.00	degrees
Inside or Mean Depth of Head	Hi or hm	720.00	mm
Shell Allowable Stress used in Calculation		136.28	N/mm²
Head Allowable Stress used in Calculation		136.28	N/mm²
Circumferential Efficiency in Plane of Saddle		1.00	
Circumferential Efficiency at Mid-Span		1.00	
Distance from Saddle Base to Centerline	B	1725.00	mm
Coefficient of Friction	mu	0.30	
Saddle Force Q, External Pressure Case		435909.69	N
Pressure used in Analysis	P	-1.030	bar

Horizontal Vessel Analysis Results:	Actual N/mm²	Allowable N/mm²

Long. Stress at Top of Midspan	-2.40	-184.50
Long. Stress at Top of Midspan	2.40	136.28
Long. Stress at Bottom of Midspan	-0.93	-184.50
Long. Stress at Bottom of Midspan	0.93	136.28
Long. Stress at Top of Saddles	8.22	136.28
Long. Stress at Bottom of Saddles	-7.21	-184.50
Long. Stress at Bottom of Saddles	7.21	136.28
Tangential Shear in Shell	3.91	109.03
Circ. Stress at Horn of Saddle	18.76	170.36
Circ. Compressive Stress in Shell	1.04	136.28

Intermediate Results: Saddle Reaction Q due to Wind or Seismic:

Transverse Saddle Reaction Force [Fwt]:
= Ftr(Ft/Num of Saddles + Z Force Load) * B / E
= 3 (152948/2 + 0) * 1725/2620
= 151050.6 N

Longitudinal Saddle Reaction Force [Fwl]:
= max(Fl, Sum of X Forces) * B / Ls
= max(25846, 0) * 1725/9000
= 4953.7 N

Load Combination Results for Q + Wind or Seismic [Q]:
= Saddle Load + max(Fwl, Fwt, Fsl, Fst)
= 284859 + max(4954, 151051, 0, 0)
= 435909.7 N

Longitudinal Wind Force [Fl]:
= WindScalar * WindPress(Platform Area + (pi/4(OD * WindDiaMult)^2))
= 1 * 2740 (0 + pi/4(2.89 * 1.2)^2)
= 25846.967 N

Summary of Loads at the Base of this Saddle:

Vertical Load (including saddle weight)	442952.62	N
Transverse Shear Load	76473.91	N
Longitudinal Shear Load	25845.63	N

Formulas and Substitutions for Horizontal Vessel Analysis:

Note: Wear Plate is Welded to the Shell, k = 0.1

Saddle Dimension [E]:
= Baseplate Length
= 2620.000 mm

The Computed K values from Table 4.15.1:

K1 = 0.1231	K2 = 1.0222	K3 = 0.7217	K4 = 0.3619
K5 = 0.7258	K6 = 0.0449	K7 = 0.0449	K8 = 0.3296
K9 = 0.2551	K10 = 0.0508	K1* = 0.2196	

Note: Dimension a is greater than or equal to Rm/2.

Moment per Equation 4.15.1 [M1]:
= -Q*a [1 - (1- a/L + (Rm²-hm²)/(2a*L))/(1+(4hm²)/3L)]
= -435910*3250[1-(1-3250/15600+(1422²-720²)/
(2*3250*15600))/(1+(4*720)/(3*15600))]
= -340512.5 N-m

Moment per Equation 4.15.2 [M2]:

```
= Q*L/4(1+2(Rm²-hm²)/(L²))/(1+(4hm²)/( 3L))-4a/L
= 435910*15600/4(1+2(1422²-720²)/(15600²))/(1+(4*720)/
  (3*15600))-4*3250/15600
= 204661.5 N-m
```

Longitudinal Stress at Top of Shell (4.15.4) [sigma1]:

```
= P * Rm/(2t) - M2/(pi*Rm²t)
= -1.03 * 1422/(2*44 ) - 204662/(pi*1422²*44 )
= -2.40 N/mm²
```

Longitudinal Stress at Bottom of Shell (4.15.5) [sigma2]:

```
= P * Rm/(2t) + M2/(pi * Rm² * t)
= -1.03 * 1422/(2 * 44 ) + 204662/(pi * 1422² * 44 )
= -0.93 N/mm²
```

Longitudinal Stress at Top of Shell at Support (4.15.8) [sigma✱3]:

```
= P * Rm/(2t) - M1/(K1*pi*Rm²t)
= -1.03*1422/(2*44)--340512/(0.12*pi*1422²*44)
= 8.22 N/mm²
```

Longitudinal Stress at Bottom of Shell at Support (4.15.9) [sigma✱4]:

```
= P * Rm/(2t) + M1/(K1✱ * pi * Rm² * t)
= -1.03*1422/(2*44)+-340512/(0.22*pi*1422²*44)
= -7.21 N/mm²
```

Maximum Shear Force in the Saddle (4.15.3) [T]:

```
= Q(L-2a)/(L+(4*hm/3))
= 435910 ( 15600 - 2 * 3250 )/(15600 + ( 4 * 720/3))
= 239539.8 N
```

Shear Stress in the shell no rings, not stiffened (4.15.12) [tau2]:

```
= K2 * T / ( Rm * t )
= 1.02 * 239540/( 1422 * 44 )
= 3.91 N/mm²
```

Decay Length (4.15.20) [x1,x2]:

```
= 0.78 * sqrt( Rm * t )
= 0.78 * sqrt( 1422 * 44 )
= 195.106 mm
```

Circumferential Stress in shell, no rings (4.15.21) [sigma6]:

```
= -K5 * Q * k / ( t( b + X1 + X2 ) )
= -0.73 * 435910 * 0.1/( 44 ( 300 + 195 + 195 ) )
= -1.04 N/mm²
```

Circ. Comp. Stress at Horn of Saddle, L>=8Rm (4.15.22) [sigma7]:

```
= -Q/(4*t(b+X1+X2)) - 3*K7*Q/(2*t²)
= -435910/(4 * 44 (300 + 195 + 195 )) -
   3 * 0.045 * 435910/(2*44²)
= -18.76 N/mm²
```

Effective reinforcing plate width (4.15.24) [B1]:

```
= min( b + 1.56 * sqrt( Rm * t ), 2a  )
= min( 300 + 1.56 * sqrt( 1422 * 44 ), 2 * 3250 )
= 690.21 mm
```

Results for Vessel Ribs, Web and Base:

Baseplate Length	Bplen	2619.9998	mm
Baseplate Thickness	Bpthk	25.0000	mm
Baseplate Width	Bpwid	350.0000	mm
Number of Ribs (inc. outside ribs)	Nribs	6	

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Rib Thickness	Ribtk	14.0000	mm
Web Thickness	Webtk	14.0000	mm
Web Location	Webloc	Center	
Saddle Yield Stress	Sy	205.0	N/m
Height of Web at Center	Hw,c	235.0	mm
Friction Coefficient	mu	0.300	

Moment of Inertia of Saddle - Transverse Direction (90 degrees to long axis)

Inertia of Shell [ShellInertia]:
= ((1.56 * sqrt(R * t) + WearPlateWidth)t^3)/12
= ((1.56 * sqrt(1400 * 44) + 350)44^3)/12
= 5233003.000 mm^4

Resolved Inertia for the Shell [I,shell]:
= ShellInertia + AShell(C1 - Y)^2
= 5233003 + 32436 (86 - 22)^2
= 138022576.000 mm^4

	B mm	D mm	Y mm	A mm^2	AY mm^3	I + AD^2 mm^4
Shell	737.2	44.0	22.0	32436.0	713592.0	0.138E+09
Wearplate	350.0	20.0	54.0	7000.0	378000.0	0.739E+07
Web	14.0	236.0	182.0	3304.0	601327.8	0.458E+08
BasePlate	350.0	25.0	312.5	8750.0	2734374.5	0.449E+09
Totals	...	...	...	51490.0	4427294.5	0.641E+09

Distance to Centroid [C1]:
= AY / A
= 4427294/51490
= 85.984 mm

Angle [beta]:
= 180 - Saddle Angle/2
= 180 - 130/2
= 115.0

Saddle Splitting Coefficient [K1]:
= (1 + cos(beta) - 0.5*$sin(beta)^2$)/(pi - beta + sin(beta)cos(beta))
= (1 + cos(115) - 0.5*$sin(115)^2$)/(pi - 2.01 + sin(115)cos(115))
= 0.2218

Saddle Splitting Force [Fh]:
= K1 * Q
= 0.22 * 435910
= 96693.4922 N

Tension Stress, St = (Fh/As)	=	5.0751 N/mm^2
Allowed Stress, Sa = 0.6 * Yield Str	=	123.0000 N/mm^2

Saddle Splitting Dimension [d]:
= B - R * sin(theta/2)/(theta/2 in radians)
= 1725 - 1400 * sin(130/2)/1.13
= 606.559 mm

Bending Moment, M = Fh * d	=	58674.0820 N-m
Bending Stress, Sb = (M * C1 / I)	=	7.8726 N/mm^2
Allowed Stress, Sa = 2/3 * Yield Str	=	136.6667 N/mm^2

Minimum Thickness of Baseplate per Moss:
= sqrt(3(Q + Saddle_Wt)BasePlateWidth / (4 * BasePlateLength * AllStress))

```
= sqrt( 3(435910 + 7043 )350/( 4 * 2620 * 137 ))
= 18.021 mm
```

Calculation of Axial Load, Intermediate Values and Compressive Stress:

Web Length Dimension [Web Length]:
```
= 2 * cos( 90 - Saddle Angle/2 )( Inside Radius + Shell Thk + Wear Plate Thk )
= 2 * cos( 90 - 130/2 )( 1400 + 44 + 20 )
= 2653.669 mm
```

Distance between Ribs [e]:
```
= Web Length / ( Nribs - 1 )
= 2654/( 6 - 1 )
= 530.734 mm
```

Baseplate Pressure Area [Ap]:
```
= e * Bpwid / 2
= 531 * 350/2
= 92878.422 mm^2
```

Bearing Pressure [Bp]:
```
= Q / ( BasePlateLength * BasePlateWidth )
= 435910/( 2620 * 350 )
= 0.475 N/mm^2
```

Axial Load [P]:
```
= Ap * Bp
= 92878 * 0.48
= 44151.156 N
```

Area of the Rib and Web [Ar]:
```
= Rib Area + Web Area
= 4004 + 3715
= 7719.137 mm^2
```

Compressive Stress [Sc]:
```
= P/Ar
= 44151/7719
= 5.720 N/mm²
```

Check of Outside Ribs:

Inertia of Saddle, Outer Ribs - Longitudinal Direction

	B	D	Y	A	AY	Io
Rib+Web	14.0	300.0	...	4200.0	...	0.315E+08

Rib dimension [D]:
```
= Saddle Width - Web Thickness
= 300 - 14
= 286.000 mm
```

Distance to Centroid from Datum [ytot]:
```
= AY / A
= 0/7719
= 0.000 mm
```

Distance to Centroid [C1]:
```
= Saddle Width / 2
= 300/2
= 150.000 mm
```

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Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31499968/7719)
= 63.881 mm

Length of Outer Rib, step 1, [Lw]:
= 2 * sin(saddle bearing angle / 2)(radius + shlthk + wpdthk)
= 2 * sin(130/2)(1400 + 44 + 20)
= 2653.669 mm

Length of Outer Rib, step 2, [Bd]:
= Baseplate length - clearance
= 2620 - 50.8
= 2569.200 mm

Length of Outer Rib, step 3, [Dd]:
= (Lw - Bd)/2
= (2654 - 2569)/2
= 42.235 mm

Length of Outer Rib [L]:
= sqrt(Rl^2 + Dd^2)
= sqrt(1082^2 + 42.2^2)
= 1082.111 mm

Intermediate Term [Cc]:
= sqrt(2 * pi^2 * Elastic Modulus / Yield Stress)
= sqrt(2 * pi^2 * 199955/205)
= 138.757

Slenderness ratio [KL/r]:
= KL/r
= 1 * 1082/63.9
= 16.940

Bending Moment [Rm]:
= Fl /(2 * Bplen) * e * L / 2
= 25846/(2 * 2620) * 531 * 1082/2
= 1416.937 N-m

Compressive Allowable, KL/r < Cc (16.9 < 139) per AISC E2-1 [Sca]:
= (1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= (1-(16.9)²/(2 * 139²))205/
(5/3+3*(16.9)/(8* 139)-(16.9³)/(8*139³)
= 118.8 N/mm²

AISC Unity Check of Outside Ribs (must be <= 1)
= Sc/Sca + (Rm * C1 / I)/Sba
= 5.72/119 + (1417 * 150/31500000)/137
= 0.097

Check of Inside Ribs:

Inertia of Saddle, Inner Ribs - Axial Direction

	B	D	Y	A	AY	Io
Rib	14.0	286.0	0.0	4004.0	0.0	0.315E+08
Web	530.7	14.0	0.0	7430.3	0.0	0.121E+06
Totals	...	...	...	11434.3	...	0.316E+08

Distance to Centroid from Datum [ytot]:
= AY / A

```
= 0/11434
= 0.000 mm
```

Distance to Centroid [C1]:
```
= Saddle Width / 2
= 300/2
= 150.000 mm
```

Length of Inner Rib [L]:
```
= Saddle Height - sqrt( (Ro + Wpdthk)^2 - (Pitch/2)^2 ) - Bpthk
= 1725 - sqrt( (1464 + 20 )^2 - (531/2)^2 ) - 25
= 260.251 mm
```

Radius of Gyration [r]:
```
= sqrt( Total Inertia / Total Area )
= sqrt( 31618128/11434 )
= 52.585 mm
```

Slenderness ratio [KL/r]:
```
= KL/r
= 1 * 260/52.6
= 4.949
```

Unit Force [Force,u]:
```
= Fl / ( 2 * Baseplate Length )
= 25846/( 2 * 2620 )
= 4.932 N/mm
```

Moment at base of inner Rib [Mbase,c]:
```
= Unit Force * e * L
= 4.93 * 531 * 260
= 681.556 N-m
```

Bending Stress due to Transverse Force and Weight Load [SigmaB,base,c]:
```
= Bending Moment / Section Modulus
= 682/210788
= 3.232 N/mm²
```

Compressive Allowable, KL/r < Cc (4.95 < 139) per AISC E2-1 [Sca]:
```
= ( 1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= ( 1-( 4.95 )²/(2 * 139² ))205/
  ( 5/3+3*(4.95 )/(8* 139 )-( 4.95³)/(8*139³)
= 121.9 N/mm²
```

AISC Unity Check of Inside Ribs (must be <= 1)
```
= Sc/Sca + ( Mbase,c * C1/I )/Sba
= 7.5/122 + ( 682 * 150/31618128 )/137
= 0.085
```

Review notes about nozzle loadings and supports in the Warnings report.

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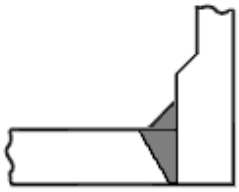
Input, Nozzle Desc: M1 From: 10

Pressure for Reinforcement Calculations	P	40.000	bar
Temperature for Internal Pressure	Temp	80	°C
Design External Pressure	Pext	1.03	bar
Temperature for External Pressure	Tempex	80	°C
Parent Material [Impact Tested]		SA-516 60	
Parent Allowable Stress at Temperature	Sv	136.28	N/mm²
Parent Allowable Stress At Ambient	Sva	147.00	N/mm²
Inside Diameter of Elliptical Head	D	2800.00	mm
Aspect Ratio of Elliptical Head	Ar	2.00	
Head Finished (Minimum) Thickness	t	40.0000	mm
Head Internal Corrosion Allowance	c	0.0000	mm
Head External Corrosion Allowance	co	0.0000	mm
Distance from Head Centerline	L1	0.0000	mm
User Entered Minimum Design Metal Temperature		-46.00	°C

Type of Element Connected to the Parent : Nozzle

Material [Impact Tested]		SA-350 LF2	
Material UNS Number		K03011	
Material Specification/Type		Forgings	
Allowable Stress at Temperature	Sn	153.86	N/mm²
Allowable Stress At Ambient	Sna	165.00	N/mm²
Diameter Basis (for tr calc only)		Inside	
Layout Angle		0.00	deg
Diameter		609.6000	mm
Size and Thickness Basis		Actual	
Actual Thickness	tn	46.0500	mm
Flange Material [Normalized]		SA-350 LF2	
Hub Height of Integral Nozzle	h	130.0000	mm
Height of Beveled Transition	L'	33.9500	mm
Hub Thickness of Integral Nozzle (tn or x+tp)		80.0000	mm
Corrosion Allowance	can	0.0000	mm
Outside Projection	ho	300.0000	mm
Weld leg size between Nozzle and Pad/Shell	Wo	10.0000	mm
Groove weld depth between Nozzle and Vessel	Wgnv	40.0000	mm
Inside Projection	h	0.0000	mm
Weld leg size, Inside Element to Shell	Wi	0.0000	mm
User Defined Nozzle/Shell Centerline Angle		90.0000	deg.
This is a Manway or Access Opening.			
Flange Class		300	
Flange Grade		GR 1.1	

The Pressure Design option was MAWP + static head (to the nozzle).



Hub Nozzle (Set-in)

Reinforcement CALCULATION, Description: M1

ASME Code, Section VIII, Div. 2, 2021, Section 4.5.1 - 4.5.14

```
Actual Inside Diameter Used in Calculation          609.600  mm.
Actual Thickness Used in Calculation                 46.050  mm
```

Nozzle input data check completed without errors.

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:

```
= 0.5*D*( exp( P/(S*E) )-1)+ci+co
= 0.5*610 *(exp( 40/(154 *1 ))-1) + 0 + 0
= 8.03 + 0 + 0 = 8.03 mm Equation 4.3.1
```

Computed Maximum Allowable Working Pressure [MAWP]:

```
= S * E * Ln( ( 2*t + D ) / D ) - Pliq
= 154 * 1 * Ln( ( 2*46 + 610 )/610 ) - 0
= 216 - 0 = 216 bar
```

Nozzle Calculations per Section 4.5: Internal Pressure Case:

Nozzle Material Factor [frn]:

```
= min[Sn/S, 1]
= min[154/136, 1]
= 1.000
```

Thickness of Nozzle at Shell [tn]:

```
= hub thickness - corrosion allowance
= 80 - 0
= 80.000 mm
```

Thickness of Nozzle at Top [tn2]:

```
= thickness - corrosion allowance
= 46 - 0
= 46.050 mm
```

Effective Pressure Radius [Reff]:

$$= 0.9/6 * Di[\ 2 + (Di/(2h))^2\ ]$$
$$= 0.9/6 * 2800\ [2 + (2800/(2 * 700\ ))^2\ ]$$
$$= 2520.000\ mm$$

Effective Length of Vessel Wall [LR]:

```
= min( sqrt( Reff * t ), 2 * Rn )
= min( sqrt( 2520 * 40 ), 2 * 305 )
= 317.490 mm
```

Intermediate value [Cn]:
```
= min( (( t + te )/tn)^0.35, 1 )
= min( (( 40 + 0 )/80 )^0.35, 1 )
= min( 0.78, 1 )
= 0.785
```

Intermediate value [Cp]:
```
= exp( ( 0.35 * di - Xo )/( 16t ) )
= exp( ( 0.35 * 2800 - 385 )/( 16 * 40 ) )
= 2.535
```

Effective Nozzle Wall Length Outside the Vessel [LH]:
```
= min( t + te + Fp * sqrt( Rn*tn ), Lpr1 + t )
= min(40+0+0.78*sqrt(305*80),300+40)
= 162.516 mm
```

Effective Vessel Thickness [teff]:
```
= t + (( A5 * frp ) / LR )
= 40+((0*1)/317)
= 40.000 mm
```

Compute Areas A1-A43 (No Pad) or A1-A5 (With Pad) :

Area Contributed by the Vessel Wall [A1]:
```
= t * LR
= 40 * 317
= 12699.605 mm^2
```

Area Contributed by the Nozzle Outside the Vessel Wall [A2]:
```
= tn * LH
= 80 * 163
= 13001.261 mm^2
```

Area Contributed by the Outside Fillet Weld [A41]:
```
= 0.5 * Leg41^2
= 0.5 * 10^2
= 50.000 mm^2
```

The total area contributed by A1 through A43 [AT]:
```
= A1 + frn( A2 + A3 ) + A41 + A42 + A43
= 12700+1(13001+0)+50+0+0
= 25750.867 mm^2
```

Nozzle Radius for Force Calculation [Rxn]:
```
= tn / ln[1 + tn/Rn ]
= 80/ln[ 1 + 80/305 ]
= 343.248 mm
```

Shell Radius for Force Calculation [Rxs]:
```
= teff / ln[ 1 + teff/Reff ]
= 40/ln[ 1 + 40/2520 ]
= 2539.957 mm
```

Allowable Local Primary Membrane Stress [Sallow]:
```
= 1.5 * S * E
= 1.5 * 136 * 1
= 204.4 N/mm²
```

Determine Force acting on the Nozzle [fN]:
```
= P * Rxn * LH
= 40 * 343 * 163
```

= 223146.0 N

Determine Force acting on the Shell [fS]:
= P * Rxs * (LR + tn)/2
= 40 * 2540 * (317 + 80)/2
= 2019337.1 N

Discontinuity Force from Internal Pressure [fY]:
= (P * Rxs * Rnc)/2
= (40 * 2540 * 305)/2
= 1548450.6 N

Area Resisting Internal Pressure [Ap]:
= (fS + fY + fN)/P
= (2019337 + 1548450 + 223146)/40
= 947676.5 mm^2

Maximum Allowable Working Pressure Candidate [Pmax1]:
= Sallow /(2 * Ap/AT - Rxs/(2 * teff))
= 204/(2 * 947676/25751 - 2540/(2*40))
= 48.8 bar

Maximum Allowable Working Pressure Candidate [Pmax2]:
= 2 * S[t/Rxs]
= 2 * 136 [40/2540]
= 42.9 bar

Maximum Allowable Working Pressure [Pmax]:
= min(Pmax1, Pmax2)
= min(48.8, 42.9)
= 42.919 bar

Average Primary Membrane Stress [SigmaAvg]:
= (fN + fS + fY) / AT
= (223146 + 2019337 + 1548450)/25751
= 147.228 N/mm²

General Primary Membrane Stress [SigmaCirc]:
= P * Rxs / (2 * teff)
= 40 * 2540/(2 * 40)
= 127.0 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg - SigmaCirc, SigmaCirc)
= max(2 * 147 - 127, 127)
= 167.4 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	167.44	N/mm²
Maximum Allowable Working Pressure	Pmax	42.92	bar

Strength of Nozzle Attachment Welds per 4.5.14

Discontinuity Force Factor [ky]:
= (Rnc + tn) / Rnc
= (305 + 80)/305
= 1.262 For set-in Nozzles

Weld Length of Nozzle to Shell Weld [Ltau]:
= pi/2 * (Rn + tn)
= pi/2 * (305 + 80)

= 604.442 mm

Weld Throat Dimensions, (0.7071*Leg Dimensions) [L41T, L42T, L43T]:
= 7.071, 0.000, 0.000, mm

Required Weld Throat Dimensions :
tc, L41T = 7.071, must be >= min(0.7 * 80.000, 6.000) Passed

Weld Load Value [fwelds]:
= min(fy * ky, 1.5 * Sn(A2 + A3), pi/4*P*Rn^2*ky^2)
= min(1548450*1.26,1.5*154(15692+0),pi/4*40*305^2*1.26^2)
= 465206.875 N

Weld Stress Value [tau]:
= fwelds/(Ltau(0.49*L41T + 0.6*tw1 + 0.49*L43T))
= 465207/(604 (0.49*7.07 + 0.6*40 + 0.49*0))
= 28.025 < or = to 136.284 Weld Stress Passed

Nozzle Calculations per Section 4.5: External Pressure Case:

Nozzle Radius for Force Calculation [Rxn]:
= tn / ln[1 + tn/Rn]
= 80/ln[1 + 80/305]
= 343.248 mm

Shell Radius for Force Calculation [Rxs]:
= teff / ln[1 + teff/Reff]
= 40/ln[1 + 40/2520]
= 2539.957 mm

Allowable Local Primary Membrane Stress [Sallow]:
= 1.5 * S
= 1.5 * 136
= 204.4 N/mm²

Determine Force acting on the Nozzle [fN]:
= P * Rxn * LH
= 1.03 * 343 * 163
= 5746.0 N

Determine Force acting on the Shell [fS]:
= P * Rxs * (LR + tn)/2
= 1.03 * 2540 * (317 + 80)/2
= 51997.9 N

Discontinuity Force from External Pressure [fY]:
= (P * Rxs * Rnc)/2
= (1.03 * 2540 * 305)/2
= 39872.6 N

Area Resisting External Pressure [Ap]:
= (fS + fY + fN)/P
= (51998 + 39873 + 5746)/1.03
= 947676.5 mm^2

Maximum Allowable Working Pressure Candidate [Pmax1]:
= Sallow /(2 * Ap/AT - Rxs/(2 * teff))
= 204/(2 * 947676/25751 - 2540/(2*40))
= 48.8 bar

Maximum Allowable Working Pressure Candidate [Pmax2]:
= 2 * S[t/Rxs]

= 2 * 136 [40/2540]
= 42.9 bar

Maximum Allowable Working Pressure [Pmax]:
= min(Pmax1, Pmax2)
= min(48.8, 42.9)
= 42.919 bar

Average Primary Membrane Stress [SigmaAvg]:
= (fN + fS + fY) / AT
= (5746 + 51998 + 39873)/25751
= 3.791 N/mm²

General Primary Membrane Stress [SigmaCirc]:
= P * Rxs / (2 * teff)
= 1.03 * 2540/(2 * 40)
= 3.3 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg - SigmaCirc, SigmaCirc)
= max(2 * 3.79 - 3.27, 3.27)
= 4.3 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	4.31	N/mm²
Maximum Allowable External Pressure	Pmax	42.92	bar

Nozzle Junction Minimum Design Metal Temperature (MDMT) Calculations:

Nozzle-Shell/Head Weld for the Nozzle (Impact tested) :

Note:
This Material was specified as being an Impact Tested (Low Temperature) Material.

Impact Test Temperature provided per Specification -46 °C

The Drop for this Nozzle is : 29.1777 mm
The Cut Length for this Nozzle is, Drop + Ho + H + T : 369.1778 mm

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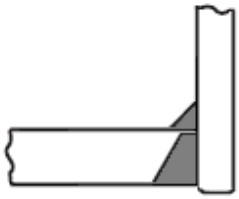
Input, Nozzle Desc: 1N From: 20

Pressure for Reinforcement Calculations	P	40.000	bar
Temperature for Internal Pressure	Temp	80	°C
Design External Pressure	Pext	1.03	bar
Temperature for External Pressure	Tempex	80	°C
Parent Material [Impact Tested]		SA-516 60	
Parent Allowable Stress at Temperature	Sv	136.28	N/mm²
Parent Allowable Stress At Ambient	Sva	147.00	N/mm²
Inside Diameter of Cylindrical Shell	D	2800.00	mm
Design Length of Section	L	16066.6689	mm
Shell Finished (Minimum) Thickness	t	44.0000	mm
Shell Internal Corrosion Allowance	c	0.0000	mm
Shell External Corrosion Allowance	co	0.0000	mm
Distance from Bottom/Left Tangent		750.00	mm
User Entered Minimum Design Metal Temperature		-46.00	°C

Type of Element Connected to the Parent : Nozzle

Material [Impact Tested]		SA-350 LF2	
Material UNS Number		K03011	
Material Specification/Type		Forgings	
Allowable Stress at Temperature	Sn	153.86	N/mm²
Allowable Stress At Ambient	Sna	165.00	N/mm²
Diameter Basis (for tr calc only)		Inside	
Layout Angle		180.00	deg
Diameter		25.4000	mm
Size and Thickness Basis		Actual	
Actual Thickness	tn	14.3000	mm
Flange Material [Normalized]		SA-350 LF2	
Flange Type		Long Weld Neck	
Corrosion Allowance	can	0.0000	mm
Outside Projection	ho	200.0000	mm
Weld leg size between Nozzle and Pad/Shell	Wo	10.0000	mm
Groove weld depth between Nozzle and Vessel	Wgnv	40.0000	mm
Inside Projection	h	0.0000	mm
Weld leg size, Inside Element to Shell	Wi	0.0000	mm
User Defined Nozzle/Shell Centerline Angle		90.0000	deg.
Flange Class		300	
Flange Grade		GR 1.1	

The Pressure Design option was MAWP + static head (to the nozzle).



Insert/Set-in Nozzle No Pad, no Inside projection

Reinforcement CALCULATION, Description: 1N

ASME Code, Section VIII, Div. 2, 2021, Section 4.5.1 - 4.5.14

```
Actual Inside Diameter Used in Calculation            25.400  mm.
Actual Thickness Used in Calculation                  14.300  mm
```

Nozzle input data check completed without errors.

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:

```
= 0.5*D*( exp( P/(S*E) )-1)+ci+co
= 0.5*25.4 *(exp( 40/(154 *1 ))-1) + 0 + 0
= 0.33 + 0 + 0 = 0.33 mm Equation 4.3.1
```

Computed Maximum Allowable Working Pressure [MAWP]:

```
= S * E * Ln( ( 2*t + D ) / D ) - Pliq
= 154 * 1 * Ln( ( 2*14.3 + 25.4 )/25.4 ) - 0
= 1160 - 0 = 1160 bar
```

Nozzle Minimum Thickness per Table 4.5.2

```
Min. required Nozzle Neck Thickness + c : 0.135 in.   3.420 mm
```

Stresses on Nozzle due to External and Pressure Loads per the ASME B31.3 Piping Code, (see 319.4.4 and 302.3.5):

```
-----------------------------------------------------------
Sustained  :      2.1,  Allowable :    153.9 N/mm²  Passed
Expansion  :      0.0,  Allowable :    396.5 N/mm²  Passed
Occasional :      1.1,  Allowable :    204.6 N/mm²  Passed
Shear      :      9.5,  Allowable :    107.7 N/mm²  Passed
```

The number of cycles on this nozzle was assumed to be 7000 or less for the determination of the expansion stress allowable.

Nozzle Calculations per Section 4.5: Internal Pressure Case:

Nozzle Material Factor [frn]:

```
= min[Sn/S, 1]
= min[154/136, 1]
= 1.000
```

Thickness of Nozzle [tn]:

```
= thickness - corrosion allowance
= 14.3 - 0
= 14.300 mm
```

Shell Diameter to Thickness ratio [D/t]:
```
= Di/t
= 2800/44
= 63.636  must be less than 400.
```

Effective Pressure Radius [Reff]:
```
= Di/2 + corrosion allowance
= 2800/2 + 0
= 1400.000 mm
```

Effective Length of Vessel Wall [LR]:
```
= min( sqrt( Reff * t ), 2 * Rn )
= min( sqrt( 1400 * 44 ), 2 * 12.7 )
= 25.400 mm
```

Thickness Limit Candidate [LH1]:
```
= min[1.5t,te] + sqrt( Rn * tn )
= min[1.5*44, 0 ] + sqrt( 12.7 * 14.3 )
= 13.476 mm
```

Thickness Limit Candidate [LH2]:
```
= Lpr1
= 200
= 200.000 mm
```

Thickness Limit Candidate [LH3]:
```
= 8( t + te )
= 8( 44 + 0 )
= 352.000 mm
```

Effective Nozzle Wall Length Outside the Vessel [LH]:
```
= min[ LH1, LH2, LH3 ] + t    for set-in nozzles
= min[ 13.5, 200, 352 ) + 44
= 57.476 mm
```

Effective Vessel Thickness [teff]:
```
= t + (( A5 * frp ) / LR )
= 44+((0*1)/25.4)
= 44.000 mm
```

Determine Parameter [lambda]:
```
= min( 12, ( 2*Rn + tn )/( sqrt( ( Di + teff ) * teff )) )
= min( 12, (2*12.7 + 14.3 )/( sqrt((2800 + 44 ) * 44 )) )
= 0.112
```

Compute Areas A1-A43 (No Pad) or A1-A5 (With Pad) :

Area Contributed by the Vessel Wall [A1]:
```
= t * LR * max( (lambda/5)^0.85, 1 )
= 44 * 25.4 * max( (0.11/5)^0.85, 1 )
= 1117.600 mm^2
```

Area Contributed by the Nozzle Outside the Vessel Wall [A2]:
```
= tn * LH
= 14.3 * 57.5
= 821.911 mm^2
```

Area Contributed by the Outside Fillet Weld [A41]:
```
= 0.5 * Leg41^2
= 0.5 * 10^2
= 50.000 mm^2
```

The total area contributed by A1 through A43 [AT]:

```
= A1 + frn( A2 + A3 ) + A41 + A42 + A43
= 1118+1(822+0)+50+0+0
= 1989.511 mm^2
```

Nozzle Radius for Force Calculation [Rxn]:

```
= tn / ln[1 + tn/Rn ]
= 14.3/ln[ 1 + 14.3/12.7 ]
= 18.960 mm
```

Shell Radius for Force Calculation [Rxs]:

```
= teff / ln[ 1 + teff/Reff ]
= 44/ln[ 1 + 44/1400 ]
= 1421.886 mm
```

Allowable Local Primary Membrane Stress [Sallow]:

```
= 1.5 * S * E
= 1.5 * 136 * 1
= 204.4 N/mm²
```

Determine Force acting on the Nozzle [fN]:

```
= P * Rxn * LH
= 40 * 19 * 57.5
= 4359.2 N
```

Determine Force acting on the Shell [fS]:

```
= P * Rxs( LR + tn )
= 40 * 1422 ( 25.4 + 14.3 )
= 225809.1 N
```

Discontinuity Force from Internal Pressure [fY]:

```
= P * Rxs * Rnc
= 40 * 1422 * 12.7
= 72236.2 N
```

Area Resisting Internal Pressure [Ap]:

```
= ( fS + fY + fN )/P
= ( 225809 + 72236 + 4359 )/40
= 75596.6 mm^2
```

Maximum Allowable Working Pressure Candidate [Pmax1]:

```
= Sallow /( 2 * Ap/AT - Rxs/teff )
= 204/( 2 * 75597/1990 - 1422/44 )
= 46.8 bar
```

Maximum Allowable Working Pressure Candidate [Pmax2]:

```
= S[t/Rxs]
= 136 [44/1422 ]
= 42.2 bar
```

Maximum Allowable Working Pressure [Pmax]:

```
= min( Pmax1, Pmax2 )
= min( 46.8, 42.2 )
= 42.167 bar
```

Average Primary Membrane Stress [SigmaAvg]:

```
= ( fN + fS + fY ) / AT
= ( 4359 + 225809 + 72236 )/1990
= 152.012 N/mm²
```

General Primary Membrane Stress [SigmaCirc]:

```
= P * Rxs / teff
= 40 * 1422/44
```

= 129.3 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg – SigmaCirc, SigmaCirc)
= max(2 * 152 – 129, 129)
= 174.7 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	174.74	N/mm²
Maximum Allowable Working Pressure	Pmax	42.17	bar

Strength of Nozzle Attachment Welds per 4.5.14

Discontinuity Force Factor [ky]:
= (Rnc + tn) / Rnc
= (12.7 + 14.3)/12.7
= 2.126 For set-in Nozzles

Weld Length of Nozzle to Shell Weld [Ltau]:
= pi/2 * (Rn + tn)
= pi/2 * (12.7 + 14.3)
= 42.411 mm

Weld Throat Dimensions, (0.7071*Leg Dimensions) [L41T, L42T, L43T]:
= 7.071, 0.000, 0.000, mm

Required Weld Throat Dimensions :
tc, L41T = 7.071, must be >= min(0.7 * 14.300, 6.000) Passed

Weld Load Value [fwelds]:
= min(fy * ky, 1.5 * Sn(A2 + A3), pi/4*P*Rn^2*ky^2)
= min(72236*2.13,1.5*154(822+0),pi/4*40*12.7^2*2.13^2)
= 2290.358 N

Weld Stress Value [tau]:
= fwelds/(Ltau(0.49*L41T + 0.6*tw1 + 0.49*L43T))
= 2290/(42.4 (0.49*7.07 + 0.6*40 + 0.49*0))
= 1.966 < or = to 136.284 Weld Stress Passed

Nozzle Calculations per Section 4.5: External Pressure Case:

Nozzle Radius for Force Calculation [Rxn]:
= tn / ln[1 + tn/Rn]
= 14.3/ln[1 + 14.3/12.7]
= 18.960 mm

Shell Radius for Force Calculation [Rxs]:
= teff / ln[1 + teff/Reff]
= 44/ln[1 + 44/1400]
= 1421.886 mm

Allowable Local Primary Membrane Stress [Sallow]:
= 1.5 * S
= 1.5 * 136
= 204.4 N/mm²

Determine Force acting on the Nozzle [fN]:
= P * Rxn * LH
= 1.03 * 19 * 57.5
= 112.2 N

Determine Force acting on the Shell [fS]:
```
= P * Rxs( LR + tn )
= 1.03 * 1422 ( 25.4 + 14.3 )
= 5814.6 N
```

Discontinuity Force from External Pressure [fY]:
```
= P * Rxs * Rnc
= 1.03 * 1422 * 12.7
= 1860.1 N
```

Area Resisting External Pressure [Ap]:
```
= ( fS + fY + fN )/P
= ( 5815 + 1860 + 112 )/1.03
= 75596.6 mm^2
```

Maximum Allowable Working Pressure Candidate [Pmax1]:
```
= Sallow /( 2 * Ap/AT - Rxs/teff )
= 204/( 2 * 75597/1990 - 1422/44 )
= 46.8 bar
```

Maximum Allowable Working Pressure Candidate [Pmax2]:
```
= S[t/Rxs]
= 136 [44/1422 ]
= 42.2 bar
```

Maximum Allowable Working Pressure [Pmax]:
```
= min( Pmax1, Pmax2 )
= min( 46.8, 42.2 )
= 42.167 bar
```

Average Primary Membrane Stress [SigmaAvg]:
```
= ( fN + fS + fY ) / AT
= ( 112 + 5815 + 1860 )/1990
= 3.914 N/mm²
```

General Primary Membrane Stress [SigmaCirc]:
```
= P * Rxs / teff
= 1.03 * 1422/44
= 3.3 N/mm²
```

Maximum Local Primary Membrane Stress [PL]:
```
= max( 2 * SigmaAvg - SigmaCirc, SigmaCirc )
= max( 2 * 3.91 - 3.33, 3.33 )
= 4.5 N/mm²
```

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	4.50	N/mm²
Maximum Allowable External Pressure	Pmax	42.17	bar

Nozzle Junction Minimum Design Metal Temperature (MDMT) Calculations:

Nozzle-Shell/Head Weld for the Nozzle (Impact tested) :

Note:
This Material was specified as being an Impact Tested (Low Temperature) Material.

Impact Test Temperature provided per Specification		-46 °C

The Drop for this Nozzle is : 0.2604 mm
The Cut Length for this Nozzle is, Drop + Ho + H + T : 244.2604 mm

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Input Echo, WRC107/537 Item 1, Description: 1N :

Diameter Basis for Vessel	Vbasis	ID	
Cylindrical or Spherical Vessel	Cylsph	Cylindrical	
Internal Corrosion Allowance	Cas	0.0000	mm
Vessel Diameter	Dv	2800.000	mm
Vessel Thickness	Tv	44.000	mm
Design Temperature	T1	80.0	C
Vessel Material		SA-516 60	
Vessel UNS Number		K02100	
Vessel Cold S.I. Allowable	Smc	147.00	N/mm²
Vessel Hot S.I. Allowable	Smh	136.28	N/mm²

Using 2 * Yield for Discontinuity Stress Allowable (Div 2, 4.1.6.3), Sps.
Make sure that material properties at this temperature are not
time-dependent for Material: SA-516 60

Attachment Type	Type	Round	
Diameter Basis for Nozzle	Nbasis	ID	
Corrosion Allowance for Nozzle	Can	0.0000	mm
Nozzle Diameter	Dn	25.400	mm
Nozzle Thickness	Tn	14.300	mm
Nozzle Material		SA-350 LF2	
Nozzle UNS Number		K03011	
Nozzle Cold S.I. Allowable	SNmc	165.00	N/mm²
Nozzle Hot S.I. Allowable	SNmh	153.86	N/mm²
Design Internal Pressure	Dp	40.000	bar
Include Pressure Thrust		No	

External Forces and Moments in WRC 107/537 Convention:

Radial Load	(SUS)	P	-1400.0	N
Longitudinal Shear	(SUS)	Vl	700.0	N
Circumferential Shear	(SUS)	Vc	1050.0	N
Circumferential Moment	(SUS)	Mc	18.0	N-m
Longitudinal Moment	(SUS)	Ml	18.0	N-m
Torsional Moment	(SUS)	Mt	105.0	N-m

Use Interactive Control		No	
WRC107 Version	Version	March 1979	
Include Pressure Stress Indices per Div. 2		No	
Compute Pressure Stress per WRC-368		No	
Local Loads applied at end of Nozzle/Attachment		No	

WRC Bulletin 537 provides equations for the dimensionless curves found in bulletin 107. As noted in the foreword to bulletin 537, "537 is equivalent to WRC 107". Where 107 is printed in the results below, "537" can be interchanged with "107".

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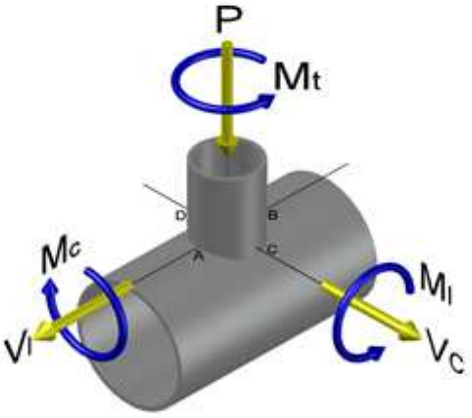

WRC 107/537 has dimensional limitations that can be found in the bulletin's Foreword and which can also be inferred by review of the non-dimensional curve limits.

Stress Attenuation Diameter (for Insert Plates) per WRC 297:

```
  = NozzleOD + 2 * 1.65 * sqrt( Rmean( t - ca ) )
  = 54.0 + 2 * 1.65 * sqrt( 1422.0 ( 44.0 - 0.0 ) )
  = 879.449 mm
```

WRC 107 Stress Calculation for SUStained loads:

Radial Load	P	-1400.0	N
Circumferential Shear	VC	1050.0	N
Longitudinal Shear	VL	700.0	N
Circumferential Moment	MC	18.0	N-m
Longitudinal Moment	ML	18.0	N-m
Torsional Moment	MT	105.0	N-m

Dimensionless Parameters used : Gamma = 32.32

Dimensionless Loads for Cylindrical Shells at Attachment Junction:

Curves read for 1979	Beta	Figure		Value	Location
N(PHI) / (P/Rm)	0.017	4C		6.328	(A,B)
N(PHI) / (P/Rm)	0.017	3C		6.574	(C,D)
M(PHI) / (P)	0.017	2C1		0.245	(A,B)
M(PHI) / (P)	0.017	1C	!	0.281	(C,D)
N(PHI) / (MC/(Rm**2 * Beta))	0.017	3A		0.073	(A,B,C,D)
M(PHI) / (MC/(Rm * Beta))	0.017	1A	!	0.105	(A,B,C,D)
N(PHI) / (ML/(Rm**2 * Beta))	0.017	3B		0.348	(A,B,C,D)
M(PHI) / (ML/(Rm * Beta))	0.017	1B	!	0.063	(A,B,C,D)
N(x) / (P/Rm)	0.017	3C		6.574	(A,B)
N(x) / (P/Rm)	0.017	4C		6.328	(C,D)
M(x) / (P)	0.017	1C1	!	0.287	(A,B)
M(x) / (P)	0.017	2C		0.250	(C,D)
N(x) / (MC/(Rm**2 * Beta))	0.017	4A		0.094	(A,B,C,D)
M(x) / (MC/(Rm * Beta))	0.017	2A	!	0.063	(A,B,C,D)
N(x) / (ML/(Rm**2 * Beta))	0.017	4B		0.076	(A,B,C,D)
M(x) / (ML/(Rm * Beta))	0.017	2B	!	0.107	(A,B,C,D)

Note - The ! mark next to the figure name denotes curve value exceeded.

Stress Concentration Factors: Kn = 1.00, Kb = 1.00

Stresses in the Vessel at the Attachment Junction (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Memb. P	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Circ. Bend. P	1.1	-1.1	1.1	-1.1	1.2	-1.2	1.2	-1.2
Circ. Memb. MC	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	0.0
Circ. Memb. MC	0.0	0.0	0.0	0.0	-0.2	0.2	0.2	-0.2
Circ. Memb. ML	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0
Circ. Bend. ML	-0.1	0.1	0.1	-0.1	0.0	0.0	0.0	0.0
Tot. Circ. Str.	1.1	-0.8	1.4	-1.1	1.1	-0.8	1.6	-1.3
Long. Memb. P	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Long. Bend. P	1.2	-1.2	1.2	-1.2	1.1	-1.1	1.1	-1.1
Long. Memb. MC	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	0.0
Long. Bend. MC	0.0	0.0	0.0	0.0	-0.1	0.1	0.1	-0.1
Long. Memb. ML	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long. Bend. ML	-0.3	0.3	0.3	-0.3	0.0	0.0	0.0	0.0
Tot. Long. Str.	1.1	-0.8	1.6	-1.3	1.1	-0.8	1.4	-1.1
Shear VC	0.3	0.3	-0.3	-0.3	0.0	0.0	0.0	0.0
Shear VL	0.0	0.0	0.0	0.0	-0.2	-0.2	0.2	0.2
Shear MT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Tot. Shear	0.8	0.8	0.2	0.2	0.3	0.3	0.7	0.7
Str. Int.	1.9	1.6	1.8	1.5	1.4	1.1	2.2	1.9

WRC 107/537 Stress Summations:

Vessel Stress Summation at Attachment Junction (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Pm (SUS)	129.3	129.3	129.3	129.3	129.3	129.3	129.3	129.3
Circ. Pl (SUS)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Circ. Q (SUS)	0.9	-0.9	1.2	-1.2	1.0	-1.0	1.5	-1.5
Long. Pm (SUS)	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7
Long. Pl (SUS)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Long. Q (SUS)	1.0	-1.0	1.5	-1.5	0.9	-0.9	1.2	-1.2
Shear Pm (SUS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shear Pl (SUS)	0.3	0.3	-0.3	-0.3	-0.2	-0.2	0.2	0.2
Shear Q (SUS)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Pm (SUS)	129.3	129.3	129.3	129.3	129.3	129.3	129.3	129.3
Pm+Pl (SUS)	129.4	129.4	129.4	129.4	129.4	129.4	129.4	129.4
Pm+Pl+Q (Total)	130.3	128.5	130.6	128.2	130.4	128.5	130.9	128.0

Vessel Stress Summation Comparison (N/mm²):

Type of Stress Int.	Max. S.I.	S.I. Allowable	Result
Pm (SUS)	129.28	136.28	Passed
Pm+Pl (SUS)	129.43	204.43	Passed
Pm+Pl+Q (TOTAL)	130.90	408.85	Passed

*Because only sustained loads were specified, the Pm+Pl+Q allowable was 3 * Smh.*

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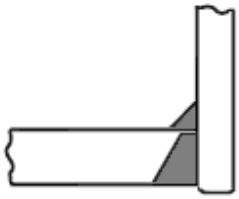
Input, Nozzle Desc: 5N From: 20

Pressure for Reinforcement Calculations	P	40.000	bar
Temperature for Internal Pressure	Temp	80	°C
Design External Pressure	Pext	1.03	bar
Temperature for External Pressure	Tempex	80	°C
Parent Material [Impact Tested]		SA-516 60	
Parent Allowable Stress at Temperature	Sv	136.28	N/mm²
Parent Allowable Stress At Ambient	Sva	147.00	N/mm²
Inside Diameter of Cylindrical Shell	D	2800.00	mm
Design Length of Section	L	16066.6689	mm
Shell Finished (Minimum) Thickness	t	44.0000	mm
Shell Internal Corrosion Allowance	c	0.0000	mm
Shell External Corrosion Allowance	co	0.0000	mm
Distance from Bottom/Left Tangent		450.00	mm
User Entered Minimum Design Metal Temperature		-46.00	°C

Type of Element Connected to the Parent : Nozzle

Material [Impact Tested]		SA-350 LF2	
Material UNS Number		K03011	
Material Specification/Type		Forgings	
Allowable Stress at Temperature	Sn	153.86	N/mm²
Allowable Stress At Ambient	Sna	165.00	N/mm²
Diameter Basis (for tr calc only)		Inside	
Layout Angle		180.00	deg
Diameter		25.4000	mm
Size and Thickness Basis		Actual	
Actual Thickness	tn	14.3000	mm
Flange Material [Normalized]		SA-350 LF2	
Flange Type		Long Weld Neck	
Corrosion Allowance	can	0.0000	mm
Outside Projection	ho	201.4580	mm
Weld leg size between Nozzle and Pad/Shell	Wo	10.0000	mm
Groove weld depth between Nozzle and Vessel	Wgnv	40.0000	mm
Inside Projection	h	0.0000	mm
Weld leg size, Inside Element to Shell	Wi	0.0000	mm
User Defined Nozzle/Shell Centerline Angle		90.0000	deg.
Flange Class		300	
Flange Grade		GR 1.1	

The Pressure Design option was MAWP + static head (to the nozzle).



Insert/Set-in Nozzle No Pad, no Inside projection

Reinforcement CALCULATION, Description: 5N

ASME Code, Section VIII, Div. 2, 2021, Section 4.5.1 - 4.5.14

```
Actual Inside Diameter Used in Calculation            25.400  mm.
Actual Thickness Used in Calculation                  14.300  mm
```

Nozzle input data check completed without errors.

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:

```
= 0.5*D*( exp( P/(S*E) )-1)+ci+co
= 0.5*25.4 *(exp( 40/(154 *1 ))-1) + 0 + 0
= 0.33 + 0 + 0 = 0.33 mm Equation 4.3.1
```

Computed Maximum Allowable Working Pressure [MAWP]:

```
= S * E * Ln( ( 2*t + D ) / D ) - Pliq
= 154 * 1 * Ln( ( 2*14.3 + 25.4 )/25.4 ) - 0
= 1160 - 0 = 1160 bar
```

Nozzle Minimum Thickness per Table 4.5.2

```
Min. required Nozzle Neck Thickness + c : 0.135 in.   3.420 mm
```

Stresses on Nozzle due to External and Pressure Loads per the ASME B31.3 Piping Code, (see 319.4.4 and 302.3.5):

```
-----------------------------------------------------------
Sustained  :      2.1,  Allowable :    153.9 N/mm²  Passed
Expansion  :      0.0,  Allowable :    396.5 N/mm²  Passed
Occasional :      1.1,  Allowable :    204.6 N/mm²  Passed
Shear      :      9.5,  Allowable :    107.7 N/mm²  Passed
```

The number of cycles on this nozzle was assumed to be 7000 or less for the determination of the expansion stress allowable.

Nozzle Calculations per Section 4.5: Internal Pressure Case:

Nozzle Material Factor [frn]:

```
= min[Sn/S, 1]
= min[154/136, 1]
= 1.000
```

Thickness of Nozzle [tn]:

```
= thickness - corrosion allowance
= 14.3 - 0
= 14.300 mm
```

Shell Diameter to Thickness ratio [D/t]:
```
= Di/t
= 2800/44
= 63.636  must be less than 400.
```

Effective Pressure Radius [Reff]:
```
= Di/2 + corrosion allowance
= 2800/2 + 0
= 1400.000 mm
```

Effective Length of Vessel Wall [LR]:
```
= min( sqrt( Reff * t ), 2 * Rn )
= min( sqrt( 1400 * 44 ), 2 * 12.7 )
= 25.400 mm
```

Thickness Limit Candidate [LH1]:
```
= min[1.5t,te] + sqrt( Rn * tn )
= min[1.5*44, 0 ] + sqrt( 12.7 * 14.3 )
= 13.476 mm
```

Thickness Limit Candidate [LH2]:
```
= Lpr1
= 201
= 201.458 mm
```

Thickness Limit Candidate [LH3]:
```
= 8( t + te )
= 8( 44 + 0 )
= 352.000 mm
```

Effective Nozzle Wall Length Outside the Vessel [LH]:
```
= min[ LH1, LH2, LH3 ] + t    for set-in nozzles
= min[ 13.5, 201, 352 ) + 44
= 57.476 mm
```

Effective Vessel Thickness [teff]:
```
= t + (( A5 * frp ) / LR )
= 44+((0*1)/25.4)
= 44.000 mm
```

Determine Parameter [lambda]:
```
= min( 12, ( 2*Rn + tn )/( sqrt( ( Di + teff ) * teff )) )
= min( 12, (2*12.7 + 14.3 )/( sqrt((2800 + 44 ) * 44 )) )
= 0.112
```

Compute Areas A1-A43 (No Pad) or A1-A5 (With Pad) :

Area Contributed by the Vessel Wall [A1]:
```
= t * LR * max( (lambda/5)^0.85, 1 )
= 44 * 25.4 * max( (0.11/5)^0.85, 1 )
= 1117.600 mm^2
```

Area Contributed by the Nozzle Outside the Vessel Wall [A2]:
```
= tn * LH
= 14.3 * 57.5
= 821.911 mm^2
```

Area Contributed by the Outside Fillet Weld [A41]:
```
= 0.5 * Leg41^2
= 0.5 * 10^2
= 50.000 mm^2
```

The total area contributed by A1 through A43 [AT]:

```
= A1 + frn( A2 + A3 ) + A41 + A42 + A43
= 1118+1(822+0)+50+0+0
= 1989.511 mm^2
```

Nozzle Radius for Force Calculation [Rxn]:

```
= tn / ln[1 + tn/Rn ]
= 14.3/ln[ 1 + 14.3/12.7 ]
= 18.960 mm
```

Shell Radius for Force Calculation [Rxs]:

```
= teff / ln[ 1 + teff/Reff ]
= 44/ln[ 1 + 44/1400 ]
= 1421.886 mm
```

Allowable Local Primary Membrane Stress [Sallow]:

```
= 1.5 * S * E
= 1.5 * 136 * 1
= 204.4 N/mm²
```

Determine Force acting on the Nozzle [fN]:

```
= P * Rxn * LH
= 40 * 19 * 57.5
= 4359.2 N
```

Determine Force acting on the Shell [fS]:

```
= P * Rxs( LR + tn )
= 40 * 1422 ( 25.4 + 14.3 )
= 225809.1 N
```

Discontinuity Force from Internal Pressure [fY]:

```
= P * Rxs * Rnc
= 40 * 1422 * 12.7
= 72236.2 N
```

Area Resisting Internal Pressure [Ap]:

```
= ( fS + fY + fN )/P
= ( 225809 + 72236 + 4359 )/40
= 75596.6 mm^2
```

Maximum Allowable Working Pressure Candidate [Pmax1]:

```
= Sallow /( 2 * Ap/AT - Rxs/teff )
= 204/( 2 * 75597/1990 - 1422/44 )
= 46.8 bar
```

Maximum Allowable Working Pressure Candidate [Pmax2]:

```
= S[t/Rxs]
= 136 [44/1422 ]
= 42.2 bar
```

Maximum Allowable Working Pressure [Pmax]:

```
= min( Pmax1, Pmax2 )
= min( 46.8, 42.2 )
= 42.167 bar
```

Average Primary Membrane Stress [SigmaAvg]:

```
= ( fN + fS + fY ) / AT
= ( 4359 + 225809 + 72236 )/1990
= 152.012 N/mm²
```

General Primary Membrane Stress [SigmaCirc]:

```
= P * Rxs / teff
= 40 * 1422/44
```

= 129.3 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg – SigmaCirc, SigmaCirc)
= max(2 * 152 – 129, 129)
= 174.7 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	174.74	N/mm²
Maximum Allowable Working Pressure	Pmax	42.17	bar

Strength of Nozzle Attachment Welds per 4.5.14

Discontinuity Force Factor [ky]:
= (Rnc + tn) / Rnc
= (12.7 + 14.3)/12.7
= 2.126 For set-in Nozzles

Weld Length of Nozzle to Shell Weld [Ltau]:
= pi/2 * (Rn + tn)
= pi/2 * (12.7 + 14.3)
= 42.411 mm

Weld Throat Dimensions, (0.7071*Leg Dimensions) [L41T, L42T, L43T]:
= 7.071, 0.000, 0.000, mm

Required Weld Throat Dimensions :
tc, L41T = 7.071, must be >= min(0.7 * 14.300, 6.000) Passed

Weld Load Value [fwelds]:
= min(fy * ky, 1.5 * Sn(A2 + A3), pi/4*P*Rn^2*ky^2)
= min(72236*2.13,1.5*154(822+0),pi/4*40*12.7^2*2.13^2)
= 2290.358 N

Weld Stress Value [tau]:
= fwelds/(Ltau(0.49*L41T + 0.6*tw1 + 0.49*L43T))
= 2290/(42.4 (0.49*7.07 + 0.6*40 + 0.49*0))
= 1.966 < or = to 136.284 Weld Stress Passed

Nozzle Calculations per Section 4.5: External Pressure Case:

Nozzle Radius for Force Calculation [Rxn]:
= tn / ln[1 + tn/Rn]
= 14.3/ln[1 + 14.3/12.7]
= 18.960 mm

Shell Radius for Force Calculation [Rxs]:
= teff / ln[1 + teff/Reff]
= 44/ln[1 + 44/1400]
= 1421.886 mm

Allowable Local Primary Membrane Stress [Sallow]:
= 1.5 * S
= 1.5 * 136
= 204.4 N/mm²

Determine Force acting on the Nozzle [fN]:
= P * Rxn * LH
= 1.03 * 19 * 57.5
= 112.2 N

Determine Force acting on the Shell [fS]:
= P * Rxs(LR + tn)
= 1.03 * 1422 (25.4 + 14.3)
= 5814.6 N

Discontinuity Force from External Pressure [fY]:
= P * Rxs * Rnc
= 1.03 * 1422 * 12.7
= 1860.1 N

Area Resisting External Pressure [Ap]:
= (fS + fY + fN)/P
= (5815 + 1860 + 112)/1.03
= 75596.6 mm^2

Maximum Allowable Working Pressure Candidate [Pmax1]:
= Sallow /(2 * Ap/AT - Rxs/teff)
= 204/(2 * 75597/1990 - 1422/44)
= 46.8 bar

Maximum Allowable Working Pressure Candidate [Pmax2]:
= S[t/Rxs]
= 136 [44/1422]
= 42.2 bar

Maximum Allowable Working Pressure [Pmax]:
= min(Pmax1, Pmax2)
= min(46.8, 42.2)
= 42.167 bar

Average Primary Membrane Stress [SigmaAvg]:
= (fN + fS + fY) / AT
= (112 + 5815 + 1860)/1990
= 3.914 N/mm²

General Primary Membrane Stress [SigmaCirc]:
= P * Rxs / teff
= 1.03 * 1422/44
= 3.3 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg - SigmaCirc, SigmaCirc)
= max(2 * 3.91 - 3.33, 3.33)
= 4.5 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	4.50	N/mm²
Maximum Allowable External Pressure	Pmax	42.17	bar

Nozzle Junction Minimum Design Metal Temperature (MDMT) Calculations:

Nozzle-Shell/Head Weld for the Nozzle (Impact tested) :

Note:
This Material was specified as being an Impact Tested (Low Temperature) Material.

Impact Test Temperature provided per Specification -46 °C

The Drop for this Nozzle is : 0.2604 mm
The Cut Length for this Nozzle is, Drop + Ho + H + T : 245.7184 mm

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Input Echo, WRC107/537 Item 1, Description: 5N :

Diameter Basis for Vessel	Vbasis	ID	
Cylindrical or Spherical Vessel	Cylsph	Cylindrical	
Internal Corrosion Allowance	Cas	0.0000	mm
Vessel Diameter	Dv	2800.000	mm
Vessel Thickness	Tv	44.000	mm
Design Temperature	T1	80.0	C
Vessel Material		SA-516 60	
Vessel UNS Number		K02100	
Vessel Cold S.I. Allowable	Smc	147.00	N/mm²
Vessel Hot S.I. Allowable	Smh	136.28	N/mm²

Using 2 * Yield for Discontinuity Stress Allowable (Div 2, 4.1.6.3), Sps.
Make sure that material properties at this temperature are not
time-dependent for Material: SA-516 60

Attachment Type	Type	Round	
Diameter Basis for Nozzle	Nbasis	ID	
Corrosion Allowance for Nozzle	Can	0.0000	mm
Nozzle Diameter	Dn	25.400	mm
Nozzle Thickness	Tn	14.300	mm
Nozzle Material		SA-350 LF2	
Nozzle UNS Number		K03011	
Nozzle Cold S.I. Allowable	SNmc	165.00	N/mm²
Nozzle Hot S.I. Allowable	SNmh	153.86	N/mm²
Design Internal Pressure	Dp	40.000	bar
Include Pressure Thrust		No	

External Forces and Moments in WRC 107/537 Convention:

Radial Load	(SUS)	P	-1400.0	N
Longitudinal Shear	(SUS)	Vl	700.0	N
Circumferential Shear	(SUS)	Vc	1050.0	N
Circumferential Moment	(SUS)	Mc	18.0	N-m
Longitudinal Moment	(SUS)	Ml	18.0	N-m
Torsional Moment	(SUS)	Mt	105.0	N-m

Use Interactive Control		No	
WRC107 Version	Version	March 1979	
Include Pressure Stress Indices per Div. 2		No	
Compute Pressure Stress per WRC-368		No	
Local Loads applied at end of Nozzle/Attachment		No	

WRC Bulletin 537 provides equations for the dimensionless curves found in bulletin 107. As noted in the foreword to bulletin 537, "537 is equivalent to WRC 107". Where 107 is printed in the results below, "537" can be interchanged with "107".

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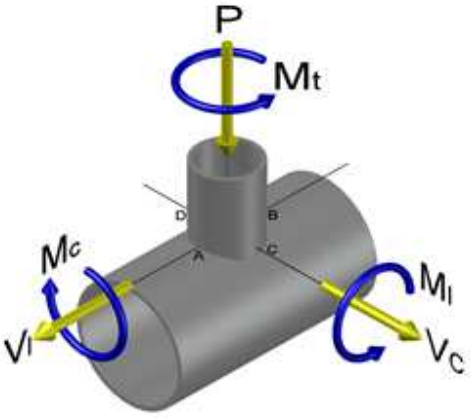

WRC 107/537 has dimensional limitations that can be found in the bulletin's Foreword and which can also be inferred by review of the non-dimensional curve limits.

Stress Attenuation Diameter (for Insert Plates) per WRC 297:

```
  = NozzleOD + 2 * 1.65 * sqrt( Rmean( t - ca ) )
  = 54.0 + 2 * 1.65 * sqrt( 1422.0 ( 44.0 - 0.0 ) )
  = 879.449 mm
```

WRC 107 Stress Calculation for SUStained loads:

Radial Load	P	-1400.0	N
Circumferential Shear	VC	1050.0	N
Longitudinal Shear	VL	700.0	N
Circumferential Moment	MC	18.0	N-m
Longitudinal Moment	ML	18.0	N-m
Torsional Moment	MT	105.0	N-m

Dimensionless Parameters used : Gamma = 32.32

Dimensionless Loads for Cylindrical Shells at Attachment Junction:

Curves read for 1979	Beta	Figure		Value	Location
N(PHI) / (P/Rm)	0.017	4C		6.328	(A,B)
N(PHI) / (P/Rm)	0.017	3C		6.574	(C,D)
M(PHI) / (P)	0.017	2C1		0.245	(A,B)
M(PHI) / (P)	0.017	1C	!	0.281	(C,D)
N(PHI) / (MC/(Rm**2 * Beta))	0.017	3A		0.073	(A,B,C,D)
M(PHI) / (MC/(Rm * Beta))	0.017	1A	!	0.105	(A,B,C,D)
N(PHI) / (ML/(Rm**2 * Beta))	0.017	3B		0.348	(A,B,C,D)
M(PHI) / (ML/(Rm * Beta))	0.017	1B	!	0.063	(A,B,C,D)
N(x) / (P/Rm)	0.017	3C		6.574	(A,B)
N(x) / (P/Rm)	0.017	4C		6.328	(C,D)
M(x) / (P)	0.017	1C1	!	0.287	(A,B)
M(x) / (P)	0.017	2C		0.250	(C,D)
N(x) / (MC/(Rm**2 * Beta))	0.017	4A		0.094	(A,B,C,D)
M(x) / (MC/(Rm * Beta))	0.017	2A	!	0.063	(A,B,C,D)
N(x) / (ML/(Rm**2 * Beta))	0.017	4B		0.076	(A,B,C,D)
M(x) / (ML/(Rm * Beta))	0.017	2B	!	0.107	(A,B,C,D)

Note - The ! mark next to the figure name denotes curve value exceeded.

Stress Concentration Factors: Kn = 1.00, Kb = 1.00

Stresses in the Vessel at the Attachment Junction (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Memb. P	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Circ. Bend. P	1.1	-1.1	1.1	-1.1	1.2	-1.2	1.2	-1.2
Circ. Memb. MC	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	0.0
Circ. Memb. MC	0.0	0.0	0.0	0.0	-0.2	0.2	0.2	-0.2
Circ. Memb. ML	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0
Circ. Bend. ML	-0.1	0.1	0.1	-0.1	0.0	0.0	0.0	0.0
Tot. Circ. Str.	1.1	-0.8	1.4	-1.1	1.1	-0.8	1.6	-1.3
Long. Memb. P	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Long. Bend. P	1.2	-1.2	1.2	-1.2	1.1	-1.1	1.1	-1.1
Long. Memb. MC	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	0.0
Long. Bend. MC	0.0	0.0	0.0	0.0	-0.1	0.1	0.1	-0.1
Long. Memb. ML	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long. Bend. ML	-0.3	0.3	0.3	-0.3	0.0	0.0	0.0	0.0
Tot. Long. Str.	1.1	-0.8	1.6	-1.3	1.1	-0.8	1.4	-1.1
Shear VC	0.3	0.3	-0.3	-0.3	0.0	0.0	0.0	0.0
Shear VL	0.0	0.0	0.0	0.0	-0.2	-0.2	0.2	0.2
Shear MT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Tot. Shear	0.8	0.8	0.2	0.2	0.3	0.3	0.7	0.7
Str. Int.	1.9	1.6	1.8	1.5	1.4	1.1	2.2	1.9

WRC 107/537 Stress Summations:

Vessel Stress Summation at Attachment Junction (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Pm (SUS)	129.3	129.3	129.3	129.3	129.3	129.3	129.3	129.3
Circ. Pl (SUS)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Circ. Q (SUS)	0.9	-0.9	1.2	-1.2	1.0	-1.0	1.5	-1.5
Long. Pm (SUS)	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7
Long. Pl (SUS)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Long. Q (SUS)	1.0	-1.0	1.5	-1.5	0.9	-0.9	1.2	-1.2
Shear Pm (SUS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shear Pl (SUS)	0.3	0.3	-0.3	-0.3	-0.2	-0.2	0.2	0.2
Shear Q (SUS)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Pm (SUS)	129.3	129.3	129.3	129.3	129.3	129.3	129.3	129.3
Pm+Pl (SUS)	129.4	129.4	129.4	129.4	129.4	129.4	129.4	129.4
Pm+Pl+Q (Total)	130.3	128.5	130.6	128.2	130.4	128.5	130.9	128.0

Vessel Stress Summation Comparison (N/mm²):

Type of Stress Int.	Max. S.I.	S.I. Allowable	Result
Pm (SUS)	129.28	136.28	Passed
Pm+Pl (SUS)	129.43	204.43	Passed
Pm+Pl+Q (TOTAL)	130.90	408.85	Passed

*Because only sustained loads were specified, the Pm+Pl+Q allowable was 3 * Smh.*

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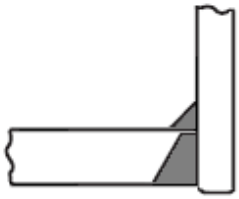
Input, Nozzle Desc: 3N From: 20

Pressure for Reinforcement Calculations	P	40.000	bar
Temperature for Internal Pressure	Temp	80	°C
Design External Pressure	Pext	1.03	bar
Temperature for External Pressure	Tempex	80	°C
Parent Material [Impact Tested]		SA-516 60	
Parent Allowable Stress at Temperature	Sv	136.28	N/mm²
Parent Allowable Stress At Ambient	Sva	147.00	N/mm²
Inside Diameter of Cylindrical Shell	D	2800.00	mm
Design Length of Section	L	16066.6689	mm
Shell Finished (Minimum) Thickness	t	44.0000	mm
Shell Internal Corrosion Allowance	c	0.0000	mm
Shell External Corrosion Allowance	co	0.0000	mm
Distance from Bottom/Left Tangent		1050.00	mm
User Entered Minimum Design Metal Temperature		-46.00	°C

Type of Element Connected to the Parent : Nozzle

Material [Impact Tested]		SA-350 LF2	
Material UNS Number		K03011	
Material Specification/Type		Forgings	
Allowable Stress at Temperature	Sn	153.86	N/mm²
Allowable Stress At Ambient	Sna	165.00	N/mm²
Diameter Basis (for tr calc only)		Inside	
Layout Angle		180.00	deg
Diameter		25.4000	mm
Size and Thickness Basis		Actual	
Actual Thickness	tn	14.3000	mm
Flange Material [Normalized]		SA-350 LF2	
Flange Type		Long Weld Neck	
Corrosion Allowance	can	0.0000	mm
Outside Projection	ho	201.4580	mm
Weld leg size between Nozzle and Pad/Shell	Wo	10.0000	mm
Groove weld depth between Nozzle and Vessel	Wgnv	40.0000	mm
Inside Projection	h	0.0000	mm
Weld leg size, Inside Element to Shell	Wi	0.0000	mm
User Defined Nozzle/Shell Centerline Angle		90.0000	deg.
Flange Class		300	
Flange Grade		GR 1.1	

The Pressure Design option was MAWP + static head (to the nozzle).



Insert/Set-in Nozzle No Pad, no Inside projection

Reinforcement CALCULATION, Description: 3N

ASME Code, Section VIII, Div. 2, 2021, Section 4.5.1 - 4.5.14

```
Actual Inside Diameter Used in Calculation            25.400  mm.
Actual Thickness Used in Calculation                  14.300  mm
```

Nozzle input data check completed without errors.

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:

```
= 0.5*D*( exp( P/(S*E) )-1)+ci+co
= 0.5*25.4 *(exp( 40/(154 *1 ))-1) + 0 + 0
= 0.33 + 0 + 0 = 0.33 mm Equation 4.3.1
```

Computed Maximum Allowable Working Pressure [MAWP]:

```
= S * E * Ln( ( 2*t + D ) / D ) - Pliq
= 154 * 1 * Ln( ( 2*14.3 + 25.4 )/25.4 ) - 0
= 1160 - 0 = 1160 bar
```

Nozzle Minimum Thickness per Table 4.5.2

```
Min. required Nozzle Neck Thickness + c : 0.135 in.   3.420 mm
```

Stresses on Nozzle due to External and Pressure Loads per the ASME B31.3 Piping Code, (see 319.4.4 and 302.3.5):

```
-----------------------------------------------------------
Sustained  :      2.1,  Allowable :    153.9 N/mm²  Passed
Expansion  :      0.0,  Allowable :    396.5 N/mm²  Passed
Occasional :      1.1,  Allowable :    204.6 N/mm²  Passed
Shear      :      9.5,  Allowable :    107.7 N/mm²  Passed
```

The number of cycles on this nozzle was assumed to be 7000 or less for the determination of the expansion stress allowable.

Nozzle Calculations per Section 4.5: Internal Pressure Case:

Nozzle Material Factor [frn]:

```
= min[Sn/S, 1]
= min[154/136, 1]
= 1.000
```

Thickness of Nozzle [tn]:

```
= thickness - corrosion allowance
= 14.3 - 0
= 14.300 mm
```

Shell Diameter to Thickness ratio [D/t]:
```
= Di/t
= 2800/44
= 63.636  must be less than 400.
```

Effective Pressure Radius [Reff]:
```
= Di/2 + corrosion allowance
= 2800/2 + 0
= 1400.000 mm
```

Effective Length of Vessel Wall [LR]:
```
= min( sqrt( Reff * t ), 2 * Rn )
= min( sqrt( 1400 * 44 ), 2 * 12.7 )
= 25.400 mm
```

Thickness Limit Candidate [LH1]:
```
= min[1.5t,te] + sqrt( Rn * tn )
= min[1.5*44, 0 ] + sqrt( 12.7 * 14.3 )
= 13.476 mm
```

Thickness Limit Candidate [LH2]:
```
= Lpr1
= 201
= 201.458 mm
```

Thickness Limit Candidate [LH3]:
```
= 8( t + te )
= 8( 44 + 0 )
= 352.000 mm
```

Effective Nozzle Wall Length Outside the Vessel [LH]:
```
= min[ LH1, LH2, LH3 ] + t    for set-in nozzles
= min[ 13.5, 201, 352 ) + 44
= 57.476 mm
```

Effective Vessel Thickness [teff]:
```
= t + (( A5 * frp ) / LR )
= 44+((0*1)/25.4)
= 44.000 mm
```

Determine Parameter [lambda]:
```
= min( 12, ( 2*Rn + tn )/( sqrt( ( Di + teff ) * teff )) )
= min( 12, (2*12.7 + 14.3 )/( sqrt((2800 + 44 ) * 44 )) )
= 0.112
```

Compute Areas A1-A43 (No Pad) or A1-A5 (With Pad) :

Area Contributed by the Vessel Wall [A1]:
```
= t * LR * max( (lambda/5)^0.85, 1 )
= 44 * 25.4 * max( (0.11/5)^0.85, 1 )
= 1117.600 mm^2
```

Area Contributed by the Nozzle Outside the Vessel Wall [A2]:
```
= tn * LH
= 14.3 * 57.5
= 821.911 mm^2
```

Area Contributed by the Outside Fillet Weld [A41]:
```
= 0.5 * Leg41^2
= 0.5 * 10^2
= 50.000 mm^2
```

The total area contributed by A1 through A43 [AT]:

```
= A1 + frn( A2 + A3 ) + A41 + A42 + A43
= 1118+1(822+0)+50+0+0
= 1989.511 mm^2
```

Nozzle Radius for Force Calculation [Rxn]:

```
= tn / ln[1 + tn/Rn ]
= 14.3/ln[ 1 + 14.3/12.7 ]
= 18.960 mm
```

Shell Radius for Force Calculation [Rxs]:

```
= teff / ln[ 1 + teff/Reff ]
= 44/ln[ 1 + 44/1400 ]
= 1421.886 mm
```

Allowable Local Primary Membrane Stress [Sallow]:

```
= 1.5 * S * E
= 1.5 * 136 * 1
= 204.4 N/mm²
```

Determine Force acting on the Nozzle [fN]:

```
= P * Rxn * LH
= 40 * 19 * 57.5
= 4359.2 N
```

Determine Force acting on the Shell [fS]:

```
= P * Rxs( LR + tn )
= 40 * 1422 ( 25.4 + 14.3 )
= 225809.1 N
```

Discontinuity Force from Internal Pressure [fY]:

```
= P * Rxs * Rnc
= 40 * 1422 * 12.7
= 72236.2 N
```

Area Resisting Internal Pressure [Ap]:

```
= ( fS + fY + fN )/P
= ( 225809 + 72236 + 4359 )/40
= 75596.6 mm^2
```

Maximum Allowable Working Pressure Candidate [Pmax1]:

```
= Sallow /( 2 * Ap/AT - Rxs/teff )
= 204/( 2 * 75597/1990 - 1422/44 )
= 46.8 bar
```

Maximum Allowable Working Pressure Candidate [Pmax2]:

```
= S[t/Rxs]
= 136 [44/1422 ]
= 42.2 bar
```

Maximum Allowable Working Pressure [Pmax]:

```
= min( Pmax1, Pmax2 )
= min( 46.8, 42.2 )
= 42.167 bar
```

Average Primary Membrane Stress [SigmaAvg]:

```
= ( fN + fS + fY ) / AT
= ( 4359 + 225809 + 72236 )/1990
= 152.012 N/mm²
```

General Primary Membrane Stress [SigmaCirc]:

```
= P * Rxs / teff
= 40 * 1422/44
```

= 129.3 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg – SigmaCirc, SigmaCirc)
= max(2 * 152 – 129, 129)
= 174.7 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	174.74	N/mm²
Maximum Allowable Working Pressure	Pmax	42.17	bar

Strength of Nozzle Attachment Welds per 4.5.14

Discontinuity Force Factor [ky]:
= (Rnc + tn) / Rnc
= (12.7 + 14.3)/12.7
= 2.126 For set-in Nozzles

Weld Length of Nozzle to Shell Weld [Ltau]:
= pi/2 * (Rn + tn)
= pi/2 * (12.7 + 14.3)
= 42.411 mm

Weld Throat Dimensions, (0.7071*Leg Dimensions) [L41T, L42T, L43T]:
= 7.071, 0.000, 0.000, mm

Required Weld Throat Dimensions :
tc, L41T = 7.071, must be >= min(0.7 * 14.300, 6.000) Passed

Weld Load Value [fwelds]:
= min(fy * ky, 1.5 * Sn(A2 + A3), pi/4*P*Rn^2*ky^2)
= min(72236*2.13,1.5*154(822+0),pi/4*40*12.7^2*2.13^2)
= 2290.358 N

Weld Stress Value [tau]:
= fwelds/(Ltau(0.49*L41T + 0.6*tw1 + 0.49*L43T))
= 2290/(42.4 (0.49*7.07 + 0.6*40 + 0.49*0))
= 1.966 < or = to 136.284 Weld Stress Passed

Nozzle Calculations per Section 4.5: External Pressure Case:

Nozzle Radius for Force Calculation [Rxn]:
= tn / ln[1 + tn/Rn]
= 14.3/ln[1 + 14.3/12.7]
= 18.960 mm

Shell Radius for Force Calculation [Rxs]:
= teff / ln[1 + teff/Reff]
= 44/ln[1 + 44/1400]
= 1421.886 mm

Allowable Local Primary Membrane Stress [Sallow]:
= 1.5 * S
= 1.5 * 136
= 204.4 N/mm²

Determine Force acting on the Nozzle [fN]:
= P * Rxn * LH
= 1.03 * 19 * 57.5
= 112.2 N

Determine Force acting on the Shell [fS]:
```
= P * Rxs( LR + tn )
= 1.03 * 1422 ( 25.4 + 14.3 )
= 5814.6 N
```

Discontinuity Force from External Pressure [fY]:
```
= P * Rxs * Rnc
= 1.03 * 1422 * 12.7
= 1860.1 N
```

Area Resisting External Pressure [Ap]:
```
= ( fS + fY + fN )/P
= ( 5815 + 1860 + 112 )/1.03
= 75596.6 mm^2
```

Maximum Allowable Working Pressure Candidate [Pmax1]:
```
= Sallow /( 2 * Ap/AT - Rxs/teff )
= 204/( 2 * 75597/1990 - 1422/44 )
= 46.8 bar
```

Maximum Allowable Working Pressure Candidate [Pmax2]:
```
= S[t/Rxs]
= 136 [44/1422 ]
= 42.2 bar
```

Maximum Allowable Working Pressure [Pmax]:
```
= min( Pmax1, Pmax2 )
= min( 46.8, 42.2 )
= 42.167 bar
```

Average Primary Membrane Stress [SigmaAvg]:
```
= ( fN + fS + fY ) / AT
= ( 112 + 5815 + 1860 )/1990
= 3.914 N/mm²
```

General Primary Membrane Stress [SigmaCirc]:
```
= P * Rxs / teff
= 1.03 * 1422/44
= 3.3 N/mm²
```

Maximum Local Primary Membrane Stress [PL]:
```
= max( 2 * SigmaAvg - SigmaCirc, SigmaCirc )
= max( 2 * 3.91 - 3.33, 3.33 )
= 4.5 N/mm²
```

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	4.50	N/mm²
Maximum Allowable External Pressure	Pmax	42.17	bar

Nozzle Junction Minimum Design Metal Temperature (MDMT) Calculations:

Nozzle-Shell/Head Weld for the Nozzle (Impact tested) :

Note:
This Material was specified as being an Impact Tested (Low Temperature) Material.

Impact Test Temperature provided per Specification		-46 °C

The Drop for this Nozzle is : 0.2604 mm
The Cut Length for this Nozzle is, Drop + Ho + H + T : 245.7184 mm

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Input Echo, WRC107/537 Item 1, Description: 3N :

Diameter Basis for Vessel	Vbasis	ID	
Cylindrical or Spherical Vessel	Cylsph	Cylindrical	
Internal Corrosion Allowance	Cas	0.0000	mm
Vessel Diameter	Dv	2800.000	mm
Vessel Thickness	Tv	44.000	mm
Design Temperature	T1	80.0	C
Vessel Material		SA-516 60	
Vessel UNS Number		K02100	
Vessel Cold S.I. Allowable	Smc	147.00	N/mm²
Vessel Hot S.I. Allowable	Smh	136.28	N/mm²

Using 2 * Yield for Discontinuity Stress Allowable (Div 2, 4.1.6.3), Sps.
Make sure that material properties at this temperature are not
time-dependent for Material: SA-516 60

Attachment Type	Type	Round	
Diameter Basis for Nozzle	Nbasis	ID	
Corrosion Allowance for Nozzle	Can	0.0000	mm
Nozzle Diameter	Dn	25.400	mm
Nozzle Thickness	Tn	14.300	mm
Nozzle Material		SA-350 LF2	
Nozzle UNS Number		K03011	
Nozzle Cold S.I. Allowable	SNmc	165.00	N/mm²
Nozzle Hot S.I. Allowable	SNmh	153.86	N/mm²
Design Internal Pressure	Dp	40.000	bar
Include Pressure Thrust		No	

External Forces and Moments in WRC 107/537 Convention:

Radial Load	(SUS)	P	-1400.0	N
Longitudinal Shear	(SUS)	Vl	700.0	N
Circumferential Shear	(SUS)	Vc	1050.0	N
Circumferential Moment	(SUS)	Mc	18.0	N-m
Longitudinal Moment	(SUS)	Ml	18.0	N-m
Torsional Moment	(SUS)	Mt	105.0	N-m

Use Interactive Control		No	
WRC107 Version	Version	March 1979	
Include Pressure Stress Indices per Div. 2		No	
Compute Pressure Stress per WRC-368		No	
Local Loads applied at end of Nozzle/Attachment		No	

WRC Bulletin 537 provides equations for the dimensionless curves found in bulletin 107. As noted in the foreword to bulletin 537, "537 is equivalent to WRC 107". Where 107 is printed in the results below, "537" can be interchanged with "107".

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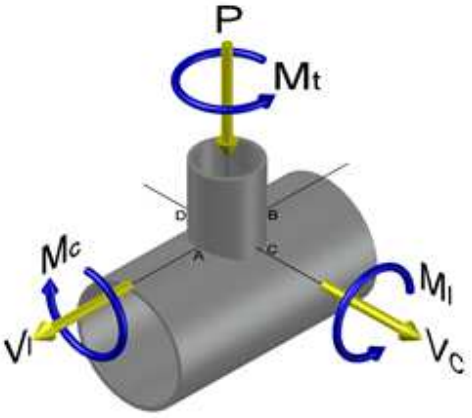

WRC 107/537 has dimensional limitations that can be found in the bulletin's Foreword and which can also be inferred by review of the non-dimensional curve limits.

Stress Attenuation Diameter (for Insert Plates) per WRC 297:

```
  = NozzleOD + 2 * 1.65 * sqrt( Rmean( t - ca ) )
  = 54.0 + 2 * 1.65 * sqrt( 1422.0 ( 44.0 - 0.0 ) )
  = 879.449 mm
```

WRC 107 Stress Calculation for SUStained loads:

Radial Load	P	-1400.0	N
Circumferential Shear	VC	1050.0	N
Longitudinal Shear	VL	700.0	N
Circumferential Moment	MC	18.0	N-m
Longitudinal Moment	ML	18.0	N-m
Torsional Moment	MT	105.0	N-m

Dimensionless Parameters used : Gamma = 32.32

Dimensionless Loads for Cylindrical Shells at Attachment Junction:

Curves read for 1979	Beta	Figure		Value	Location
N(PHI) / (P/Rm)	0.017	4C		6.328	(A,B)
N(PHI) / (P/Rm)	0.017	3C		6.574	(C,D)
M(PHI) / (P)	0.017	2C1		0.245	(A,B)
M(PHI) / (P)	0.017	1C	!	0.281	(C,D)
N(PHI) / (MC/(Rm**2 * Beta))	0.017	3A		0.073	(A,B,C,D)
M(PHI) / (MC/(Rm * Beta))	0.017	1A	!	0.105	(A,B,C,D)
N(PHI) / (ML/(Rm**2 * Beta))	0.017	3B		0.348	(A,B,C,D)
M(PHI) / (ML/(Rm * Beta))	0.017	1B	!	0.063	(A,B,C,D)
N(x) / (P/Rm)	0.017	3C		6.574	(A,B)
N(x) / (P/Rm)	0.017	4C		6.328	(C,D)
M(x) / (P)	0.017	1C1	!	0.287	(A,B)
M(x) / (P)	0.017	2C		0.250	(C,D)
N(x) / (MC/(Rm**2 * Beta))	0.017	4A		0.094	(A,B,C,D)
M(x) / (MC/(Rm * Beta))	0.017	2A	!	0.063	(A,B,C,D)
N(x) / (ML/(Rm**2 * Beta))	0.017	4B		0.076	(A,B,C,D)
M(x) / (ML/(Rm * Beta))	0.017	2B	!	0.107	(A,B,C,D)

Note - The ! mark next to the figure name denotes curve value exceeded.

Stress Concentration Factors: Kn = 1.00, Kb = 1.00

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Stresses in the Vessel at the Attachment Junction (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Memb. P	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Circ. Bend. P	1.1	-1.1	1.1	-1.1	1.2	-1.2	1.2	-1.2
Circ. Memb. MC	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	0.0
Circ. Memb. MC	0.0	0.0	0.0	0.0	-0.2	0.2	0.2	-0.2
Circ. Memb. ML	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0
Circ. Bend. ML	-0.1	0.1	0.1	-0.1	0.0	0.0	0.0	0.0
Tot. Circ. Str.	1.1	-0.8	1.4	-1.1	1.1	-0.8	1.6	-1.3
Long. Memb. P	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Long. Bend. P	1.2	-1.2	1.2	-1.2	1.1	-1.1	1.1	-1.1
Long. Memb. MC	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	0.0
Long. Bend. MC	0.0	0.0	0.0	0.0	-0.1	0.1	0.1	-0.1
Long. Memb. ML	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long. Bend. ML	-0.3	0.3	0.3	-0.3	0.0	0.0	0.0	0.0
Tot. Long. Str.	1.1	-0.8	1.6	-1.3	1.1	-0.8	1.4	-1.1
Shear VC	0.3	0.3	-0.3	-0.3	0.0	0.0	0.0	0.0
Shear VL	0.0	0.0	0.0	0.0	-0.2	-0.2	0.2	0.2
Shear MT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Tot. Shear	0.8	0.8	0.2	0.2	0.3	0.3	0.7	0.7
Str. Int.	1.9	1.6	1.8	1.5	1.4	1.1	2.2	1.9

WRC 107/537 Stress Summations:

Vessel Stress Summation at Attachment Junction (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Pm (SUS)	129.3	129.3	129.3	129.3	129.3	129.3	129.3	129.3
Circ. Pl (SUS)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Circ. Q (SUS)	0.9	-0.9	1.2	-1.2	1.0	-1.0	1.5	-1.5
Long. Pm (SUS)	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7
Long. Pl (SUS)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Long. Q (SUS)	1.0	-1.0	1.5	-1.5	0.9	-0.9	1.2	-1.2
Shear Pm (SUS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shear Pl (SUS)	0.3	0.3	-0.3	-0.3	-0.2	-0.2	0.2	0.2
Shear Q (SUS)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Pm (SUS)	129.3	129.3	129.3	129.3	129.3	129.3	129.3	129.3
Pm+Pl (SUS)	129.4	129.4	129.4	129.4	129.4	129.4	129.4	129.4
Pm+Pl+Q (Total)	130.3	128.5	130.6	128.2	130.4	128.5	130.9	128.0

Vessel Stress Summation Comparison (N/mm²):

Type of Stress Int.	Max. S.I.	S.I. Allowable	Result
Pm (SUS)	129.28	136.28	Passed
Pm+Pl (SUS)	129.43	204.43	Passed
Pm+Pl+Q (TOTAL)	130.90	408.85	Passed

*Because only sustained loads were specified, the Pm+Pl+Q allowable was 3 * Smh.*

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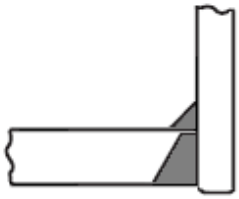
Input, Nozzle Desc: 2N **From: 60**

Pressure for Reinforcement Calculations	P	40.000	bar
Temperature for Internal Pressure	Temp	80	°C
Design External Pressure	Pext	1.03	bar
Temperature for External Pressure	Tempex	80	°C
Parent Material [Impact Tested]		SA-516 60	
Parent Allowable Stress at Temperature	Sv	136.28	N/mm²
Parent Allowable Stress At Ambient	Sva	147.00	N/mm²
Inside Diameter of Cylindrical Shell	D	2800.00	mm
Design Length of Section	L	16066.6689	mm
Shell Finished (Minimum) Thickness	t	44.0000	mm
Shell Internal Corrosion Allowance	c	0.0000	mm
Shell External Corrosion Allowance	co	0.0000	mm
Distance from Bottom/Left Tangent		15100.00	mm
User Entered Minimum Design Metal Temperature		-46.00	°C

Type of Element Connected to the Parent : Nozzle

Material [Impact Tested]		SA-350 LF2	
Material UNS Number		K03011	
Material Specification/Type		Forgings	
Allowable Stress at Temperature	Sn	153.86	N/mm²
Allowable Stress At Ambient	Sna	165.00	N/mm²
Diameter Basis (for tr calc only)		Inside	
Layout Angle		0.00	deg
Diameter		25.4000	mm
Size and Thickness Basis		Actual	
Actual Thickness	tn	14.3000	mm
Flange Material [Normalized]		SA-350 LF2	
Flange Type		Long Weld Neck	
Corrosion Allowance	can	0.0000	mm
Outside Projection	ho	370.0000	mm
Weld leg size between Nozzle and Pad/Shell	Wo	10.0000	mm
Groove weld depth between Nozzle and Vessel	Wgnv	44.0000	mm
Inside Projection	h	0.0000	mm
Weld leg size, Inside Element to Shell	Wi	0.0000	mm
User Defined Nozzle/Shell Centerline Angle		90.0000	deg.
Flange Class		300	
Flange Grade		GR 1.1	

The Pressure Design option was MAWP + static head (to the nozzle).



Insert/Set-in Nozzle No Pad, no Inside projection

Reinforcement CALCULATION, Description: 2N

ASME Code, Section VIII, Div. 2, 2021, Section 4.5.1 - 4.5.14

```
Actual Inside Diameter Used in Calculation            25.400  mm.
Actual Thickness Used in Calculation                  14.300  mm
```

Nozzle input data check completed without errors.

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:

```
= 0.5*D*( exp( P/(S*E) )-1)+ci+co
= 0.5*25.4 *(exp( 40/(154 *1 ))-1) + 0 + 0
= 0.33 + 0 + 0 = 0.33 mm Equation 4.3.1
```

Computed Maximum Allowable Working Pressure [MAWP]:

```
= S * E * Ln( ( 2*t + D ) / D ) - Pliq
= 154 * 1 * Ln( ( 2*14.3 + 25.4 )/25.4 ) - 0
= 1160 - 0 = 1160 bar
```

Nozzle Minimum Thickness per Table 4.5.2

```
Min. required Nozzle Neck Thickness + c : 0.135 in.   3.420 mm
```

Stresses on Nozzle due to External and Pressure Loads per the ASME B31.3 Piping Code, (see 319.4.4 and 302.3.5):

```
-----------------------------------------------------------
Sustained  :      2.1,  Allowable :    153.9 N/mm²  Passed
Expansion  :      0.0,  Allowable :    396.5 N/mm²  Passed
Occasional :      1.1,  Allowable :    204.6 N/mm²  Passed
Shear      :      9.5,  Allowable :    107.7 N/mm²  Passed
```

The number of cycles on this nozzle was assumed to be 7000 or less for the determination of the expansion stress allowable.

Nozzle Calculations per Section 4.5: Internal Pressure Case:

Nozzle Material Factor [frn]:

```
= min[Sn/S, 1]
= min[154/136, 1]
= 1.000
```

Thickness of Nozzle [tn]:

```
= thickness - corrosion allowance
= 14.3 - 0
= 14.300 mm
```

Shell Diameter to Thickness ratio [D/t]:
```
= Di/t
= 2800/44
= 63.636  must be less than 400.
```

Effective Pressure Radius [Reff]:
```
= Di/2 + corrosion allowance
= 2800/2 + 0
= 1400.000 mm
```

Effective Length of Vessel Wall [LR]:
```
= min( sqrt( Reff * t ), 2 * Rn )
= min( sqrt( 1400 * 44 ), 2 * 12.7 )
= 25.400 mm
```

Thickness Limit Candidate [LH1]:
```
= min[1.5t,te] + sqrt( Rn * tn )
= min[1.5*44, 0 ] + sqrt( 12.7 * 14.3 )
= 13.476 mm
```

Thickness Limit Candidate [LH2]:
```
= Lpr1
= 370
= 370.000 mm
```

Thickness Limit Candidate [LH3]:
```
= 8( t + te )
= 8( 44 + 0 )
= 352.000 mm
```

Effective Nozzle Wall Length Outside the Vessel [LH]:
```
= min[ LH1, LH2, LH3 ] + t    for set-in nozzles
= min[ 13.5, 370, 352 ) + 44
= 57.476 mm
```

Effective Vessel Thickness [teff]:
```
= t + (( A5 * frp ) / LR )
= 44+((0*1)/25.4)
= 44.000 mm
```

Determine Parameter [lambda]:
```
= min( 12, ( 2*Rn + tn )/( sqrt( ( Di + teff ) * teff )) )
= min( 12, (2*12.7 + 14.3 )/( sqrt((2800 + 44 ) * 44 )) )
= 0.112
```

Compute Areas A1-A43 (No Pad) or A1-A5 (With Pad) :

Area Contributed by the Vessel Wall [A1]:
```
= t * LR * max( (lambda/5)^0.85, 1 )
= 44 * 25.4 * max( (0.11/5)^0.85, 1 )
= 1117.600 mm^2
```

Area Contributed by the Nozzle Outside the Vessel Wall [A2]:
```
= tn * LH
= 14.3 * 57.5
= 821.911 mm^2
```

Area Contributed by the Outside Fillet Weld [A41]:
```
= 0.5 * Leg41^2
= 0.5 * 10^2
= 50.000 mm^2
```

The total area contributed by A1 through A43 [AT]:

```
= A1 + frn( A2 + A3 ) + A41 + A42 + A43
= 1118+1(822+0)+50+0+0
= 1989.511 mm^2
```

Nozzle Radius for Force Calculation [Rxn]:

```
= tn / ln[1 + tn/Rn ]
= 14.3/ln[ 1 + 14.3/12.7 ]
= 18.960 mm
```

Shell Radius for Force Calculation [Rxs]:

```
= teff / ln[ 1 + teff/Reff ]
= 44/ln[ 1 + 44/1400 ]
= 1421.886 mm
```

Allowable Local Primary Membrane Stress [Sallow]:

```
= 1.5 * S * E
= 1.5 * 136 * 1
= 204.4 N/mm²
```

Determine Force acting on the Nozzle [fN]:

```
= P * Rxn * LH
= 40 * 19 * 57.5
= 4359.2 N
```

Determine Force acting on the Shell [fS]:

```
= P * Rxs( LR + tn )
= 40 * 1422 ( 25.4 + 14.3 )
= 225809.1 N
```

Discontinuity Force from Internal Pressure [fY]:

```
= P * Rxs * Rnc
= 40 * 1422 * 12.7
= 72236.2 N
```

Area Resisting Internal Pressure [Ap]:

```
= ( fS + fY + fN )/P
= ( 225809 + 72236 + 4359 )/40
= 75596.6 mm^2
```

Maximum Allowable Working Pressure Candidate [Pmax1]:

```
= Sallow /( 2 * Ap/AT - Rxs/teff )
= 204/( 2 * 75597/1990 - 1422/44 )
= 46.8 bar
```

Maximum Allowable Working Pressure Candidate [Pmax2]:

```
= S[t/Rxs]
= 136 [44/1422 ]
= 42.2 bar
```

Maximum Allowable Working Pressure [Pmax]:

```
= min( Pmax1, Pmax2 )
= min( 46.8, 42.2 )
= 42.167 bar
```

Average Primary Membrane Stress [SigmaAvg]:

```
= ( fN + fS + fY ) / AT
= ( 4359 + 225809 + 72236 )/1990
= 152.012 N/mm²
```

General Primary Membrane Stress [SigmaCirc]:

```
= P * Rxs / teff
= 40 * 1422/44
```

= 129.3 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg – SigmaCirc, SigmaCirc)
= max(2 * 152 – 129, 129)
= 174.7 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	174.74	N/mm²
Maximum Allowable Working Pressure	Pmax	42.17	bar

Strength of Nozzle Attachment Welds per 4.5.14

Discontinuity Force Factor [ky]:
= (Rnc + tn) / Rnc
= (12.7 + 14.3)/12.7
= 2.126 For set-in Nozzles

Weld Length of Nozzle to Shell Weld [Ltau]:
= pi/2 * (Rn + tn)
= pi/2 * (12.7 + 14.3)
= 42.411 mm

Weld Throat Dimensions, (0.7071*Leg Dimensions) [L41T, L42T, L43T]:
= 7.071, 0.000, 0.000, mm

Required Weld Throat Dimensions :
tc, L41T = 7.071, must be >= min(0.7 * 14.300, 6.000) Passed

Weld Load Value [fwelds]:
= min(fy * ky, 1.5 * Sn(A2 + A3), pi/4*P*Rn^2*ky^2)
= min(72236*2.13,1.5*154(822+0),pi/4*40*12.7^2*2.13^2)
= 2290.358 N

Weld Stress Value [tau]:
= fwelds/(Ltau(0.49*L41T + 0.6*tw1 + 0.49*L43T))
= 2290/(42.4 (0.49*7.07 + 0.6*44 + 0.49*0))
= 1.808 < or = to 136.284 Weld Stress Passed

Nozzle Calculations per Section 4.5: External Pressure Case:

Nozzle Radius for Force Calculation [Rxn]:
= tn / ln[1 + tn/Rn]
= 14.3/ln[1 + 14.3/12.7]
= 18.960 mm

Shell Radius for Force Calculation [Rxs]:
= teff / ln[1 + teff/Reff]
= 44/ln[1 + 44/1400]
= 1421.886 mm

Allowable Local Primary Membrane Stress [Sallow]:
= 1.5 * S
= 1.5 * 136
= 204.4 N/mm²

Determine Force acting on the Nozzle [fN]:
= P * Rxn * LH
= 1.03 * 19 * 57.5
= 112.2 N

Determine Force acting on the Shell [fS]:
```
= P * Rxs( LR + tn )
= 1.03 * 1422 ( 25.4 + 14.3 )
= 5814.6 N
```

Discontinuity Force from External Pressure [fY]:
```
= P * Rxs * Rnc
= 1.03 * 1422 * 12.7
= 1860.1 N
```

Area Resisting External Pressure [Ap]:
```
= ( fS + fY + fN )/P
= ( 5815 + 1860 + 112 )/1.03
= 75596.6 mm^2
```

Maximum Allowable Working Pressure Candidate [Pmax1]:
```
= Sallow /( 2 * Ap/AT - Rxs/teff )
= 204/( 2 * 75597/1990 - 1422/44 )
= 46.8 bar
```

Maximum Allowable Working Pressure Candidate [Pmax2]:
```
= S[t/Rxs]
= 136 [44/1422 ]
= 42.2 bar
```

Maximum Allowable Working Pressure [Pmax]:
```
= min( Pmax1, Pmax2 )
= min( 46.8, 42.2 )
= 42.167 bar
```

Average Primary Membrane Stress [SigmaAvg]:
```
= ( fN + fS + fY ) / AT
= ( 112 + 5815 + 1860 )/1990
= 3.914 N/mm²
```

General Primary Membrane Stress [SigmaCirc]:
```
= P * Rxs / teff
= 1.03 * 1422/44
= 3.3 N/mm²
```

Maximum Local Primary Membrane Stress [PL]:
```
= max( 2 * SigmaAvg - SigmaCirc, SigmaCirc )
= max( 2 * 3.91 - 3.33, 3.33 )
= 4.5 N/mm²
```

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	4.50	N/mm²
Maximum Allowable External Pressure	Pmax	42.17	bar

Nozzle Junction Minimum Design Metal Temperature (MDMT) Calculations:

Nozzle-Shell/Head Weld for the Nozzle (Impact tested) :

Note:
This Material was specified as being an Impact Tested (Low Temperature) Material.

Impact Test Temperature provided per Specification	-46 °C

The Drop for this Nozzle is : 0.2604 mm
The Cut Length for this Nozzle is, Drop + Ho + H + T : 414.2604 mm

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Input Echo, WRC107/537 Item 1, Description: 2N :

Diameter Basis for Vessel	Vbasis	ID	
Cylindrical or Spherical Vessel	Cylsph	Cylindrical	
Internal Corrosion Allowance	Cas	0.0000	mm
Vessel Diameter	Dv	2800.000	mm
Vessel Thickness	Tv	44.000	mm
Design Temperature	T1	80.0	C
Vessel Material		SA-516 60	
Vessel UNS Number		K02100	
Vessel Cold S.I. Allowable	Smc	147.00	N/mm²
Vessel Hot S.I. Allowable	Smh	136.28	N/mm²

Using 2 * Yield for Discontinuity Stress Allowable (Div 2, 4.1.6.3), Sps.
Make sure that material properties at this temperature are not
time-dependent for Material: SA-516 60

Attachment Type	Type	Round	
Diameter Basis for Nozzle	Nbasis	ID	
Corrosion Allowance for Nozzle	Can	0.0000	mm
Nozzle Diameter	Dn	25.400	mm
Nozzle Thickness	Tn	14.300	mm
Nozzle Material		SA-350 LF2	
Nozzle UNS Number		K03011	
Nozzle Cold S.I. Allowable	SNmc	165.00	N/mm²
Nozzle Hot S.I. Allowable	SNmh	153.86	N/mm²
Design Internal Pressure	Dp	40.000	bar
Include Pressure Thrust		No	

External Forces and Moments in WRC 107/537 Convention:

Radial Load	(SUS)	P	-1400.0	N
Longitudinal Shear	(SUS)	Vl	700.0	N
Circumferential Shear	(SUS)	Vc	1050.0	N
Circumferential Moment	(SUS)	Mc	18.0	N-m
Longitudinal Moment	(SUS)	Ml	18.0	N-m
Torsional Moment	(SUS)	Mt	105.0	N-m

Use Interactive Control		No	
WRC107 Version	Version	March 1979	
Include Pressure Stress Indices per Div. 2		No	
Compute Pressure Stress per WRC-368		No	
Local Loads applied at end of Nozzle/Attachment		No	

WRC Bulletin 537 provides equations for the dimensionless curves found in bulletin 107. As noted in the foreword to bulletin 537, "537 is equivalent to WRC 107". Where 107 is printed in the results below, "537" can be interchanged with "107".

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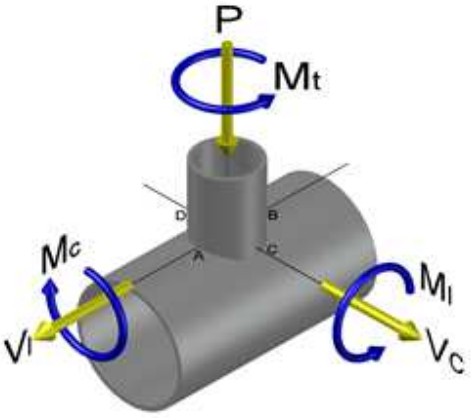

WRC 107/537 has dimensional limitations that can be found in the bulletin's Foreword and which can also be inferred by review of the non-dimensional curve limits.

Stress Attenuation Diameter (for Insert Plates) per WRC 297:

```
  = NozzleOD + 2 * 1.65 * sqrt( Rmean( t - ca ) )
  = 54.0 + 2 * 1.65 * sqrt( 1422.0 ( 44.0 - 0.0 ) )
  = 879.449 mm
```

WRC 107 Stress Calculation for SUStained loads:

Radial Load	P	-1400.0	N
Circumferential Shear	VC	1050.0	N
Longitudinal Shear	VL	700.0	N
Circumferential Moment	MC	18.0	N-m
Longitudinal Moment	ML	18.0	N-m
Torsional Moment	MT	105.0	N-m

Dimensionless Parameters used : Gamma = 32.32

Dimensionless Loads for Cylindrical Shells at Attachment Junction:

Curves read for 1979	Beta	Figure		Value	Location
N(PHI) / (P/Rm)	0.017	4C		6.328	(A,B)
N(PHI) / (P/Rm)	0.017	3C		6.574	(C,D)
M(PHI) / (P)	0.017	2C1		0.245	(A,B)
M(PHI) / (P)	0.017	1C	!	0.281	(C,D)
N(PHI) / (MC/(Rm**2 * Beta))	0.017	3A		0.073	(A,B,C,D)
M(PHI) / (MC/(Rm * Beta))	0.017	1A	!	0.105	(A,B,C,D)
N(PHI) / (ML/(Rm**2 * Beta))	0.017	3B		0.348	(A,B,C,D)
M(PHI) / (ML/(Rm * Beta))	0.017	1B	!	0.063	(A,B,C,D)
N(x) / (P/Rm)	0.017	3C		6.574	(A,B)
N(x) / (P/Rm)	0.017	4C		6.328	(C,D)
M(x) / (P)	0.017	1C1	!	0.287	(A,B)
M(x) / (P)	0.017	2C		0.250	(C,D)
N(x) / (MC/(Rm**2 * Beta))	0.017	4A		0.094	(A,B,C,D)
M(x) / (MC/(Rm * Beta))	0.017	2A	!	0.063	(A,B,C,D)
N(x) / (ML/(Rm**2 * Beta))	0.017	4B		0.076	(A,B,C,D)
M(x) / (ML/(Rm * Beta))	0.017	2B	!	0.107	(A,B,C,D)

Note - The ! mark next to the figure name denotes curve value exceeded.

Stress Concentration Factors: Kn = 1.00, Kb = 1.00

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Stresses in the Vessel at the Attachment Junction (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Memb. P	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Circ. Bend. P	1.1	-1.1	1.1	-1.1	1.2	-1.2	1.2	-1.2
Circ. Memb. MC	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	0.0
Circ. Memb. MC	0.0	0.0	0.0	0.0	-0.2	0.2	0.2	-0.2
Circ. Memb. ML	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0
Circ. Bend. ML	-0.1	0.1	0.1	-0.1	0.0	0.0	0.0	0.0
Tot. Circ. Str.	1.1	-0.8	1.4	-1.1	1.1	-0.8	1.6	-1.3
Long. Memb. P	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Long. Bend. P	1.2	-1.2	1.2	-1.2	1.1	-1.1	1.1	-1.1
Long. Memb. MC	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	0.0
Long. Bend. MC	0.0	0.0	0.0	0.0	-0.1	0.1	0.1	-0.1
Long. Memb. ML	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long. Bend. ML	-0.3	0.3	0.3	-0.3	0.0	0.0	0.0	0.0
Tot. Long. Str.	1.1	-0.8	1.6	-1.3	1.1	-0.8	1.4	-1.1
Shear VC	0.3	0.3	-0.3	-0.3	0.0	0.0	0.0	0.0
Shear VL	0.0	0.0	0.0	0.0	-0.2	-0.2	0.2	0.2
Shear MT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Tot. Shear	0.8	0.8	0.2	0.2	0.3	0.3	0.7	0.7
Str. Int.	1.9	1.6	1.8	1.5	1.4	1.1	2.2	1.9

WRC 107/537 Stress Summations:

Vessel Stress Summation at Attachment Junction (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Pm (SUS)	129.3	129.3	129.3	129.3	129.3	129.3	129.3	129.3
Circ. Pl (SUS)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Circ. Q (SUS)	0.9	-0.9	1.2	-1.2	1.0	-1.0	1.5	-1.5
Long. Pm (SUS)	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7
Long. Pl (SUS)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Long. Q (SUS)	1.0	-1.0	1.5	-1.5	0.9	-0.9	1.2	-1.2
Shear Pm (SUS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shear Pl (SUS)	0.3	0.3	-0.3	-0.3	-0.2	-0.2	0.2	0.2
Shear Q (SUS)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Pm (SUS)	129.3	129.3	129.3	129.3	129.3	129.3	129.3	129.3
Pm+Pl (SUS)	129.4	129.4	129.4	129.4	129.4	129.4	129.4	129.4
Pm+Pl+Q (Total)	130.3	128.5	130.6	128.2	130.4	128.5	130.9	128.0

Vessel Stress Summation Comparison (N/mm²):

Type of Stress Int.	Max. S.I.	S.I. Allowable	Result
Pm (SUS)	129.28	136.28	Passed
Pm+Pl (SUS)	129.43	204.43	Passed
Pm+Pl+Q (TOTAL)	130.90	408.85	Passed

*Because only sustained loads were specified, the Pm+Pl+Q allowable was 3 * Smh.*

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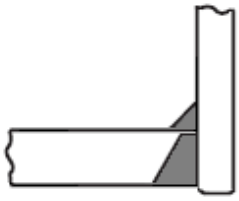
Input, Nozzle Desc: K2 From: 60

Pressure for Reinforcement Calculations	P	40.000	bar
Temperature for Internal Pressure	Temp	80	°C
Design External Pressure	Pext	1.03	bar
Temperature for External Pressure	Tempex	80	°C
Parent Material [Impact Tested]		SA-516 60	
Parent Allowable Stress at Temperature	Sv	136.28	N/mm²
Parent Allowable Stress At Ambient	Sva	147.00	N/mm²
Inside Diameter of Cylindrical Shell	D	2800.00	mm
Design Length of Section	L	16066.6689	mm
Shell Finished (Minimum) Thickness	t	44.0000	mm
Shell Internal Corrosion Allowance	c	0.0000	mm
Shell External Corrosion Allowance	co	0.0000	mm
Distance from Bottom/Left Tangent		14700.00	mm
User Entered Minimum Design Metal Temperature		-46.00	°C

Type of Element Connected to the Parent : Nozzle

Material [Impact Tested]		SA-350 LF2	
Material UNS Number		K03011	
Material Specification/Type		Forgings	
Allowable Stress at Temperature	Sn	153.86	N/mm²
Allowable Stress At Ambient	Sna	165.00	N/mm²
Diameter Basis (for tr calc only)		Inside	
Layout Angle		0.00	deg
Diameter		25.4000	mm
Size and Thickness Basis		Actual	
Actual Thickness	tn	14.3000	mm
Flange Material [Normalized]		SA-350 LF2	
Flange Type		Long Weld Neck	
Corrosion Allowance	can	0.0000	mm
Outside Projection	ho	370.0000	mm
Weld leg size between Nozzle and Pad/Shell	Wo	10.0000	mm
Groove weld depth between Nozzle and Vessel	Wgnv	44.0000	mm
Inside Projection	h	0.0000	mm
Weld leg size, Inside Element to Shell	Wi	0.0000	mm
User Defined Nozzle/Shell Centerline Angle		90.0000	deg.
Flange Class		300	
Flange Grade		GR 1.1	

The Pressure Design option was MAWP + static head (to the nozzle).



Insert/Set-in Nozzle No Pad, no Inside projection

Reinforcement CALCULATION, Description: K2

ASME Code, Section VIII, Div. 2, 2021, Section 4.5.1 - 4.5.14

```
Actual Inside Diameter Used in Calculation          25.400  mm.
Actual Thickness Used in Calculation                14.300  mm
```

Nozzle input data check completed without errors.

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:

```
= 0.5*D*( exp( P/(S*E) )-1)+ci+co
= 0.5*25.4 *(exp( 40/(154 *1 ))-1) + 0 + 0
= 0.33 + 0 + 0 = 0.33 mm Equation 4.3.1
```

Computed Maximum Allowable Working Pressure [MAWP]:

```
= S * E * Ln( ( 2*t + D ) / D ) - Pliq
= 154 * 1 * Ln( ( 2*14.3 + 25.4 )/25.4 ) - 0
= 1160 - 0 = 1160 bar
```

Nozzle Minimum Thickness per Table 4.5.2

```
Min. required Nozzle Neck Thickness + c : 0.135 in.   3.420 mm
```

Nozzle Calculations per Section 4.5: Internal Pressure Case:

Nozzle Material Factor [frn]:

```
= min[Sn/S, 1]
= min[154/136, 1]
= 1.000
```

Thickness of Nozzle [tn]:

```
= thickness - corrosion allowance
= 14.3 - 0
= 14.300 mm
```

Shell Diameter to Thickness ratio [D/t]:

```
= Di/t
= 2800/44
= 63.636  must be less than 400.
```

Effective Pressure Radius [Reff]:

```
= Di/2 + corrosion allowance
= 2800/2 + 0
= 1400.000 mm
```

Effective Length of Vessel Wall [LR]:
= min(sqrt(Reff * t), 2 * Rn)
= min(sqrt(1400 * 44), 2 * 12.7)
= 25.400 mm

Thickness Limit Candidate [LH1]:
= min[1.5t,te] + sqrt(Rn * tn)
= min[1.5*44, 0] + sqrt(12.7 * 14.3)
= 13.476 mm

Thickness Limit Candidate [LH2]:
= Lpr1
= 370
= 370.000 mm

Thickness Limit Candidate [LH3]:
= 8(t + te)
= 8(44 + 0)
= 352.000 mm

Effective Nozzle Wall Length Outside the Vessel [LH]:
= min[LH1, LH2, LH3] + t for set-in nozzles
= min[13.5, 370, 352) + 44
= 57.476 mm

Effective Vessel Thickness [teff]:
= t + ((A5 * frp) / LR)
= 44+((0*1)/25.4)
= 44.000 mm

Determine Parameter [lambda]:
= min(12, (2*Rn + tn)/(sqrt((Di + teff) * teff)))
= min(12, (2*12.7 + 14.3)/(sqrt((2800 + 44) * 44)))
= 0.112

Compute Areas A1-A43 (No Pad) or A1-A5 (With Pad) :

Area Contributed by the Vessel Wall [A1]:
= t * LR * max((lambda/5)$^{0.85}$, 1)
= 44 * 25.4 * max((0.11/5)$^{0.85}$, 1)
= 1117.600 mm^2

Area Contributed by the Nozzle Outside the Vessel Wall [A2]:
= tn * LH
= 14.3 * 57.5
= 821.911 mm^2

Area Contributed by the Outside Fillet Weld [A41]:
= 0.5 * Leg41^2
= 0.5 * 10^2
= 50.000 mm^2

The total area contributed by A1 through A43 [AT]:
= A1 + frn(A2 + A3) + A41 + A42 + A43
= 1118+1(822+0)+50+0+0
= 1989.511 mm^2

Nozzle Radius for Force Calculation [Rxn]:
= tn / ln[1 + tn/Rn]
= 14.3/ln[1 + 14.3/12.7]
= 18.960 mm

Shell Radius for Force Calculation [Rxs]:
= teff / ln[1 + teff/Reff]
= 44/ln[1 + 44/1400]
= 1421.886 mm

Allowable Local Primary Membrane Stress [Sallow]:
= 1.5 * S * E
= 1.5 * 136 * 1
= 204.4 N/mm²

Determine Force acting on the Nozzle [fN]:
= P * Rxn * LH
= 40 * 19 * 57.5
= 4359.2 N

Determine Force acting on the Shell [fS]:
= P * Rxs(LR + tn)
= 40 * 1422 (25.4 + 14.3)
= 225809.1 N

Discontinuity Force from Internal Pressure [fY]:
= P * Rxs * Rnc
= 40 * 1422 * 12.7
= 72236.2 N

Area Resisting Internal Pressure [Ap]:
= (fS + fY + fN)/P
= (225809 + 72236 + 4359)/40
= 75596.6 mm^2

Maximum Allowable Working Pressure Candidate [Pmax1]:
= Sallow /(2 * Ap/AT – Rxs/teff)
= 204/(2 * 75597/1990 – 1422/44)
= 46.8 bar

Maximum Allowable Working Pressure Candidate [Pmax2]:
= S[t/Rxs]
= 136 [44/1422]
= 42.2 bar

Maximum Allowable Working Pressure [Pmax]:
= min(Pmax1, Pmax2)
= min(46.8, 42.2)
= 42.167 bar

Average Primary Membrane Stress [SigmaAvg]:
= (fN + fS + fY) / AT
= (4359 + 225809 + 72236)/1990
= 152.012 N/mm²

General Primary Membrane Stress [SigmaCirc]:
= P * Rxs / teff
= 40 * 1422/44
= 129.3 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg – SigmaCirc, SigmaCirc)
= max(2 * 152 – 129, 129)
= 174.7 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	174.74	N/mm²

```
Maximum Allowable Working Pressure        Pmax       42.17  bar
```

Strength of Nozzle Attachment Welds per 4.5.14

Discontinuity Force Factor [ky]:
```
= ( Rnc + tn ) / Rnc
= ( 12.7 + 14.3 )/12.7
= 2.126 For set-in Nozzles
```

Weld Length of Nozzle to Shell Weld [Ltau]:
```
= pi/2 * ( Rn + tn )
= pi/2 * ( 12.7 + 14.3 )
= 42.411 mm
```

Weld Throat Dimensions, (0.7071*Leg Dimensions) [L41T, L42T, L43T]:
```
= 7.071,  0.000,  0.000, mm
```

Required Weld Throat Dimensions :
tc, L41T = 7.071, must be >= min(0.7 * 14.300, 6.000) Passed

Weld Load Value [fwelds]:
```
= min( fy * ky, 1.5 * Sn( A2 + A3 ), pi/4*P*Rn^2*ky^2 )
= min(72236*2.13,1.5*154(822+0),pi/4*40*12.7^2*2.13^2)
= 2290.358 N
```

Weld Stress Value [tau]:
```
= fwelds/(Ltau(0.49*L41T + 0.6*tw1 + 0.49*L43T ) )
= 2290/(42.4 (0.49*7.07 + 0.6*44 + 0.49*0 ) )
= 1.808 < or = to 136.284 Weld Stress Passed
```

Nozzle Calculations per Section 4.5: External Pressure Case:

Nozzle Radius for Force Calculation [Rxn]:
```
= tn / ln[1 + tn/Rn ]
= 14.3/ln[ 1 + 14.3/12.7 ]
= 18.960 mm
```

Shell Radius for Force Calculation [Rxs]:
```
= teff / ln[ 1 + teff/Reff ]
= 44/ln[ 1 + 44/1400 ]
= 1421.886 mm
```

Allowable Local Primary Membrane Stress [Sallow]:
```
= 1.5 * S
= 1.5 * 136
= 204.4 N/mm²
```

Determine Force acting on the Nozzle [fN]:
```
= P * Rxn * LH
= 1.03 * 19 * 57.5
= 112.2 N
```

Determine Force acting on the Shell [fS]:
```
= P * Rxs( LR + tn )
= 1.03 * 1422 ( 25.4 + 14.3 )
= 5814.6 N
```

Discontinuity Force from External Pressure [fY]:
```
= P * Rxs * Rnc
= 1.03 * 1422 * 12.7
= 1860.1 N
```

Area Resisting External Pressure [Ap]:

```
= ( fS + fY + fN )/P
= ( 5815 + 1860 + 112 )/1.03
= 75596.6 mm^2
```

Maximum Allowable Working Pressure Candidate [Pmax1]:

```
= Sallow /( 2 * Ap/AT - Rxs/teff )
= 204/( 2 * 75597/1990 - 1422/44 )
= 46.8 bar
```

Maximum Allowable Working Pressure Candidate [Pmax2]:

```
= S[t/Rxs]
= 136 [44/1422 ]
= 42.2 bar
```

Maximum Allowable Working Pressure [Pmax]:

```
= min( Pmax1, Pmax2 )
= min( 46.8, 42.2 )
= 42.167 bar
```

Average Primary Membrane Stress [SigmaAvg]:

```
= ( fN + fS + fY ) / AT
= ( 112 + 5815 + 1860 )/1990
= 3.914 N/mm²
```

General Primary Membrane Stress [SigmaCirc]:

```
= P * Rxs / teff
= 1.03 * 1422/44
= 3.3 N/mm²
```

Maximum Local Primary Membrane Stress [PL]:

```
= max( 2 * SigmaAvg - SigmaCirc, SigmaCirc )
= max( 2 * 3.91 - 3.33, 3.33 )
= 4.5 N/mm²
```

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	4.50	N/mm²
Maximum Allowable External Pressure	Pmax	42.17	bar

Nozzle Junction Minimum Design Metal Temperature (MDMT) Calculations:

Nozzle-Shell/Head Weld for the Nozzle (Impact tested) :

Note:
This Material was specified as being an Impact Tested (Low Temperature) Material.

Impact Test Temperature provided per Specification -46 °C

The Drop for this Nozzle is : 0.2604 mm
The Cut Length for this Nozzle is, Drop + Ho + H + T : 414.2604 mm

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		JOB	23096		
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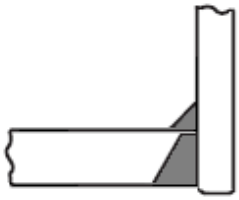
Input, Nozzle Desc: K1 From: 60

Pressure for Reinforcement Calculations	P	40.000	bar
Temperature for Internal Pressure	Temp	80	°C
Design External Pressure	Pext	1.03	bar
Temperature for External Pressure	Tempex	80	°C
Parent Material [Impact Tested]		SA-516 60	
Parent Allowable Stress at Temperature	Sv	136.28	N/mm²
Parent Allowable Stress At Ambient	Sva	147.00	N/mm²
Inside Diameter of Cylindrical Shell	D	2800.00	mm
Design Length of Section	L	16066.6689	mm
Shell Finished (Minimum) Thickness	t	44.0000	mm
Shell Internal Corrosion Allowance	c	0.0000	mm
Shell External Corrosion Allowance	co	0.0000	mm
Distance from Bottom/Left Tangent		14300.00	mm
User Entered Minimum Design Metal Temperature		-46.00	°C

Type of Element Connected to the Parent : Nozzle

Material [Impact Tested]		SA-350 LF2	
Material UNS Number		K03011	
Material Specification/Type		Forgings	
Allowable Stress at Temperature	Sn	153.86	N/mm²
Allowable Stress At Ambient	Sna	165.00	N/mm²
Diameter Basis (for tr calc only)		Inside	
Layout Angle		0.00	deg
Diameter		25.4000	mm
Size and Thickness Basis		Actual	
Actual Thickness	tn	14.3000	mm
Flange Material [Normalized]		SA-350 LF2	
Flange Type		Long Weld Neck	
Corrosion Allowance	can	0.0000	mm
Outside Projection	ho	370.0000	mm
Weld leg size between Nozzle and Pad/Shell	Wo	10.0000	mm
Groove weld depth between Nozzle and Vessel	Wgnv	44.0000	mm
Inside Projection	h	0.0000	mm
Weld leg size, Inside Element to Shell	Wi	0.0000	mm
User Defined Nozzle/Shell Centerline Angle		90.0000	deg.
Flange Class		300	
Flange Grade		GR 1.1	

The Pressure Design option was MAWP + static head (to the nozzle).



Insert/Set-in Nozzle No Pad, no Inside projection

Reinforcement CALCULATION, Description: K1

ASME Code, Section VIII, Div. 2, 2021, Section 4.5.1 - 4.5.14

```
Actual Inside Diameter Used in Calculation          25.400  mm.
Actual Thickness Used in Calculation                14.300  mm
```

Nozzle input data check completed without errors.

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:

```
= 0.5*D*( exp( P/(S*E) )-1)+ci+co
= 0.5*25.4 *(exp( 40/(154 *1 ))-1) + 0 + 0
= 0.33 + 0 + 0 = 0.33 mm Equation 4.3.1
```

Computed Maximum Allowable Working Pressure [MAWP]:

```
= S * E * Ln( ( 2*t + D ) / D ) - Pliq
= 154 * 1 * Ln( ( 2*14.3 + 25.4 )/25.4 ) - 0
= 1160 - 0 = 1160 bar
```

Nozzle Minimum Thickness per Table 4.5.2

```
Min. required Nozzle Neck Thickness + c : 0.135 in.   3.420 mm
```

Nozzle Calculations per Section 4.5: Internal Pressure Case:

Nozzle Material Factor [frn]:

```
= min[Sn/S, 1]
= min[154/136, 1]
= 1.000
```

Thickness of Nozzle [tn]:

```
= thickness - corrosion allowance
= 14.3 - 0
= 14.300 mm
```

Shell Diameter to Thickness ratio [D/t]:

```
= Di/t
= 2800/44
= 63.636  must be less than 400.
```

Effective Pressure Radius [Reff]:

```
= Di/2 + corrosion allowance
= 2800/2 + 0
= 1400.000 mm
```

Effective Length of Vessel Wall [LR]:
```
= min( sqrt( Reff * t ), 2 * Rn )
= min( sqrt( 1400 * 44 ), 2 * 12.7 )
= 25.400 mm
```

Thickness Limit Candidate [LH1]:
```
= min[1.5t,te] + sqrt( Rn * tn )
= min[1.5*44, 0 ] + sqrt( 12.7 * 14.3 )
= 13.476 mm
```

Thickness Limit Candidate [LH2]:
```
= Lpr1
= 370
= 370.000 mm
```

Thickness Limit Candidate [LH3]:
```
= 8( t + te )
= 8( 44 + 0 )
= 352.000 mm
```

Effective Nozzle Wall Length Outside the Vessel [LH]:
```
= min[ LH1, LH2, LH3 ] + t    for set-in nozzles
= min[ 13.5, 370, 352 ) + 44
= 57.476 mm
```

Effective Vessel Thickness [teff]:
```
= t + (( A5 * frp ) / LR )
= 44+((0*1)/25.4)
= 44.000 mm
```

Determine Parameter [lambda]:
```
= min( 12, ( 2*Rn + tn )/( sqrt( ( Di + teff ) * teff )) )
= min( 12, (2*12.7 + 14.3 )/( sqrt((2800 + 44 ) * 44 )) )
= 0.112
```

Compute Areas A1-A43 (No Pad) or A1-A5 (With Pad) :

Area Contributed by the Vessel Wall [A1]:
```
= t * LR * max( (lambda/5)^0.85, 1 )
= 44 * 25.4 * max( (0.11/5)^0.85, 1 )
= 1117.600 mm^2
```

Area Contributed by the Nozzle Outside the Vessel Wall [A2]:
```
= tn * LH
= 14.3 * 57.5
= 821.911 mm^2
```

Area Contributed by the Outside Fillet Weld [A41]:
```
= 0.5 * Leg41^2
= 0.5 * 10^2
= 50.000 mm^2
```

The total area contributed by A1 through A43 [AT]:
```
= A1 + frn( A2 + A3 ) + A41 + A42 + A43
= 1118+1(822+0)+50+0+0
= 1989.511 mm^2
```

Nozzle Radius for Force Calculation [Rxn]:
```
= tn / ln[1 + tn/Rn ]
= 14.3/ln[ 1 + 14.3/12.7 ]
= 18.960 mm
```

Shell Radius for Force Calculation [Rxs]:
= teff / ln[1 + teff/Reff]
= 44/ln[1 + 44/1400]
= 1421.886 mm

Allowable Local Primary Membrane Stress [Sallow]:
= 1.5 * S * E
= 1.5 * 136 * 1
= 204.4 N/mm²

Determine Force acting on the Nozzle [fN]:
= P * Rxn * LH
= 40 * 19 * 57.5
= 4359.2 N

Determine Force acting on the Shell [fS]:
= P * Rxs(LR + tn)
= 40 * 1422 (25.4 + 14.3)
= 225809.1 N

Discontinuity Force from Internal Pressure [fY]:
= P * Rxs * Rnc
= 40 * 1422 * 12.7
= 72236.2 N

Area Resisting Internal Pressure [Ap]:
= (fS + fY + fN)/P
= (225809 + 72236 + 4359)/40
= 75596.6 mm^2

Maximum Allowable Working Pressure Candidate [Pmax1]:
= Sallow /(2 * Ap/AT – Rxs/teff)
= 204/(2 * 75597/1990 – 1422/44)
= 46.8 bar

Maximum Allowable Working Pressure Candidate [Pmax2]:
= S[t/Rxs]
= 136 [44/1422]
= 42.2 bar

Maximum Allowable Working Pressure [Pmax]:
= min(Pmax1, Pmax2)
= min(46.8, 42.2)
= 42.167 bar

Average Primary Membrane Stress [SigmaAvg]:
= (fN + fS + fY) / AT
= (4359 + 225809 + 72236)/1990
= 152.012 N/mm²

General Primary Membrane Stress [SigmaCirc]:
= P * Rxs / teff
= 40 * 1422/44
= 129.3 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg – SigmaCirc, SigmaCirc)
= max(2 * 152 – 129, 129)
= 174.7 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	174.74	N/mm²

```
Maximum Allowable Working Pressure        Pmax       42.17  bar
```

Strength of Nozzle Attachment Welds per 4.5.14

Discontinuity Force Factor [ky]:
```
= ( Rnc + tn ) / Rnc
= ( 12.7 + 14.3 )/12.7
= 2.126 For set-in Nozzles
```

Weld Length of Nozzle to Shell Weld [Ltau]:
```
= pi/2 * ( Rn + tn )
= pi/2 * ( 12.7 + 14.3 )
= 42.411 mm
```

Weld Throat Dimensions, (0.7071*Leg Dimensions) [L41T, L42T, L43T]:
```
= 7.071,  0.000,  0.000, mm
```

Required Weld Throat Dimensions :
tc, L41T = 7.071, must be >= min(0.7 * 14.300, 6.000) Passed

Weld Load Value [fwelds]:
```
= min( fy * ky, 1.5 * Sn( A2 + A3 ), pi/4*P*Rn^2*ky^2 )
= min(72236*2.13,1.5*154(822+0),pi/4*40*12.7^2*2.13^2)
= 2290.358 N
```

Weld Stress Value [tau]:
```
= fwelds/(Ltau(0.49*L41T + 0.6*tw1 + 0.49*L43T ) )
= 2290/(42.4 (0.49*7.07 + 0.6*44 + 0.49*0 ) )
= 1.808 < or = to 136.284 Weld Stress Passed
```

Nozzle Calculations per Section 4.5: External Pressure Case:

Nozzle Radius for Force Calculation [Rxn]:
```
= tn / ln[1 + tn/Rn ]
= 14.3/ln[ 1 + 14.3/12.7 ]
= 18.960 mm
```

Shell Radius for Force Calculation [Rxs]:
```
= teff / ln[ 1 + teff/Reff ]
= 44/ln[ 1 + 44/1400 ]
= 1421.886 mm
```

Allowable Local Primary Membrane Stress [Sallow]:
```
= 1.5 * S
= 1.5 * 136
= 204.4 N/mm²
```

Determine Force acting on the Nozzle [fN]:
```
= P * Rxn * LH
= 1.03 * 19 * 57.5
= 112.2 N
```

Determine Force acting on the Shell [fS]:
```
= P * Rxs( LR + tn )
= 1.03 * 1422 ( 25.4 + 14.3 )
= 5814.6 N
```

Discontinuity Force from External Pressure [fY]:
```
= P * Rxs * Rnc
= 1.03 * 1422 * 12.7
= 1860.1 N
```

Area Resisting External Pressure [Ap]:

```
= ( fS + fY + fN )/P
= ( 5815 + 1860 + 112 )/1.03
= 75596.6 mm^2
```

Maximum Allowable Working Pressure Candidate [Pmax1]:

```
= Sallow /( 2 * Ap/AT - Rxs/teff )
= 204/( 2 * 75597/1990 - 1422/44 )
= 46.8 bar
```

Maximum Allowable Working Pressure Candidate [Pmax2]:

```
= S[t/Rxs]
= 136 [44/1422 ]
= 42.2 bar
```

Maximum Allowable Working Pressure [Pmax]:

```
= min( Pmax1, Pmax2 )
= min( 46.8, 42.2 )
= 42.167 bar
```

Average Primary Membrane Stress [SigmaAvg]:

```
= ( fN + fS + fY ) / AT
= ( 112 + 5815 + 1860 )/1990
= 3.914 N/mm²
```

General Primary Membrane Stress [SigmaCirc]:

```
= P * Rxs / teff
= 1.03 * 1422/44
= 3.3 N/mm²
```

Maximum Local Primary Membrane Stress [PL]:

```
= max( 2 * SigmaAvg - SigmaCirc, SigmaCirc )
= max( 2 * 3.91 - 3.33, 3.33 )
= 4.5 N/mm²
```

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	4.50	N/mm²
Maximum Allowable External Pressure	Pmax	42.17	bar

Nozzle Junction Minimum Design Metal Temperature (MDMT) Calculations:

Nozzle-Shell/Head Weld for the Nozzle (Impact tested) :

Note:
This Material was specified as being an Impact Tested (Low Temperature) Material.

Impact Test Temperature provided per Specification -46 °C

The Drop for this Nozzle is : 0.2604 mm
The Cut Length for this Nozzle is, Drop + Ho + H + T : 414.2604 mm

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		ITEM	V-25001 A÷F		

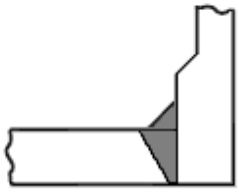
Input, Nozzle Desc: 4N **From: 60**

Pressure for Reinforcement Calculations	P	40.000	bar
Temperature for Internal Pressure	Temp	80	°C
Design External Pressure	Pext	1.03	bar
Temperature for External Pressure	Tempex	80	°C
Parent Material [Impact Tested]		SA-516 60	
Parent Allowable Stress at Temperature	Sv	136.28	N/mm²
Parent Allowable Stress At Ambient	Sva	147.00	N/mm²
Inside Diameter of Cylindrical Shell	D	2800.00	mm
Design Length of Section	L	16066.6689	mm
Shell Finished (Minimum) Thickness	t	44.0000	mm
Shell Internal Corrosion Allowance	c	0.0000	mm
Shell External Corrosion Allowance	co	0.0000	mm
Distance from Bottom/Left Tangent		13900.00	mm
User Entered Minimum Design Metal Temperature		-46.00	°C

Type of Element Connected to the Parent : Nozzle

Material [Impact Tested]		SA-350 LF2	
Material UNS Number		K03011	
Material Specification/Type		Forgings	
Allowable Stress at Temperature	Sn	153.86	N/mm²
Allowable Stress At Ambient	Sna	165.00	N/mm²
Diameter Basis (for tr calc only)		Inside	
Layout Angle		0.00	deg
Diameter		101.6000	mm
Size and Thickness Basis		Actual	
Actual Thickness	tn	22.2000	mm
Flange Material [Normalized]		SA-350 LF2	
Hub Height of Integral Nozzle	h	100.0000	mm
Height of Beveled Transition	L'	12.8000	mm
Hub Thickness of Integral Nozzle (tn or x+tp)		35.0000	mm
Corrosion Allowance	can	0.0000	mm
Outside Projection	ho	370.0000	mm
Weld leg size between Nozzle and Pad/Shell	Wo	10.0000	mm
Groove weld depth between Nozzle and Vessel	Wgnv	44.0000	mm
Inside Projection	h	0.0000	mm
Weld leg size, Inside Element to Shell	Wi	0.0000	mm
User Defined Nozzle/Shell Centerline Angle		90.0000	deg.
Flange Class		300	
Flange Grade		GR 1.1	

The Pressure Design option was MAWP + static head (to the nozzle).



Hub Nozzle (Set-in)

Reinforcement CALCULATION, Description: 4N

ASME Code, Section VIII, Div. 2, 2021, Section 4.5.1 - 4.5.14

```
Actual Inside Diameter Used in Calculation          101.600  mm.
Actual Thickness Used in Calculation                 22.200  mm
```

Nozzle input data check completed without errors.

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:

```
= 0.5*D*( exp( P/(S*E) )-1)+ci+co
= 0.5*102 *(exp( 40/(154 *1 ))-1) + 0 + 0
= 1.34 + 0 + 0 = 1.34 mm Equation 4.3.1
```

Computed Maximum Allowable Working Pressure [MAWP]:

```
= S * E * Ln( ( 2*t + D ) / D ) - Pliq
= 154 * 1 * Ln( ( 2*22.2 + 102 )/102 ) - 0
= 558 - 0 = 558 bar
```

Nozzle Minimum Thickness per Table 4.5.2

```
Min. required Nozzle Neck Thickness + c : 0.245 in.   6.220 mm
```

Stresses on Nozzle due to External and Pressure Loads per the ASME B31.3 Piping Code, (see 319.4.4 and 302.3.5):

```
-----------------------------------------------------------
Sustained   :     11.0,  Allowable :    153.9 N/mm²  Passed
Expansion   :      0.0,  Allowable :    387.6 N/mm²  Passed
Occasional  :      3.8,  Allowable :    204.6 N/mm²  Passed
Shear       :      6.1,  Allowable :    107.7 N/mm²  Passed
```

The number of cycles on this nozzle was assumed to be 7000 or less for the determination of the expansion stress allowable.

Nozzle Calculations per Section 4.5: Internal Pressure Case:

Nozzle Material Factor [frn]:

```
= min[Sn/S, 1]
= min[154/136, 1]
= 1.000
```

Thickness of Nozzle at Shell [tn]:

```
= hub thickness - corrosion allowance
= 35 - 0
= 35.000 mm
```

Thickness of Nozzle at Top [tn2]:
```
= thickness - corrosion allowance
= 22.2 - 0
= 22.200 mm
```

Shell Diameter to Thickness ratio [D/t]:
```
= Di/t
= 2800/44
= 63.636  must be less than 400.
```

Effective Pressure Radius [Reff]:
```
= Di/2 + corrosion allowance
= 2800/2 + 0
= 1400.000 mm
```

Effective Length of Vessel Wall [LR]:
```
= min( sqrt( Reff * t ), 2 * Rn )
= min( sqrt( 1400 * 44 ), 2 * 50.8 )
= 101.600 mm
```

Thickness Limit Candidate [LH1]:
```
= min[1.5t,te] + sqrt( Rn * tn )
= min[1.5*44, 0 ] + sqrt( 50.8 * 35 )
= 42.166 mm
```

Thickness Limit Candidate [LH2]:
```
= Lpr1
= 370
= 370.000 mm
```

Thickness Limit Candidate [LH3]:
```
= 8( t + te )
= 8( 44 + 0 )
= 352.000 mm
```

Effective Nozzle Wall Length Outside the Vessel [LH]:
```
= min[ LH1, LH2, LH3 ] + t    for set-in nozzles
= min[ 42.2, 370, 352 ) + 44
= 86.166 mm
```

Effective Vessel Thickness [teff]:
```
= t + (( A5 * frp ) / LR )
= 44+((0*1)/102)
= 44.000 mm
```

Determine Parameter [lambda]:
```
= min( 12, ( 2*Rn + tn )/( sqrt( ( Di + teff ) * teff )) )
= min( 12, (2*50.8 + 35 )/( sqrt((2800 + 44 ) * 44 )) )
= 0.386
```

Compute Areas A1-A43 (No Pad) or A1-A5 (With Pad) :

Area Contributed by the Vessel Wall [A1]:
```
= t * LR * max( (lambda/5)^0.85, 1 )
= 44 * 102 * max( (0.39/5)^0.85, 1 )
= 4470.400 mm^2
```

Area Contributed by the Nozzle Outside the Vessel Wall [A2]:
```
= tn * LH
= 35 * 86.2
= 3015.822 mm^2
```

Area Contributed by the Outside Fillet Weld [A41]:

= 0.5 * $Leg41^2$
= 0.5 * 10^2
= 50.000 mm^2

The total area contributed by A1 through A43 [AT]:
= A1 + frn(A2 + A3) + A41 + A42 + A43
= 4470+1(3016+0)+50+0+0
= 7536.222 mm^2

Nozzle Radius for Force Calculation [Rxn]:
= tn / ln[1 + tn/Rn]
= 35/ln[1 + 35/50.8]
= 66.778 mm

Shell Radius for Force Calculation [Rxs]:
= teff / ln[1 + teff/Reff]
= 44/ln[1 + 44/1400]
= 1421.886 mm

Allowable Local Primary Membrane Stress [Sallow]:
= 1.5 * S * E
= 1.5 * 136 * 1
= 204.4 N/mm²

Determine Force acting on the Nozzle [fN]:
= P * Rxn * LH
= 40 * 66.8 * 86.2
= 23017.5 N

Determine Force acting on the Shell [fS]:
= P * Rxs(LR + tn)
= 40 * 1422 (102 + 35)
= 776965.2 N

Discontinuity Force from Internal Pressure [fY]:
= P * Rxs * Rnc
= 40 * 1422 * 50.8
= 288944.6 N

Area Resisting Internal Pressure [Ap]:
= (fS + fY + fN)/P
= (776965 + 288945 + 23018)/40
= 272215.5 mm^2

Maximum Allowable Working Pressure Candidate [Pmax1]:
= Sallow /(2 * Ap/AT - Rxs/teff)
= 204/(2 * 272216/7536 - 1422/44)
= 51.2 bar

Maximum Allowable Working Pressure Candidate [Pmax2]:
= S[t/Rxs]
= 136 [44/1422]
= 42.2 bar

Maximum Allowable Working Pressure [Pmax]:
= min(Pmax1, Pmax2)
= min(51.2, 42.2)
= 42.167 bar

Average Primary Membrane Stress [SigmaAvg]:
= (fN + fS + fY) / AT
= (23018 + 776965 + 288945)/7536

= 144.505 N/mm²

General Primary Membrane Stress [SigmaCirc]:
= P * Rxs / teff
= 40 * 1422/44
= 129.3 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg – SigmaCirc, SigmaCirc)
= max(2 * 145 – 129, 129)
= 159.7 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	159.73	N/mm²
Maximum Allowable Working Pressure	Pmax	42.17	bar

Strength of Nozzle Attachment Welds per 4.5.14

Discontinuity Force Factor [ky]:
= (Rnc + tn) / Rnc
= (50.8 + 35)/50.8
= 1.689 For set-in Nozzles

Weld Length of Nozzle to Shell Weld [Ltau]:
= pi/2 * (Rn + tn)
= pi/2 * (50.8 + 35)
= 134.774 mm

Weld Throat Dimensions, (0.7071*Leg Dimensions) [L41T, L42T, L43T]:
= 7.071, 0.000, 0.000, mm

Required Weld Throat Dimensions :
tc, L41T = 7.071, must be >= min(0.7 * 35.000, 6.000) Passed

Weld Load Value [fwelds]:
= min(fy * ky, 1.5 * Sn(A2 + A3), pi/4*P*Rn^2*ky^2)
= min(288945*1.69,1.5*154(3016+0),pi/4*40*50.8^2*1.69^2)
= 23128.664 N

Weld Stress Value [tau]:
= fwelds/(Ltau(0.49*L41T + 0.6*tw1 + 0.49*L43T))
= 23129/(135 (0.49*7.07 + 0.6*44 + 0.49*0))
= 5.747 < or = to 136.284 Weld Stress Passed

Nozzle Calculations per Section 4.5: External Pressure Case:

Nozzle Radius for Force Calculation [Rxn]:
= tn / ln[1 + tn/Rn]
= 35/ln[1 + 35/50.8]
= 66.778 mm

Shell Radius for Force Calculation [Rxs]:
= teff / ln[1 + teff/Reff]
= 44/ln[1 + 44/1400]
= 1421.886 mm

Allowable Local Primary Membrane Stress [Sallow]:
= 1.5 * S
= 1.5 * 136
= 204.4 N/mm²

Determine Force acting on the Nozzle [fN]:
```
= P * Rxn * LH
= 1.03 * 66.8 * 86.2
= 592.7 N
```

Determine Force acting on the Shell [fS]:
```
= P * Rxs( LR + tn )
= 1.03 * 1422 ( 102 + 35 )
= 20006.9 N
```

Discontinuity Force from External Pressure [fY]:
```
= P * Rxs * Rnc
= 1.03 * 1422 * 50.8
= 7440.3 N
```

Area Resisting External Pressure [Ap]:
```
= ( fS + fY + fN )/P
= ( 20007 + 7440 + 593 )/1.03
= 272215.5 mm^2
```

Maximum Allowable Working Pressure Candidate [Pmax1]:
```
= Sallow /( 2 * Ap/AT - Rxs/teff )
= 204/( 2 * 272216/7536 - 1422/44 )
= 51.2 bar
```

Maximum Allowable Working Pressure Candidate [Pmax2]:
```
= S[t/Rxs]
= 136 [44/1422 ]
= 42.2 bar
```

Maximum Allowable Working Pressure [Pmax]:
```
= min( Pmax1, Pmax2 )
= min( 51.2, 42.2 )
= 42.167 bar
```

Average Primary Membrane Stress [SigmaAvg]:
```
= ( fN + fS + fY ) / AT
= ( 593 + 20007 + 7440 )/7536
= 3.721 N/mm²
```

General Primary Membrane Stress [SigmaCirc]:
```
= P * Rxs / teff
= 1.03 * 1422/44
= 3.3 N/mm²
```

Maximum Local Primary Membrane Stress [PL]:
```
= max( 2 * SigmaAvg - SigmaCirc, SigmaCirc )
= max( 2 * 3.72 - 3.33, 3.33 )
= 4.1 N/mm²
```

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	4.11	N/mm²
Maximum Allowable External Pressure	Pmax	42.17	bar

Nozzle Junction Minimum Design Metal Temperature (MDMT) Calculations:

Nozzle-Shell/Head Weld for the Nozzle (Impact tested) :

Note:
This Material was specified as being an Impact Tested (Low Temperature) Material.

```
Impact Test Temperature provided per Specification          -46 °C
```

The Drop for this Nozzle is : 2.6316 mm
The Cut Length for this Nozzle is, Drop + Ho + H + T : 416.6316 mm

Input Echo, WRC107/537 Item 1, Description: 4N :

```
Diameter Basis for Vessel                  Vbasis       ID
Cylindrical or Spherical Vessel            Cylsph       Cylindrical
Internal Corrosion Allowance                  Cas       0.0000  mm
Vessel Diameter                                Dv    2800.000  mm
Vessel Thickness                               Tv      44.000  mm

Design Temperature                             T1        80.0  C
Vessel Material                                      SA-516 60
Vessel UNS Number                                    K02100
Vessel Cold S.I. Allowable                   Smc      147.00  N/mm²
Vessel Hot  S.I. Allowable                   Smh      136.28  N/mm²
```

Using 2 * Yield for Discontinuity Stress Allowable (Div 2, 4.1.6.3), Sps.
Make sure that material properties at this temperature are not
time-dependent for Material: SA-516 60

```
Attachment Type                              Type       Round

Diameter Basis for Nozzle                  Nbasis       ID
Corrosion Allowance for Nozzle                Can       0.0000  mm
Nozzle Diameter                                Dn      101.600  mm
Nozzle Thickness                               Tn       35.000  mm
Nozzle Material                                      SA-350 LF2
Nozzle UNS Number                                    K03011
Nozzle Cold S.I. Allowable                  SNmc      165.00  N/mm²
Nozzle Hot  S.I. Allowable                  SNmh      153.86  N/mm²

Design Internal Pressure                       Dp       40.000  bar
Include Pressure Thrust                                    No
```

External Forces and Moments in WRC 107/537 Convention:

```
Radial Load              (SUS)                  P      -5600.0  N
Longitudinal Shear       (SUS)                 Vl       2800.0  N
Circumferential Shear    (SUS)                 Vc       4200.0  N
Circumferential Moment   (SUS)                 Mc       1120.0  N-m
Longitudinal Moment      (SUS)                 Ml       1456.0  N-m
Torsional Moment         (SUS)                 Mt       1680.0  N-m


Use Interactive Control                                  No
WRC107 Version                             Version       March  1979

Include Pressure Stress Indices per Div. 2                         No
Compute Pressure Stress per WRC-368                                No
Local Loads applied at end of Nozzle/Attachment                    No
```

WRC Bulletin 537 provides equations for the dimensionless curves found in bulletin 107. As noted in the foreword to bulletin 537, "537 is equivalent to WRC 107". Where 107 is printed in the results below, "537" can be interchanged with "107".

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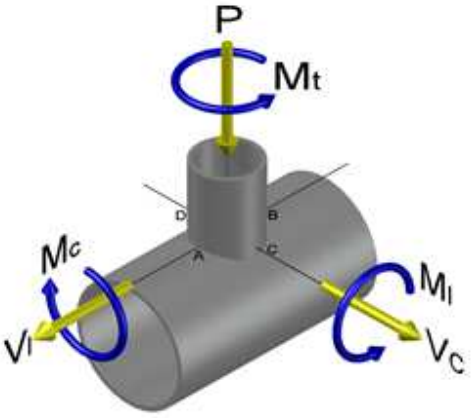

WRC 107/537 has dimensional limitations that can be found in the bulletin's Foreword and which can also be inferred by review of the non-dimensional curve limits.

Stress Attenuation Diameter (for Insert Plates) per WRC 297:

```
  = NozzleOD + 2 * 1.65 * sqrt( Rmean( t - ca ) )
  = 171.6 + 2 * 1.65 * sqrt( 1422.0 ( 44.0 - 0.0 ) )
  = 997.049 mm
```

WRC 107 Stress Calculation for SUStained loads:

Radial Load	P	-5600.0	N
Circumferential Shear	VC	4200.0	N
Longitudinal Shear	VL	2800.0	N
Circumferential Moment	MC	1120.0	N-m
Longitudinal Moment	ML	1456.0	N-m
Torsional Moment	MT	1680.0	N-m

Dimensionless Parameters used : Gamma = 32.32

Dimensionless Loads for Cylindrical Shells at Attachment Junction:

Curves read for 1979	Beta	Figure	Value	Location
N(PHI) / (P/Rm)	0.053	4C	6.088	(A,B)
N(PHI) / (P/Rm)	0.053	3C	6.029	(C,D)
M(PHI) / (P)	0.053	2C1	0.153	(A,B)
M(PHI) / (P)	0.053	1C	0.193	(C,D)
N(PHI) / (MC/(Rm**2 * Beta))	0.053	3A	0.421	(A,B,C,D)
M(PHI) / (MC/(Rm * Beta))	0.053	1A	0.104	(A,B,C,D)
N(PHI) / (ML/(Rm**2 * Beta))	0.053	3B	1.571	(A,B,C,D)
M(PHI) / (ML/(Rm * Beta))	0.053	1B	0.058	(A,B,C,D)
N(x) / (P/Rm)	0.053	3C	6.029	(A,B)
N(x) / (P/Rm)	0.053	4C	6.088	(C,D)
M(x) / (P)	0.053	1C1	0.196	(A,B)
M(x) / (P)	0.053	2C	0.153	(C,D)
N(x) / (MC/(Rm**2 * Beta))	0.053	4A	0.532	(A,B,C,D)
M(x) / (MC/(Rm * Beta))	0.053	2A	0.062	(A,B,C,D)
N(x) / (ML/(Rm**2 * Beta))	0.053	4B	0.427	(A,B,C,D)
M(x) / (ML/(Rm * Beta))	0.053	2B	0.097	(A,B,C,D)

Stress Concentration Factors: Kn = 1.00, Kb = 1.00

Stresses in the Vessel at the Attachment Junction (N/mm²)

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Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Memb. P	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Circ. Bend. P	2.7	-2.7	2.7	-2.7	3.3	-3.3	3.3	-3.3
Circ. Memb. MC	0.0	0.0	0.0	0.0	-0.1	-0.1	0.1	0.1
Circ. Memb. MC	0.0	0.0	0.0	0.0	-4.8	4.8	4.8	-4.8
Circ. Memb. ML	-0.5	-0.5	0.5	0.5	0.0	0.0	0.0	0.0
Circ. Bend. ML	-3.5	3.5	3.5	-3.5	0.0	0.0	0.0	0.0
Tot. Circ. Str.	-0.8	0.9	7.2	-5.1	-1.0	1.9	8.8	-7.5
Long. Memb. P	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Long. Bend. P	3.4	-3.4	3.4	-3.4	2.7	-2.7	2.7	-2.7
Long. Memb. MC	0.0	0.0	0.0	0.0	-0.1	-0.1	0.1	0.1
Long. Bend. MC	0.0	0.0	0.0	0.0	-2.9	2.9	2.9	-2.9
Long. Memb. ML	-0.1	-0.1	0.1	0.1	0.0	0.0	0.0	0.0
Long. Bend. ML	-5.9	5.9	5.9	-5.9	0.0	0.0	0.0	0.0
Tot. Long. Str.	-2.0	2.9	9.9	-8.6	0.2	0.6	6.2	-4.8
Shear VC	0.4	0.4	-0.4	-0.4	0.0	0.0	0.0	0.0
Shear VL	0.0	0.0	0.0	0.0	-0.2	-0.2	0.2	0.2
Shear MT	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Tot. Shear	1.2	1.2	0.5	0.5	0.6	0.6	1.1	1.1
Str. Int.	2.7	3.4	10.0	8.7	1.7	2.1	9.2	7.9

WRC 107/537 Stress Summations:

Vessel Stress Summation at Attachment Junction (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Pm (SUS)	129.3	129.3	129.3	129.3	129.3	129.3	129.3	129.3
Circ. Pl (SUS)	0.1	0.1	1.0	1.0	0.4	0.4	0.6	0.6
Circ. Q (SUS)	-0.8	0.8	6.1	-6.1	-1.4	1.4	8.1	-8.1
Long. Pm (SUS)	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7
Long. Pl (SUS)	0.4	0.4	0.7	0.7	0.4	0.4	0.7	0.7
Long. Q (SUS)	-2.4	2.4	9.3	-9.3	-0.2	0.2	5.5	-5.5
Shear Pm (SUS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shear Pl (SUS)	0.4	0.4	-0.4	-0.4	-0.2	-0.2	0.2	0.2
Shear Q (SUS)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Pm (SUS)	129.3	129.3	129.3	129.3	129.3	129.3	129.3	129.3
Pm+Pl (SUS)	129.3	129.3	130.3	130.3	129.7	129.7	129.9	129.9
Pm+Pl+Q (Total)	128.5	130.2	136.5	124.2	128.3	131.2	138.1	121.8

Vessel Stress Summation Comparison (N/mm²):

Type of Stress Int.	Max. S.I.	S.I. Allowable	Result

Pm (SUS)	129.28	136.28	Passed
Pm+Pl (SUS)	130.31	204.43	Passed
Pm+Pl+Q (TOTAL)	138.08	408.85	Passed

*Because only sustained loads were specified, the Pm+Pl+Q allowable was 3 * Smh.*

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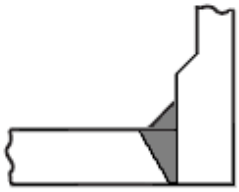
Input, Nozzle Desc: M2 From: 70

Pressure for Reinforcement Calculations	P	40.000	bar
Temperature for Internal Pressure	Temp	80	°C
Design External Pressure	Pext	1.03	bar
Temperature for External Pressure	Tempex	80	°C
Parent Material [Impact Tested]		SA-516 60	
Parent Allowable Stress at Temperature	Sv	136.28	N/mm²
Parent Allowable Stress At Ambient	Sva	147.00	N/mm²
Inside Diameter of Elliptical Head	D	2800.00	mm
Aspect Ratio of Elliptical Head	Ar	2.00	
Head Finished (Minimum) Thickness	t	40.0000	mm
Head Internal Corrosion Allowance	c	0.0000	mm
Head External Corrosion Allowance	co	0.0000	mm
Distance from Head Centerline	L1	0.0000	mm
User Entered Minimum Design Metal Temperature		-46.00	°C

Type of Element Connected to the Parent : Nozzle

Material [Impact Tested]		SA-350 LF2	
Material UNS Number		K03011	
Material Specification/Type		Forgings	
Allowable Stress at Temperature	Sn	153.86	N/mm²
Allowable Stress At Ambient	Sna	165.00	N/mm²
Diameter Basis (for tr calc only)		Inside	
Layout Angle		0.00	deg
Diameter		609.6000	mm
Size and Thickness Basis		Actual	
Actual Thickness	tn	46.0500	mm
Flange Material [Normalized]		SA-350 LF2	
Hub Height of Integral Nozzle	h	130.0000	mm
Height of Beveled Transition	L'	28.9500	mm
Hub Thickness of Integral Nozzle (tn or x+tp)		80.0000	mm
Corrosion Allowance	can	0.0000	mm
Outside Projection	ho	300.0000	mm
Weld leg size between Nozzle and Pad/Shell	Wo	10.0000	mm
Groove weld depth between Nozzle and Vessel	Wgnv	40.0000	mm
Inside Projection	h	0.0000	mm
Weld leg size, Inside Element to Shell	Wi	0.0000	mm
User Defined Nozzle/Shell Centerline Angle		90.0000	deg.
This is a Manway or Access Opening.			
Flange Class		300	
Flange Grade		GR 1.1	

The Pressure Design option was MAWP + static head (to the nozzle).



Hub Nozzle (Set-in)

Reinforcement CALCULATION, Description: M2

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```
Actual Inside Diameter Used in Calculation          609.600  mm.
Actual Thickness Used in Calculation                 46.050  mm
```

Nozzle input data check completed without errors.

Cylindrical Shell Calculation - Section 4.3.3.1

Computed Minimum Required Thickness [t]:

```
= 0.5*D*( exp( P/(S*E) )-1)+ci+co
= 0.5*610 *(exp( 40/(154 *1 ))-1) + 0 + 0
= 8.03 + 0 + 0 = 8.03 mm Equation 4.3.1
```

Computed Maximum Allowable Working Pressure [MAWP]:

```
= S * E * Ln( ( 2*t + D ) / D ) - Pliq
= 154 * 1 * Ln( ( 2*46 + 610 )/610 ) - 0
= 216 - 0 = 216 bar
```

Nozzle Calculations per Section 4.5: Internal Pressure Case:

Nozzle Material Factor [frn]:

```
= min[Sn/S, 1]
= min[154/136, 1]
= 1.000
```

Thickness of Nozzle at Shell [tn]:

```
= hub thickness - corrosion allowance
= 80 - 0
= 80.000 mm
```

Thickness of Nozzle at Top [tn2]:

```
= thickness - corrosion allowance
= 46 - 0
= 46.050 mm
```

Effective Pressure Radius [Reff]:

$$= 0.9/6 * Di[\ 2 + (Di/(2h))^2\ ]$$
$$= 0.9/6 * 2800\ [2 + (2800/(2 * 700\ ))^2\ ]$$
$$= 2520.000\ mm$$

Effective Length of Vessel Wall [LR]:

```
= min( sqrt( Reff * t ), 2 * Rn )
= min( sqrt( 2520 * 40 ), 2 * 305 )
= 317.490 mm
```

Intermediate value [Cn]:
```
= min( (( t + te )/tn)^0.35, 1 )
= min( (( 40 + 0 )/80 )^0.35, 1 )
= min( 0.78, 1 )
= 0.785
```

Intermediate value [Cp]:
```
= exp( ( 0.35 * di - Xo )/( 16t ) )
= exp( ( 0.35 * 2800 - 385 )/( 16 * 40 ) )
= 2.535
```

Effective Nozzle Wall Length Outside the Vessel [LH]:
```
= min( t + te + Fp * sqrt( Rn*tn ), Lpr1 + t )
= min(40+0+0.78*sqrt(305*80),300+40)
= 162.516 mm
```

Effective Vessel Thickness [teff]:
```
= t + (( A5 * frp ) / LR )
= 40+((0*1)/317)
= 40.000 mm
```

Compute Areas A1-A43 (No Pad) or A1-A5 (With Pad) :

Area Contributed by the Vessel Wall [A1]:
```
= t * LR
= 40 * 317
= 12699.605 mm^2
```

Area Contributed by the Nozzle Outside the Vessel Wall [A2]:
```
= tn * LH
= 80 * 163
= 13001.261 mm^2
```

Area Contributed by the Outside Fillet Weld [A41]:
```
= 0.5 * Leg41^2
= 0.5 * 10^2
= 50.000 mm^2
```

The total area contributed by A1 through A43 [AT]:
```
= A1 + frn( A2 + A3 ) + A41 + A42 + A43
= 12700+1(13001+0)+50+0+0
= 25750.867 mm^2
```

Nozzle Radius for Force Calculation [Rxn]:
```
= tn / ln[1 + tn/Rn ]
= 80/ln[ 1 + 80/305 ]
= 343.248 mm
```

Shell Radius for Force Calculation [Rxs]:
```
= teff / ln[ 1 + teff/Reff ]
= 40/ln[ 1 + 40/2520 ]
= 2539.957 mm
```

Allowable Local Primary Membrane Stress [Sallow]:
```
= 1.5 * S * E
= 1.5 * 136 * 1
= 204.4 N/mm²
```

Determine Force acting on the Nozzle [fN]:
```
= P * Rxn * LH
= 40 * 343 * 163
```

= 223146.0 N

Determine Force acting on the Shell [fS]:
= P * Rxs * (LR + tn)/2
= 40 * 2540 * (317 + 80)/2
= 2019337.1 N

Discontinuity Force from Internal Pressure [fY]:
= (P * Rxs * Rnc)/2
= (40 * 2540 * 305)/2
= 1548450.6 N

Area Resisting Internal Pressure [Ap]:
= (fS + fY + fN)/P
= (2019337 + 1548450 + 223146)/40
= 947676.5 mm^2

Maximum Allowable Working Pressure Candidate [Pmax1]:
= Sallow /(2 * Ap/AT - Rxs/(2 * teff))
= 204/(2 * 947676/25751 - 2540/(2*40))
= 48.8 bar

Maximum Allowable Working Pressure Candidate [Pmax2]:
= 2 * S[t/Rxs]
= 2 * 136 [40/2540]
= 42.9 bar

Maximum Allowable Working Pressure [Pmax]:
= min(Pmax1, Pmax2)
= min(48.8, 42.9)
= 42.919 bar

Average Primary Membrane Stress [SigmaAvg]:
= (fN + fS + fY) / AT
= (223146 + 2019337 + 1548450)/25751
= 147.228 N/mm²

General Primary Membrane Stress [SigmaCirc]:
= P * Rxs / (2 * teff)
= 40 * 2540/(2 * 40)
= 127.0 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg - SigmaCirc, SigmaCirc)
= max(2 * 147 - 127, 127)
= 167.4 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	167.44	N/mm²
Maximum Allowable Working Pressure	Pmax	42.92	bar

Strength of Nozzle Attachment Welds per 4.5.14

Discontinuity Force Factor [ky]:
= (Rnc + tn) / Rnc
= (305 + 80)/305
= 1.262 For set-in Nozzles

Weld Length of Nozzle to Shell Weld [Ltau]:
= pi/2 * (Rn + tn)
= pi/2 * (305 + 80)

= 604.442 mm

Weld Throat Dimensions, (0.7071*Leg Dimensions) [L41T, L42T, L43T]:
= 7.071, 0.000, 0.000, mm

Required Weld Throat Dimensions :
tc, L41T = 7.071, must be >= min(0.7 * 80.000, 6.000) Passed

Weld Load Value [fwelds]:
= min(fy * ky, 1.5 * Sn(A2 + A3), pi/4*P*Rn^2*ky^2)
= min(1548450*1.26,1.5*154(15692+0),pi/4*40*305^2*1.26^2)
= 465206.875 N

Weld Stress Value [tau]:
= fwelds/(Ltau(0.49*L41T + 0.6*tw1 + 0.49*L43T))
= 465207/(604 (0.49*7.07 + 0.6*40 + 0.49*0))
= 28.025 < or = to 136.284 Weld Stress Passed

Nozzle Calculations per Section 4.5: External Pressure Case:

Nozzle Radius for Force Calculation [Rxn]:
= tn / ln[1 + tn/Rn]
= 80/ln[1 + 80/305]
= 343.248 mm

Shell Radius for Force Calculation [Rxs]:
= teff / ln[1 + teff/Reff]
= 40/ln[1 + 40/2520]
= 2539.957 mm

Allowable Local Primary Membrane Stress [Sallow]:
= 1.5 * S
= 1.5 * 136
= 204.4 N/mm²

Determine Force acting on the Nozzle [fN]:
= P * Rxn * LH
= 1.03 * 343 * 163
= 5746.0 N

Determine Force acting on the Shell [fS]:
= P * Rxs * (LR + tn)/2
= 1.03 * 2540 * (317 + 80)/2
= 51997.9 N

Discontinuity Force from External Pressure [fY]:
= (P * Rxs * Rnc)/2
= (1.03 * 2540 * 305)/2
= 39872.6 N

Area Resisting External Pressure [Ap]:
= (fS + fY + fN)/P
= (51998 + 39873 + 5746)/1.03
= 947676.5 mm^2

Maximum Allowable Working Pressure Candidate [Pmax1]:
= Sallow /(2 * Ap/AT - Rxs/(2 * teff))
= 204/(2 * 947676/25751 - 2540/(2*40))
= 48.8 bar

Maximum Allowable Working Pressure Candidate [Pmax2]:
= 2 * S[t/Rxs]

= 2 * 136 [40/2540]
= 42.9 bar

Maximum Allowable Working Pressure [Pmax]:
= min(Pmax1, Pmax2)
= min(48.8, 42.9)
= 42.919 bar

Average Primary Membrane Stress [SigmaAvg]:
= (fN + fS + fY) / AT
= (5746 + 51998 + 39873)/25751
= 3.791 N/mm²

General Primary Membrane Stress [SigmaCirc]:
= P * Rxs / (2 * teff)
= 1.03 * 2540/(2 * 40)
= 3.3 N/mm²

Maximum Local Primary Membrane Stress [PL]:
= max(2 * SigmaAvg - SigmaCirc, SigmaCirc)
= max(2 * 3.79 - 3.27, 3.27)
= 4.3 N/mm²

Summary of Nozzle Pressure/Stress Results:

Allowed Local Primary Membrane Stress	Sallow	204.43	N/mm²
Local Primary Membrane Stress	PL	4.31	N/mm²
Maximum Allowable External Pressure	Pmax	42.92	bar

Nozzle Junction Minimum Design Metal Temperature (MDMT) Calculations:

Nozzle-Shell/Head Weld for the Nozzle (Impact tested) :

Note:
This Material was specified as being an Impact Tested (Low Temperature) Material.

Impact Test Temperature provided per Specification -46 °C

The Drop for this Nozzle is : 29.1777 mm
The Cut Length for this Nozzle is, Drop + Ho + H + T : 369.1778 mm

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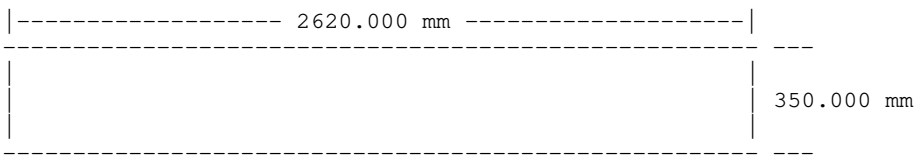
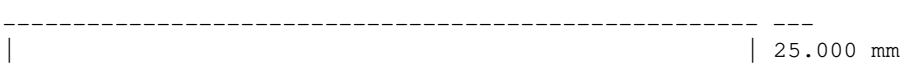
Saddle Parameters:

Saddle Width	300.000	mm
Saddle Bearing Angle	130.000	deg.
Centerline Dimension	1725.000	mm
Wear Pad Width	350.000	mm
Wear Pad Thickness	20.000	mm
Wear Pad Bearing Angle	142.000	deg.
Distance from Saddle to Tangent	3250.000	mm
Baseplate Length	2620.000	mm
Baseplate Thickness	25.000	mm
Baseplate Width	350.000	mm
Number of Ribs (including outside ribs)	6	
Rib Thickness	14.000	mm
Web Thickness	14.000	mm
Height of Center Web	235.000	mm
Number of Bolts in Baseplate	8	

Baseplate Sketch



Baseplate Plan View



Baseplate Side View

Summary of Maximum Saddle Loads, Operating Case, Un-Factored:

Maximum Vertical Saddle Load	442952.62	N
Maximum Transverse Saddle Shear Load	98018.42	N
Maximum Longitudinal Saddle Shear Load	25845.63	N

The Wind and Seismic loads were not load factored in this analysis.

Summary of Maximum Saddle Loads, Pressure Test Case:

Maximum Vertical Saddle Load	832850.81	N
Maximum Transverse Saddle Shear Load	19118.48	N
Maximum Longitudinal Saddle Shear Load	6461.41	N

Local Stress Analysis Results:

Description	Analysis Type	Max Stress Ratio	High Stress Location	Pass Fail
Lifting Lugs	WRC-107/537	0.949	n/a	Passed
1N	WRC-107/537	0.949	n/a	Passed
5N	WRC-107/537	0.949	n/a	Passed
3N	WRC-107/537	0.949	n/a	Passed
2N	WRC-107/537	0.949	n/a	Passed
4N	WRC-107/537	0.949	n/a	Passed

Weights:

Fabricated - Bare W/O Removable Internals	58619.1	kg

Shop Test	– Fabricated + Water (Full)	160379.5	kg
Shipping	– Fab. + Rem. Intls.+ Shipping App.	58619.1	kg
Erected	– Fab. + Rem. Intls.+ Insul. (etc)	58619.1	kg
Empty	– Fab. + Intls. + Details + Wghts.	58619.1	kg
Operating	– Empty + Operating Liquid (No CA)	58879.1	kg
Field Test	– Empty Weight + Water (Full)	160379.5	kg

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FLANGE 4N (for Flange Rating Check)

Flange Input Data Values

Description: FLANGE 4N :

Flange 4N

Flange Type		Integral Weld Neck	
Design Pressure	P	40.00	bar
Design Temperature		80	°C
Internal Corrosion Allowance	ci	0.0000	mm
External Corrosion Allowance	ce	0.0000	mm
Use Corrosion Allowance in Thickness Calcs.		No	
Flange Inside Diameter	B	101.600	mm
Flange Outside Diameter	A	254.000	mm
Flange Thickness	t	30.2000	mm
Thickness of Hub at Small End	go	22.2000	mm
Thickness of Hub at Large End	g1	22.2000	mm
Length of Hub	h	200.0000	mm
Flange Material		SA-350 LF2	
Flange Material UNS number		K03011	
Flange Allowable Stress At Temperature	Sfo	153.70	N/mm²
Flange Allowable Stress At Ambient	Sfa	165.50	N/mm²
Bolt Material		SA-193 B7	
Bolt Allowable Stress At Temperature	Sb	172.38	N/mm²
Bolt Allowable Stress At Ambient	Sa	172.38	N/mm²
Diameter of Bolt Circle	C	200.000	mm
Nominal Bolt Diameter	a	19.0500	mm
Type of Threads		TEMA Thread Series	
Number of Bolts		8	
Flange Face Outside Diameter	Fod	157.200	mm
Flange Face Inside Diameter	Fid	101.600	mm
Flange Facing Sketch		1, Code Sketch 1a	
Gasket Outside Diameter	Go	149.400	mm
Gasket Inside Diameter	Gi	127.000	mm
Gasket Factor	m	3.0000	
Gasket Design Seating Stress	y	68.95	N/mm²
Column for Gasket Seating		2, Code Column II	
Gasket Thickness	tg	4.5000	mm
Axial Force on Flange		5600.00	N
Bending Moment on Flange		1837.00	N-m

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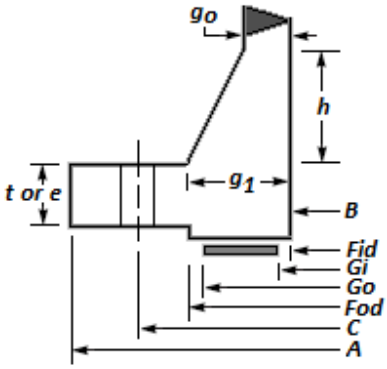

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Hub Small End Required Thickness due to Internal Pressure:
```
= ( P( R + Ca )/( S - 0.5 * P )) + ( Ca + Caext )
= (40(102+0)/(154-0.5*40))+(0)
= 1.3397 mm
```

Small End Hub MAWP:
```
= S * log( ( 2 * T + R ) / R )
= 154 * log( ( 2 * 22.2 + 50.8 )/50.8 )
= 557.179 bar
```

Small End Hub MAPnc:
```
= Sa * log( ( 2.0 * T + R ) / R )
= 166 * log( ( 2.0 * 22.2 + 50.8 )/50.8 )
= 599.955 bar
```

Corroded Flange ID,	Bcor = B+2*ci	101.600	mm
Corroded Large Hub,	g1Cor = g1-ci	22.200	mm
Corroded Small Hub,	g0Cor = go-ci	22.200	mm
Code R Dimension,	R = (C-B)/2 - g1	27.000	mm
Gasket Contact Width,	N = (Go - Gi)/2	11.200	mm
Basic Gasket Width,	bo = N/2	5.600	mm
Effective Gasket Width,	b = bo	5.600	mm
Gasket Reaction Diameter,	G = (Go + Gi)/2	138.200	mm

Basic Flange and Bolt Loads:

Hydrostatic End Load due to Pressure [H]:
```
= pi/4 * G² * Peq
= pi/4 * 138² * 40
= 60005.629 N
```

Contact Load on Gasket Surfaces [Hp]:
```
= 2 * b * pi * G * m * P
= 2 * 5.6 * pi * 138 * 3 * 40
= 58355.695 N
```

Hydrostatic End Load at Flange ID [Hd]:
```
= pi/4 * Bcor² * P
= pi/4 * 102² * 40
= 32431.225 N
```

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Pressure Force on Flange Face [Ht]:
= H - Hd
= 60006 - 32431
= 27574.404 N

Design Bolt Load for the Operating Condition [Wo]:
= max(H + Hp + H'p, 0)
= max(60006 + 58356 + 0, 0)
= 118361.328 N

Design Bolt Load for the Gasket Seating Condition [Wg]:
= y * b * pi * G + yPart * bPart * lp
= 68.9*5.6*pi*138+0*0*0
= 167626.734 N

Required Bolt Area [Am]:
= max((Wo + Fa + 4Me/G)/Sb, Wg/Sa)
= max((118361 + 5600 + 4*1837/138)/172, 167627/172)
= 1027.551 mm^2

Bolting Information for TEMA Imperial Thread Series (Non Mandatory):

	Minimum	Actual	Maximum
Bolt Area:	1027.551	1558.706	
Radial Distance between Hub and Bolts:	28.575	27.000	
Radial Distance between Bolts and Edge:	20.637	27.000	
Circ. Spacing between the Bolts:	44.450	76.537	68.300

Min. Gasket Contact Width (Brownell Young) [Not an ASME Calc] [Nmin]:
= Ab * Sa/(y * pi(Go + Gi))
= 1559 * 172/(68.9 * pi(149 + 127))
= 4.488 mm

Flange Design Bolt Load, Gasket Seating [W]:
= Sa(Am + Ab) / 2
= 172 (1028 + 1559)/2
= 222884.14 N

Gasket Load for the Operating Condition [HG]:
= Wo - H
= 118361 - 60006
= 58355.70 N

Moment Arm Calculations:

Distance to Gasket Load Reaction [hg]:
= (C - G) / 2
= (200 - 138)/2
= 30.9000 mm

Distance to Face Pressure Reaction [ht]:
= (R + g1 + hg) / 2
= (27 + 22.2 + 30.9)/2
= 40.0500 mm

Distance to End Pressure Reaction [hd]:
= R + (g1 / 2)
= 27 + (22.2/2.0)
= 38.1000 mm

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The following values have been computed from Table 4.16.7:

Determine Geometry Factors [Aa, Bb, Cc, Ddg]:
Aa = 76.2, Bb = 30.2, Cc = 26.2 and Ddg = 22.2 mm

Compute the value of [Kab]:
= Aa * Bb^3 * (1/3 - 0.210 * (Bb/Aa) * (1-1/12 * (Bb/Aa)^4))
= 76.2 * 30.2^3 * (1/3 - 0.210 * (30.2/76.2) * (1-1/12 * (30.2/76.2)^4))
= 525284.812 mm^4

Compute the value of [Kcd]:
= Cc * Ddg^3 * (1/3 - 0.105 * (Ddg/Cc) * (1-1/192 * (Ddg/Cc)^4))
= 26.2*22.2^3*(1/3-0.105*(22.2/26.2)*(1-1/192*(22.2/26.2)^4))
= 70095.086 mm^4

Flange Inertia Term [Ip,term1]:
= Kab + Kcd = 32.1 + 4.28
= 595379.875 mm^4

Flange Inertia Term [Ip,term2]:
= Ar * t^3 (1/3 - 0.21(t/AR)(1 - 1/12(t/AR)^4))
= 76.2 * 30.2^3 (1/3 - 0.21(30.2/76.2)(1 - 1/12(30.2/3)^4))
= 525284.812 mm^4

Flange Inertia [Ip]:
= max(Ip,term1, Ip,term2)
= max(595380, 525285)
= 595379.9 mm^4

Flange Inertia for Integral Types [I]:
= 0.0874 * L * go^2 * ho * B / V
= 0.0874 * 1.45 * 22.2 **2 * 47.5 * 102/0.55
= 547869.688 mm^4

Summary of Moments for Internal Pressure: (N-m)

Loading		Force	Distance	Bolt Corr	Moment
End Pressure,	Md	32431.	38.1000	1.0000	1236.
Face Pressure,	Mt	27574.	40.0500	1.0000	1105.
Gasket Load,	Mg	58356.	30.9000	1.0000	1804.
Gasket Seating,	Matm	222884.	30.9000	1.0000	6890.
Moment Load,	Moe				1809.

Moment Value, eq. 4.16.16, [Moe]:
= 4Me[I/(0.384 * IP + I))*(hD /(C-2*hD)) + FA * hD
= 4*1837[547870/(0.384*595380+547870))*(38.1/(200-2*38.1))+
5600*38.1
= 1809.002 N-m

Total Moment for Operation,	Mop	5954. N-m
Total Moment for Gasket seating,	Matm	6890. N-m

Effective Hub Length, ho = sqrt(Bcor*goCor)		47.492 mm
Hub Ratio,	h/h0 = Defined as 2	2.000
Thickness Ratio,	g1/g0 = (g1Cor/goCor)	1.000

Note: Because g1 = g0, the ratio h/h0 has been set to 2.

Flange Factors for Integral Flange:
Factor F per 4.16.5 0.926

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```
Factor V per 4.16.5                                  0.549
Factor f per 4.16.5                                  1.000
Factors from Table 4-16.4                    K =     2.500
                    T =      1.339           U =     2.474
                    Y =      2.251           Z =     1.381
                    e =    0.0195 1/mm       d = 0.10544E+06 mm³
Stress Factors                             Alpha =   1.589
                 Beta =      1.785         Gamma =   1.186
                Delta =      0.261        Lambda =   1.448
```

Longitudinal Hub Stress, Operating [SHo]:

$= (f * Mop / Bcor) / (L * g1^2)$
$= (1*5954/102)/(1.45*22.2^2)$
$= 82.12\ N/mm^2$

Longitudinal Hub Stress, Seating [SHa]:

$= (f * Matm / Bcor) / (L * g1^2)$
$= (1*6890/102)/(1.45*22.2^2)$
$= 95.03\ N/mm^2$

Radial Flange Stress, Operating [SRo]:

$= (beta * Mop / Bcor) / (L * t^2)$
$= (1.78*5954/102)/(1.45*30.2^2)$
$= 79.21\ N/mm^2$

Radial Flange Stress, Seating [SRa]:

$= (beta * Matm/Bcor) / (L * t^2)$
$= (1.78*6890/102)/(1.45*30.2^2)$
$= 91.66\ N/mm^2$

Tangential Flange Stress, Operating [STo]:

$= (Y * Mo / (t^2 * Bcor)) - Z * SRo$
$= (2.25*5954/(30.2^2*102))-1.38*79.2$
$= 35.22\ N/mm^2$

Tangential Flange Stress, Seating [STa]:

$= (y * Matm / (t^2 * Bcor)) - Z * SRa$
$= (2.25*6890/(30.2^2*102))-1.38*91.7$
$= 40.76\ N/mm^2$

Average Flange Stress, Operating [SAo]:

$= (SHo + max(SRo, STo)) / 2$
$= (82.1+max(79.2,35.2))/2$
$= 80.66\ N/mm^2$

Average Flange Stress, Seating [SAa]:

$= (SHa + max(SRa, STa)) / 2$
$= (95+max(91.7,40.8))/2$
$= 93.34\ N/mm^2$

Bolt Stress, Operating [BSo]:

$= (Wm1 + Fa + 4Me/G) / Ab$
$= 171509/1559$
$= 110.04\ N/mm^2$

Bolt Stress, Seating [BSa]:

$= (Wm2 / Ab)$
$= (167627/1559)$
$= 107.55\ N/mm^2$

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Flange Stress Analysis Results: N/mm²

	Operating		Gasket Seating	
	Actual	Allowed	Actual	Allowed
Longitudinal Hub	82.12	230.55	95.03	248.25
Radial Flange	79.21	153.70	91.66	165.50
Tangential Flange	35.22	153.70	40.76	165.50
Maximum Average	80.66	153.70	93.34	165.50
Bolting	110.04	172.38	107.55	172.38

Minimum Required Flange Thickness 23.368 mm
Estimated M.A.W.P. (Operating) 72.8 bar
Estimated Finished Weight of Flange at given Thk. 23.3 kg
Estimated Unfinished Weight of Forging at given Thk 75.9 kg

Flange Rigidity Based on Required Thickness [ASME]:

Flange Rigidity Criterion, Seating per Table 4.16.10 [Jg]:
= 52.14 * Ma / Bsc * Cnv_fac * V / (Lambda * Eamb * go^2 * ho * Ki)
= 52.14*6890/1*1000*0.55/(1.21*202713*22.2^2*47.5*0.3)
= 0.114 (should be <= 1)

Flange Rigidity Criterion, Operating per Table 4.16.10 [Jo]:
= 52.14 * Mo / Bsc * Cnv_fac * V / (Lambda * Eop * goc^2 * ho * Ki)
= 52.14*5954/1*1000*0.55/(1.21*199340*22.2^2*47.5*0.3)
= 0.100 (should be <= 1)

Flange Rigidity Based on Given Thickness [ASME]:

Flange Rigidity Criterion, Seating per Table 4.16.10 [Jg]:
= 52.14 * Ma / Bsc * Cnv_fac * V / (Lambda * Eamb * go^2 * ho * Ki)
= 52.14*6890/1*1000*0.55/(1.45*202713*22.2^2*47.5*0.3)
= 0.095 (should be <= 1)

Flange Rigidity Criterion, Operating per Table 4.16.10 [Jo]:
= 52.14 * Mo / Bsc * Cnv_fac * V / (Lambda * Eop * goc^2 * ho * Ki)
= 52.14*5954/1*1000*0.55/(1.45*199340*22.2^2*47.5*0.3)
= 0.084 (should be <= 1)

Minimum Design Metal Temperature Results:
Note:
This Material was specified as being an Impact Tested (Low Temperature) Material.

Impact Test Temperature provided per Specification -46 °C

Note: UCS-66(b)(-c) was considered in the flange MDMT calculation.

Per ASME VIII-2, 4.16.2.3, Perform Calculations in the New Condition:

Flange Stress Analysis Results: N/mm²

	Operating		Gasket Seating	
	Actual	Allowed	Actual	Allowed
Longitudinal Hub	82.12	248.25	95.03	248.25
Radial Flange	79.21	165.50	91.66	165.50
Tangential Flange	35.22	165.50	40.76	165.50
Maximum Average	80.66	165.50	93.34	165.50
Bolting	110.04	172.38	107.55	172.38

Minimum Required Flange Thickness, no Corrosion: 23.368 mm

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LIFTING LUGS :

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VERIFICATION OF LIFTING LUG **EQUIPMENT: V-25001 A-F**

Design data:

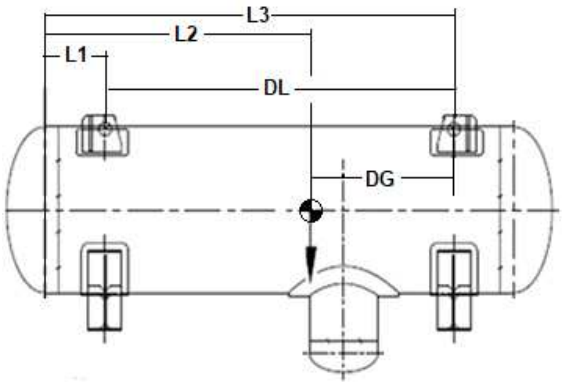
Total weight	W:	59800	Kg <--	=	586638 N
Number of Lug	NL:	4	<--		
Shock factor	SF:	1.50	<--		
Material	SA-516 70		or equivalent <--		
Yield stress	SY:	262.0	N/mm² <--		
Allowable stress: tension	ST:	157.2	N/mm²	= (Fy*0.6)	
Allowable stress: bending	SB:	172.9	N/mm²	= (Fy*0.66)	
Allowable stress: shear	SS:	104.8	N/mm²	= (Fy*0.4)	
Allowable stress: weld	SW:	104.8	N/mm²	= (Fy*0.4)	

Detailed lifting weight breakdown:

Fabrication :	57800 kg	<--
Insulation:	0 kg	<--
Platforms:	1500 kg	<--
Misc welded	500 kg	<--
other:	n.a. kg	<--
	kg	<--
Tot:	59800.00 kg	

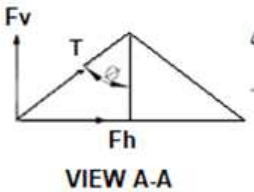
Equipment Data

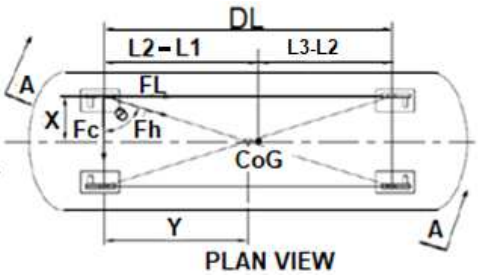
Internal Diameter	ID:	2800	mm <--
Thickness at Lug location	E:	44	mm <--
Insulation thickness	It:	0	mm <--
Elevation of 1st Lug from TL	L1:	3250	mm <--
Elevation of 2nd Lug from TL	L3:	12250	mm <--
Elevation of CoG from TL	L2:	7800	mm <--
Distance between lugs	DL:	9000	mm
Closest Lug to G distance	DG:	4450	mm
Distance Y to lifting point	Y:	4500	mm <--
Distance X to lifting point	X:	1020	mm <--
X suggested :		1021	mm



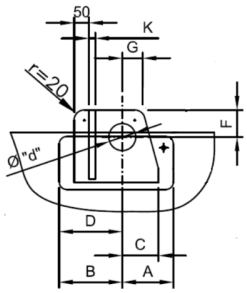
Max. lifting angle	∅:	30.00	° <--	=	0.52 rad
Max transv. lifting angle	α :	75.00	° <--	=	1.31 rad

Geometrical data of lug



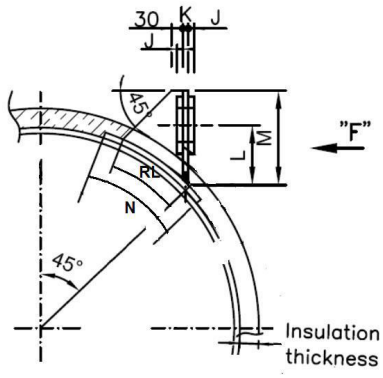


TYPE I "F" VIEW



Tipe of lug **II**

			min or suggested	
L :	200 mm <--		191	ok
F :	145 mm <--			
D+C :	385 mm <--			
A+B :	495 mm <--			
RL	345 mm <--		345.00	suggested
N :	445 mm <--		445	suggested
G+D:	330 mm <--			
G:	110 mm <--			
d :	100 mm <--			
H :	180 mm <--			
M :	345 mm			



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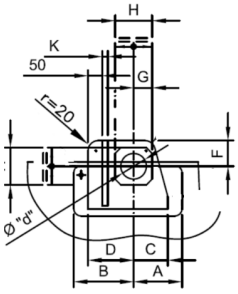

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K : 30 mm <--
J : 20 mm <--
K (rib) : 30 mm <--
Pad T: 25 mm <--

Weld leg on lug : U : 18 mm <--
Weld leg on pad : V : 18 mm <--
Shackle diameter: Ds: 70 mm <--

Lifting Lug weight

Pad:	43.23	Kg
Rib:	14.02	Kg
Lug	29.43	Kg
Reinf.	7.71	Kg
Total	94.38	kg

Loads on lug

Max Vertical load acting on lugs Fv = W *(L-A)*SF /(L*NL/2) = 222434 N

Tension acting on the rope: Ts = Fv/cos (∅) = 256844 N

Max horizontal load on lugs: FH = Ts*sin(∅) = 128422 N

Angle horizontal plane: $\theta = \tan^{-1}(Y/X)$ = 77.2 deg

Longitudinal Load: FL = FH*sin(θ) = 125245 N

Circumferential Load: Fc = FHcos(θ) = 28389 N

Tension stress at hole section

Area : A_{hs} = (2*G - d) * (K) + (H-d)*(2*J))
A_{hs} = 6800.0 mm²

Tension stress: St = Ts / A_{hs} = 37.8 N/mm² ? ST = 157.2 N/mm² Ok!

Tension stress at base section

Area : A_{bs} = ((C+D)*K)
A_{bs} = 11550.00 mm²

Tension stress: St = Ts/ A_{bs} = 22.2 N/mm² ? ST = 157.2 N/mm² Ok!

Bending Stress at base section

Circumferential Bending Moment : Mc = Fc * L = 5677788 N*mm

Longitudinal Bending Moment: ML = Fv * L = 25049066 N*mm

Section Inertia : 108438018 mm^4

Section Modulus Ws: 313566 mm^3 (transverse direction)

Section Modulus Wl: 20000000 mm^3 (longitudinal direction without considering the stiffener)

Minumum section modulus W: 313566 mm^3

Max Circumeferential Bending stress: Sb = M / W = 18.1 N/mm² ? SB = 172.92 N/mm² Ok!

Max Longitudinal Bending stress: Sb = M / W = 1.3 N/mm² ? SB = 172.92 N/mm² Ok!

Combined stress at base section

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Circumferential: Sc = SQR (St² + Sb²) = 28.7 N/mm² ? SB = 172.92 N/mm² Ok!

Longitudinal: Sc = SQR (St² + Sb²) = 22.3 N/mm² ? SB = 104.80 N/mm² Ok!

Check of welding at base of lug

Length of weld: Lw = 2*(C+D)+2*RL+2*K+2*Krib
Lw = 1550.0 mm

Weld resisting area: Aw = Lw*U*(sqr(2))/2)
Aw = 19728.3 mm²

Stress on weld: S = Ts / Aw = 13.02 N/mm² ? SW = 104.80 N/mm² OK!

Check of welding at pad edge

Length of weld: Lw = 2*N +2*(A+B)
Lw = 1880.00 mm

Weld resisting area: Aw = Lw*V*(sqr(2))/2)
Weld resisting area: Aw = 23928.49 mm²

Stress on weld: S = Ts / Aw = 10.73 N/mm² ? SW = 104.80 N/mm² OK!

Shackle shear Stress

Required shackle diameter Dp = ?(2*Fv / (π*SS))
Dp = 36.8 mm ? 70 mm

Shear stress on shackle: SSsh = Fv / (2* Apin) = Fv / (2*(0.25*π*Ds²)
SSsh = 28.90 N/mm² ? 104.8 N/mm² Ok!

Lug thickness - bearing Stress

Required thickness Kreq = Fv / (Ds*SS)
Kreq = 30.3 mm

Available thickness Ktot = K + 2*J
Ktot = 70.00 mm Ok!

Collar required thickness Jreq = max(0, 0.5(Kreq - K)
Jreq = 0.16 mm ? 20 mm Ok!

Bearing stress BS = Fv / Abearing
BS = Fv / (Ds*(K+2*J))
BS = 45.4 N/mm² ? 235.80 N/mm² Ok!

Load on vessel surface (for WRC 107 analysis):

P = Fv cos(45°) - Fo sin(45°) =	66475.45 N	6776.29	Kg	
Mc = Vc * L cos (45°) =	60522.58 Nm	6169.48	Kgm	see sketch on next page
Vc = Fv sin(45°) + Fo cos(45°) :	248092.79 N	25289.79	Kg	
VL = Fo =	128422.45 N	13090.97	Kg	
ML = ML =	25049.07 Nm	2553.42	Kgm	

Dimensions to be considered for WRC analysis

Lug width = C1 = 2* 0.2 * RL = 98.00 mm

Lug Length = C2 = 2* 0.4 * (D+C) = 308.00 mm

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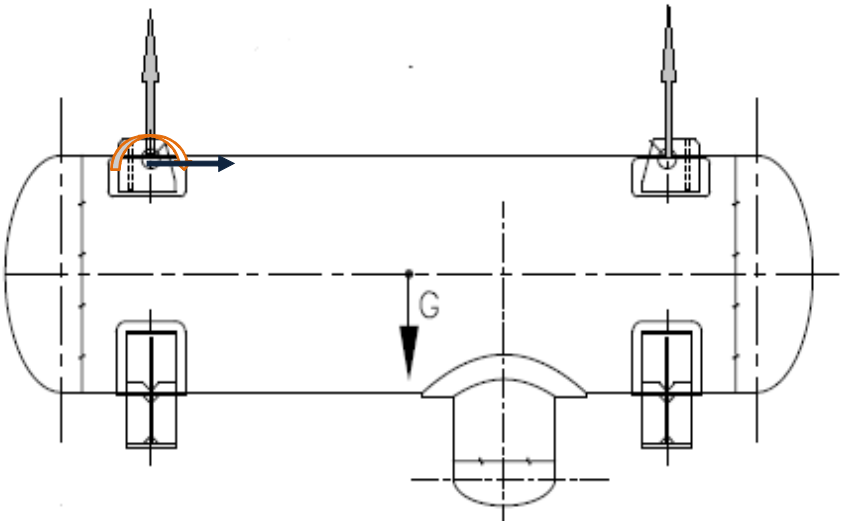

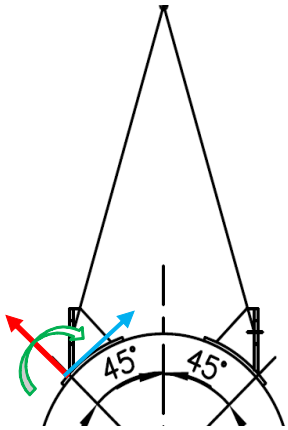

Input Echo, WRC107/537 Item 1, Description: Lifting Lugs :

Diameter Basis for Vessel	Vbasis	ID	
Cylindrical or Spherical Vessel	Cylsph	Cylindrical	
Internal Corrosion Allowance	Cas	0.0000	mm
Vessel Diameter	Dv	2800.000	mm
Vessel Thickness	Tv	44.000	mm
Design Temperature	T1	80.0	C
Vessel Material		SA-516 60	
Vessel UNS Number		K02100	
Vessel Cold S.I. Allowable	Smc	147.00	N/mm²
Vessel Hot S.I. Allowable	Smh	136.28	N/mm²

Using 2 * Yield for Discontinuity Stress Allowable (Div 2, 4.1.6.3), Sps.
Make sure that material properties at this temperature are not
time-dependent for Material: SA-516 60

Attachment Type	Type	Rectangular	
Parameter C11	C11	98.00	mm
Parameter C22	C22	308.00	mm
Thickness of Reinforcing Pad	Tpad	25.000	mm
Pad Parameter C11P	C11p	445.000	mm
Pad Parameter C22P	C22p	495.000	mm
Design Internal Pressure	Dp	40.000	bar
Include Pressure Thrust		No	

External Forces and Moments in WRC 107/537 Convention:

Radial Load	(SUS)	P	-66476.0	N
Longitudinal Shear	(SUS)	Vl	128423.0	N
Circumferential Shear	(SUS)	Vc	248093.0	N
Circumferential Moment	(SUS)	Mc	60523.0	N-m
Longitudinal Moment	(SUS)	Ml	25050.0	N-m
Torsional Moment	(SUS)	Mt	0.0	N-m

Use Interactive Control		No
WRC107 Version	Version	March 1979
Include Pressure Stress Indices per Div. 2		No
Compute Pressure Stress per WRC-368		No
Local Loads applied at end of Nozzle/Attachment		No

WRC Bulletin 537 provides equations for the dimensionless curves found in bulletin 107. As noted in the foreword to bulletin 537, "537 is equivalent to WRC 107". Where 107 is printed in the results below, "537" can be interchanged with "107".

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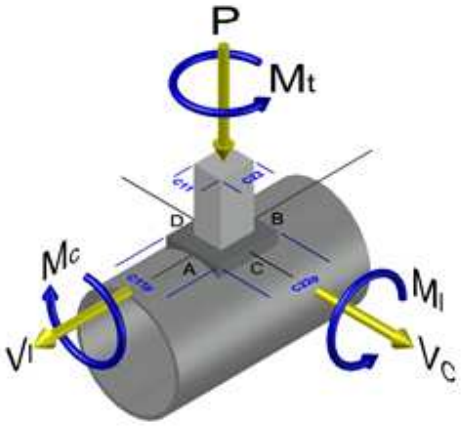

WRC 107/537 has dimensional limitations that can be found in the bulletin's Foreword and which can also be inferred by review of the non-dimensional curve limits.

WRC 107 Stress Calculation for SUStained loads:

Radial Load	P	-66476.0	N
Circumferential Shear	VC	248093.0	N
Longitudinal Shear	VL	128423.0	N
Circumferential Moment	MC	60523.0	N-m
Longitudinal Moment	ML	25050.0	N-m
Torsional Moment	MT	0.0	N-m

Dimensionless Parameters used : Gamma = 20.79

Dimensionless Loads for Cylindrical Shells at Attachment Junction:

Curves read for 1979	Beta	Figure	Value	Location
N(PHI) / (P/Rm)	0.087	4C	3.922	(A,B)
N(PHI) / (P/Rm)	0.087	3C	3.666	(C,D)
M(PHI) / (P)	0.054	2C1	0.176	(A,B)
M(PHI) / (P)	0.054	1C	0.210	(C,D)
N(PHI) / (MC/(Rm**2 * Beta))	0.050	3A	0.178	(A,B,C,D)
M(PHI) / (MC/(Rm * Beta))	0.062	1A	0.104	(A,B,C,D)
N(PHI) / (ML/(Rm**2 * Beta))	0.073	3B	1.198	(A,B,C,D)
M(PHI) / (ML/(Rm * Beta))	0.067	1B	0.058	(A,B,C,D)
N(x) / (P/Rm)	0.072	3C	3.816	(A,B)
N(x) / (P/Rm)	0.072	4C	3.986	(C,D)
M(x) / (P)	0.074	1C1	0.186	(A,B)
M(x) / (P)	0.074	2C	0.146	(C,D)
N(x) / (MC/(Rm**2 * Beta))	0.050	4A	0.231	(A,B,C,D)
M(x) / (MC/(Rm * Beta))	0.084	2A	0.060	(A,B,C,D)
N(x) / (ML/(Rm**2 * Beta))	0.073	4B	0.310	(A,B,C,D)
M(x) / (ML/(Rm * Beta))	0.087	2B	0.090	(A,B,C,D)

Stress Concentration Factors: Kn = 1.00, Kb = 1.00

Stresses in the Vessel at the Attachment Junction (N/mm²)

Type of Stress	Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl

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Circ. Memb. P	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5
Circ. Bend. P	14.8	-14.8	14.8	-14.8	17.6	-17.6	17.6	-17.6
Circ. Memb. MC	0.0	0.0	0.0	0.0	-0.6	-0.6	0.6	0.6
Circ. Memb. MC	0.0	0.0	0.0	0.0	-88.8	88.8	88.8	-88.8
Circ. Memb. ML	-2.2	-2.2	2.2	2.2	0.0	0.0	0.0	0.0
Circ. Bend. ML	-19.2	19.2	19.2	-19.2	0.0	0.0	0.0	0.0
Tot. Circ. Str.	-4.0	4.9	38.7	-29.1	-69.3	73.0	109.4	-103.3
Long. Memb. P	2.6	2.6	2.6	2.6	2.7	2.7	2.7	2.7
Long. Bend. P	15.5	-15.5	15.5	-15.5	12.3	-12.3	12.3	-12.3
Long. Memb. MC	0.0	0.0	0.0	0.0	-1.1	-1.1	1.1	1.1
Long. Bend. MC	0.0	0.0	0.0	0.0	-38.0	38.0	38.0	-38.0
Long. Memb. ML	-0.9	-0.9	0.9	0.9	0.0	0.0	0.0	0.0
Long. Bend. ML	-22.9	22.9	22.9	-22.9	0.0	0.0	0.0	0.0
Tot. Long. Str.	-5.8	9.0	42.0	-35.0	-24.2	27.4	54.1	-46.5
Shear VC	18.3	18.3	-18.3	-18.3	0.0	0.0	0.0	0.0
Shear VL	0.0	0.0	0.0	0.0	-3.0	-3.0	3.0	3.0
Shear MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tot. Shear	18.3	18.3	-18.3	-18.3	-3.0	-3.0	3.0	3.0
Str. Int.	36.7	36.9	58.8	50.7	69.5	73.2	109.6	103.5

Dimensionless Parameters used : Gamma = 32.32

Dimensionless Loads for Cylindrical Shells at Pad Edge:

Curves read for 1979	Beta	Figure	Value	Location
N(PHI) / (P/Rm)	0.176	4C	4.890	(A,B)
N(PHI) / (P/Rm)	0.176	3C	3.532	(C,D)
M(PHI) / (P)	0.162	2C1	0.056	(A,B)
M(PHI) / (P)	0.162	1C	0.087	(C,D)
N(PHI) / (MC/(Rm**2 * Beta))	0.162	3A	1.233	(A,B,C,D)
M(PHI) / (MC/(Rm * Beta))	0.180	1A	0.085	(A,B,C,D)
N(PHI) / (ML/(Rm**2 * Beta))	0.168	3B	3.543	(A,B,C,D)
M(PHI) / (ML/(Rm * Beta))	0.171	1B	0.034	(A,B,C,D)
N(x) / (P/Rm)	0.169	3C	3.652	(A,B)
N(x) / (P/Rm)	0.169	4C	4.955	(C,D)
M(x) / (P)	0.171	1C1	0.088	(A,B)
M(x) / (P)	0.171	2C	0.052	(C,D)
N(x) / (MC/(Rm**2 * Beta))	0.162	4A	2.028	(A,B,C,D)
M(x) / (MC/(Rm * Beta))	0.201	2A	0.039	(A,B,C,D)
N(x) / (ML/(Rm**2 * Beta))	0.168	4B	1.231	(A,B,C,D)
M(x) / (ML/(Rm * Beta))	0.179	2B	0.050	(A,B,C,D)

Stress Concentration Factors: Kn = 1.00, Kb = 1.00

Stresses in the Vessel at the Edge of Reinforcing Pad (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Memb. P	5.2	5.2	5.2	5.2	3.8	3.8	3.8	3.8
Circ. Bend. P	11.5	-11.5	11.5	-11.5	18.0	-18.0	18.0	-18.0
Circ. Memb. MC	0.0	0.0	0.0	0.0	-4.6	-4.6	4.6	4.6
Circ. Memb. MC	0.0	0.0	0.0	0.0	-62.1	62.1	62.1	-62.1

Circ. Memb. ML	-5.3	-5.3	5.3	5.3	0.0	0.0	0.0	0.0
Circ. Bend. ML	-10.8	10.8	10.8	-10.8	0.0	0.0	0.0	0.0
Tot. Circ. Str.	0.7	-0.9	32.8	-11.8	-44.9	43.3	88.4	-71.8
Long. Memb. P	3.9	3.9	3.9	3.9	5.3	5.3	5.3	5.3
Long. Bend. P	18.1	-18.1	18.1	-18.1	10.7	-10.7	10.7	-10.7
Long. Memb. MC	0.0	0.0	0.0	0.0	-7.5	-7.5	7.5	7.5
Long. Bend. MC	0.0	0.0	0.0	0.0	-26.0	26.0	26.0	-26.0
Long. Memb. ML	-2.0	-2.0	2.0	2.0	0.0	0.0	0.0	0.0
Long. Bend. ML	-15.3	15.3	15.3	-15.3	0.0	0.0	0.0	0.0
Tot. Long. Str.	4.6	-0.8	39.2	-27.5	-17.6	13.0	49.5	-23.8
Shear VC	6.3	6.3	-6.3	-6.3	0.0	0.0	0.0	0.0
Shear VL	0.0	0.0	0.0	0.0	-2.9	-2.9	2.9	2.9
Shear MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tot. Shear	6.3	6.3	-6.3	-6.3	-2.9	-2.9	2.9	2.9
Str. Int.	13.3	12.7	43.1	29.7	45.2	43.5	88.6	72.0

WRC 107/537 Stress Summations:

Vessel Stress Summation at Attachment Junction (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Pm (SUS)	79.2	83.2	79.2	83.2	79.2	83.2	79.2	83.2
Circ. Pl (SUS)	0.5	0.5	4.8	4.8	1.9	1.9	3.0	3.0
Circ. Q (SUS)	-4.4	4.4	33.9	-33.9	-71.1	71.1	106.4	-106.4
Long. Pm (SUS)	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6
Long. Pl (SUS)	1.6	1.6	3.5	3.5	1.6	1.6	3.8	3.8
Long. Q (SUS)	-7.4	7.4	38.5	-38.5	-25.8	25.8	50.3	-50.3
Shear Pm (SUS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shear Pl (SUS)	18.3	18.3	-18.3	-18.3	-3.0	-3.0	3.0	3.0
Shear Q (SUS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pm (SUS)	79.2	83.2	79.2	83.2	79.2	83.2	79.2	83.2
Pm+Pl (SUS)	87.0	90.5	91.0	94.6	81.3	85.3	82.5	86.5
Pm+Pl+Q (Total)	82.2	95.3	125.6	61.6	16.8	156.3	188.7	20.8

Vessel Stress Summation Comparison (N/mm²):

Type of Stress Int.	Max. S.I.	S.I. Allowable	Result
Pm (SUS)	83.22	136.28	Passed
Pm+Pl (SUS)	94.57	204.43	Passed
Pm+Pl+Q (TOTAL)	188.74	408.85	Passed

*Because only sustained loads were specified, the Pm+Pl+Q allowable was 3 * Smh.*

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WRC 107/537 Stress Summations:

Vessel Stress Summation at Reinforcing Pad Edge (N/mm²)

Type of Stress Load	Stress Intensity Values at Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Circ. Pm (SUS)	125.3	129.3	125.3	129.3	125.3	129.3	125.3	129.3
Circ. Pl (SUS)	-0.1	-0.1	10.5	10.5	-0.8	-0.8	8.3	8.3
Circ. Q (SUS)	0.8	-0.8	22.3	-22.3	-44.1	44.1	80.1	-80.1
Long. Pm (SUS)	62.7	62.7	62.7	62.7	62.7	62.7	62.7	62.7
Long. Pl (SUS)	1.9	1.9	5.9	5.9	-2.3	-2.3	12.8	12.8
Long. Q (SUS)	2.7	-2.7	33.4	-33.4	-15.3	15.3	36.7	-36.7
Shear Pm (SUS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shear Pl (SUS)	6.3	6.3	-6.3	-6.3	-2.9	-2.9	2.9	2.9
Shear Q (SUS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pm (SUS)	125.3	129.3	125.3	129.3	125.3	129.3	125.3	129.3
Pm+Pl (SUS)	125.9	129.8	136.4	140.4	124.6	128.6	133.8	137.8
Pm+Pl+Q (Total)	126.7	129.0	158.8	118.0	80.7	172.7	213.8	58.0

Vessel Stress Summation Comparison (N/mm²):

Type of Stress Int.	Max. S.I.	S.I. Allowable	Result
Pm (SUS)	129.32	136.28	Passed
Pm+Pl (SUS)	140.37	204.43	Passed
Pm+Pl+Q (TOTAL)	213.81	408.85	Passed

*Because only sustained loads were specified, the Pm+Pl+Q allowable was 3 * Smh.*

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ASME VIII Division 2 Horizontal Vessel Analysis, Left Saddle:

Horizontal Vessel Stress Calculations : Ocean Transport

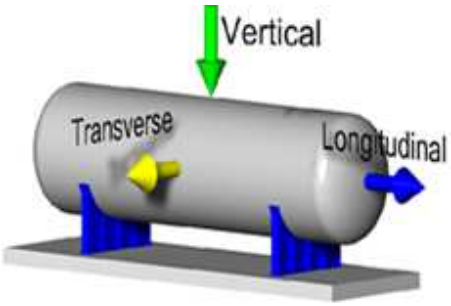
Note:
Wear Pad Width (350.00) is less than 1.56*sqrt(rm*t)
and less than 2a. The wear plate will be ignored.

Minimum Wear Plate Width to be considered in analysis [b1]:

```
= min( b + 1.56*sqrt( Rm * t ), 2a )
= min( 300 + 1.56*sqrt( 1422 * 44 ), 2 * 3250 )
= 690.2121 mm
```

Input and Calculated Values:

Vessel Mean Radius	Rm	1422.00	mm
Shell Thickness used in this Case	t	44.000	mm
Stiffened Vessel Length per 4.15.6	L	15600.00	mm
Distance from Saddle to Vessel tangent	a1 or a	3250.00	mm
Saddle Width	b1 or b	300.00	mm
Saddle Bearing Angle	delta or theta	130.00	degrees
Inside or Mean Depth of Head	Hi or hm	720.00	mm
Shell Allowable Stress used in Calculation		136.28	N/mm²
Head Allowable Stress used in Calculation		136.28	N/mm²
Circumferential Efficiency in Plane of Saddle		1.00	
Circumferential Efficiency at Mid-Span		1.00	
Distance from Saddle Base to Centerline	B	1725.00	mm
Coefficient of Friction	mu	0.50	
Saddle Force Q for this Transportation Case		692905.50	N
Shipping Longitudinal Acceleration	gx	0.70	g
Shipping Transverse Acceleration	gz	0.70	g
Shipping Vertical Acceleration	gy	1.50	g
Vertical Acceleration Acting with Transverse	gw	1.50	g
Internal Pressure during Transport		0.50	bar
Transportation Wind Load Scalar Factor	wlsf	1.00	
Transportation Wind Velocity	wv	0.0	m/sec



Horizontal Vessel Analysis Results:	Actual N/mm²	Allowable N/mm²
Long. Stress at Top of Midspan	-0.36	-209.01
Long. Stress at Top of Midspan	0.36	136.28
Long. Stress at Bottom of Midspan	1.97	136.28
Long. Stress at Top of Saddles	16.53	136.28

Long. Stress at Bottom of Saddles	-8.01	-209.01
Long. Stress at Bottom of Saddles	8.01	136.28
Tangential Shear in Shell	6.22	109.03
Circ. Stress at Horn of Saddle	29.82	204.43
Circ. Compressive Stress in Shell	1.66	136.28

Intermediate Results: Saddle Reaction Q due to Ocean Transport Load:

Transverse Force due to Wind during Transport [Ft_w]:
```
= Transverse Area * 0.00256 * wv^2 * wlsf
= 601 * 0.00256 * 0^2 * 1
= 0.0 lbf
= 0.000 N
```

Longitudinal Force due to Wind during Transport [Fl_w]:
```
= pi * D^2/4 * 0.00256 * wv^2 * wlsf * Wind Dia. Mult
= pi * 9.48^2/4 * 0.00256 * 0^2 * 1 * 1.2
= 0.0 lbf
= 0.0 N
```

Transverse Force due to Lateral Acceleration [Ft]:
```
= gz * Saddle Load * gw + Ft_w
= 0.7 * 277162 * 1.5 + 0
= 291020.3 N
```

Longitudinal Force due to Axial Acceleration [Fl]:
```
= gx * Saddle Load * gw + Fl_w
= 0.7 * 277162 * 1.5 + 0
= 291020.3 N
```

Saddle Reaction Force due to Transverse Load [Fwt]:
```
= Ft/Num of Saddles * B / E
= 582041/2 * 1725/2620
= 191606.9 N
```

Saddle Reaction Force due to Longitudinal Load [Fwl]:
```
= Fl * B / Ls
= 291020 * 1725/9000
= 55778.9 N
```

Saddle Reaction Force due to Vertical Transportation Acceleration [Fsl]:
```
= Saddle Load * gy
= 277162 * 1.5
= 415743.281 N
```

Load Combination Results due to Transport Loading [Q]:
```
= Saddle Load + max( Fwl, Fwt, Fsl )
= 277162 + max( 55779, 95803, 415743 )
= 692905.5 N
```

Summary of Loads at the Base of this Saddle:

Vertical Load (including saddle weight)	699948.38	N
Transverse Shear Load	191606.89	N
Longitudinal Shear Load	291020.31	N

Formulas and Substitutions for Horizontal Vessel Analysis:

Note: Wear Plate is Welded to the Shell, k = 0.1

Saddle Dimension [E]:

= Baseplate Length
= 2620.000 mm

The Computed K values from Table 4.15.1:

K1 = 0.1231 K2 = 1.0222 K3 = 0.7217 K4 = 0.3619
K5 = 0.7258 K6 = 0.0449 K7 = 0.0449 K8 = 0.3296
K9 = 0.2551 K10 = 0.0508 K1* = 0.2196

Note: Dimension a is greater than or equal to Rm/2.

Moment per Equation 4.15.1 [M1]:
= -Q*a [1 - (1- a/L + (Rm²-hm²)/(2a*L))/(1+(4hm²)/3L)]
= -692906*3250[1-(1-3250/15600+(1422²-720²)/
(2*3250*15600))/(1+(4*720)/(3*15600))]
= -541265.6 N-m

Moment per Equation 4.15.2 [M2]:
= Q*L/4(1+2(Rm²-hm²)/(L²))/(1+(4hm²)/(3L))-4a/L
= 692906*15600/4(1+2(1422²-720²)/(15600²))/(1+(4*720)/
(3*15600))-4*3250/15600
= 325322.1 N-m

Longitudinal Stress at Top of Shell (4.15.4) [sigma1]:
= P * Rm/(2t) - M2/(pi*Rm²t)
= 0.5 * 1422/(2*44) - 325322/(pi*1422²*44)
= -0.36 N/mm²

Longitudinal Stress at Bottom of Shell (4.15.5) [sigma2]:
= P * Rm/(2t) + M2/(pi * Rm² * t)
= 0.5 * 1422/(2 * 44) + 325322/(pi * 1422² * 44)
= 1.97 N/mm²

Longitudinal Stress at Top of Shell at Support (4.15.8) [sigma✱3]:
= P * Rm/(2t) - M1/(K1*pi*Rm²t)
= 0.5*1422/(2*44)--541266/(0.12*pi*1422²*44)
= 16.53 N/mm²

Longitudinal Stress at Bottom of Shell at Support (4.15.9) [sigma✱4]:
= P * Rm/(2t) + M1/(K1✱ * pi * Rm² * t)
= 0.5*1422/(2*44)+-541266/(0.22*pi*1422²*44)
= -8.01 N/mm²

Maximum Shear Force in the Saddle (4.15.3) [T]:
= Q(L-2a)/(L+(4*hm/3))
= 692906 (15600 - 2 * 3250)/(15600 + (4 * 720/3))
= 380763.3 N

Shear Stress in the shell no rings, not stiffened (4.15.12) [tau2]:
= K2 * T / (Rm * t)
= 1.02 * 380763/(1422 * 44)
= 6.22 N/mm²

Decay Length (4.15.20) [x1,x2]:
= 0.78 * sqrt(Rm * t)
= 0.78 * sqrt(1422 * 44)
= 195.106 mm

Circumferential Stress in shell, no rings (4.15.21) [sigma6]:
= -K5 * Q * k / (t(b + X1 + X2))
= -0.73 * 692906 * 0.1/(44 (300 + 195 + 195))
= -1.66 N/mm²

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Circ. Comp. Stress at Horn of Saddle, L>=8Rm (4.15.22) [sigma7]:

$= -Q/(4*t(b+X1+X2)) - 3*K7*Q/(2*t^2)$

$= -692906/(4 * 44 (300 + 195 + 195)) -$
$3 * 0.045 * 692906/(2*44^2)$

$= -29.82 \text{ N/mm}^2$

Effective reinforcing plate width (4.15.24) [B1]:

$= \min(b + 1.56 * \sqrt{(Rm * t)}, 2a)$

$= \min(300 + 1.56 * \sqrt{(1422 * 44)}, 2 * 3250)$

$= 690.21 \text{ mm}$

Results for Vessel Ribs, Web and Base:

Baseplate Length	Bplen	2619.9998	mm
Baseplate Thickness	Bpthk	25.0000	mm
Baseplate Width	Bpwid	350.0000	mm
Number of Ribs (inc. outside ribs)	Nribs	6	
Rib Thickness	Ribtk	14.0000	mm
Web Thickness	Webtk	14.0000	mm
Web Location	Webloc	Center	
Saddle Yield Stress	Sy	205.0	N/m
Height of Web at Center	Hw,c	235.0	mm
Friction Coefficient	mu	0.500	

Moment of Inertia of Saddle - Transverse Direction (90 degrees to long axis)

Inertia of Shell [ShellInertia]:

$= ((1.56 * \sqrt{(R * t)} + \text{WearPlateWidth})t^3)/12$

$= ((1.56 * \sqrt{(1400 * 44)} + 350)44^3)/12$

$= 5233003.000 \text{ mm}^4$

Resolved Inertia for the Shell [I,shell]:

$= \text{ShellInertia} + \text{AShell}(C1 - Y)^2$

$= 5233003 + 32436 (86 - 22)^2$

$= 138022576.000 \text{ mm}^4$

	B mm	D mm	Y mm	A mm^2	AY mm^3	I + AD^2 mm^4
Shell	737.2	44.0	22.0	32436.0	713592.0	0.138E+09
Wearplate	350.0	20.0	54.0	7000.0	378000.0	0.739E+07
Web	14.0	236.0	182.0	3304.0	601327.8	0.458E+08
BasePlate	350.0	25.0	312.5	8750.0	2734374.5	0.449E+09
Totals	...	...	...	51490.0	4427294.5	0.641E+09

Distance to Centroid [C1]:

$= AY / A$

$= 4427294/51490$

$= 85.984 \text{ mm}$

Angle [beta]:

$= 180 - \text{Saddle Angle}/2$

$= 180 - 130/2$

$= 115.0$

Saddle Splitting Coefficient [K1]:

$= (1 + \cos(\text{beta}) - 0.5*\sin(\text{beta})^2)/(\pi - \text{beta} + \sin(\text{beta})\cos(\text{beta}))$

$= (1 + \cos(115) - 0.5*\sin(115)^2)/(\pi - 2.01 + \sin(115)\cos(115))$

$= 0.2218$

Saddle Splitting Force [Fh]:

$= K1 * Q$

$= 0.22 * 692906$

$= 153700.3125 \text{ N}$

```
Tension Stress, St = ( Fh/As )        =          8.0672  N/mm²
Allowed Stress, Sa = 0.6 * Yield Str =        123.0000  N/mm²
```

Saddle Splitting Dimension [d]:

```
  = B - R * sin(theta/2)/(theta/2 in radians)
  = 1725 - 1400 * sin(130/2)/1.13
  = 606.559 mm
```

```
Bending Moment, M  = Fh * d           =      93266.0938  N-m

Bending Stress, Sb = ( M * C1 / I  ) =         12.5140  N/mm²
Allowed Stress, Sa = 2/3 * Yield Str =        136.6667  N/mm²
```

Minimum Thickness of Baseplate per Moss:

```
  = sqrt( 3( Q + Saddle_Wt )BasePlateWidth / ( 4 * BasePlateLength * AllStress ))
  = sqrt( 3(692906 + 7043 )350/( 4 * 2620 * 137 ))
  = 22.653 mm
```

Calculation of Axial Load, Intermediate Values and Compressive Stress:

Web Length Dimension [Web Length]:

```
  = 2 * cos( 90 - Saddle Angle/2 )( Inside Radius + Shell Thk + Wear Plate Thk )
  = 2 * cos( 90 - 130/2 )( 1400 + 44 + 20 )
  = 2653.669 mm
```

Distance between Ribs [e]:

```
  = Web Length / ( Nribs - 1 )
  = 2654/( 6 - 1 )
  = 530.734 mm
```

Baseplate Pressure Area [Ap]:

```
  = e * Bpwid / 2
  = 531 * 350/2
  = 92878.422 mm^2
```

Bearing Pressure [Bp]:

```
  = Q / ( BasePlateLength * BasePlateWidth )
  = 692906/( 2620 * 350 )
  = 0.756 N/mm^2
```

Axial Load [P]:

```
  = Ap * Bp
  = 92878 * 0.76
  = 70181.000 N
```

Area of the Rib and Web [Ar]:

```
  = Rib Area + Web Area
  = 4004 + 3715
  = 7719.137 mm^2
```

Compressive Stress [Sc]:

```
  = P/Ar
  = 70181/7719
  = 9.093 N/mm²
```

Check of Outside Ribs:

Inertia of Saddle, Outer Ribs - Longitudinal Direction

```
                B |          D |          Y |          A |         AY |         Io |
-------------------------------------------------------------------------------------
```

Rib+Web	14.0	300.0	...	4200.0	...	0.315E+08

Rib dimension [D]:
= Saddle Width - Web Thickness
= 300 - 14
= 286.000 mm

Distance to Centroid from Datum [ytot]:
= AY / A
= 0/7719
= 0.000 mm

Distance to Centroid [C1]:
= Saddle Width / 2
= 300/2
= 150.000 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31499968/7719)
= 63.881 mm

Length of Outer Rib, step 1, [Lw]:
= 2 * sin(saddle bearing angle / 2)(radius + shlthk + wpdthk)
= 2 * sin(130/2)(1400 + 44 + 20)
= 2653.669 mm

Length of Outer Rib, step 2, [Bd]:
= Baseplate length - clearance
= 2620 - 50.8
= 2569.200 mm

Length of Outer Rib, step 3, [Dd]:
= (Lw - Bd)/2
= (2654 - 2569)/2
= 42.235 mm

Length of Outer Rib [L]:
= sqrt(Rl^2 + Dd^2)
= sqrt(1082^2 + 42.2^2)
= 1082.111 mm

Intermediate Term [Cc]:
= sqrt(2 * pi^2 * Elastic Modulus / Yield Stress)
= sqrt(2 * pi^2 * 199955/205)
= 138.757

Slenderness ratio [KL/r]:
= KL/r
= 1 * 1082/63.9
= 16.940

Bending Moment [Rm]:
= Fl /(2 * Bplen) * e * L / 2
= 291020/(2 * 2620) * 531 * 1082/2
= 15954.633 N-m

Compressive Allowable, KL/r < Cc (16.9 < 139) per AISC E2-1 [Sca]:
= (1-(Klr)^2/(2*Cc^2))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr^3)/(8*Cc^3)
= (1-(16.9)^2/(2 * 139^2))205/
(5/3+3*(16.9)/(8* 139)-(16.9^3)/(8*139^3)
= 118.8 N/mm^2

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AISC Unity Check of Outside Ribs (must be <= 1)

```
= Sc/Sca + ( Rm * C1 / I )/Sba
= 9.09/119 + ( 15955 * 150/31500000 )/137
= 0.632
```

Check of Inside Ribs:

Inertia of Saddle, Inner Ribs - Axial Direction

	B	D	Y	A	AY	Io
Rib	14.0	286.0	0.0	4004.0	0.0	0.315E+08
Web	530.7	14.0	0.0	7430.3	0.0	0.121E+06
Totals	...	...	...	11434.3	...	0.316E+08

Distance to Centroid from Datum [ytot]:

```
= AY / A
= 0/11434
= 0.000 mm
```

Distance to Centroid [C1]:

```
= Saddle Width / 2
= 300/2
= 150.000 mm
```

Length of Inner Rib [L]:

```
= Saddle Height - sqrt( (Ro + Wpdthk)^2 - (Pitch/2)^2 ) - Bpthk
= 1725 - sqrt( (1464 + 20 )^2 - (531/2)^2 ) - 25
= 260.251 mm
```

Radius of Gyration [r]:

```
= sqrt( Total Inertia / Total Area )
= sqrt( 31618128/11434 )
= 52.585 mm
```

Slenderness ratio [KL/r]:

```
= KL/r
= 1 * 260/52.6
= 4.949
```

Unit Force [Force,u]:

```
= Fl / ( 2 * Baseplate Length )
= 291020/( 2 * 2620 )
= 55.538 N/mm
```

Moment at base of inner Rib [Mbase,c]:

```
= Unit Force * e * L
= 55.5 * 531 * 260
= 7674.279 N-m
```

Bending Stress due to Transverse Force and Weight Load [SigmaB,base,c]:

```
= Bending Moment / Section Modulus
= 7674/210788
= 36.396 N/mm²
```

Compressive Allowable, KL/r < Cc (4.95 < 139) per AISC E2-1 [Sca]:

```
= ( 1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= ( 1-( 4.95 )²/(2 * 139² ))205/
  ( 5/3+3*(4.95 )/(8* 139 )-( 4.95³)/(8*139³)
= 121.9 N/mm²
```

AISC Unity Check of Inside Ribs (must be <= 1)

```
= Sc/Sca + ( Mbase,c * C1/I )/Sba
= 11.9/122 + ( 7674 * 150/31618128 )/137
```

= 0.364

ASME VIII Division 2 Horizontal Vessel Analysis, Right Saddle:

Note:
Wear Pad Width (350.00) is less than 1.56*sqrt(rm*t)
and less than 2a. The wear plate will be ignored.

Minimum Wear Plate Width to be considered in analysis [b1]:
= min(b + 1.56*sqrt(Rm * t), 2a)
= min(300 + 1.56*sqrt(1422 * 44), 2 * 3250)
= 690.2121 mm

Input and Calculated Values:

Vessel Mean Radius	Rm	1422.00	mm
Shell Thickness used in this Case	t	44.000	mm
Stiffened Vessel Length per 4.15.6	L	15600.00	mm
Distance from Saddle to Vessel tangent	a1 or a	3250.00	mm
Saddle Width	b1 or b	300.00	mm
Saddle Bearing Angle	delta or theta	130.00	degrees
Inside or Mean Depth of Head	Hi or hm	720.00	mm
Shell Allowable Stress used in Calculation		136.28	N/mm²
Head Allowable Stress used in Calculation		136.28	N/mm²
Circumferential Efficiency in Plane of Saddle		1.00	
Circumferential Efficiency at Mid-Span		1.00	
Distance from Saddle Base to Centerline	B	1725.00	mm
Coefficient of Friction	mu	0.30	
Saddle Force Q for this Transportation Case		708925.50	N
Shipping Longitudinal Acceleration	gx	0.70	g
Shipping Transverse Acceleration	gz	0.70	g
Shipping Vertical Acceleration	gy	1.50	g
Vertical Acceleration Acting with Transverse	gw	1.50	g
Internal Pressure during Transport		0.50	bar
Transportation Wind Load Scalar Factor	wlsf	1.00	
Transportation Wind Velocity	wv	0.0	m/sec

Horizontal Vessel Analysis Results:	Actual N/mm²	Allowable N/mm²
Long. Stress at Top of Midspan	-0.38	-209.01
Long. Stress at Top of Midspan	0.38	136.28
Long. Stress at Bottom of Midspan	2.00	136.28
Long. Stress at Top of Saddles	16.89	136.28
Long. Stress at Bottom of Saddles	-8.21	-209.01
Long. Stress at Bottom of Saddles	8.21	136.28
Tangential Shear in Shell	6.37	109.03
Circ. Stress at Horn of Saddle	30.51	204.43
Circ. Compressive Stress in Shell	1.69	136.28

Intermediate Results: Saddle Reaction Q due to Ocean Transport Load:

Transverse Force due to Wind during Transport [Ft_w]:
= Transverse Area * 0.00256 * wv^2 * wlsf
= 601 * 0.00256 * 0^2 * 1
= 0.0 lbf

= 0.000 N

Longitudinal Force due to Wind during Transport [Fl_w]:
= pi * D^2/4 * 0.00256 * wv^2 * wlsf * Wind Dia. Mult
= pi * 9.48^2/4 * 0.00256 * 0^2 * 1 * 1.2
= 0.0 lbf
= 0.0 N

Transverse Force due to Lateral Acceleration [Ft]:
= gz * Saddle Load * gw + Ft_w
= 0.7 * 283570 * 1.5 + 0
= 297748.7 N

Longitudinal Force due to Axial Acceleration [Fl]:
= gx * Saddle Load * gw + Fl_w
= 0.7 * 283570 * 1.5 + 0
= 297748.7 N

Saddle Reaction Force due to Transverse Load [Fwt]:
= Ft/Num of Saddles * B / E
= 595497/2 * 1725/2620
= 196036.8 N

Saddle Reaction Force due to Longitudinal Load [Fwl]:
= Fl * B / Ls
= 297749 * 1725/9000
= 57068.5 N

Saddle Reaction Force due to Vertical Transportation Acceleration [Fsl]:
= Saddle Load * gy
= 283570 * 1.5
= 425355.281 N

Load Combination Results due to Transport Loading [Q]:
= Saddle Load + max(Fwl, Fwt, Fsl)
= 283570 + max(57068, 98018, 425355)
= 708925.5 N

Summary of Loads at the Base of this Saddle:

Vertical Load (including saddle weight)	715968.44	N
Transverse Shear Load	196036.84	N
Longitudinal Shear Load	297748.69	N

Formulas and Substitutions for Horizontal Vessel Analysis:

Note: Wear Plate is Welded to the Shell, k = 0.1

Saddle Dimension [E]:
= Baseplate Length
= 2620.000 mm

The Computed K values from Table 4.15.1:

K1 = 0.1231	K2 = 1.0222	K3 = 0.7217	K4 = 0.3619
K5 = 0.7258	K6 = 0.0449	K7 = 0.0449	K8 = 0.3296
K9 = 0.2551	K10 = 0.0508	K1* = 0.2196	

Note: Dimension a is greater than or equal to Rm/2.

Moment per Equation 4.15.1 [M1]:
= $-Q*a\ [1 - (1- a/L + (Rm^2-hm^2)/(2a*L))/(1+(4hm^2)/3L)]$
= $-708926*3250[1-(1-3250/15600+(1422^2-720^2)/$
$(2*3250*15600))/(1+(4*720)/(3*15600))]$
= −553779.8 N−m

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Moment per Equation 4.15.2 [M2]:
```
= Q*L/4(1+2(Rm²-hm²)/(L²))/(1+(4hm²)/( 3L))-4a/L
= 708926*15600/4(1+2(1422²-720²)/(15600²))/(1+(4*720)/
  (3*15600))-4*3250/15600
= 332843.6 N-m
```

Longitudinal Stress at Top of Shell (4.15.4) [sigma1]:
```
= P * Rm/(2t) - M2/(pi*Rm²t)
= 0.5 * 1422/(2*44 ) - 332844/(pi*1422²*44 )
= -0.38 N/mm²
```

Longitudinal Stress at Bottom of Shell (4.15.5) [sigma2]:
```
= P * Rm/(2t) + M2/(pi * Rm² * t)
= 0.5 * 1422/(2 * 44 ) + 332844/(pi * 1422² * 44 )
= 2.00 N/mm²
```

Longitudinal Stress at Top of Shell at Support (4.15.8) [sigma✱3]:
```
= P * Rm/(2t) - M1/(K1*pi*Rm²t)
= 0.5*1422/(2*44)--553780/(0.12*pi*1422²*44)
= 16.89 N/mm²
```

Longitudinal Stress at Bottom of Shell at Support (4.15.9) [sigma✱4]:
```
= P * Rm/(2t) + M1/(K1✱ * pi * Rm² * t)
= 0.5*1422/(2*44)+-553780/(0.22*pi*1422²*44)
= -8.21 N/mm²
```

Maximum Shear Force in the Saddle (4.15.3) [T]:
```
= Q(L-2a)/(L+(4*hm/3))
= 708926 ( 15600 - 2 * 3250 )/(15600 + ( 4 * 720/3))
= 389566.5 N
```

Shear Stress in the shell no rings, not stiffened (4.15.12) [tau2]:
```
= K2 * T / ( Rm * t )
= 1.02 * 389567/( 1422 * 44 )
= 6.37 N/mm²
```

Decay Length (4.15.20) [x1,x2]:
```
= 0.78 * sqrt( Rm * t )
= 0.78 * sqrt( 1422 * 44 )
= 195.106 mm
```

Circumferential Stress in shell, no rings (4.15.21) [sigma6]:
```
= -K5 * Q * k / ( t( b + X1 + X2 ) )
= -0.73 * 708926 * 0.1/( 44 ( 300 + 195 + 195 ) )
= -1.69 N/mm²
```

Circ. Comp. Stress at Horn of Saddle, L>=8Rm (4.15.22) [sigma7]:
```
= -Q/(4*t(b+X1+X2)) - 3*K7*Q/(2*t²)
= -708926/(4 * 44 (300 + 195 + 195 )) -
   3 * 0.045 * 708926/(2*44²)
= -30.51 N/mm²
```

Effective reinforcing plate width (4.15.24) [B1]:
```
= min( b + 1.56 * sqrt( Rm * t ), 2a  )
= min( 300 + 1.56 * sqrt( 1422 * 44 ), 2 * 3250 )
= 690.21 mm
```

Results for Vessel Ribs, Web and Base:

Baseplate Length	Bplen	2619.9998	mm
Baseplate Thickness	Bpthk	25.0000	mm

Baseplate Width	Bpwid	350.0000	mm
Number of Ribs (inc. outside ribs)	Nribs	6	
Rib Thickness	Ribtk	14.0000	mm
Web Thickness	Webtk	14.0000	mm
Web Location	Webloc	Center	
Saddle Yield Stress	Sy	205.0	N/m
Height of Web at Center	Hw,c	235.0	mm
Friction Coefficient	mu	0.300	

Moment of Inertia of Saddle - Transverse Direction (90 degrees to long axis)

Inertia of Shell [ShellInertia]:

$= ((1.56 * \sqrt{R * t} + WearPlateWidth)t^3)/12$
$= ((1.56 * \sqrt{1400 * 44} + 350)44^3)/12$
$= 5233003.000 \text{ mm}^4$

Resolved Inertia for the Shell [I,shell]:

$= ShellInertia + AShell(C1 - Y)^2$
$= 5233003 + 32436 (86 - 22)^2$
$= 138022576.000 \text{ mm}^4$

	B mm	D mm	Y mm	A mm^2	AY mm³	I + AD² mm^4
Shell	737.2	44.0	22.0	32436.0	713592.0	0.138E+09
Wearplate	350.0	20.0	54.0	7000.0	378000.0	0.739E+07
Web	14.0	236.0	182.0	3304.0	601327.8	0.458E+08
BasePlate	350.0	25.0	312.5	8750.0	2734374.5	0.449E+09
Totals	...	...	...	51490.0	4427294.5	0.641E+09

Distance to Centroid [C1]:

$= AY / A$
$= 4427294/51490$
$= 85.984 \text{ mm}$

Angle [beta]:

$= 180 - Saddle\ Angle/2$
$= 180 - 130/2$
$= 115.0$

Saddle Splitting Coefficient [K1]:

$= (1 + \cos(beta) - 0.5*\sin(beta)^2)/(pi - beta + \sin(beta)\cos(beta))$
$= (1 + \cos(115) - 0.5*\sin(115)^2)/(pi - 2.01 + \sin(115)\cos(115))$
$= 0.2218$

Saddle Splitting Force [Fh]:

$= K1 * Q$
$= 0.22 * 708926$
$= 157253.8594 \text{ N}$

Tension Stress, St = (Fh/As) =	8.2538	N/mm²
Allowed Stress, Sa = 0.6 * Yield Str =	123.0000	N/mm²

Saddle Splitting Dimension [d]:

$= B - R * \sin(theta/2)/(theta/2 \text{ in radians})$
$= 1725 - 1400 * \sin(130/2)/1.13$
$= 606.559 \text{ mm}$

Bending Moment, M = Fh * d =	95422.4141	N-m
Bending Stress, Sb = (M * C1 / I) =	12.8033	N/mm²
Allowed Stress, Sa = 2/3 * Yield Str =	136.6667	N/mm²

Minimum Thickness of Baseplate per Moss:

= sqrt(3(Q + Saddle_Wt)BasePlateWidth / (4 * BasePlateLength * AllStress))
= sqrt(3(708926 + 7043)350/(4 * 2620 * 137))
= 22.911 mm

Calculation of Axial Load, Intermediate Values and Compressive Stress:

Web Length Dimension [Web Length]:

= 2 * cos(90 - Saddle Angle/2)(Inside Radius + Shell Thk + Wear Plate Thk)
= 2 * cos(90 - 130/2)(1400 + 44 + 20)
= 2653.669 mm

Distance between Ribs [e]:

= Web Length / (Nribs - 1)
= 2654/(6 - 1)
= 530.734 mm

Baseplate Pressure Area [Ap]:

= e * Bpwid / 2
= 531 * 350/2
= 92878.422 mm^2

Bearing Pressure [Bp]:

= Q / (BasePlateLength * BasePlateWidth)
= 708925/(2620 * 350)
= 0.773 N/mm^2

Axial Load [P]:

= Ap * Bp
= 92878 * 0.77
= 71803.586 N

Area of the Rib and Web [Ar]:

= Rib Area + Web Area
= 4004 + 3715
= 7719.137 mm^2

Compressive Stress [Sc]:

= P/Ar
= 71804/7719
= 9.303 N/mm²

Check of Outside Ribs:

Inertia of Saddle, Outer Ribs - Longitudinal Direction

	B	D	Y	A	AY	Io
Rib+Web	14.0	300.0	...	4200.0	...	0.315E+08

Rib dimension [D]:

= Saddle Width - Web Thickness
= 300 - 14
= 286.000 mm

Distance to Centroid from Datum [ytot]:

= AY / A
= 0/7719
= 0.000 mm

Distance to Centroid [C1]:

= Saddle Width / 2

= 300/2
= 150.000 mm

Radius of Gyration [r]:
= sqrt(Total Inertia / Total Area)
= sqrt(31499968/7719)
= 63.881 mm

Length of Outer Rib, step 1, [Lw]:
= 2 * sin(saddle bearing angle / 2)(radius + shlthk + wpdthk)
= 2 * sin(130/2)(1400 + 44 + 20)
= 2653.669 mm

Length of Outer Rib, step 2, [Bd]:
= Baseplate length - clearance
= 2620 - 50.8
= 2569.200 mm

Length of Outer Rib, step 3, [Dd]:
= (Lw - Bd)/2
= (2654 - 2569)/2
= 42.235 mm

Length of Outer Rib [L]:
= sqrt(Rl^2 + Dd^2)
= sqrt(1082^2 + 42.2^2)
= 1082.111 mm

Intermediate Term [Cc]:
= sqrt(2 * pi^2 * Elastic Modulus / Yield Stress)
= sqrt(2 * pi^2 * 199955/205)
= 138.757

Slenderness ratio [KL/r]:
= KL/r
= 1 * 1082/63.9
= 16.940

Bending Moment [Rm]:
= Fl /(2 * Bplen) * e * L / 2
= 297749/(2 * 2620) * 531 * 1082/2
= 16323.504 N-m

Compressive Allowable, KL/r < Cc (16.9 < 139) per AISC E2-1 [Sca]:
= (1-$(Klr)^2$/(2*Cc^2))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr^3)/(8*Cc^3)
= (1-(16.9)^2/(2 * 139^2))205/
(5/3+3*(16.9)/(8* 139)-(16.9^3)/(8*139^3)
= 118.8 N/mm^2

AISC Unity Check of Outside Ribs (must be <= 1)
= Sc/Sca + (Rm * C1 / I)/Sba
= 9.3/119 + (16324 * 150/31500000)/137
= 0.647

Check of Inside Ribs:

Inertia of Saddle, Inner Ribs - Axial Direction

	B	D	Y	A	AY	Io
Rib	14.0	286.0	0.0	4004.0	0.0	0.315E+08
Web	530.7	14.0	0.0	7430.3	0.0	0.121E+06
Totals	...	...	...	11434.3	...	0.316E+08

Distance to Centroid from Datum [ytot]:
```
= AY / A
= 0/11434
= 0.000 mm
```

Distance to Centroid [C1]:
```
= Saddle Width / 2
= 300/2
= 150.000 mm
```

Length of Inner Rib [L]:
```
= Saddle Height - sqrt( (Ro + Wpdthk)^2 - (Pitch/2)^2 ) - Bpthk
= 1725 - sqrt( (1464 + 20 )^2 - (531/2)^2 ) - 25
= 260.251 mm
```

Radius of Gyration [r]:
```
= sqrt( Total Inertia / Total Area )
= sqrt( 31618128/11434 )
= 52.585 mm
```

Slenderness ratio [KL/r]:
```
= KL/r
= 1 * 260/52.6
= 4.949
```

Unit Force [Force,u]:
```
= Fl / ( 2 * Baseplate Length )
= 297749/( 2 * 2620 )
= 56.822 N/mm
```

Moment at base of inner Rib [Mbase,c]:
```
= Unit Force * e * L
= 56.8 * 531 * 260
= 7851.709 N-m
```

Bending Stress due to Transverse Force and Weight Load [SigmaB,base,c]:
```
= Bending Moment / Section Modulus
= 7852/210788
= 37.237 N/mm²
```

Compressive Allowable, KL/r < Cc (4.95 < 139) per AISC E2-1 [Sca]:
```
= ( 1-(Klr)²/(2*Cc²))Fy/(5/3+3*(Klr)/(8*Cc)-(Klr³)/(8*Cc³)
= ( 1-( 4.95 )²/(2 * 139² ))205/
  ( 5/3+3*(4.95 )/(8* 139 )-( 4.95³)/(8*139³)
= 121.9 N/mm²
```

AISC Unity Check of Inside Ribs (must be <= 1)
```
= Sc/Sca + ( Mbase,c * C1/I )/Sba
= 12.2/122 + ( 7852 * 150/31618128 )/137
= 0.372
```

Review notes about nozzle loadings and supports in the Warnings report.

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Anchor Bolts check during Ocean Transport:

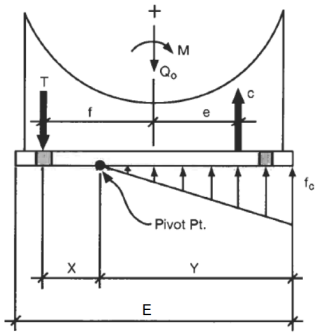
Check bolts During Transport Conditions

Design data

Vertical acceleration (+/-)	gv	0.5	<---	g	<---
Lateral acceleration (+/-)	gl	0.7	<---	g	<---
Longitudinal acceleration (+/-)	gt	0.7	<---	g	<---
Shipping weight of the equipment	W	574819	<---	N	
Saddle weight	Ws	7043.2	<---	N	
Saddle height	B	1725	<---	mm	
Saddle base length	E	2620	<---	mm	
Saddle base Width	F	350	<---	mm	
Saddle base plate	tb	25	<---	mm	
Saddle base plate allowable bearing stress	Sba	204	<---	N/mm²	
Web Length	WebL	2620	<---	mm	
Distance between saddles	L	9000	<---	mm	
Weight on left saddle	Wl	277162	<---	N	
Weight on right saddle	Wr	283570	<---	N	
Number of bolts per saddle	N	8	<---		
Bolt Size	Db	30	<---	mm	
Bolt root area	Ar	508	<---	mm²	
Bolt allowable tension stress	Sbt	373	<---	N/mm²	
Bolt allowable shear stress	Sbh	264	<---	N/mm²	
Transversae distance between bolts	Lb	2055	<---	mm	
Modular ratio Steel/Concrete Es/Ec	n1	1	(= 1 for steel foundation)		<---

Case 1

gv = 0.5 g
gl = 0.7 g
gt = 0.7 g



Transverse Force due to lateral acceleration (Left Saddle)

Ft = gt * Wl * gv
Ft = 97006.7 N

Transverse Force due to lateral acceleration (Right Saddle)

Ft = gt * Wr * gv
Ft = 99249.5 N

Longitudinal Force due to Axial acceleration

Fl = gl * W * gw
Fl = 201187 N

Saddle Reaction Force due to Transverse Load (Left Saddle)

Fwt = Ft * B / E
Fwt = 63868.9 N

Saddle Reaction Force due to Transverse Load (Right Saddle)

Fwt = Ft * B / E
Fwt = 65345.6 N

Shear Stress in a Single bolt, Longitudinal Direction

(Assumed that only bolts on fixed saddle resist to shear)

taub,l = Fl / (Ar * N)
taub,l = 49.5 N/mm²
OK!

Shear Stress in a Single bolt, Transverse Direction (Left Saddle)
taub,t = Ft / (Ar * N)
taub,t = 23.9 N/mm²
OK!

Shear Stress in a Single bolt, Transverse Direction (Right Saddle)
taub,t = Ft / (Ar * N)
taub,t = 24.4 N/mm²
OK!

Bolt Area Calculation per Dennis R. Moss
Procedure 3-11 – Anchor Bolts

No Uplift in longitudinal direction have been assumed
(Assumed that only bolts on fixed saddle resist to shear)
Bolt Area due to Longitudinal Shear Load
Abl = Fl / (Sbh * N)
Abl = 95.26 mm²
OK

LEFT SADDLE
Bolt Area due to transverse load (Left Saddle)
Moment on Base Plate due to Transverse load
Rmom= B * Ft
Rmom= 167337 Nm

Eccentricity
e = Rmom / (Wl+Ws)
e = 588.8 mm
Uplift occurs in Transverse Direction

Calculation of bolt tension for the most loaded case
At = 2032 mm² Total Bolt Area in tension
f = 1027.5 mm
K1 = 3*(e – 0.5*E) = -2163.64
K2 = 6*n1*At*(f+e) = 56302
–
K3 = –K2 * (E/2+f) = 131606465.9
Y = 1746.7 mm Start value of iterative process to solve the following equation
Y = 2165.70 mm End value of iterative process to solve the following equation
$Y^3 + K1*Y^2 + K2*Y + K3 = 0$

Total tension force in outermost bolts
T = (Wl+Ws)*[(E/2–Y/3–e) / (E/2–Y/3+f)] =
T = 120.93 N

Bolt required area
Abt = T/(N/2 * Sbt)
Tb = 0.08 mm²
OK!

Required area of a Single Bolt
Abr = Max(Abl; Abr) =
Abr = **95.3**
OK!

Baseplate Thickness Calculation per D. Moss

Bearing Pressure (fc)

fc = 2*(Wl+Ws+T) / (Y*F)

fc = 0.75 N/mm²

Distance from Baseplate edge to the Web

Ed = (E-WebL)/2

Ed = 0 mm

Overturning Moment due to bolt tension

Mt = T*Ed

Mt = 0.00 Nm

Equivalent Bearing Pressure

f1 = fc * (Y-Ed) / Y

f1 = 0.75 N/mm²

Overturning Moment due to bearing Pressure

Mc = (Ed² * F/6) * (f1 + 2*fc)

Mc = 0.00

Baseplate Required Thickness

Treq= Sqrt(6 * max(Mt, Mc) / (F*Sb))

Treq= 0.00 mm

OK!

RIGHT SADDLE

Bolt Area due to transverse load (Right Saddle)

Moment on Base Plate due to Transverse load

Rmom= B * Ft

Rmom= 171205 Nm

Eccentricity

e = Rmom / (Wr+Ws)

e = 589.1 mm

Uplift occurs in Transverse Direction

Calculation of bolt tension for the most loaded case

At = 2032 mm² Total Bolt Area in tension

f = 1027.5 mm

K1 = 3*(e - 0.5*E) = -2162.65

K2 = 6*n1*At*(f+e) = 56314

-

K3 = -K2 * (E/2+f) = 131633329.3

Y = 1746.7 mm Start value of iterative process to solve the following equation

Y = 2164.72 mm End value of iterative process to solve the following equation

$Y^3 + K1*Y^2 + K2*Y + K3 = 0$

Total tension force in outermost bolts

T = (Wr+Ws)*[(E/2-Y/3-e) / (E/2-Y/3+f)] =

T = 124.471 N

Bolt required area

Abt = T/(N/2 * Sbt)

Abt = 0.08 mm²

OK!

Required area of a Single Bolt

Abr = Max(Abl; Abr) =

Abr = **95.3**

OK!

Baseplate Thickness Calculation per D. Moss

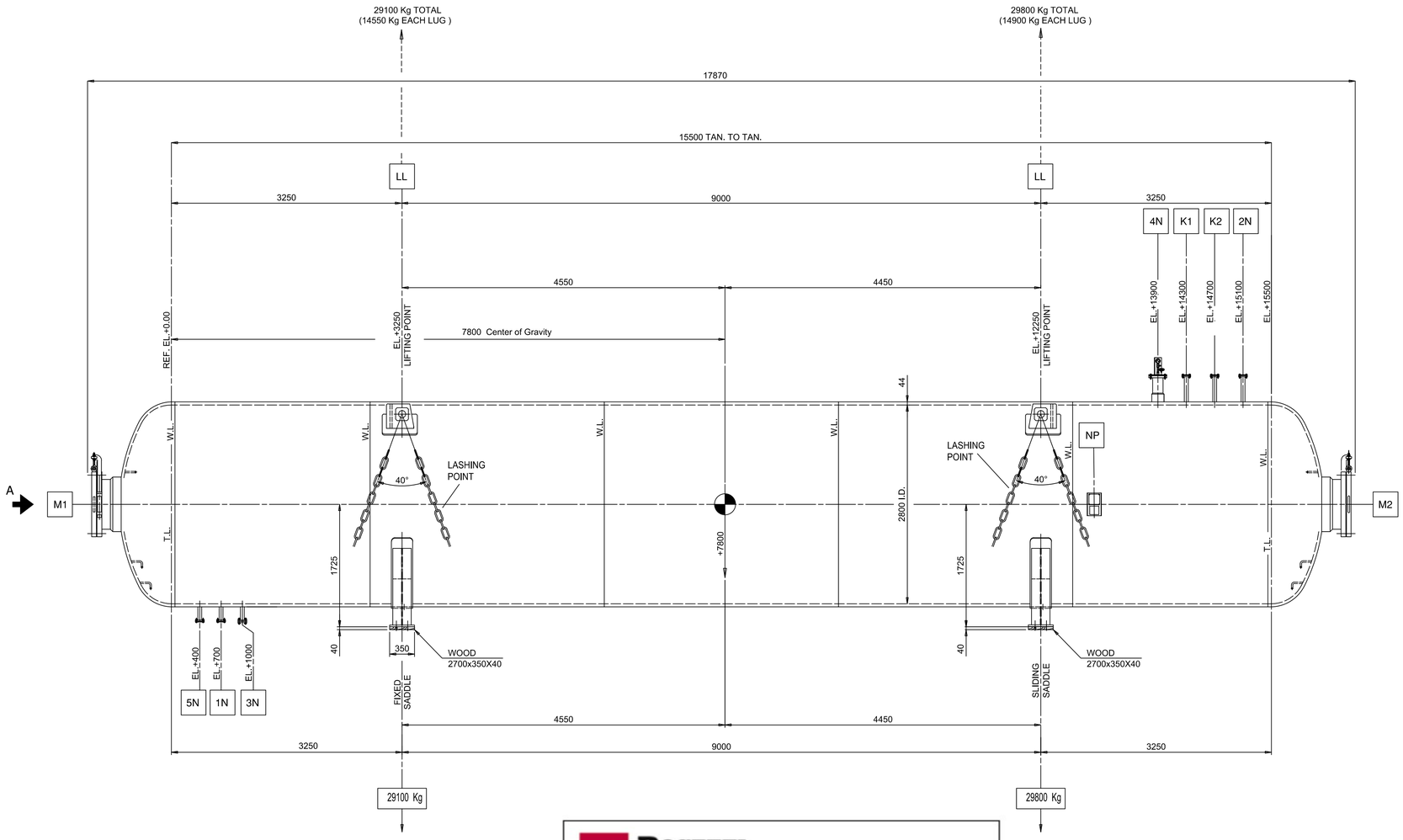
Bearing Pressure (fc)

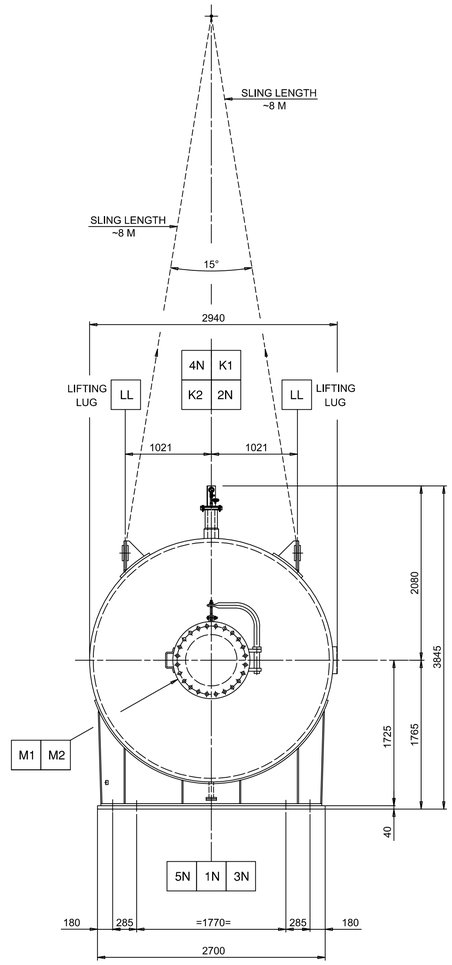
fc = 2*(Wl+Ws+T) / (Y*F)
fc = 0.77 N/mm²
Distance from Baseplate edge to the Web
Ed = (E-WebL)/2
Ed = 0 mm
Overturning Moment due to bolt tension
Mt = T*Ed
Mt = 0.00 Nm
Equivalent Bearing Pressure
f1 = fc * (Y-Ed) / Y
f1 = 0.77 N/mm²
Overturning Moment due to bearing Pressure
Mc = (Ed² * F/6) * (f1 + 2*fc)
Mc = 0.00
Baseplate Required Thickness
Treq= Sqrt(6 * max(Mt, Mc) / (F*Sb))
Treq= 0.00 mm
OK!

PART 1 - SECTION 7

Transportation / Lifting Arrangement Drawing (doc. no. 1723001756-TI-DD-00021)

SAFE WORKING LOAD (SWL) FOR EACH LUG
30000 Kg (WITH SAFETY FACTOR 1.5)



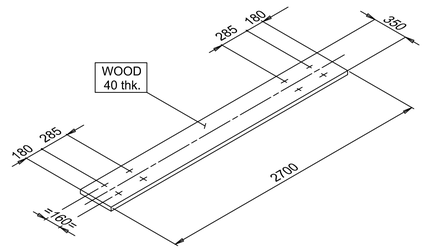


VIEW FROM -A-

ROSETTI MARINO	
1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
	10-10-2024



No. 2 PIECES

NOTES:

1) FOR EQUIPMENT ASSEMBLY, BILL OF MATERIAL & GENERAL NOTES SEE DRAWINGS: N. 23096-01-EGA1 & DWG. N. 23096-01-EBM1 .
2) LIFTING OF THE EQUIPMENT TO BE PERFORMED BY MEANS OF DEVICES WITH ADEQUATE LOADING CAPACITY (OUT OF B&R SCOPE OF SUPPLY).
3) LIFTING POINTS AND C.O.G. SHALL BE MARKED BY PAINTING ON THE OPPOSITE SIDES OF SHELL.
4) LOOSE PARTS AND SPARE PARTS SHIPPED IN A SEPARATE WOODEN BOX WITH A SEPARATE PACKING LIST.
5) LASHING POINTS SHALL BE PROTECTED WITH A POLYETHYLENE SHEET TO PREVENT PAINT FROM BEING DAMAGED. TRUE POSITION, PROTECTION AND LASHING OUTFIT SHALL BE DEFINED AND EQUIPPED BY THE CARRIER.
6) ALL WOODS MUST BE HEAT TREATED AND CERTIFIED ACCORDING TO ISPM 15.
7) TRANSPORTATION FROM ALBIGNASEGO TO RAVENNA SITE
8) PADEYES DESIGN IN SUITABLE FOR TWO SLINGS ARRANGEMENTS WITHOUT SPREADER BARS
9) PRESSURIZE VESSEL WITH NITROGEN TO POSITIVE INTERNAL PRESSURE OF 0,3÷0,5 Bar. ⚠4

QUANTITY :		1
EMPTY WEIGHT :	(KGS)	58700
GROSS WEIGHT :	(KGS)	58900
OVERALL LENGTH :	(mm)	(L)=17870
OVERALL WIDTH :	(mm)	(W)=2940
OVERALL HEIGHT :	(mm)	(H)=3845

BREMBANA&ROLLE — VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.
PURCHASE ORDER No.: 1723001756 123A90A
PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK
LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.

B&R CAD FILE No.: 23096-01-EGA1.DWG | MFR'S S.N. 23096-01-SNA/F | B&R DRAWING No. 23096-01-ESH1

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
4	03/10/2024	AD	MT	DR	ISSUE FOR INFORMATION (IFI)
3	19/08/2024	AD	MT	DR	ISSUE FOR INFORMATION (IFI)
2	12/07/2024	E.G	MT	DR	ISSUE FOR INFORMATION (IFI)
1	13/05/2024	AD	MT	DR	ISSUE FOR INFORMATION (IFI)
0	30/04/2024	AD	MT	DR	ISSUE FOR REVIEW (IFR)

CROSSWIND — ROSETTI MARINO

SHIPPING DRAWING
HYDROGEN STORAGE VESSEL ITEM : V-25001A/F

CONTRACT NO. CW-I-WP4-2023-05 / H2 STORAGE | SCALE 1:35

DRAWN A.FRANCO | CHECKED M.TONIOLO | APPROVED D.PASSERINI | DATE 03/10/24

A1 | DRAWING NO. 1723001756-TI-DD-00021 | SHEET 1 | REV. 4

File Name : - 1723001756-TI-DD-00021

PART 1 - SECTION 8

Shipping, Packing, Handling and Storage and Preservation Procedure (doc. no. 1723001756-QC-PRO-00020)

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**SHIPPING, PACKING, HANDLING&STORAGE and PRESERVATION PROCEDURE H2 STORAGE VESSEL**	Sheet 1 of 8 Date: 27/08/2024 Rev: 3

Base Load Power Hub (BLPH)

SHIPPING, PACKING, HANDLING & STORAGE and PRESERVATION PROCEDURE
H2 STORAGE VESSEL

Document Number: 1723001756-QC-PRO-00020

Document Class: 3

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
M. Bln	02/09/2024

Rev.	Date	Description	Prepared	Reviewed	Approved
3	27/08/2024	Issue for Information (IFI)	M. Toniolo	D. Passerini	D. Passerini
2	26/06/2024	Issue for Information (IFI)	M. Toniolo	D. Passerini	D. Passerini
1	14/06/2024	Issue for Information (IFI)	M. Toniolo	D. Passerini	D. Passerini
0	26/04/2024	Issue for Information (IFI)	M. Toniolo	D. Passerini	D. Passerini

B&R BREMBANA&ROLLE

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**SHIPPING, PACKING, HANDLING&STORAGE and PRESERVATION PROCEDURE H2 STORAGE VESSEL**	Sheet 2 of 8 Date: 27/08/2024 Rev: 3

Revision / Change Log

Rev.	Description
0	Issue for Information (IFI)
1	Issue for Information (IFI)
2	Issue for Information (IFI)
3	Issue for Information (IFI)

HOLD LIST

No.	Description
1	
2	
3	
4	

BREMBANA&ROLLE	SHIPPING, PACKING, HANDLING & STORAGE and PRESERVATION PROCEDURE	DOC.	23096-EIM2	REV.	3
		Sheet	3 of 8		
		JOB	23096		
		ITEM	V-25001 A-F		

CLIENT:	**ROSETTI MARINO**
PURCHASE ORDER No.:	**1723001756 123A90A**
END USER:	**CROSSWIND**
ENGINEERING	**ROSETTI MARINO**
PROJECT:	**BLPH PLATFORM**
SITE:	**HOLLANDSE KUST NOORD SITE V**
ITEM:	**V-25001 A-F**
EQUIPMENT TYPE:	**HORIZONTAL EQUIPMENT**
SERVICE:	**H2 STORAGE VESSEL**
MANUFACTURER	**BREMBANA & ROLLE S.p.A.**
JOB NOMBER:	**23096**
SERIAL NUMBER	**23096-01-SNA-SNF**

REV.	DESCRIPTION	DATE	ORIGINATOR [Project Eng.]	CHECK [Project Tech.Mng.]	APPROVAL [Engineering Mgr.]
3	Issued for APPROVAL	27/08/2024	M. TONIOLO	D. PASSERINI	D. PASSERINI
2	Issued for APPROVAL	26/06/2024	M. TONIOLO	D. PASSERINI	D. PASSERINI
1	Issued for APPROVAL	14/06/2024	M. TONIOLO	D. PASSERINI	D. PASSERINI
0	Issued for APPROVAL	26/04/2024	M. TONIOLO	D.PASSERINI	D.PASSERINI

CONTENTS

1.1. SCOPE 5
1.2. REFERENCE DOCUMENTS 5
2.1. GENERAL INSTRUCTIONS 6
2.2. PROTECTION FOR TRANSPORT, STORAGE 6
2.2.1. PREPARATION OF ITEMS FOR SHIPPING 6
2.2.2. SPARE PARTS 7
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1. FOREWORD

1.1. SCOPE

This manual details the methods employed for the preparation of shipping of the Equipments under the scope of works of Brembana&Rolle.

1.2. REFERENCE DOCUMENTS

All activities and operations in the scope of this manual shall be done strictly in accordance, with the following documents:

- General Arrangement drawings:
  B&R ref.: 23096-01-EGA1 (Client Doc. no. 1723001756-MAC-DA-00004)
- Shipping drawings:
  B&R ref. 23096-01-ESH1 (Client Doc. no. 1723001756-TI-DD-00021)
- Nitrogen Purging drawings:
  B&R ref. 23096-01-EPRS (Client Doc. no. 1723001756-TI-DD-00021)
- Mechanical calculations and nozzle loading calculations:
  B&R ref. 23096-01-EMC1 (Client Doc. no. 1723001756-MAC-CAL-00003)
- TECHNICAL SPECIFICATION 123A90-DDL-MAC-SP-50026_01

Any conflict discovered among the above mentioned documents shall be brought to the attention of B&R and solved before proceeding with the works. Other specific documents may be issued by B&R whenever required by special applications of the pressure equipment; they will be pointed out to the attention of the involved personnel by means of notes on the General Arrangement drawing.

2. SECTION 1

2.1. GENERAL INSTRUCTIONS

The employed personnel shall be of proved experience and skill about activities of pressure equipment operation, handling and movement. Works shall be executed according to the documents mentioned in the foreword.

The tags of the equipment covered by this procedure are the following:

ITEM	S/N	DWG #	TYPE
V-25001 A-F ③	23096-01-SNA-SNF ②	23096-01-EGA1 1723001756-MAC-DA-00004	H2 Storage Vessel

2.2. PROTECTION FOR TRANSPORT, STORAGE

2.2.1. PREPARATION OF ITEMS FOR SHIPPING

The items shall be internally and externally cleaned, in manner to remove weld spatters, scales, rust, cuts, filings and any other foreign material. For SS, clad, alloy lined steels, stainless steel brushes shall be used on alloy. Solvents shall be free of chlorides.

After hydrostatic test the water shall be completely drained from the item and then the pressure vessel shall be wiped and blown dry. For stainless steel units, air temperature is limited to 50°C.
The item shall be externally coated, following surface preparation and coating cycles in full adherence to the applicable painting data-sheets and specification.

The machined surfaces that do not require painting (such as gasket contact surface of flanges not closed with process blind flanges) shall be cleaned and coated with a rust preventive such as grease or peeling product (i.e. Tectyl 846 or similar product approved), before closing. All openings shall be made watertight against external atmosphere.

All flanged connections which are not furnished with permanent blinds shall be covered with rubber gaskets 3 mm thick and 6 mm minimum thick, full diameter, steel plate covers. The covers shall be installed with at least 4 bolts (except for the items with nitrogen blanket which require all the openings are closed with full bolting covers and marked with appropriate tag). Flanges drilled for bolting larger than 3/4" diameter may be secured with 3/4" diameter bolts and suitable cut washers. Flanged openings shall be covered with taped heavy plastic sheet. Tape containing chlorides shall not be used on stainless steel.

Bolts thread of pressure retaining bolts, if not otherwise protected, shall be coated with molybdenum disulphide based anti-seizing lubricant.

The items included in the supply shall be conditioned for shipping in accordance with the table below.

ITEM	NITROGEN internal overpressure ≥ 0.5 bar g	SILICA GEL BAGS
V-25001 A-F ③	☒ ②	☒

Threaded vent holes shall be protected by a suitable plugging, at least by silicone application or heavy grease.
Pieces or parts used for protection or reinforcement purposes must not be welded to the equipment.
Surface areas of the item which may come in contact with the slings shall be covered with rubber strips or similar to prevent any type of damages during lifting operation.

2.2.2. SPARE PARTS

Spare parts like gaskets, stud bolt, special tools shall be separately boxed for each mean item. The spares shall be labelled with the equipment item number and cross reference to the relevant drawing.
The box for spare shall be wrapped in waxed paper, the internal protection of box shall be water-proof lined paper and suitable for handling by forks.

2.2.3. INSPECTION BEFORE SHIPPING

All items shall be inspected before shipping, to verify draining, drying, cleaning, blasting and coating quality.

All spare parts boxes shall be inspected for quantity, quality and suitability of package.

Only after satisfactory result of all packing and marking requirements set forth in this procedure, the items shall be released for shipping.

2.2.4. CERTIFICATION BEFORE SHIPPING

At least, the sandblasting and coating inspection certificates shall be inserted in the Data Book.
② Xerox-copy of the nameplate(s) verified and stamped by the ASME and PED inspectors (as applicable) shall be also inserted in the Data Book.

2.3. HANDLING

Horizontal Equipment shall be handled by using their own lifting devices installed. Unless otherwise noted they must be kept in the operating position during handling activities.
A spreader-beam shall be used to maintain vertical the direction of the slings connected.
Cranes of adequate capacity shall be selected on the basis of the maximum loads that can be applied on the lifting devices as highlighted on the Shipping Drawing of the equipment

2.4. UNPACKING AFTER SHIPPING

The equipment has been prepared for shipping by B&R at shop.
Once the equipment is delivered at site it must be submitted to a scheduled visual inspection to check the integrity of all its parts, the surface coating and to insure that nitrogen pressure (if any) does not decrease below the minimum requirement.
Specifically, the pressure target value of 0.3 barg shall be checked and restored anytime the internal pressure is found lower; a touch-up of surface coating only is requested in case of local defect are observed.

The timing of this visual check must be as much frequent as possible at the beginning of the shipping and storage period and can be progressively reduced based on the positive result of the inspection; namely from 7 days up to once a month.

With continuing positive inspection results, sudden failure will not be expected. This justifies for enlarged timing between two subsequent visual checks. Nevertheless, care shall be paid to the accessibility at the equipment by unauthorized people, as this may be cause for voluntary or not damaging actions. (i.e. recovery of blind flanges, studs and nuts, etc. is not uncommon in an extended site area where different Companies are operating).

2.5. PRESERVATION AND STORAGE

It is recommended that the storage of the equipment at site will take place in a covered area, since weather conditions are expected to be the most probable cause of degradation of the protection foreseen on outer surfaces. If it is not feasible Client shall take all the necessary measure to preserve the equipment integrity until the equipment will be operated.

The equipment are protected for the transport and storage prior to erection as necessary against physical damage and/or corrosion which may occur due to the method and conditions of transport and the time which may elapse before erection, up to maximum of three months. For longer storage periods, protection shall be restored by the User at site, with particular attention to the protection of machined surfaces and the compatibility (e.g. against corrosion) of any material used for physical protection.

In case the items are covered with tarpaulin, insure that there is no direct contact between the equipment surface and the covering sheets and, better, a sufficient light is granted in order to let air circulate freely around the equipment.
This, especially in the high humidity areas (sea, tropical, etc.), where the change of air saturated conditions during the 24 day hours easily drive to the formation of water condense on surfaces where no air refreshing is granted, will prevent the condense to form and persist between the equipment and the tarpaulin, promoting a quicker paint degradation.

PART 2

CERTIFICATION DOSSIER

Fabrication site: Albignasego – PD – ITALY

Section 1

Index

1723001756-QC-DB-00017_02 - V25001A

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTI MARINO

MANUFACTURER RECORD BOOK (FINAL DOSSIER) INDEX

CLIENT:	ROSETTI MARINO	Contract Nº:	CW-I-WP4-2023-05
PROJECT NAME:	HOLLANDSE KUST NOORD WIND PARK Project	Doc. No. :	1723001756-QC-DB-00017
EQUIPMENT:	ITEM V25001 A-F	COMPANY REFER:	23096-QBDI

PART 2 – CERTIFICATION DOSSIER

	DESCRIPTION	PAGE
1	Index	260 - 261
2	Inspection Release Certificate	262 - 263
3	Manufacturer Data Report	264 - 295
4	Declaration of Conformity acc. to PED 2014/68/EU / ATEX (if required)	296 - 297
5	ITP approved, signed and stamped for each activity which has been witnessed and/or reviewed by any representative of involved parties (doc. no. 1723001756-QC-ITP-00002)	298 - 314
6	List of utilized materials / PMA / Material certificates and test coupon certificate, including welding material certificates	315 - 505
7	Copies of Company approved waivers to Vendor requirements.	506 - 507
8	All Non Conformity Reports and Repairs reports with final disposition and resolutions.	508 - 509
9	Approved Welding Procedures Specification and Procedure Qualification Record.	510 - 618
10	Welding map	619 - 620
11	List of Welders and Qualified Operators (doc. no. 1723001756-WEL-LIS-00015)	621 - 681
12	Manufacturing & NDE procedures (NDE, PMI,forming ,...) / NDE Operators List & Qualifications (doc. no. 1723001756-NDT-PRO-00009) (doc. no. 1723001756-NDT-LIS-00010)	682 - 815
13	Non Destructive Tests Certificates (RX, UT, PM, LP, Hardness, etc.)	816 - 853
14	PWHT Procedure / Certificate of Heat Treatment and Graphs (doc. no. 1723001756-WC-PRO-00011)	854 - 866
15	Hydrostatic procedure / Certificates of Hydrostatic, Pneumatic and Leakage Tests (doc. no. 1723001756-QC-PRO-00012)	867 - 894
16	Certificate of Visual and Dimensional Checking, thickness and tolerances	895 - 913
17	Panting procedure / Certificate of cleanness, protection and painting (doc. no. 1723001756-MAT-PRO-00008)	914 - 964
18	Weighing Procedure & report	965 - 966
19	Name Plate (copy or facsimile)	967 - 969
20	Instruction Operating Manual (doc. no. 1723001756-MAC-MAN-00019)	970 - 1007
21	Spare Parts List for Commisioning and 2 years operation (doc. no. 1723001756-COM-LIS-00018)	1008 - 1013
22	Packing list	1014 - 1016

Fabrication site: Albignasego – PD – ITALY

Section 2

Inspection Release Certificate

ROSETTI MARINO	RELEASE NOTE	Nr. RN-1756-BRE-02	Sheet 1 of 1
		Date 26/09/2024	Rev. 0
PROGETTO *Project* HOLLANDSE KUST NOORD WIND PARK	CLIENTE: *Client* CROSSWIND	COMMESSA *Job* 123A90	
FORNITORE *Vendor* BREMBANA & ROLLE		NUMERO D' ORDINE *Purchase Order No.* 1723001756	

Release Note	☐ FOR PAYMENT	☒ FOR SHIPMENT

RELEASE NOTE FOR PAYMENT

RELEASE NOTE FOR SHIPMENT

POS. Item	Q.TA' Quantity	DESCRIZIONE Description	Nr. TAG TAG No.	TIPO DI ISPEZIONE / Kind of Inspection	ESITO / Result
10	1	**H2 SERVICE STORAGE VESSEL V-25001 A** ACCORDING TO ASME VIII DIV 2 - INCLUDING RADIOGRAPHYC EXAMINATION RT-1 - ASME STAMP - NBR	V-25001 A	FINAL	SATISFACTORY

DOCUMENTI APPLICABILI / *APPLICABLE DOCUMENTS*

POSIZIONE *Items*	TIPO DI DOCUMENTO *Type of Document*	NUMERO DI DOCUMENTO *Document Number*	Rev.	COD. DI APPROV. *Approv. Code*
10	Purchase Order	1723001756	1	n/a

PUNCH LIST: ☐ SI / *YES* VEDI PUNCH LIST ALLEGATA N° / *REFER TO ATTACHED PUNCH LIST N°*
☒ NO/ *NO*

CONTROLLO VALIDITA' FIDEJUSSIONE / *PERFORMANCE or WARRANTY BOND expiration date check*
Estensione Fidejussione Richiesta *(Performance or Warranty Bond Extension of Validity required)*
☐ SI / *YES* ☒ NO/ *NO*
Acceptance Method: *Performance or Warranty Bond valid if actually delivery date it's not greater than two weeks from contractual delivery date.*

RELEASE NOTE

RISULTATO / *RESULT*	FORNITURA / *SUPPLY*	DISTRIBUZIONE A: / *DISTRIBUTION TO:*	
☒ POSITIVO / *POSITIVE*	☐ COMPLETA / *COMPLETE*	☒ Project Manager	☒ Administration
☐ NEGATIVO / *NEGATIVE*	☒ PARZIALE / *PARTIAL*	☒ Project Quality Manager	☒ Project Eng-/Procurement Coord
☐ PUNTI PENDENTI / *PUNCH-LIST*	☐ ULTIMA / *FINAL*	☒ Warehouse	☒ Supplier

NOTE / *NOTES*

Note:
None

L' INCARICATO /*Person in charge* ROSETTI MARINO *Supply Management dept.*		IL RAPPR. DEL CLIENTE / *Client Representative*	IL FORNITORE /*Vendor*	CONSTRUCTION MANAGER *Only requested for Punch List to be closed at Yard*
Nome Cognome *Name Surname*	**Firma** *Signature*			
Martino Basile	Digitally signed by Martino Basile Date: 2024.09.26 12:28:17+02'00'	N.A.	N.A.	N.A.

QUESTO DOCUMENTO NON SOLLEVA IL FORNITORE DALLA RESPONSABILITA' DI EVENTUALI DIFETTI E/O MALFUNZIONAMENTI RILEVATI DURANTE L'USO / *The present RELEASE NOTE does not relieve the Supplier of the responsibility of any possible defects and/or malfunctioning arising during the utilisation.*

Fabrication site: Albignasego – PD – ITALY

Section 3

Manufacturer Data Report

ORIGINATOR: Engineering Services s.r.o., Engineering Office, Za Hladkovem 680/12, Prague, 169 00 Czech Republic	DOCUMENT NUMBER: UDS-2307

PROJECT: HOLLANDSE KUST NOORD WIND PARK

USER'S DESIGN SPECIFICATION FOR
Hydrogen Storage Vessels Item: V–25001A/B/C/D/E/F

This Document outlines the characteristics, design conditions and all necessary data for the subject equipment for compliance with ASME VIII, Div.2 (Class 2), Part 2.2, 2021 Edition. The document is prepared in behalf of User:

CROSSWIND Hollandse Kust Noord Wind Park, Netherlands

REV	DESCRIPTION OF REVISIONS	PREP'D	CHK'D	APPRV'D	PROJECT APPROVED	DATE
1	ISSUED FOR CERTIFICATION	MC	MC			8.1.2024
0	ISSUED FOR REVIEW	MC	MC			1.12.2023

Rev.	Section	Revision Description
0	All	ISSUED FOR REVIEW
1	4.3; 5.1; 5.2; 5.3; 5.4.2; 8.1; 8.4; 9.1	ISSUED FOR CERTIFICATION

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INTRODUCTION

1.1. PROJECT INTRODUCTION

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

1.1. PURPOSE

This specification covers all the requirements outlined in ASME VIII, Div. 2, and Part 2.2 for the design and construction of Hydrogen Storage Vessel Item: V-25001A/F (6 Vessels).
Any proposed deviation from this specification by the Supplier is to be made by written request for approval by the User and for a revision of this specification.

1.2. DEFINITIONS

The **USER**, as referred to in CROSSWIND Hollande Kust Noord Wind Park, Netherlands

The **SUPPLIER**, is Rosetti Marino S.p.A, Via Trieste, 48122 Ravenna – Italy

The **MANUFACTURER**, is Brembana & Rolle S.p.A., Valbrembo (BG) Italy

The **INSPECTOR** is the person who carries out all the inspections specified in the rules of ASME Sec. VIII Div. 2.
The word **CODE** indicates the ASME Section VIII Div.2, Ed. 2021 with any referenced Sections.

The word **'shall'** indicates a mandatory requirement.
The word **'should'** indicates a recommendation.

1.3. REFERENCE STANDARDS

a)	ASME Sec.VIII, Div. 2, 2021 Edition	–"Rules for Construction of Pressure Vessels"
b)	ASME Sec.II, Part A , 2021 Edition	– "Ferrous Material Specifications"
c)	ASME Sec.II, Part C , 2021 Edition	– "Specifications for Welding Rods, Electrodes, and Filler Metals"
d)	ASME Sec.II, Part D , 2021 Edition	– "Material Properties"
e)	ASME Sec V, Edition 2021	– "Non-destructive Examination".
f)	ASME Sec IX, Edition 2021	– "Welding and Brazing Qualifications".
g)	2014/68/EU	– "PED – Pressure Equipment Directive''.

1.4 ORDER OF PRECEDENCE

For the design of the vessel the following order of precedence shall apply:

a.) ASME Sec.VIII, Div. 2, 2021 Edition
b.) Standards mentioned in Table 1.1 of ASME Sec.VIII, Div. 2, incl. the year of acceptable edition
c.) other International Standards
d.) Recommended Practices

In any case of conflicting requirements the ASME Sec.VIII, Div. 2, 2021 Edition shall have priority before any other Code, Standard or Recommended Practice.

2. INSTALLATION SITE

2.1 LOCATION

Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee.

2.2 JURISDICTIONAL AUTHORITY

2014/68/EU – PED – Pressure Equipment Directive.

2.3 ENVIRONMENTAL CONDITIONS

2.3.1 WIND DESIGN LOADS

According to prescriptions of document n° CWHKN-INN-BPH-DTS-00005 – BLHP PLATFORM SITE AND ENGINEERING DATA. 1 Year Return, 3 sec. gust = 35 m/sec, 100 Year Return, 3 sec. gust = 45 m/sec.

2.3.2 EARTHQUAKE DESIGN LOADS

Not considered.

2.3.3 SNOW LOADS

Not considered.

2.3.3 LOWEST ONE DAY MEAN TEMPERATURE FOR LOCATION

-29 deg. C as per Meteorological data available.

3. VESSEL IDENTIFICATION

3.1 VESSEL NUMBER & IDENTIFICATION

Hydrogen Storage Vessels Item: V—25001A/B/C/D/E/F (6 Vessels)

3.2 SERVICE FLUIDS & PROPERTIES

a) Service Fluid : Hydrogen
Design Density : 2,06 kg/m3
Design Viscosity : 0.000357 Pa·s (0.357 cP)

4. VESSEL CONFIGURATION AND CONTROLLING DIMENSIONS

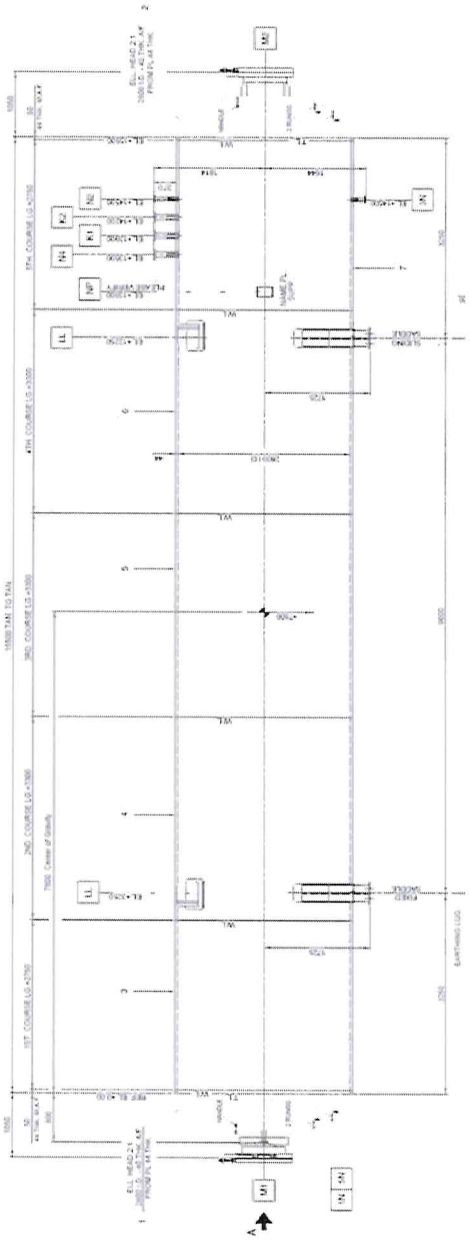
4.1 OUTLINE DRAWINGS
DWG 1723001756-MAC-DA-00004

4.2 VESSEL ORIENTATION (VERTICAL or HORIZONTAL)
HORIZONTAL

4.3 OPENINGS, CONNECTIONS, CLOSURES INCLUDING QUANTITY & LOCATION

MK.	QTY'	DIA.	RATING	TYPE FLANGE	THK.	I.D.	SELFREINF. THK.	PROJECTION	SERVICE
M2	1	24"	300#	LWN-RF Spec. + BL.	46.05	609.6	80.0	SEE DWG	MANHOLE c/w DAVIT
M1	1	24"	300#	LWN-RF Spec. + BL.	46.05	609.6	80.0	SEE DWG	MANHOLE c/w DAVIT
K2	1	1"	300#	LWNF	14,3	25,4	-	1814	PRESS. TRASM. (CTRL)
K1	1	1"	300#	LWNF	14,3	25,4	-	1814	PRESS. TRASM. (ESD)
5N	1	1"	300#	LWN-RF	14.3	25.4	20.0	1644	NITROGEN PURGING
4N	1	2" HOLD	300#	LWNF	16.65	508	-	1814	PSV CONNECTION
3N	1	1"	300#	LWNF	14.3	25.4	-	1644	DRAIN
2N	1	1"	300#	LWNF	14.3	25.4	-	1814	HYDROGEN OUTLET
1N	1	1"	300#	LWN-RF.	14.3	25.4	20.0	1644	HYDROGEN INLET

Nozzles´ Orientation and Principal Dimensions:



4.4 PRINICIPAL DIMENSIONS

Size : Approx. overall length 17 600 mm, Inside Diameter 2 800 mm,

Internal Volume (Approx.) : 101200 L

4.5 SUPPORT METHOD

Vessel shall be supported on two Saddles. One shall be designed as a fixed saddle and the second as a sliding saddle. The SUPPLIER shall use 3D design tool to as great extent as possible to plan for location of all brackets, supports etc. to allow for as little rework as possible later in the skid assembly process.

5. DESIGN CONDITIONS

5.1 SPECIFIED DESIGN PRESSURE

Design Pressure: 40/FV bar g

5.2 DESIGN TEMPERATURE

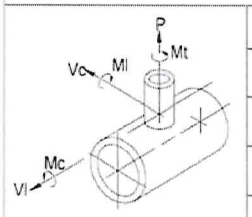
Design Temperature: 80 °C at specified coincident internal design pressure of 40/FV bar g

5.3 MINIMUM DESIGN METAL TEMPERATURE (MDMT)

MDMT: - 29 °C at specified coincident internal design pressure of 40/FV bar g

5.4 DEAD , LIVE & OTHER LOADS

5.4.1 Nozzle Load:

NOZZLE LOCAL LOADS								
	NOZZLE	NPS	Vl [N]	P [N]	Vc [N]	Mc [Nm]	Mt [Nm]	Ml [Nm]
	4N	2" - 300#	2100	2800	1400	280	420	364

5.4.2 Static Loads

Approximate dead weight, hydro-test and operating loads are as follows:

Weight Fabricated	~60 200	Kg
Weight Empty	~60 200	Kg
Weight Operating (max)	~60 460	Kg
Weight Hydrostatic (Shop)	~161 900	Kg

5.4.4 **Vessel Calculations to be performed as per PART-4 of the Code (Design by Rules Requirements).**

6. OPERATING CONDITIONS

6.1 OPERATING PRESSURE

Operating Pressure: 30 bar g

6.2 OPERATING TEMPERATURE

Operating Temperature: between -29 °C and 20 °C

6.3 TRANSIENT THERMAL GRADIENT ACROSS VESSEL

Not Applicable (Steady State Design Temperature condition)

7. DESIGN FATIGUE LIFE

7.1 Vessel is assumed to operate under 180 shut-down / start-up cycles per year, design life (2 years). Manufacturer shall perform the fatigue screening per Part 5.5.2.3 of ASME code section VIII Div. 2.

No Corrosion Fatigue is anticipated due the materials used

8. MATERIALS OF CONSTRUCTION

8.1

Materials of constructions (Selected as per Part 3):	
Shell	SA 516 Gr. 60 HIC
Eliptical Heads	SA 516 Gr. 60 HIC
Forgings (Nozzles)	SA 350 LF2 CL.1
Saddles	SA 516 Gr. 60
Internals, Externals	SA 516 Gr. 60
Bolts/Nuts	SA 193 GR.B7/SA 194 GR.2H
Pipes	SA 333 GR.6
Flange Gaskets	S.W. 304 S.S. Graphite with S.S. inner ring and Epoxy-coated C.S. outer rings

8.2 CORROSION AND EROSION

With the material selected in §8.1 no corrosion allowance is required. The Item is designed for noncorrosive service.

Erosion of the vessel due to fluid motion is negligible.

8.3 SERVICE CONDITIONS AFFECTING SELECTION OF MATERIAL

Service Duty	Continuous
Sour Service	No
Hydrogen Service	Yes
Specific Toughness Requirement	No
Lethal Service	No

8.4 ADDITIONAL TOUGHNESS REQUIREMENTS

Toughness testing shall be performed as required by ASME BPVC.VIII.2 in Part 3.11. If required shall be performed at a temperature not greater than -29 °C with acceptance criteria of 27J average, 20J single, which is to include the weld metal and HAZ of welded components.

8.5 FILLER METAL REQUIREMENTS TO MEET CORROSION RESISTANCE

There is need for specific weld filler material to meet corrosion resistance requirements.
For Production Test Plates the impact testing shall confirm to para 3.11.8.4.

9. LOADS AND LOAD CASES

9.1 Applicable Loads (As per Table 4.1.1 of Code) :

Design Load Parameter	Description	Applicability / Remarks
P	Internal Maximum Allowable Working Pressure	Applicable (Refer Cl. 5.1 above.)
Ps	Static head from liquid or bulk materials (e.g. catalyst)	Applicable (Refer Cl. 3.2 above.)
D	Dead Weight of the vessel , Contents and Appurtenances , including the following :-	
	Weight of vessel including internals, supports.	Applicable (Refer Cl. 5.4.2 above)
	Weight of Vessel contents under operating & test conditions.	
	Refractory Linings, Insulation.	Not Applicable.
	Static Reactions from weight of attached equipment. A Platform might be attached to the vessel.	Applicable
	Transportation loads (The static forces obtained as equivalent to the dynamic loads experienced during normal operation of a transport vessel)	Applicable
L	Appurtenances Live Load Effect of Fluid Flow Head resulting from wave reaction	Not Applicable
E	Earth quake Loads	Not Applicable (Refer Cl. 2.3.2 above)

W	Wind Loads	Applicable (Refer Cl. 2.3.1 above)
S	Snow Loads	Not Applicable (Refer Cl. 2.3.3 above)
F	Loads due to Deflagration	Not Applicable

9.2 APPLICABLE DESIGN LOAD CONDITIONS (As per Table 4.1.2 of Code) :

SR. NO.	Design Load Combinations	General PrimaryMembraneAllowable Stress(*)
1	P + Ps + D	S
2	P + Ps + D + L Note 1	S
3	P + Ps + D + S Note 1	S
4	0.9 P + Ps + D + 0.75 L + 0.75 S	S
5	0.9 P + Ps + D + (0.6W or 0.7 E)	S
6	0.9 P + Ps + D + 0.75 (0.6W or 0.7 E) + 0.75 L + 0.75 S	S
7	0.6 D + (0.6W or 0.7 E)	S
8	Ps + D + F	S
9	Other load combinations	Not Applicable

Notes:-

1) Load Combinations No. 1, 2 & 3 are same for this particular vessel because L & S are not applicable.

10. OVERPRESSURE REQUIREMENTS

10.1 Overpressure protection will be provided by the user/supplier.

11. ADDITIONAL REQUIREMENTS:

11.1 Requirement related to NDE , restrictive chemistry & Heat Treatment :

a) Examination Group 1b per Tables 7.1 and 7.2 of Section VIII, Div. 2
b) Shell and Head Materials shall be tested for Hydrogen Induced Cracking (NACE TM0284)
c) PWHT and Preheat shall be performed in compliance with Part 6.4. of Section VIII, Div.2.

11.2 Any Non-mandatory or optional provisions of the Code are not considered to be Mandatory for these Vessels.

11.3 The Vessels shall be marked per 2-F.1. of ASME BPVC VIII.2

11.4 Pneumatic testing shall not be accepted in lieu of hydrostatic testing on vessels. The manufacturer´s written procedure shall be used for hydrotesting. The procedure shall fulfill the requirements of Part 8.2 of Section VIII, Div. 2.

11.5 After Hydro test Vessel shall be fully drained, cleaned & dried.

12. CERTIFICATION OF COMPLIANCE

I , the undersigned, being experienced and competent in the applicable field of design related to pressure vessel requirements relative to this User's Design Specification, certify that to the best of my knowledge and belief it is correct and complete with respect to the Design and Service Conditions given and provides a complete basis for construction in accordance with Part 2, 2.2.3 and other applicable requirements of the ASME Section VIII, Division 2 Pressure Vessel Code, Class 2, Edition 2021, and No Code Case(s) .

This certification is made on behalf of the organization that will operate these vessels:

CROSSWIND Hollandse Kust Noord Wind Park, Netherlands

Certified by:

Title and areas of responsibility: Complete UDS, Doc. No. UDS-2307

Date: January 8, 2024

Miloslav Choc - Certifying Engineer

Digitally signed by Miloslav Choc - Certifying Engineer
DN: cn=Miloslav Choc - Certifying Engineer, o=UK Section No. 601144, ou=International Registered Professional Engineer, email=miloslav.choc@gmail.com, c=CZ
Date: 2024.01.08 10:25:16 +01'00'

Certified by:

Title and areas of responsibility:

Date:

Certifying Engineer Seal: (As required)

Date:

Engineer's registration authority: International Register of Professional Engineers

Registration authority location: UK Section, London, United Kingdom

Engineer's registration number (if applicable): 601144

CERTIFICATION OF COMPLIANCE OF THE MANUFACTURER'S DESIGN REPORT

I (We), the undersigned, being experienced and competent in the applicable field of design related to pressure vessel construction relative to the certified User's Design Specification, certify that to the best of my knowledge and belief the Manufacturer's Design Report is complete, accurate and complies with the User's Design Specification and with all the other applicable construction requirements of the ASME Section VIII, Division 2 Pressure Vessel Code, Class 2, 2021 Edition and Code Case(s) N/A.

This certification is made on behalf of the Manufacturer Brembana & Rolle S.p.A. - Italy.

Certified by: _____

Title and areas of responsibility: _____

Date: _____

Certified by: _____

Title and areas of responsibility: _____

Date: _____

Certifying Engineer Seal: Dana E. Petroni, P.E., P.Eng.

Date: 17 June 2024



Engineer's registration authority: PESAC, L.L.C.

Registration authority location: Texas, U.S.A.

Engineer's registration number (if applicable): 97934

PESAC L.L.C.
Texas Engineering
Firm Registration
F-11364

Authorized Inspector Review:

LRQA Verification Limited
~~Witnessed~~ Reviewed LRQA
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 17/09/2024

Date: _____

23096-MDR-Rev0
17 June 2024

MANUFACTURER'S DESIGN REPORT

This report is prepared in accordance with the requirement of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 2 Class 2, Edition 2021.

CLIENT	**Rosetti Marino S.p.A.**

Job. No.	**23096**
Vessel or Item No.	**V-25001A/B/C/D/E/F**
Serial No.	**23096-01-SNA/B/C/D/E/F**

Documents covered by this Design Report

a) DRAWINGS

Drawing Number	Rev	Description
23096-01-EGA1	**5**	**GENERAL ARRANGEMENT/FOUNDATION LOADING DRAWING**
23096-01-EBM1	**3**	**DETAIL DRAWING – BILL OF MATERIAL**
23096-01-ED01	**2**	**DETAIL DRAWING – CROSS SECTION – EXPLODED VIEW**
23096-01-ED02	**0**	**DETAIL DRAWING – MANHOLE DAVIT**
23096-01-ENP1	**3**	**NAMEPLATE DRAWING**
23096-01-EWM1	**3**	**WELDING DETAIL DRAWING**

b) MATERIAL SPECIFICATION

Material Specification	Component
SA-516 Gr.60 HIC	**SHELL and HEAD**
SA-516 Gr.60	**WELDED ATTACHMENTS**
SA-350 LF2 CL.1	**FORGINGS**
SA-333 Gr.6	**PIPES**
SA-516 Gr.60	**SADDLE**
SA-350 LF2 CL.1	**BLIND FLANGES**
SA-193 Gr.B7 / SA-194 Gr.2H	**EXTERNAL BOLTS / NUTS**
SA-193 Gr.B6 / SA-194 Gr.6	**INTERNAL BOLTS / NUTS**
S.W. 316 S.S. GRAPHITE FILLED w/ 316 S.S. INNER RING & EPOXY COATED C.S. OUTER RINGS	**FLANGE GASKETS**

c) DESIGN CALCULATION and ANALYSIS

c.1 Documentation of design by rules calculation in Part 4:

Calculation Report	Rev	Description
23096-01-EMC1	**3**	**MECHANICAL CALCULATION**

c.2 Documentation of Design by analysis calculations in Part 5:

Calculation Report	Rev	Description
Not Applicable	**---**	**Not Applicable**

d) USER DESIGN SPECIFICATION

Document Number	Rev	Description
UDS-2307	**1**	**USER´S DESIGN SPECIFICATION** **Hydrogen Storage Vessels Item: V-25001A/B/C/D/E/F**

e) Results of fatigue analysis, in accordance to paragraph 5.5:

Calculation Report	Rev	Description
Fatigue Analysis Not Applicable	**---**	**Fatigue Analysis Not Applicable per Section 7 of UDS-2307**

f) Any assumptions used by the Manufacturer to perform the vessel design: **NONE**

BREMBANA&ROLLE	MANUFATCURER'S DESIGN REPORT FATIGUE SCREENING	Doc.	214R-2023	REV.	0
		Sheet	1	Of	4
		Job	Off-214R		
		Item	V25001		

Fatigue screening to ASME VIII Div. 2, Ed. 2021

Job Number / *Numero commessa*:	Off. 214R-2023
Item / *Apparecchio*:	V-25001
Service / *Servizio*:	H2 Storage Vessel
Serial no. / *N° di fabbrica*:	n.a.
Code Edition/ *Edizione Codice*:	Edition 2021

Type of construction:
Integral ☑
Non Integral ☐

Fatigue Hystory of the equipment:
Design Life of the equipment: 2 Years

Selected Screening Method: **A**
(to para. 5.5.2.3)

Table 5.9
Fatigue-Screening Criteria for Method A

Type of Construction	Component Description	Fatigue-Screening Criteria
Integral construction	Attachments and nozzles in the knuckle region of formed heads	$N_{\Delta FP} + N_{\Delta PO} + N_{\Delta TE} + N_{\Delta TR} \leq 350$
	All other components	$N_{\Delta FP} + N_{\Delta PO} + N_{\Delta TE} + N_{\Delta TR} \leq 1000$
Nonintegral construction	Attachments and nozzles in the knuckle region of formed heads	$N_{\Delta FP} + N_{\Delta PO} + N_{\Delta TE} + N_{\Delta TR} \leq 60$
	All other components	$N_{\Delta FP} + N_{\Delta PO} + N_{\Delta TE} + N_{\Delta TR} \leq 400$

Condition for the application:
Tensile strength table of materials used for the construction of the equipment:

Materials (pressure parts)	Su (MPa) **
SA-516 60	415
SA-765 II / SA-350 LF2	485
SA-333 6	415

** From Table U of ASME Section IID-M Ed.2021

All tensile strengths are less than 552 MPa; The method is applicable.

BREMBANA&ROLLE	MANUFATCURER'S DESIGN REPORT FATIGUE SCREENING	Doc.	214R-2023		REV.	0
		Sheet	2	Of	4	
		Job	Off-214R			
		Item	V25001			

Step1:
Load history based on the information based on the information in the User's Design Specification.

Temperature and pressure changes within the expected life of the equipment:

CASE 1: NORMAL OPERATION
30 barg@20°C to 4 barg@ -8,4°C and viceversa 180 times per Year

CASE 2 – STANDARD START-UP AND SHUT-DOWN
Number of Cycles: Assumed 1 per Years

No changes in metal temperature differences between any two adjacent points. The equipment is assumed to have uniform temperature during service

Step 2
Determine the expected (design) number of full-range pressure cycles including start-up and shut-down, and designate the value of $N_{\Delta FP}$:

It is assumed that the expected full range of pressure cycles is given by the sum of all the cycles declared on the above load history and therefore:

$N_{\Delta FP}$ = 1*2 (case 2) = 2 cycles

Step 3:
Determine the expected number of pressure cycles in which the range of pressure variation exceeds 20% of the design pressure (for integral construction) or 15% of the design pressure (for non-integral construction), and designate the value of $N_{\Delta PO}$:
(Pressure cycles in which the pressure variation does not exceed these percentages of the design pressure and pressure cycles caused by fluctuations in atmospheric conditions do not need to be considered in this evaluation)

From loading history declared, pressure cycles in which the range of pressure variation exceeds 15% / 20% (as applicable) of the design pressure are the following:

$N_{\Delta PO}$ = 180*2 (case 1) = 360 cycles

Step 4:
Determine the effective number of changes in metal temperature differences between any two adjacent points ΔTe, and designate the value of $N_{\Delta TE}$:

From loading history declared on the UDS, the following temperature changes are expected:

$N_{\Delta TE}$ = 0

BREMBANA&ROLLE	MANUFATCURER'S DESIGN REPORT FATIGUE SCREENING	Doc.	214R-2023		REV.	0
		Sheet	3	Of	4	
		Job	Off-214R			
		Item	V25001			

Step 5:
Determine the number of temperature cycles for components involving welds between materials having different coefficients of thermal expansion that cause the value of (α1 - α2) * ΔT to exceed 0.00034 and designate the value as $N_{\Delta T\alpha}$:

From loading history declared. no materials with different thermal expansions are part of the equipment, therefore:

$N_{\Delta T\alpha} = 0$

Step 6:
Verify if the expected number of operating cycles from STEPs 2, 3, 4 and satisfy the criterion in table 5.9.

For non-integral construction (all other components): $N_{\Delta FP} + N_{\Delta PO} + N_{\Delta TE} + N_{\Delta T\alpha} \leq 400$
For integral construction (all other components): $N_{\Delta FP} + N_{\Delta PO} + N_{\Delta TE} + N_{\Delta T\alpha} \leq 1000$

Since: $N_{\Delta FP} + N_{\Delta PO} + N_{\Delta TE} + N_{\Delta T\alpha} = 2 + 360 + 0 + 0 = 362 <= 1000$.

Fatigue analysis is not required.

Reference Tables

Table 5.8
Temperature Factors for Fatigue-Screening Criteria

Metal Temperature Differential		
°C	°F	Temperature Factor for Fatigue-Screening Criteria
28 or less	50 or less	0
29 to 56	51 to 100	1
57 to 83	101 to 150	2
84 to 139	151 to 250	4
140 to 194	251 to 350	8
195 to 250	351 to 450	12
Greater than 250	Greater than 450	20

GENERAL NOTES:
(a) If the weld metal temperature differential is unknown or cannot be established, a value of 20 shall be used.
(b) As an example illustrating the use of this table, consider a component subject to metal temperature differentials for the following number of thermal cycles:

Temperature Differential	Temperature Factor Based on Temperature Differential	Number of Thermal Cycles
28°C (50°F)	0	1,000
50°C (90°F)	1	250
222°C (400°F)	12	5

The effective number of thermal cycles due to changes in metal temperature is: $N_{\Delta TE}$ = 1,000(0) + 250(1) + 5(12) = 310 cycles

Table 5.9
Fatigue-Screening Criteria for Method A

Type of Construction	Component Description	Fatigue-Screening Criteria
Integral construction	Attachments and nozzles in the knuckle region of formed heads	$N_{\Delta PP} + N_{\Delta PD} + N_{\Delta TE} + N_{\Delta TA} \leq 350$
	All other components	$N_{\Delta PP} + N_{\Delta PD} + N_{\Delta TE} + N_{\Delta TA} \leq 1{,}000$
Nonintegral construction	Attachments and nozzles in the knuckle region of formed heads	$N_{\Delta PP} + N_{\Delta PD} + N_{\Delta TE} + N_{\Delta TA} \leq 60$
	All other components	$N_{\Delta PP} + N_{\Delta PD} + N_{\Delta TE} + N_{\Delta TA} \leq 400$

Document no:	MLN/DAD/PED24/263
Issue number	1
Page 1 of 3	

Inspection Services
Design Appraisal Document

LRQA Inspection Iberia, S.A.
Notified Body nº 0094
C/ Princesa, nº 29 – 1º
28008 Madrid - Spain

Date
17/07/2024

Quote this reference on all future communications
MLN/DAD/PED24/263 (PRJ11100426663)

Client	: Brembana & Rolle S.p.A.
Client Order no.	: 1723001756 123A90A – Job 23096
Type of pressure equipment	: Vessel
Manufacturing no.	: 23096-01-SNA/B/C/D/E/F
Project	: Base Load Power Hub (BLPH) – Rosetti Marino – HOLLANDSE KUST NOORD SITE V
Subject	: H_2 Storage Vessel
Item	: V-25001A÷F
Module	: G - Unit Verification

1. The documents listed below, have been examined for compliance with the design requirements of the

ASME VIII Div. 2 Class 2, Edition 2021

in support of the **essential safety requirements** of the **Pressure Equipment Directive 2014/68/EU** for the design conditions stated in the documentation and are assigned an appraisal status as shown.

2. Key Design Parameters

Loadings

Loadings:	Applicable	Not applicable	Appraised
Internal pressure	X		Yes
External pressure	X		Yes
Weight	X		Yes
External nozzle loads	X		Yes
Mechanical loads acting on attachments	X		Yes
Thermal loads		X	No
Fatigue (cyclic service)		X	No
Loads due to wind	X		Yes
Loads due to earthquake		X	No
Loads due to transport	X		Yes
Blast		X	No

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Document no:	MLN/DAD/PED24/263
Issue number	1
Page 2 of 3	

Inspection Services
Design Appraisal Document

Design data

Chamber		Vessel		
Max./min. allowable Pressure PS	[bar]	40 / -1		
Max./min. allowable Temperature	[°C]	80 / -29		
Test pressure	[bar]	57.2		
Capacity (vessels)	[L]	101200		
Fluid		Hydrogen		
Corrosion allowance	[mm]	0		

PED data

Chamber	Vessel		
Fluid classification (group) according to PED 2014/68/EU, article 13	1		
Applicable table acc. PED, article.3 par.1 / PED, appendix II	1		
Category PED, appendix II	**IV** (category of the equipment is the highest category of any chamber)		

3. The following point(s) need to be considered:

3.1. For pressure equipment in categories II, III and IV, operating procedures and personnel for permanent joining of components must be approved by a competent third party, acc. to PED Annex I, par. 3.1.2.

3.2. For pressure equipment in categories III and IV, the personnel for non-destructive testing of permanent joints must be approved by a recognized third-party organization, acc. to PED Annex I, par. 3.1.3.

This document is issued in support of an EC Directives activity. The certification decision and EC Directive certification will be issued by LRQA Inspection Iberia, S.A., who recognises the undersigned as an authorised Surveyor.

Andrea F. Magrì
Design Appraisal Surveyor
On behalf of LRQA Inspection Iberia, S.A.
NOBO 0054

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Document no:	MLN/DAD/PED24/263
Issue number	1
Page 3 of 3	

Inspection Services
Design Appraisal Document

4. List of Documents:

Document no.	Title	Rev.	Appraisal Status	Date
23096-01-EGA1	General Arrangement Drawing and Foundation Loading Diagram	5	A	14/05/2024
23096-01-ED01	Detailed Drawing	2	A	21/03/2024
23096-01-ED02	Detail Drawing Manhole Davit	0	A	23/11/2023
23096-01-EWM1	Welding Detail Drawing	3	A	18/03/2024
23096-01-ENP1	Name Plate Drawing	3	A	14/06/2024
23096-01-EBM1	Detailed Drawing – Bill of Material	3	A	14/06/2024
23096/PMA/01÷04	Particular Material Appraisal	0	A	27/05/2024
23096-EHA1	Risk Analysis	0	SI	11/04/2024
23096-ESR	Essential Safety Requirements	0	SI	11/04/2024
23096-01-EMC1	Mechanical Calculation	3	SI	14/05/2024
23096-01-EIM1	Instruction Operating Manual	0	SI	15/04/2024

Appraisal Status Key

A	Examined and found in accordance with Pressure Equipment Directive 2014/68/EU
SI	Retained as supporting documentation for information only

Distribution

Brembana & Rolle S.p.A.	DAD (Electronic Original)
LRQA Inspection Iberia, S.A.	DAD (Electronic Original)

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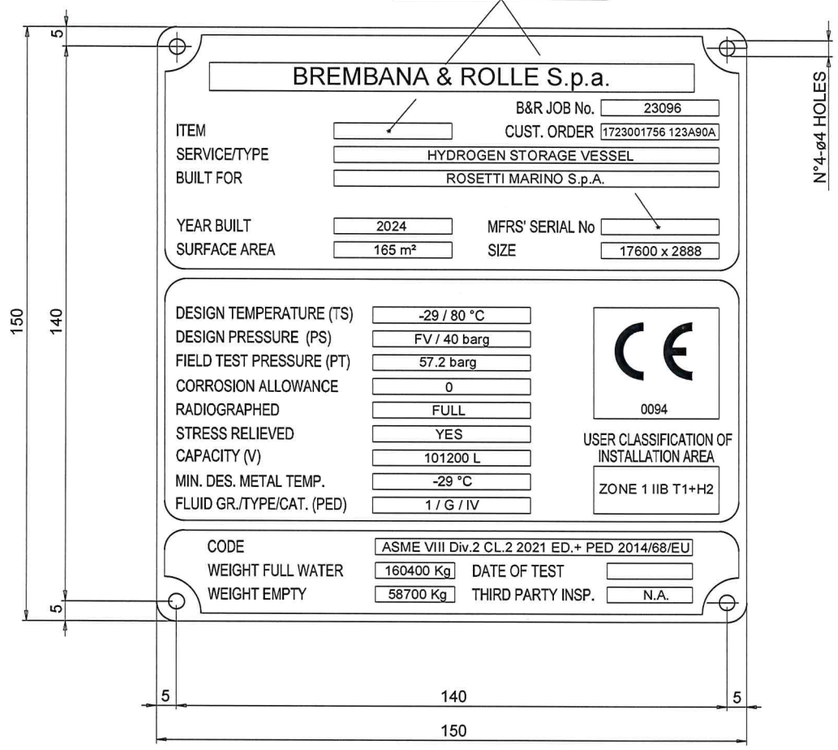
ITEM	MFRS' SERIAL No
V-25001A	23096-01-SNA
V-25001B	23096-01-SNB
V-25001C	23096-01-SNC
V-25001D	23096-01-SND
V-25001E	23096-01-SNE
V-25001F	23096-01-SNF

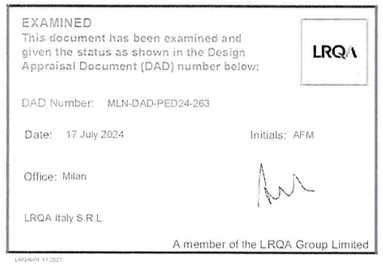


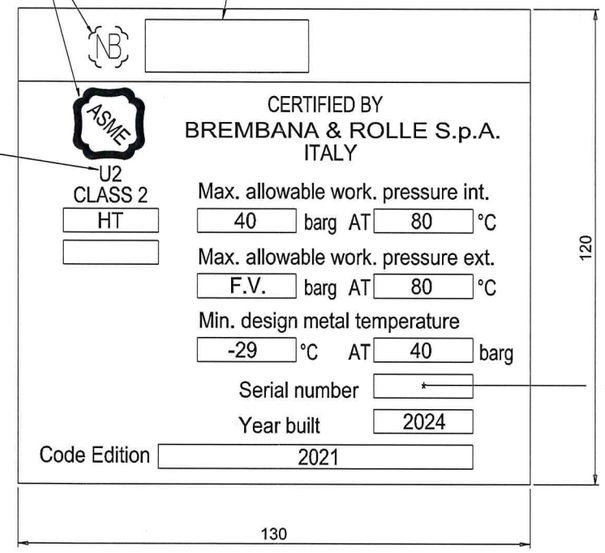
(39) CLIENT NAME PLATE

STAMPIGLIATO IN OFFICINA DA BREMBANA&ROLLE
STAMPED IN SHOP BY BREMBANA&ROLLE

ESEGUITO DAL FORNITORE DELLA TARGA
TO BE PERFORMED BY NAME PLATE SUPPLIER

ESEGUITO DAL FORNITORE
DELLA TARGA
TO BE PERFORMED BY
NAME PLATE SUPPLIER





(40) ASME NAME PLATE

MFRS' SERIAL No
23096-01-SNA
23096-01-SNB
23096-01-SNC
23096-01-SND
23096-01-SNE
23096-01-SNF

23096-01-EBM1	Bill of material and General Notes
23096-01-ED01	Detail Drawing (NP support)
23096-01-EGA1	General Arrangement
Manufacturer Dwg. No.	Description
Reference documents/belong to drawing	

NOTE-NOTES

1) TUTTE LE LETTERE E I NUMERI SONO INCISI CHIMICAMENTE
ALL LETTERS AND NUMBER ARE CHEMICALLY ETCHED
2) LA TARGA SARA' IN MATERIALE S.S. 316L CON Sp. 2 mm
NAME PLATE SHALL BE IN S.S. 316L MATERIAL WITH 2 mm THK
3) ALTEZZA MINIMA DELLE LETTERE 4 mm
MINIMUM HEIGHT OF LETTERS 5/32"
4) CARATTERI SONO INCISI O IN RILIEVO MINIMO 0.004 INC. (O.10mm)
CHARACTERS EITHER INDENTED OR RAISED MIN 0.004 INC. (O.10mm)
5) PER ASSIEME APPARECCHIO, VEDI DISEGNO 23096-01-EGA1
FOR GENERAL ASSEMBLY , SEE DWG 23096-01-EGA1

BREMBANA&ROLLE

VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.

PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK

PURCHASE ORDER No.: 1723001756 123A90A

LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.

B&R CAD FILE No: 23096-01-EGA1.dwg | MFR'S S.N. 23096-01-SNA/F | B&R DRAWING No. 23096-01-ENP1

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
3	14/06/2024	AFQ	MT	DR	ACCEPTED FOR CONSTRUCTION (AFC)
2	18/03/2024	AFQ	MT	DR	ACCEPTED FOR CONSTRUCTION (AFC)
1	16/02/2024	AFQ	MT	DR	ACCEPTED FOR CONSTRUCTION (AFC)
0	30/11/2023	AFQ	MT	DR	ISSUE FOR INFORMATION (IFI)

CROSSWIND

ROSETTI MARINO

NAME PLATE DRAWING
H2 STORAGE VESSEL ITEM : V-25001A/F

CONTRACT NO. CW-I-WP4-2023-05 / H2 STORAGE | SCALE 1:1

DRAWN A.FRANCO | CHECKED M.TONIOLO | APPROVED D.PASSERINI | DATE 14/06/24

A2 | DRAWING NO. 1723001756-MAC-DD-00006 | SHEET 1 | REV. 3

File Name : 1723001756-MAC-DD-00006

GENERAL NOTES

CODES :

1.a) No 6 EQUIPMENT REQUIRED.

1.b) CONSTRUCTION OF EQUIPMENT WILL BE ACC. TO : ASME VIII DIV. 2 CL.2 2021 ED .- "U2" STAMPED+NBR PED 2014/68/EU - CE MARKING

1.c) STANDARD EMPLOYED UNLESS OTHERWISE INDICATED: ASME B.16.5- 2017 FOR FLANGES UP TO 24"; ASME B.1.1-2003 2A/2B FOR STUD BOLTS AND NUTS. ASME B.36.10-2004 FOR PIPES; ASME B.16.9-2009 FOR FITTINGS.

FORMING :

2.a) 2:1 ELL. HEAD MK.1- HOT FORMED IN ONE PIECE FROM PL.44 THK (NORMALIZED AFTER FORMING)

2.b) 2:1 ELL. HEAD MK.2- HOT FORMED IN ONE PIECE FROM PL.44 THK (NORMALIZED AFTER FORMING)

WELDING :

3.a) MIN. WELD TOE-TO-TOE DISTANCE: 50 mm FROM NOZZLES WELD; SHELL THK. FROM SHELL SEAMS TO EXTERNAL ATTACHMENTS.

3.b) ALL FILLET WELDS ARE CONTINUOUS AND HAVE A MIN. THROAT =0.5*THK. OF THINNEST PLATE JOINTED (IF NOT OTHERWISE INDICATED ON THE DRAWING).

3.c) ALL INTERNAL WELDED ATTACHMENTS SHALL BE ATTACHED BY FULL PENETRATION WELDS.

MAIN FLANGES / NOZZLES :

4.a) THE BOLTS HOLES (IF NOT OTHERWISE INDICATED) OF ALL FLANGES, AND GIRTH FLANGES, SHALL STRADDLE THE NORMAL AXES OF VESSEL.

4.b) THE GASKET CONTACT SEALING SURFACE OF RF FACING NOZZLES SHALL HAVE A ROUGHNESS OF Ra 3.2 TO 6.3 µm (125 TO 250 µinch) ACCORDING TO ASME B16.5-2013 EDITION PARA 6.4.5.3.

GASKETS :

5.a) S.W. 316 S.S. GRAPHITE FILLED WITH 316 S.S. INNER RING & EPOXY-COATED C.S. OUTER RINGS

BOLTS :

6.a) BOLT TIGHTENING AS FOLLOWS :
- FOR BOLTS DIA LOWER THAN 2" WITH TORQUE WRENCH.
- FOR BOLTS DIA EQUAL OR GREATER THAN 2" WITH HYDRAULIC BOLT TENSIONING.
- FOR BOLT TIGHTENING METHOD, BOLT FORCE AND TORQUE TO BE APPLIED SEE PROCEDURE 22176/M.

6.b) THE THREAD OF EXTERNAL BOLTS AND NUTS SHALL BE PROTECTED WITH ANTI-SEIZE PRODUCT TYPE "MOLYKOTE 1000 SOLID LUBRICANT PASTE".

6.c) ALL SIZES: BOLTS, STUDS AND NUTS SHALL BE VISUAL EXAMINED ACC. TO ASME VIII DIV.2 §.3.7.2(A).
n > 1": BOLTS, STUDS AND NUTS SHALL UNDERGO TO MT OR PT EXAMINATION ACCORDING TO ASME VIII DIV.2 §.3.7.2(B).
n > 2": BOLTS, STUDS AND NUTS SHALL UNDERGO TO UT EXAMINATION OVER THE ENTIRE SURFACE PRIOR THREADING ACCORDING TO ASME VIII DIV.2 §.3.7.2(C).
n > 4": BOLTS, STUDS AND NUTS SHALL UNDERGO TO UT EXAMINATION OVER AN ENTIRE END SURFACE PRIOR OR AFTER THREADING ACCORDING TO ASME VIII DIV.2 §.3.7.2(D).

CERTIFICATE / IMPACT TEST :

7.a) ALL PRESSURE PARTS MATERIALS AND PARTS WELDED TO THEM SHALL BE FURNISHED WITH CERTIFICATE ACCORDING TO EN 10204 TYPE 3.1

7.b) MATERIALS FOR PRESSURE PARTS AND PARTS WELDED TO THEM IMPACT TESTED AS FOLLOWS:
-SA 516 GR.60 PLATES : IMPACT TEST@-46°C MUST BE PERFORMED IN AS DELIVERED CONDITION, AFTER MIN. SPWHT AND MAX. SPWHT .
-SA-350 LF2 Cl.1 FORGING : CHARPY V NOTCH IMPACT TESTING SHALL BE PERFORMED AS PER THE APPLICABLE SA MATERIAL SPECIFICATION AT LEAST AT -46°C IN AS DELIVERED CONDITION, AFTER MIN. SPWHT AND MAX. SPWHT .
-SA 193 Gr.B7 BOLTING: EXEMPTED FROM IMPACT TEST UP TO 2-1/2" DIA.

7.c) 100% UT & RT GAMMA RAYS BEFORE PWHT AND 100% UT AFTER PWHT

7.d) CODE IMPACT TEST EXEMPTIONS: 3
SA-516 GR.60 : EXEMPTED UP TO 44mm @ -29 °C AS PER Fig. 3.8M AND TABLE 3.15 FOR MAT. IN CURVE D. 3
SA-350 LF2 CL.1 : EXEMPTED DOWN TO -48 °C AS PER 3.11.2.4 (b)
SA-193 B7 / SA-194 2H : EXEMPTED DOWN TO -48 °C FOR BOLT SIZE 2-1/2" AND LESS AS PER TABLE 3.4

TOLERANCE :

8.a) DIMENSION TOLERANCES SHALL BE IN ACCORDANCE WITH THE APPLICABLE CONSTRUCTION CODE ASME VIII DIV.2 .
MAX. OVALIZATION OF DIAMETER (ASME VIII DIV.2 § 4.3.2) 1%, MILL PLATE UNDER TOLERANCE (ASME SA 20) 0,3 mm.,
PIPE UNDER TOLERANCE 12,5 %, CONSTRUCTION TOLERANCE B&R (DIMENSIONAL).

SHIPPING / MARKING :

9.a) ALL SLAG, LOOSE, SCALE, DIRT, WELD SPATTER, OILS, PAINT AND OTHER MATERIALS SHALL BE REMOVED BEFORE THE FINAL INSPECTION.

9.b) AFTER HYDRAULIC TEST THE EQUIPMENT SHALL BE DRAINED AND DRIED.

9.c) FOR SHIPPING: ALL OPEN NOZZLES SHALL BE SEALED HERMETICALLY WITH BLIND FLANGES FROM PLATE AND RUBBER GASKET. SHALL BE SECURED WITH MINIMUM OF 4 BOLTS.
THE INTERNAL OF EQUIPMENT SHALL BE PROTECTED WITH NITROGEN (SEE DWG. 23096-01-EPRS1).

9.d) VENT HOLES SHALL BE PLUGGED WITH GREASE AFTER HYDRAULIC TEST.

9.e) THE TEST SHALL BE CARRIED OUT USING POTABLE WATER WITH LESS THAN 50 PPM OF CHLORIDES CONTENT

9.f) UNLESS OTHERWISE INDICATED, THE TEST PRESSURE SHALL BE HELD FOR AT LEAST 1(ONE) HOUR PER 25 MM OF PLATE THICKNESS BUT IN NO CASE LESS THAN 1(ONE) HOUR

MISCELLANEOUS :

10.a) FATIGUE ANALYSIS: NO

10.b) SPARE PARTS: 300% GASKETS AND 10% BOLTS (MINIMUM 5 PIECES FOR EACH TYPE UNITS) FOR EACH MANHOLE

10.c) THE PRESSURE SAFETY VALVES (P.S.V.) SHALL BE INSTALLED ON THE PIPELINE BY USER.

10.d) SPECIAL SERVICE : NO LETHAL SERVICE.

10.e) NOZZLES PROJECTION ARE FROM C.L OR T.L. OF VESSEL TO GASKET FACE OF FLANGE.

10.f) ALL DIM. ARE IN MILLIMETER AND UNIT OF MEASUREMENT SHALL BE S.I UNLESS OTHERWISE INDICATED

10.g) ALL INT. AND EXT. PARTS, APPURTENANCES AND ACCESSORIES, DIRECTLY WELDED TO THE SHELL SHALL BE MADE OF THE SAME MATERIAL CHARACTERISTICS OF THE EQUIPMENT

10.h) ALL NOZZLES SHALL HAVE INSIDE CORNER ROUNDED TO 3 MM RADIUS MIN.UNLESS OTHERWISE SPECIFIED.

10.i) NO WELD MAY EXECUTED DIRECTLY TO THE PRESSURE PARTS, SUBJECTED TO POST WELD HEAT TREATMENT. AFTER THAT THE HEAT TREATMENT HAS BEEN CARRIED OUT. THE SAME SHALL BE CLEARLY MARKED ON SHELL AS FOLLOW: "POST WELD HEAT TREATED. DO NOT BURN, WELD OR HAMMER".

10.l) HIC TEST FOR PLATES ACCORDING TO ISO 15156

10.m) WIND ACC. TO PRESCRIPTIONS OF DOC. N° CWHKN-INN-BPH-DTS-00005-BLHP PLATFORM SITE AND ENG. DATA

EXAMINED
This document has been examined and given the status as shown in the Design Appraisal Document (DAD) number below:
LRQA
DAD Number MLN-DAD-PED24-203
Date 17 July 2024 Initials: AFM
Office Milan
LRQA Italy S.R.L.
A member of the LRQA Group Limited

MATERIAL LIST FOR No.6 EQUIPMENTS

MK / MC.	Q.TY / Q.TÀ	DESCRIPTION / DESCRIZIONE	DIMENSIONS / DIMENSIONI	MATERIAL / MATERIALE
57				
56				
55				
54				
53				
52				
51				
50				
49	6+18+18	GASKET (3N)	Ø1"-300#-RF-4.5 Thk.	SEE NOTE 5.a
48	24+12+12	STUD BOLTS+2 NUTS (3N)	Ø5/8"-UNC-B1.1-85 Lg.	SA 193 Gr.B7+ SA 194 Gr.2H
47	6	FLANGE (3N)	Ø1"-300#-BLIND-RF	SA 350 LF2 Cl.1
46	6	PLATE (SEE DETAIL)	2604x334x3 THK.	SA 240 304
45	6	PLATE (SEE DETAIL)	14 Thk.	SA 516 Gr.60
44	24	PLATE (SADDLE)	123x272x14 Thk.	SA 516 Gr.60
43	24	PLATE (SADDLE)	123x647x14 Thk.	SA 516 Gr.60
42	12	PLATE (SADDLE)	260x1079x14 Thk.	SA 516 Gr.60
41	6	FLANGE (4N)	254 O.D.-101.6 I.D.-416.6 Thk.	SA 350 LF2 Cl.1
40	6	ASME NAME PLATE	SEE DWG. 23096-01-ENP1	316L S.S.
39	6	NAME PLATE	SEE DWG. 23096-01-ENP1	316L S.S.
38	24	RIVET	Ø3.5-15 Lg.	304 S.S.
37	6	BASE PLATE	350x2620x25 Thk.	SA 516 Gr.60
36	6	BASE PLATE	350x2620x25 Thk.	SA 516 Gr.60
35	6	PLATE (SEE DETAIL)	14 Thk.	SA 516 Gr.60
34	24	PLATE (SADDLE)	123x275x14 Thk.	SA 516 Gr.60
33	24	PLATE (SADDLE)	123x650x14 Thk.	SA 516 Gr.60
32	12	PLATE (SADDLE)	260x1082x14 Thk.	SA 516 Gr.60
31	12	WEAR PLATE (SADDLE)	300x3580 Dev.-20 Thk.	SA 516 Gr.60
30	12	EARTHING LUG	50x85x4 Thk. (SEE DETAIL)	316L S.S.
29	6	NAME PLATE SUPPORT	320x300x5 Thk.	SA 240 316L
28	24	PLATE	30 Thk. (SEE DETAIL)	SA 516 Gr.70
27	48	WASHER (LIFTING LUG)	180x180-20 Thk.-100 Dia.	SA 516 Gr.70
26	24	REINFORCING PLATE	495x445x25 Thk.	SA 516 Gr.60
25	24	LIFTING LUG	385x345x30 Thk.	SA 516 Gr.70
24	24	ROD (RUNG)	Ø20-725 Lg.	S275J2 EN10025-2
23	12	ROD (HANDLE)	Ø20-582 Lg.	S275J2 EN10025-2
22	6	FLANGE (3N)	Ø1"-300#-LWN-RF-244 Lg.	SA 350 LF2 Cl.1
21	6	FLANGE (2N)	Ø1"-300#-LWN-RF-414 Lg.	SA 350 LF2 Cl.1
20	6	FLANGE (K2)	Ø1"-300#-LWN-RF-414 Lg.	SA 350 LF2 Cl.1
19	6	FLANGE (K1)	Ø1"-300#-LWN-RF-414 Lg.	SA 350 LF2 Cl.1
18	-	DELETED	-	-
17	6	FLANGE (5N)	Ø1"-300#-LWN-RF-244 Lg.	SA 350 LF2 Cl.1
16	6	FLANGE (1N)	Ø1"-300#-LWN-RF-244 Lg.	SA 350 LF2 Cl.1
15	6+18+18	GASKET (M2)	Ø24"-300#-RF-4.5 Thk.	SEE NOTE 5.a
14	144+15+15	STUD BOLTS+2 NUTS (M2)	Ø1 1/2"-8UN-B1.1-260 Lg.	SA 193 Gr.B7+ SA 194 Gr.2H
13	6	FLANGE (M2)	Ø24"-300#-BLIND-RF	SA 350 LF2 Cl.1
12	6	FORGING (M2)	914.4 O.D.-609.6 I.D.-382.8 Thk.	SA 350 LF2 Cl.1
11	6+18+18	GASKET (M1)	Ø24"-300#-RF-4.5 Thk.	SEE NOTE 5.a
10	144+15+15	STUD BOLTS+2 NUTS (M1)	Ø1 1/2"-8UN-B1.1-260 Lg.	SA 193 Gr.B7+ SA 194 Gr.2H
9	6	FLANGE (M1)	Ø24"-300#-BLIND-RF	SA 350 LF2 Cl.1
8	6	FORGING (M1)	914.4 O.D.-609.6 I.D.-382.8 Thk.	SA 350 LF2 Cl.1
7	6	SHELL ELEMENT (4)	2800 I.D.-44 Thk.-2750 Lg.	SA 516 Gr.60
6	6	SHELL ELEMENT (4)	2800 I.D.-44 Thk.-3300 Lg.	SA 516 Gr.60
5	6	SHELL ELEMENT (3)	2800 I.D.-44 Thk.-3300 Lg.	SA 516 Gr.60
4	6	SHELL ELEMENT (2)	2800 I.D.-44 Thk.-3300 Lg.	SA 516 Gr.60
3	6	SHELL ELEMENT (1)	2800 I.D.-44 Thk.-2750 Lg.	SA 516 Gr.60
2	6	HEAD (COLL.=44 THK. M.A.F.)	2800 I.D.-40 Min. thk.	SA 516 Gr.60
1	6	HEAD (COLL.=44 THK M.A.F.)	2800 I.D.-40 Min. thk.	SA 516 Gr.60

B&R BREMBANA&ROLLE VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.
PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK
PURCHASE ORDER No.: 1723001756 123A90A
LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.

B&R CAD FILE No: 23096-01-EGA1.dwg — MFR'S S.N. 23096-01-SNA/F — B&R DRAWING No. 23096-01-EBM1

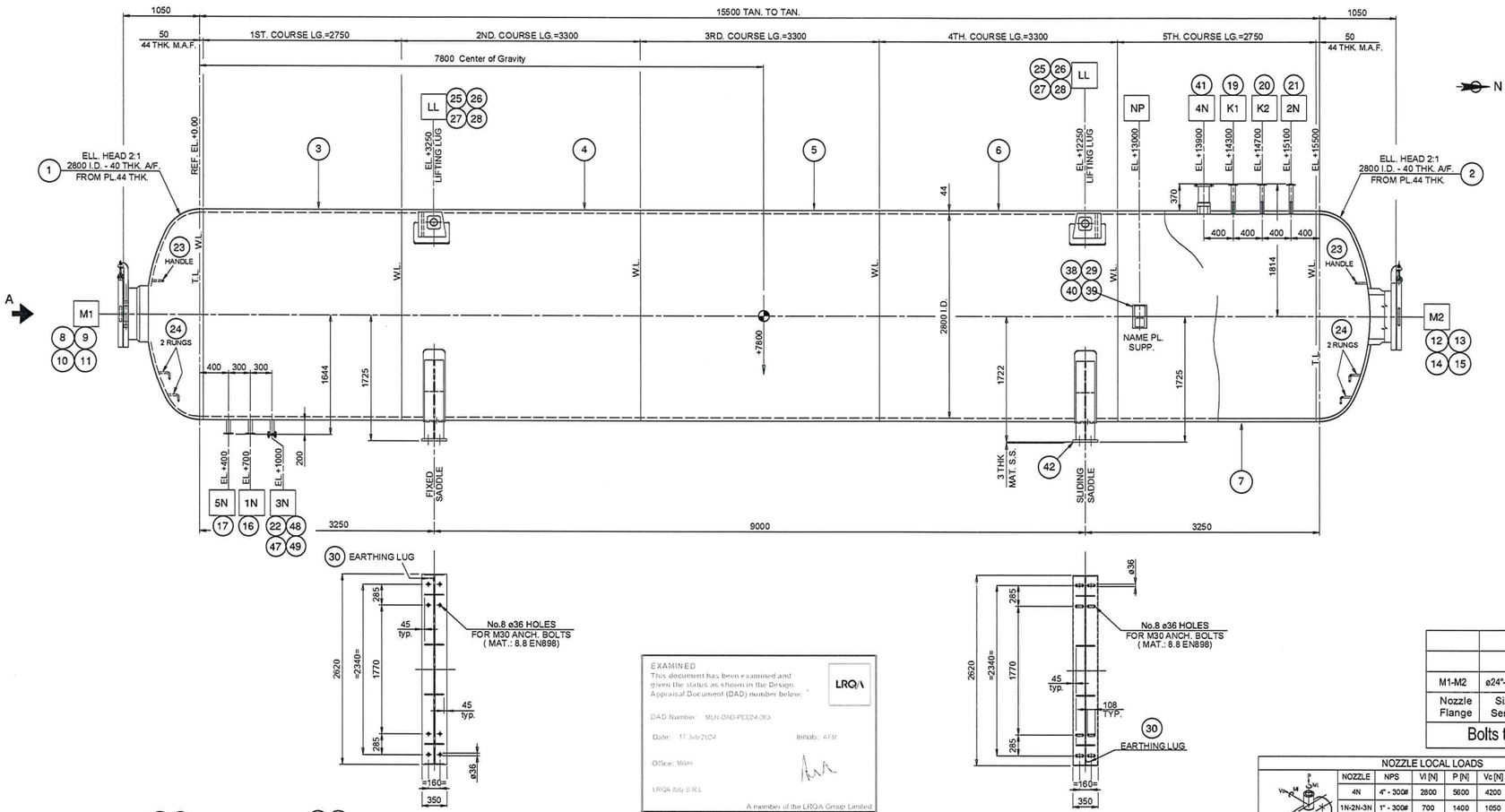
REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
3	14/06/2024	AF	MT	DP	ISSUE FOR INFORMATION (IFI)
2	18/03/2024	AF	MT	DP	ISSUE FOR INFORMATION (IFI)
1	07/02/2024	AF	MT	DP	ISSUE FOR INFORMATION (IFI)
0	30/11/2023	AF	MT	DP	ISSUE FOR INFORMATION (IFI)

CROSSWIND — ROSETTI MARINO

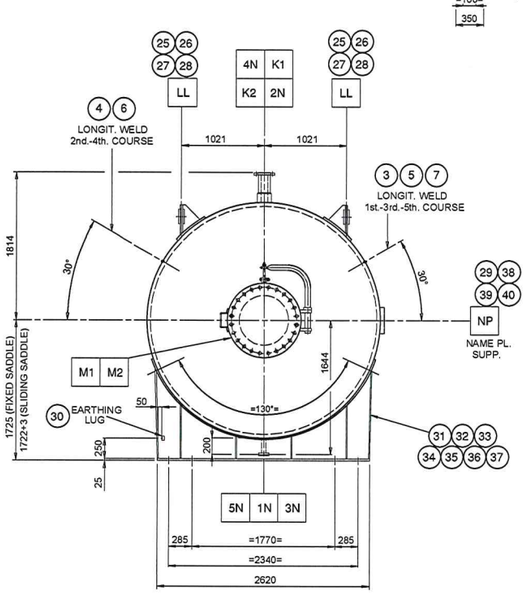
DETAILED DRAWING – BILL OF MATERIAL
H2 STORAGE VESSEL ITEM : V–25001A/F

CONTRACT NO. CW–I–WP4–2023–05 / H2 STORAGE — SCALE 1:1
DRAWN A.FRANCO — CHECKED M.TONIOLO — APPROVED D.PASSERINI — DATE 14/06/24
A1 — DRAWING NO. 1723001756–MAC–DD–00024 — SHEET 1 — REV. 3

File Name : 1723001756–MAC–DD–00024



EXAMINED
This document has been examined and given the status as shown in the Design Appraisal Document (DAD) number below:
DAD Number: MUN-DAD-PED24-263
Date: 17 July 2024 Initials: AFM
Office: Milan
LRQA Italy S.R.L.
A member of the LRQA Group Limited



VIEW FROM -A-

NOTES

1) No.6 PIECES REQUIRED
2) FOR BILL OF MATERIALS AND GENERAL NOTES SEE DRAWING 23096-01-EBM1
3) FOR WELDING DETAIL SEE DRAWING 23096-01-EWM1
4) BOLT HOLES OF THE NOZZLES SHALL ALWAYS STRADDLE THE PRINCIPAL CENTERLINES OF THE VESSELS OR THEIR PARALLEL LINES.
5) NOZZLES PROJECTIONS REFERRED FROM VESSEL CENTERLINE TO FACE FLANGE.
6) REINFORCING PADS SHALL BE PROVIDED WITH ONE ¼" NPT TELL TALE HOLE (B1.20.1)
7) MAWP SET EQUAL TO DESIGN PRESSURE TO ASME VIII DIV.2 PART.2 PARA 2.2.3.1 (d) (1)

NORME DI COSTRUZIONE		ASME VIII Div.2 CLASS 2 2021 ED.
CODE OF CONSTRUCTION		PED 2014/68/EU
USER CLASSIFICATION OF INSTALLATION AREA		ZONE 1 IIB T1+H2
CLASSIF. UTENTE AREA DI INSTALLAZIONE		
MARCATURA		CERTIFICATION MARK "UZI" + NBR CE
MARKING		
ENTE NOTIFICATO		LRQA INSPECTION IBERIA SA. No.0094
NOTIFIED BODY		
ANTINCENDIO (ESCLUSO DALLA NS. FORNITURA)	mm	NO
FIREPROOFING (NOT INCLUDED IN OUR SCOPE OF SUPPLY)		
ISOLAMENTO (ESCLUSO DALLA NS. FORNITURA)	mm	NO
INSULATION (NOT INCLUDED IN OUR SCOPE OF SUPPLY)		
PESO PIENO D'ACQUA (IN SHOP)	Kg	160400
TOTAL WEIGHT FULL WATER		
CAPACITÀ	m³	101.2 (101200 L)
CAPACITY (V)		
PESO IN ESERCIZIO	Kg	58900
OPERATING WEIGHT		
PESO A VUOTO ASSIEMATO	Kg	58700
EMPTY WEIGHT		
PESO DI FABBRICAZIONE	Kg	58700
FABRICATED WEIGHT		
PESO DI SOLLEVAMENTO	Kg	58700
LIFTING WEIGHT		
CONTROLLI NON DISTRUTTIVI		SEE "INSPECTION TEST PLAN" 1723001756-QC-ITP-00002
N.D.T.		
PARTICOLARI DI SALDATURA		SEE "WELDING BOOK" 1723001756-WEL-PRO-00014
WELDING DETAIL		
MASSIMA OVALIZZAZIONE SUL DIAMETRO	%	1
MAX. OVALIZATION OF DIAMETER		
VENTO		NEN - EN 1991-1-4
WIND		
TERREMOTO		N/A
EARTHQUAKE		
NEVE		NEN - EN 1991-1-3
SNOW		
EFFICIENZA GIUNTI		1
JOINT EFFICIENCY		
RADIOGRAFIA / UT		100%
RADIOGRAPHY / UT		
RICOTTURA		YES
P.W.H.T.		
PED MODULE		G
MODULO PED		
CATEGORY		IV
CATEGORIA		
PED FLUID GROUP		1
GRUPPO FLUIDO PED		
TALLONE DI SALDATURA		NO
WELDING COUPON		
COLLAUDO / GRUPPO ISPEZIONE		1B
EXAMINATION / EXAMINATION GROUP		
CORROSIONE AMMISSIBILE	mm	NO
CORROSION ALLOWANCE		
NOME DEL FLUIDO		HYDROGEN
FLUID NAME		
PRESSIONE DI PROVA IDRAULICA	barg	57.2
HYDRAULIC TEST PRESSURE (PT)		
M.D.M.T.	°C	-29
M.D.M.T. (TM)		
SURFACE TREATMENT		1723001756-MAC-PRO-00008
TRATT. SUPERF.		
TEMPERATURA DI ESERCIZIO	°C	20
OPERATING TEMPERATURE		
MASS. PRESS. AMM. DI LAVORO EXT.	barg	F.V. @ 80°C
MAX. ALLOW. WORKING PRESS. EXT.		
PRESSIONE DI ESERCIZIO	barg	30
OPERATING PRESSURE		
TEMPERATURA DI PROGETTO	°C	-29 / 80
DESIGN TEMPERATURE (TS)		
PRESSIONE DI PROGETTO	barg	40
DESIGN PRESSURE (MAWP) (PS) (7)		
	barg	

M1-M2	ø24"-300#	Min.: 2003 Max.: 2754
Nozzle Flange	Size Series	Bolt Torque Value (Nxm)

Bolts tightening

NOZZLE LOCAL LOADS

NOZZLE	NPS	Vl [N]	P [N]	Vc [N]	Mc [Nm]	Mt [Nm]	Ml [Nm]
4N	4" - 300#	2800	5600	4200	1120	1680	1456
1N-2N-3N	1" - 300#	700	1400	1050	18	105	18
5N	1" - 300#	700	1400	1050	18	105	18

FOUNDATION LOADS

CONDITION			ERECTION	OPERATING	HY-TEST
WEIGHT		[kg]	58700	58900	160400
WIND	LONG. SHEAR LOAD	[kN]	26	26	7
	TRANS. SHEAR LOAD	[kN]	77	77	20
	LONG. MOMENT	[kNm]	45	45	12.1
	TRASVERSAL MOMENT	[kNm]	132.8	132.8	34.5
EARTHQUAKE	LONG. SHEAR LOAD	[kN]	-	-	-
	TRANS. SHEAR LOAD	[kN]	-	-	-
	LONG. MOMENT	[kNm]	-	-	-
	TRASVERSAL MOMENT	[kNm]	-	-	-
			UNFACTORED LOAD		

- LONGIT. WIND SHEAR ACTING ON FIXED SADDLE
- TRANSV. WIND SHEAR IS THE GLOBAL VALUE ACTING ON THE EQUIPMENT. TO BE DIVIDED BY TWO FOR SHEAR ACTING ON THE SINGLE SADDLE

SHELL	SA 516 Gr.60 HIC
ELLIPTICAL HEAD	SA 516 Gr.60 HIC
SADDLE	SA 516 Gr.60
EXT. WELDED	SA 516 Gr.60
INT. WELDED	SA 516 Gr.60
INTERNALS REMOV.	-
FORGINGS (1N-2N-3N-4N-5N-K1-K2)	SA 350 LF2 CL.1
FORGINGS (M1-M2)	SA 350 LF2 CL.1
PIPES	SA 333 GR.6
BLIND FLANGES (M1-M2)	SA 350 LF2 CL.1
STUD BOLTS & NUTS	SA 193 GR.B7 / SA 194 GR.2H
INT. BOLTING	SA 193 GR.B6 / SA 194 GR.6
GASKET	
FLANGE GASKETS	S.W. 316 S.S. GRAPHITE FILLED WITH 316 S.S. INNER RING & EPOXY-COATED C.S. OUTER RINGS

MATERIALS LIST FOR MAIN COMPONENTS

Mechanical Calculation	1723001756-MAC-CAL-00003	23096-01-EMC1	M2	1	24"	300#	LWN-RF Spec. + BL.	46.05	609.6	80,0	SEE DWG	MANHOLE C/W DAVIT
			M1	1	24"	300#	LWN-RF Spec. + BL.	46.05	609.6	80,0	SEE DWG	MANHOLE C/W DAVIT
Shipping Drawing	1723001756-TI-DD-00021	23096-01-ESH1	K2	1	1"	300#	LWN-RF	14.3	25.4	-	1814	PRESS. TRASM. (CTRL)
Name Plates Drawing	1723001756-MAC-DD-00006	23096-01-ENP1	K1	1	1"	300#	LWN-RF	14.3	25.4	-	1814	PRESS. TRASM. (ESD)
Welding map Drawing	1723001756-WEL-DD-00014	23096-01-EWM1	5N	1	1"	300#	LWN-RF	14.3	25.4	-	1644	NITROGEN PURGING
Bill of Material & Notes	1723001756-MAC-DD-00024	23096-01-EBM1	4N	1	4"	300#	LWN-RF	22.2	101.6	35,0	1814	PSV CONNECTION
Details Drawing - 2	1723001756-MAC-DD-00023	23096-01-ED02	3N	1	1"	300#	LWN-RF + BL.	14.3	25.4	-	1644	DRAIN WITH BLIND
Details Drawing - 1	1723001756-MAC-DC-00005	23096-01-ED01	2N	1	1"	300#	LWN-RF	14.3	25.4	-	1814	HYDROGEN OUTLET
General Arrangement	1723001756-MAC-DA-00004	23096-01-EGA1	1N	1	1"	300#	LWN-RF	14.3	25.4	-	1644	HYDROGEN INLET
TITLE	Project Doc. No.	B&R Doc. No.	MK.	Q.TY	DIA.	RATING	TYPE FLANGE	THK.	I.D.	SELFREINF. THK.	PROJECTION	SERVICE

LIST OF DRAWINGS

NOZZLES TABLE

DESCRIPTION

DESIGN DATA TABLE

BREMBANA&ROLLE — VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.
PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK
PURCHASE ORDER No.: 1723001756 123A90A
LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.

B&R CAD FILE No: 23096-01-EGA1.dwg — MFR'S S.N. 23096-01-SNA/F — B&R DRAWING No. 23096-01-EGA1

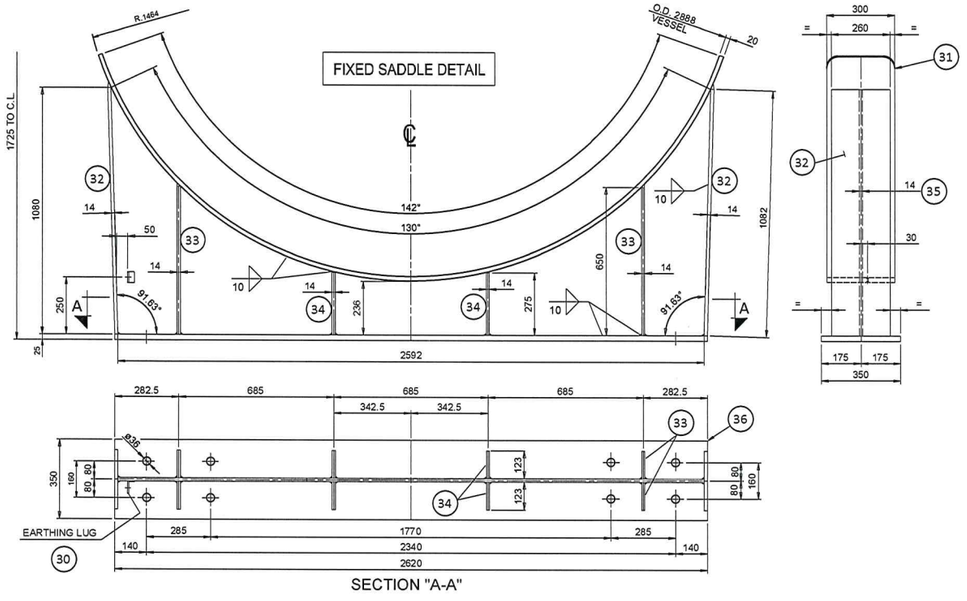
REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
5	14/05/2024	AG	AF	AF	ACCEPTED FOR CONSTRUCTION (AFC)
4	18/03/2024	AG	AF	AF	ACCEPTED FOR CONSTRUCTION (AFC)
3	21/02/2024	AG	AF	AF	ACCEPTED FOR CONSTRUCTION (AFC)
2	16/02/2024	AG	AF	AF	ISSUE FOR REVIEW (IFR)
1	21/12/2023	AG	AF	AF	ISSUE FOR REVIEW (IFR)
0	16/11/2023	AG	AF	AF	ISSUE FOR REVIEW (IFR)

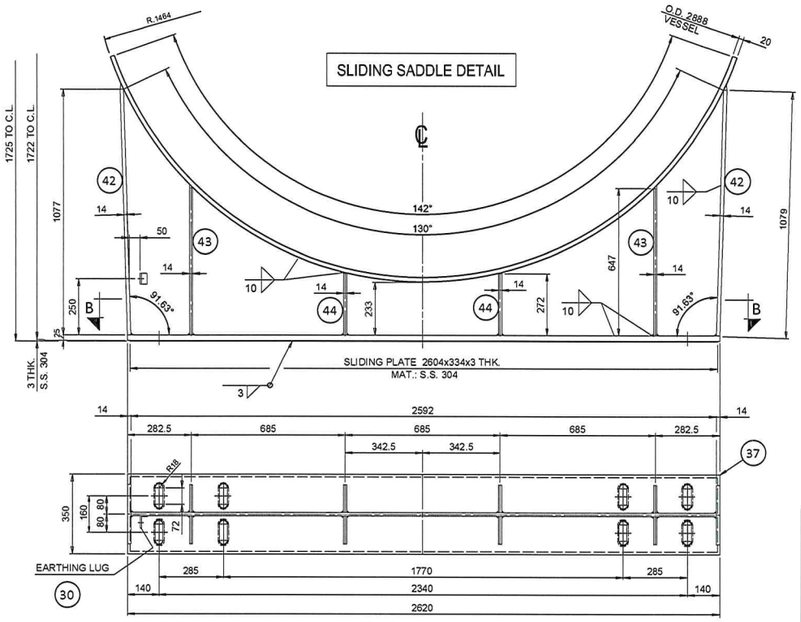
CROSSWIND — ROSETTI MARINO

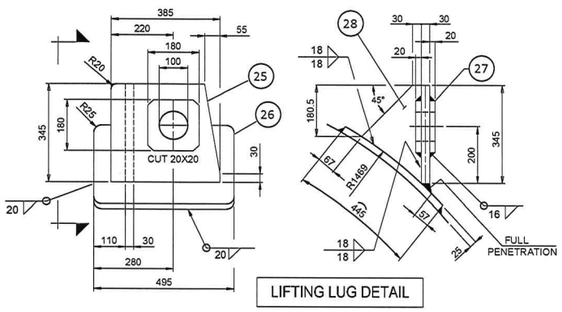
GENERAL ARRANGEMENT DRAWING AND FOUNDATION LOADING DIAGRAM
HYDROGEN STORAGE VESSEL ITEM : V-25001A/F

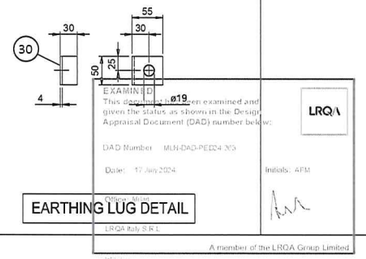
CONTRACT NO. CW-I-WP4-2023-05 / H2 STORAGE — SCALE 1:35
DRAWN A.FRANCO — CHECKED M.TONIOLO — APPROVED D.PASSERINI — DATE 14/05/24
A1 — DRAWING NO. 1723001756-MAC-DA-00004 — SHEET 1 — REV. 4

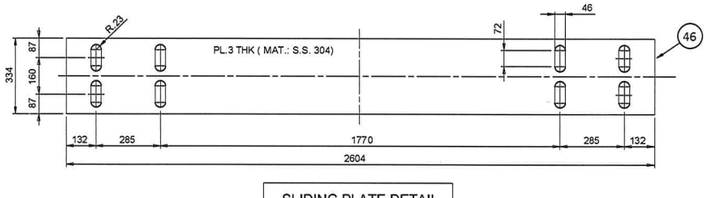
File Name : 1723001756-MAC-DA-00004.DWG

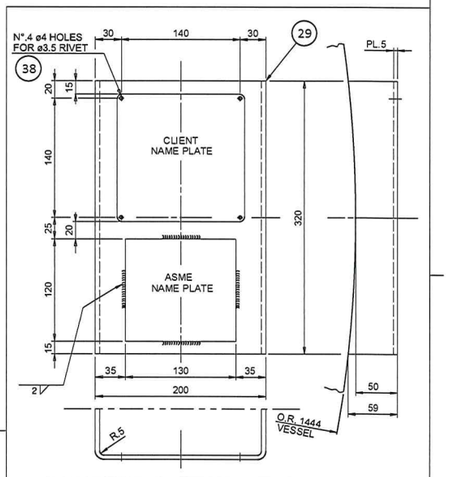


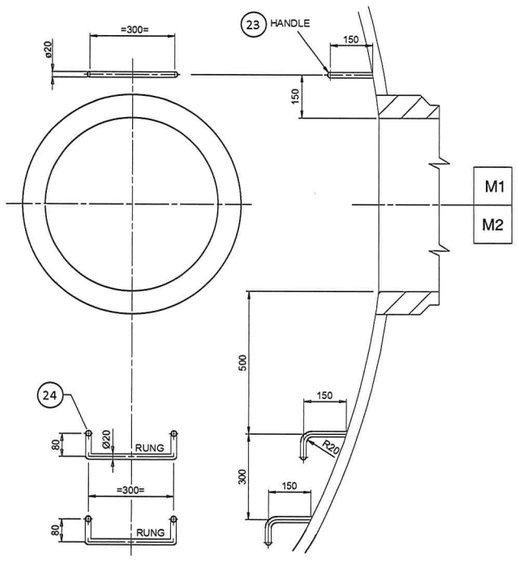


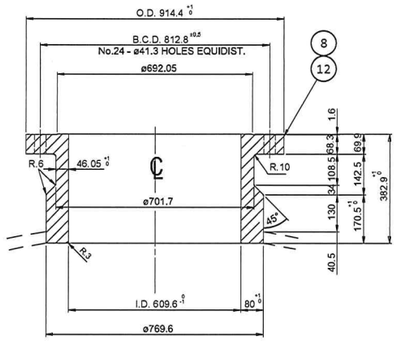


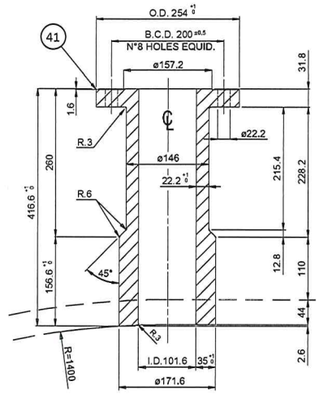












23096-01-EWM1	Welding map Drawing
23096-01-EBM1	Bill of material and General Notes
23096-01-ED02	Manhole Davit Detail
23096-01-EGA1	General Arrangement
Manufacturer Dwg. No.	Description
Reference documents/belong to drawing	

BREMBANA&ROLLE — VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.	PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK
PURCHASE ORDER No.: 1723001756 123A90A	LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.
IMAX CAD FILE No: 23096-01-EGA1.dwg	MFR'S S.N. 23096-01-SNA/F — B&R DRAWING No. 23096-01-ED01

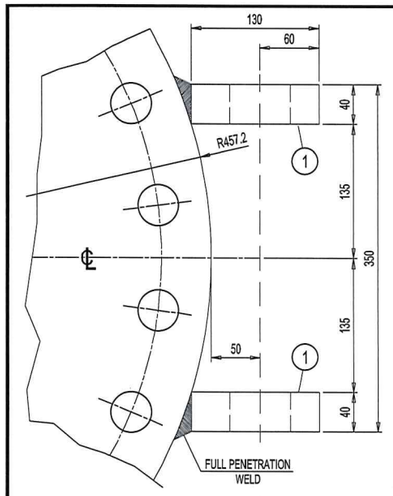
REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
2	21/03/2024				ISSUE FOR INFORMATION (IFI)
1	07/02/2024				ISSUE FOR INFORMATION (IFI)
0	23/11/2023				ISSUE FOR INFORMATION (IFI)

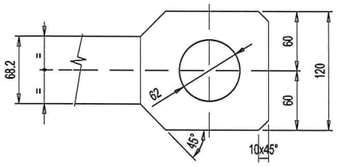
CROSSWIND — ROSETTI MARINO

DETAILED DRAWING INCLUDING CROSS SECTION-EXPLODED VIEW DRAWING
H2 STORAGE VESSEL ITEM : V-25001A/F

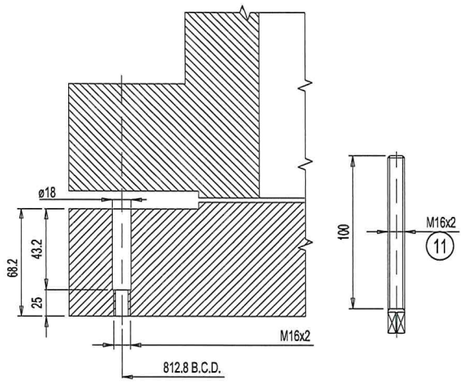
CONTRACT NO. CW-I-WP4-2023-05 / H2 STORAGE					SCALE 1:10
DRAWN D.ADELINI	CHECKED M.TONIOLO	APPROVED D.PASSERINI	DATE 23/11/23		
A1	DRAWING NO. 1723001756-MAC-DD-00005		SHEET 1	REV. 2	

File Name : 1723001756-MAC-DD-00005.DWG

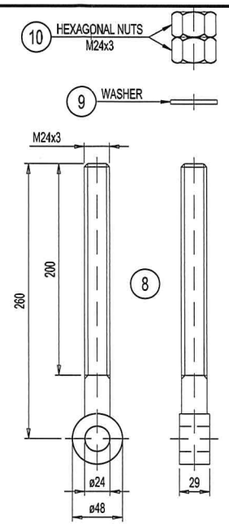




SUPPORT PLATES DETAIL

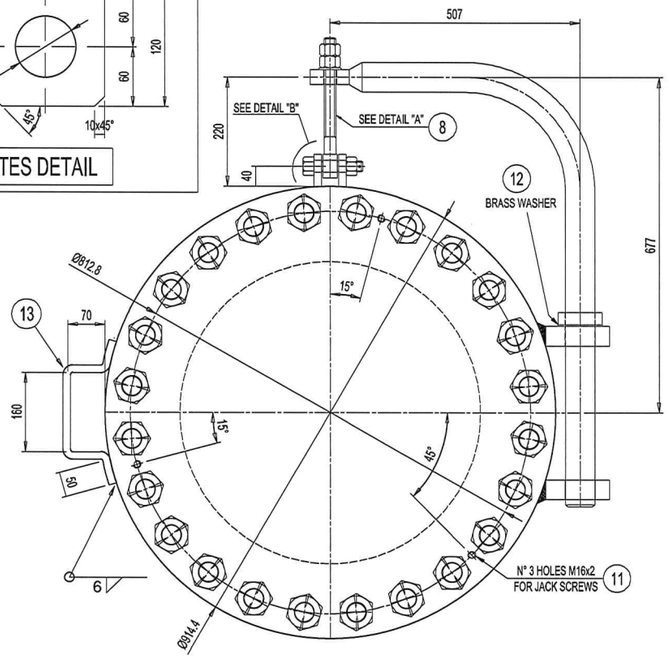


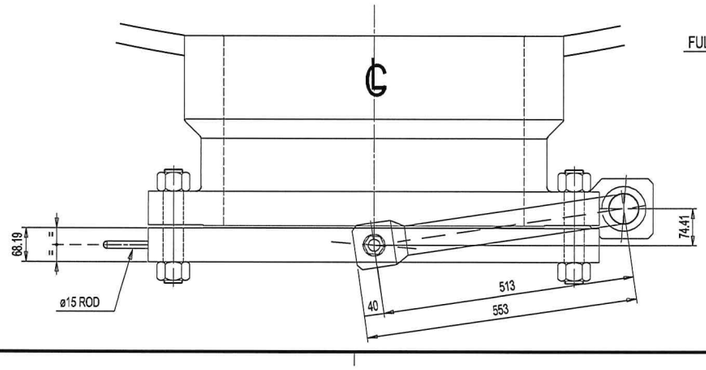
JACK SCREWS DETAIL



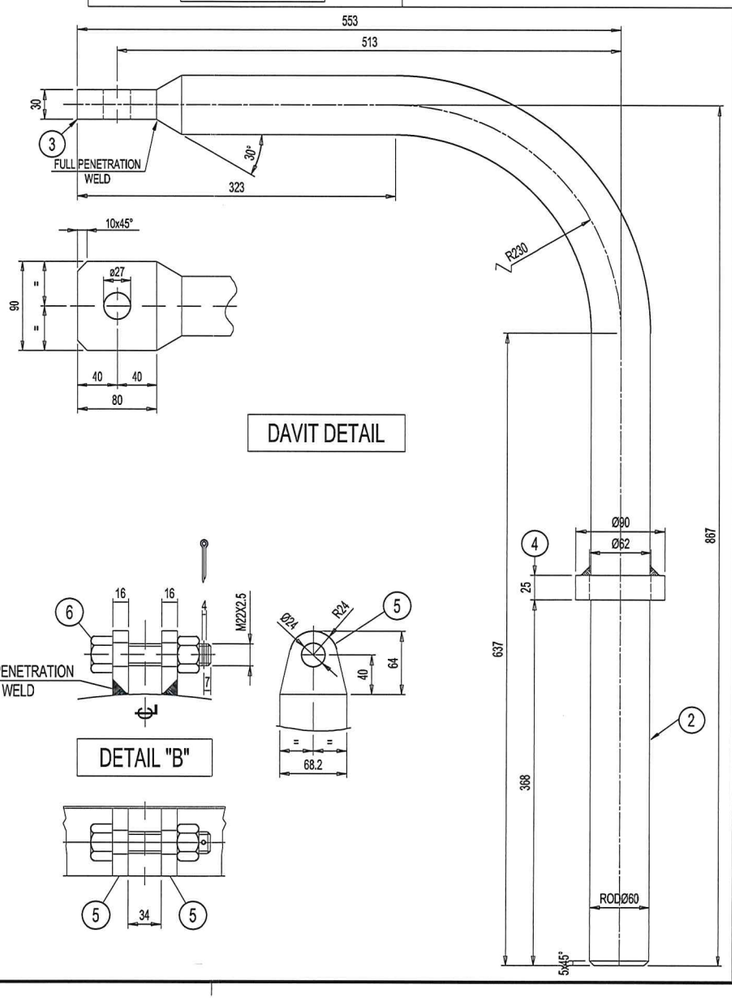
DETAIL "A"

13	ROD	1		SA 36	ø15-438 Lg.	–
12	WASHER	2		BRASS	90 O.D.-62 I.D.-3 Thk.	–
11	JACK SCREW H.H.	6		SA 307 Gr.B	M16x2-100 Lg.	Note 6b
10	HEXAGONAL NUT	4		SA 194 Gr.2H	M24x3	–
9	WASHER	2		SA 36 or equivalent	40 O.D.-25 I.D.-4 Thk.	–
8	EYE BOLT (SEE DETAIL)	2		SA 193 Gr.B7+ SA 194 Gr.2H	M24x3-260 Lg.	–
7	SPLIT PIN	2		S.S. 304	4 Dia.-45 Lg.	–
6	BOLT WITH NUT	2		SA 193 Gr.B7+ SA 194 Gr.2H	M22x2.5-100 Lg.	Note 6b
5	PLATE	4		SA 516 Gr.70	68x100x16 Thk.	3.1 Cert
4	RING	2		SA 516 Gr.70	90 O.D.-62 I.D.-25 Thk.	–
3	PLATE	2		SA 516 Gr.70	80x90x30 Thk.	–
2	ROD	2		SA 36 or equivalent	ø60-1236 Lg.	–
1	PLATE	4		SA 516 Gr.70	130x120x40 Thk.	3.1 Cert
MK	DESCRIPTION	Q.TY	Standard	MATERIAL	DIMENSIONS	Mat. test report
MC.	DESCRIZIONE	Q.TÀ	Standard	MATERIALE	DIMENSIONI	





DAVIT DETAIL



DETAIL "B"

23096-01-EGA1	General Arrangement
Manufacturer Dwg. No.	Description
Reference documents/belong to drawing	

EXAMINED
This document has been examined and given the status as shown in the Design Appraisal Document (DAD) number below:
LRQA
DAD Number: MLN-DAD-PED24-263
Date: 17 July 2024 Initials: AFM
Office: Milan
LRQA Italy S.R.L.
A member of the LRQA Group Limited

BREMBANA&ROLLE

VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.

PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK

PURCHASE ORDER No.: 1723001756 123A90A

LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.

B&R CAD FILE No: 23096-01-EGA1.dwg

MFR'S S.N. 23096-01-SNA/F

B&R DRAWING No. 23096-01-ED02

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
0	23/11/2023	AG	MT	DP	ISSUE FOR INFORMATION (IFR)

CROSSWIND

ROSETTI MARINO

DETAIL DRAWING MANHOLE DAVIT H2 STORAGE VESSEL ITEM : V-25001A/F

CONTRACT NO. CW-I-WP4-2023-05 / H2 STORAGE

SCALE 1:10

DRAWN D.ADELINI CHECKED M.TONIOLO APPROVED D.PASSERINI DATE 23/11/23

A2

DRAWING NO. 1723001756-MAC-DD-00023

SHEET 1

REV. 0

File Name : 1723001756-MAC-DD-00023.DWG

Mfr. Representative _____ Date 20-09-2024
Authorized Inspector _____ Date 20-09-2024

FORM A-1 MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS

As Required by the Provisions of the ASME Code Rules, Section VIII, Division 2

1. Manufactured and certified by Brembana & Rolle S.p.A. Via Delle Industrie 35 Albignasego (Padova) 35020 Italy
(Name and address of manufacturer)

2. Manufactured for Rosetti Marino S.p.A.
(Name and address of purchaser)

3. Location of installation CROSSWIND HOLLANDE KUST NOORD WIND PARK, NETHERLANDS
(Name and address)

4. Type: Horizontal (Horiz. or vert. tank) | 23096-01-SNA (Mfr.'s serial no.) | - (CRN) | (1) (Drawing no.) | 1032 (Nat'l. Bd. no.) | 2024 (Year built)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to ASME Code, Section VIII, Division 2.
2021 (Year) | 2 (Class) | - (Code case no.)

Items 6 to 11 incl. to be completed for single wall vessels, jackets of jacketed vessels, or shells of heat exchangers

6. Shell: SA 516 Gr.60 (Material (spec. no., grade)) | 44 mm (Nom. thk.) | 0 mm (Corr. allow.) | 2800 mm (Diameter) | 15400 mm (Length (overall))

7. Seams: Butt (Longitudinal) | (2) (Heat treatment) | VT-MT-RT 100% examination (Nondestructive examination)
Butt (Girth) | (2) (Heat treatment) | VT-MT-RT 100% examination (Nondestructive examination) | 5 (No. of courses)

8. Heads: (a) Matl. SA 516 Gr.60 (Spec. no., grade) (b) Matl. SA 516 Gr.60 (Spec. no., grade)

	Location (Top, Bottom, End)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	Left end	40 mm	0 mm	2450 mm	466.6 mm	2:1	-	-	-	both
(b)	Right end	40 mm	0 mm	2450 mm	466.6 mm	2:1	-	-	-	both

9. If removable, bolts used (describe other fastenings): - (Matl. spec. no., grade, size, number)

10. Jacket closure - (Describe as ogee and weld, bar, etc.) If bar, give dimensions -. If bolted, describe or sketch.

11. MAWP 40 Barg (Internal) F.V. (External) at max. temp. 80°C (Internal) 80°C (External) Min. design metal temp. -29°C at 40Barg
Impact test (3) At test temperature of (3)
Hydro., pneu., or comb test pressure Hydrostatic test

Items 12 and 13 to be completed for tube sections

12. Tubesheets
- (Stationary matl. (spec. no., grade)) | - (Diam. (subject to pressure)) | - (Nom. thk.) | - (Corr. allow.) | - (Attach. (wld., bolted))
- (Floating matl. (spec. no., grade)) | - (Diam.) | - (Nom. thk.) | - (Corr. allow.) | - (Attach. (wld., bolted))

13. Tubes
- (Matl. (spec. no., grade)) | - (O.D.) | - (Nom. thk.) | - (Number) | - (Type (straight or "U"))

Items 14 to 18 incl. to be completed for inner chambers of jacketed vessels, or channels of heat exchangers

14. Shell
- (Material (spec. no., grade)) | - (Nom. thk.) | - (Corr. allow.) | - (Diameter) | - (Length (overall))

15. Seams
- (Longitudinal) | - (Heat treatment) | - (Nondestructive examination)
- (Girth) | - (Heat treatment) | - (Nondestructive examination) | - (No. of courses)

16. Heads: (a) Matl. - (Spec. no., grade) (b) Matl. - (Spec. no., grade)

	Location (Top, Bottom, End)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	-	-	-	-	-	-	-	-	-	-
(b)	-	-	-	-	-	-	-	-	-	-

17. If removable, bolts used (describe other fastenings): - (Matl. spec. no., grade, size, number)

18. MAWP - (Internal) - (External) at max. temp. - (Internal) - (External) Min. design metal temp. - at -
Impact test - At test temperature of -
Hydro., pneu., or comb test pressure -

Mfr Representative _____ Date 20-09-2024
Authorized Inspector _____ Date 20-09-2024

FORM A-1

Page 2 of 3

Manufactured by Brembana & Rolle S.p.A. Via Delle Industrie 35 Albignasego (Padova) 35020 Italy

Manufacturer's Serial No. 23096-01-SNA CRN - National Board No. 1032

Items below to be completed for all vessels where applicable.

19. Nozzles inspection and pressure relief device openings

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diam. or Size	Type	Material	Nom. Thk.	Reinforcement Material	How Attached	Location
Note (4)	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

20. Body Flanges

Body Flanges on Shells

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

Body Flanges on Heads

No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Bolting			
									Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

21. Support Skirt no (Yes or no) Lugs 4 (No.) Legs 0 (No.) Other No.2 Saddles (Describe) Attached Welded on shell (Where and how)

22. Service: Fatigue analysis required no (Yes or no) and Hydrogen service (Describe contents or service)

Remarks:

(1) DWG 23096-01-EGA1 Rev.5; (2) Heat treated in furnace @610 ± 10°C for 3 hours, heating and cooling rate ≤60°C/h; (3) SA 516 Gr.60 plates are impact tested @-46°C. Exempt up to 44 mm @-29°C as per Fig. 3.8M and table 3.15 for Material in curve D. SA 350 LF2 CL.1 forging are impact tested @-46°C. Exempted down to -48°Cas per 3.11.2.4(b). SA 193 Gr.B7 bolting exempted from impact test up to 2 1/2" DIA as per Table 3.4. (4) See form A-3 enclosed. (5) See additional notes on form A-3

CERTIFICATION OF DESIGN

User's Design Specification on file at CROSSWIND HOLLANDE KUST NOORD WIND PARK, NETHERLANDS

Manufacturer's Design Report on file at Brembana & Rolle S.p.A. Via Delle Industrie 35 Albignasego (Padova) 35020 Italy

User's Design Specification certified by Miloslav Choc PE State United Kingdom Reg. No. 601144

Manufacturer's Design Report certified by Dana E. Petroni PE State Texas, U.S.A. Reg. No. 97934

CERTIFICATE OF SHOP COMPLIANCE

We certify that the statements in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 2.

"U2" Certificate of Authorization No. 25338 expires January 08, 2027

Date Sep 20, 2024 Co. name Brembana & Rolle SpA (Manufacturer) Signed _____ (Representative)

CERTIFICATE OF SHOP INSPECTION

Vessel made by Brembana & Rolle SpA at Rolle Shop – Via Delle Industrie 35 – Albignasego (Padova) – 35020 – Italy

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and employed by LRQA VERIFICATION LTD of UK, have inspected the pressure vessel described in this Manufacturer's Data Report on August 09, 2024, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 2. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's' Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date Sep 20, 2024 Signed _____ (Authorized Inspector) Commissions AI 13421 (National Board Authorized Inspector Commission number)

(07/21)

Mfr Representative _____ Date 20-09-2024
Authorized Inspector _____ Date 20-09-2024

FORM A-1

Page 3 of 3

Manufactured by Brembana & Rolle S.p.A. Via Delle Industrie 35 Albignasego (Padova) 35020 Italy

Manufacturer's Serial No. 23096-01-SNA CRN - National Board No. 1032

CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE

We certify that the field assembly construction of all parts of this vessel conforms with the requirements of Section VIII, Division 2 of the ASME BOILER AND PRESSURE VESSEL CODE.

"U2" Certificate of Authorization No. _____ expires _____

Date _____ Co. name _____ Signed _____
Assembler that certified and constructed field assembly — Representative

CERTIFICATE OF FIELD ASSEMBLY INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and employed by _____ of _____ have compared the statements in this Manufacturer's Data Report with the described pressure vessel and state that parts referred to as data items _____ not included in the certificate of shop inspection, have been inspected by me and that, to the best of my knowledge and belief, the Manufacturer has constructed and assembled this pressure vessel in accordance with the ASME Code, Section VIII, Division 2.

The described vessel was inspected and subjected to a hydrostatic test of _____.

By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date _____ Signed _____ Commissions _____
Authorized Inspector — National Board Authorized Inspector Commission number

(07/17)

Mfr. Representative: Date: 20-09-2024

Authorized Inspector: Date: 20-09-2024

FORM A-3 MANUFACTURER'S DATA REPORT

SUPPLEMENTARY SHEET

As Required by the Provisions of the ASME Code Rules, Section VIII, Division 2

1. Manufactured and certified by Brembana & Rolle S.p.A. Via Delle Industrie 35 Albignasego (Padova) 35020 Italy
(Name and address of Manufacturer)

2. Manufactured for Rosetti Marino S.p.A.
(Name and address of Purchaser)

3. Location of installation CROSSWIND HOLLANDE KUST NOORD WIND PARK, NETHERLANDS
(Name and address)

4. Type Horizontal (Horiz. or vert. tank) | 23096-01-SNA (Mfr.'s Serial No.) | - (CRN) | 23096-01-EGA1 rev.5 (Drawing No.) | 1032 (Nat'l Board. No.) | 2024 (Year Built)

Data Report Item Number

Remarks

(4)

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diam. or Size	Type	Material	Nom. Thk.	Reinforcement Material	How Attached	Location
1N Hydrogen inlet	1	1" 300#	LWN-RF	SA 350 LF2 CL1	14.3mm	no	4.2.10.6	-
2N Hydrogen outlet	1	1" 300#	LWN-RF	SA 350 LF2 CL1	14.3mm	no	4.2.10.6	-
3N Drain with blind (6)	1	1" 300#	LWN-RF+BLIND	SA 350 LF2 CL1	14.3mm	no	4.2.10.6	-
4N PSV Connection	1	4" 300#	LWN-RF	SA 350 LF2 CL1	22.2mm	no	4.2.10.6	-
5N Nitrogen purging	1	1" 300#	LWN-RF	SA 350 LF2 CL1	14.3mm	no	4.2.10.6	-
K1 Press. Trasm.(ESD)	1	1" 300#	LWN-RF	SA 350 LF2 CL1	14.3mm	no	4.2.10.6	-
K2 Press. Trasm.(CTRL)	1	1" 300#	LWN-RF	SA 350 LF2 CL1	14.3mm	no	4.2.10.6	-
M1 Manhole C/W davit (7)	1	24" 300#	LWN-RF special+BLIND	SA 350 LF2 CL1	46.05mm	no	4.2.10.6	-
M2 Manhole C/W davit (7)	1	24" 300#	LWN-RF special+BLIND	SA 350 LF2 CL1	46.05mm	no	4.2.10.6	-

(6) Nozzle N3 bolted to blind flange dia 1" 300# thk 15.9mm Material SA 350 LF2 CL1 with No.4 stud bolts dia 5/8" UNC B1.1 85 lg material SA 193 Gr.B7 and with No.8 nuts material SA 194 Gr.2H.

(7) Nozzles M1/M2 bolted to blind flange dia 24" 300# thk 68.2mm Material SA 350 LF2 CL1 with No.24 stud bolts dia 1 1/2" UNC B1.1 260 lg material SA 193 Gr.B7 and with No.48 nuts material SA 194 Gr.2H.

(8) Pressure safety valves shall be installed by user.

(9) HIC test for plates as per ISO 15156.

(10) No lethal service.

Date Sep 20, 2024 Co. Name Brembana & Rolle SpA (Manufacturer) Signed M.Galli (Representative)

Date Sep 20, 2024 Signed F. Zanon (Authorized Inspector) Commissions AI 13421 (National Board Authorized Inspector Commission number)

(07/17)

Fabrication site: Albignasego – PD – ITALY

Section 4

Declaration of Conformity acc. to PED 2014/68/UE / ATEX (if required)

DECLARATION OF CONFORMITY		No Documento / Document No	23096-01-SNA / CON
		Pagina / Page	01 of 01

We hereby certify that the following unit

ITEM: V-25001A - H2 STORAGE VESSEL S.N : 23096-01-SNA – Dwg. No. 23096-01-EGA1 Rev. 5

is in compliance with the essential safety requirements of 2014/68/UE directive :

ANNEX II, III & VII of PRESSURE EQUIPMENT DIRECTIVE 2014/68/UE		
DESIGN PARAMETERS		**SHELL SIDE**
Design pressure PS	(bar)	40 / F.V.
Design Temperature TS	(°C)	-29 / 80
Volume	(litre)	101200
Fluid Group		1
Table		1
Category		IV
Module		G
Pressure Test	(barg)	57.2

Code applied: ASME VIII Div. 2 CLASS2 2021 Ed.; PED 2014/68/UE.

Notified Body: LRQA Inspection Iberia, S.A. C/Princesa, 29,1°. 28008 Madrid

Authorization No 0094

Certificate of Conformity according to Module G. Report No.: 0094/PED/MLN/240392 ENG

BREMBANA&ROLLE S.p.A.
Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)

M. ROTTOLI
C.E.O.

07/10/24

Signature and Date

Fabrication site: Albignasego – PD – ITALY

Section 5

ITP approved, signed and stamped for each activity which has been witnessed and/or reviewed by any representative of involved parties

SERIAL No. 23096-01-SNA

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**INSPECTION AND TEST PLAN** **V-25001 A ~~%~~ F** **H2 STORAGE VESSEL**	Sheet 1 of 16 Date: 31/05/2024 Rev: 03

Base Load Power Hub (BLPH)

INSPECTION AND TEST PLAN ITEM V-25001 A ~~%~~ F
H2 STORAGE VESSEL

Document Number: 1723001756-QC-ITP-00002

Document Class: 2

ROSETTI MARINO	
1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED
NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.	
Sign	Date
R.Dgl.Espo.Tr	24/06/2024

03	31/05/2024	Accepted for Construction (AFC)	M.Rampazzo	P.Franzolin	M.Galli
02	07/03/2024	Issue for Review	M.Rampazzo	P.Franzolin	M.Galli
01	24/01/2024	Issue for Review	M.Rampazzo	P.Franzolin	M.Galli
00	24/11/2023	Issue for Review	M.Rampazzo	P.Franzolin	M.Galli
Rev.	Date	Description	Prepared	Reviewed	Approved

B&R BREMBANA&ROLLE

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**INSPECTION AND TEST PLAN** **V-25001 A % F** **H2 STORAGE VESSEL**	Sheet 2 of 15 Date: 31/05/2024 Rev: 03

Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
01	Issue for Review (IFR)
02	Issue for Review (IFR)
03	Issue for Review (IFR)

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**INSPECTION AND TEST PLAN** **V-25001 A % F** **H2 STORAGE VESSEL**	Sheet 3 of 15 Date: 31/05/2024 Rev: 03

HOLDS LIST

No.	Description
1	
2	
3	
4	

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QUALITY CONTROL PLAN

Doc.N°:	23096-01-QCPA
Sheet	1 of 13

Albignasego - Padova (Italy)

Project	*Crosswind Hollande Kust Noord Wind Park Project*	Job N°	*23096*	Dwg N°	*23096-01-EGA1*
Owner	*CROSSWIND*	P.O. N°	*1723001756 123A90A*	Base Material	*SA 516 Gr.60 HIC*
Purchaser	*ROSETTI MARINO*	Item N°	*V25001 A~~-F~~ A*	WOL Material	
Vendor	*B&R*	Serial N°	*23096-01-SNA~~-F~~ A*	Clad Material	

Applicable Documents

CODE		CLIENT SPEC.S	
☑	ASME VIII Div.2 Ed 2021 Cl.2	☑	123A90-DDL-MAC-SP-50026
☑	ASME V Ed 2021	☐	
☑	ASME II/A Ed 2021	☐	
☑	ASME II/C Ed 2021	☐	
☑	ASME IX Ed 2021	☐	
☑	ASME B16.5	☐	
☑	2014/68/EU	☐	
☐		☐	
☐		☐	

Inspection Agencies

☑	B&R
☑	ROSETTI
☑	CROSSWIND
☑	ASME Inspector
☑	PED Inspector

MDMT	-29°C
ASME STAMP	REQUIRED
NATIONAL BOARD	REQUIRED
LETHAL SERVICE	NOT REQUIRED
HYDROGEN SERVICE	REQUIRED
NOTIFICATION ADVICE TIME	10 CALENDAR DAYS FOR W & HOLD POINTS

V	:	*B&R*	*C1*	:	*ASME Inspector*
P	:	*ROSETTI*	*C2*	:	*PED Inspector*
O	:	*CROSSWIND*			

Abbreviations

W	*Witness point*	VT	Visual Test	PMI	Positive mat.identification
H	*Hold point*	DC	Dimensional Check	HT	Hardness Test
R	*Review*	PT	Penetrant Test	PA	Phased Array
S	*Spot Witness*	MT	Magnetic Test	TOFD	Time of flight Diffraction
M	*Monitoring*	RT	Radiographic Test		
A	*Approval*	UT	Ultrasonic Test		
I	*Random inspection*				
WFO	*Witness First Of*				

Surveillance Inspection	Level

APPROVALS / SIGNATURE AND DATE

Inspection Agency	ASME/PED Inspector
LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 09/08/2024	☐ LRQA verification ltd ☑ 0034 ☐ ☐ Witnessed ☐ Monitored ☑ Reviewed MATTIA CRIVELLARI Ref. No.. Office: Milan 09/08/2024

Rev.N°	Date	Description	Prepared by	Checked by	Approved by
03	30/05/2024	Issued for Approval	P.Franzolin	S.Volpato	M.Galli
02	06/03/2024	Issued for Approval	P.Franzolin	S.Volpato	M.Galli
01	24/01/2024	Issued for Approval	P.Franzolin	S.Volpato	M.Galli
00	21/11/2023	Issued for Approval	P.Franzolin	S.Volpato	M.Galli

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QUALITY CONTROL PLAN

Doc.N°:	23096-01-QCPA
Sheet	

Albignasego - Padova (Italy)

Project	*Crosswind Hollande Kust Noord Wind Park Project*	Job N°	*23096*	Dwg N°	*23096-01-EGA1*
Owner	*CROSSWIND*	P.O. N°	*1723001756 123A90A*		
Purchaser	*ROSETTI MARINO*	Item N°	*V25001 A÷F* A		
Vendor	*B&R*	Serial N°	*23096-01-SNA÷F* A		

Applicable Documents

Client Doc.N°	B&R Doc.N°	Title	Revision 0	1	2	3	4	5	6	7	8	9	10
	23096-01-EGA1	General Arrangement	X	X	X	X	X	X					
	23096-01-EMC1	Mechanical Calculation	X	X	X	X							
	23096-01-TWB1	Welding Book	X	X	X	X	X						
	23096-01-QCPA	Quality Control Plan	X	X	X	X	X						
	23096-TPWF	Post Weld Heat Treatment	X	X	X								
	23096-QNDE	NDE Procedure	X	X	X	X							
	23096-QHT1	Hydrostatic pressure testing procedure	X	X	X	X							

Applicable Standard / Specification

Ref.Doc.N°	B&R Doc.N°	Title	B&R Doc.Revision
23096-QNDE	001 RT 21	Radiographic examination procedure	0 1 2 3 4 5 6 7 8 9 10
23096-QNDE	002 PT 21	Liquid penetrant test procedure	0 1 2 3 4 5 6 7 8 9 10
23096-QNDE	003 MT 21	Magnetic particle inspection procedure	0 1 2 3 4 5 6 7 8 9 10
23096-QNDE	004 UTA 21	Ultrasonic manual inspection procedure of ferritic welds	0 1 2 3 4 5 6 7 8 9 10
23096-QNDE	006 DC 21	Dimensional check procedure	0 1 2 3 4 5 6 7 8 9 10
23096-QNDE	007 VT 21	Visual test procedure	0 1 2 3 4 5 6 7 8 9 10
23096-QNDE	008 HB	Hardness test procedure	0 1 2 3 4 5 6 7 8 9 10
23096-QHT1	100 HPT 21	Hydrostatic pressure testing procedure	0 1 2 3 4 5 6 7 8 9 10
			0 1 2 3 4 5 6 7 8 9 10
			0 1 2 3 4 5 6 7 8 9 10
			0 1 2 3 4 5 6 7 8 9 10
			0 1 2 3 4 5 6 7 8 9 10
			0 1 2 3 4 5 6 7 8 9 10
			0 1 2 3 4 5 6 7 8 9 10
			0 1 2 3 4 5 6 7 8 9 10
			0 1 2 3 4 5 6 7 8 9 10
			0 1 2 3 4 5 6 7 8 9 10
			0 1 2 3 4 5 6 7 8 9 10

Sub-Contractor Documents

Client Doc.N°	B&R Doc.N°	Title	Revision 0	1	2	3	4	5	6	7	8	9	10
	23096-QHF	Head Forming procedure	X										

1723001756-QC-DB-00017_02 - V25001A

QUALITY CONTROL PLAN

Doc.N°:	23096-01-QCPA
Albignasego - Padova (Italy)	Sheet 3 of 13

Project	*Crosswind Hollande Kust Noord Wind Park Project*	Job N°	*23096*	Dwg N° :	*23096-01-EGA1*
Owner	*CROSSWIND*	P.O. N°	*1723001756 123A90A*		
Purchaser	*ROSETTI MARINO*	Item N°	*V25001 A÷F* A		
Vendor	*B&R*	Serial N°	*23096-01-SNA÷F* A		

	Activities/Fabrication Steps	Test/Inspection	Extent of Inspection	B&R Reference Doc.	Client spec.	Acceptance Criteria	Doc. Required	Involved Party: Date	V: Point	B&R Sign	P: Point	ROSETTI Sign	O: Point	CROSSWIND Sign	C1: Point	ASME Inspector Sign	C2: Point	PED Inspector Sign	Report N°	REMARKS
Step N°	CHAPTER 1 - Documents Approval																			
1	Pre-inspection meeting		100%	PIM Agenda	==	====	MoM of PIM	14/02/24	H		R		R						==	
2	Calculations	Approval	100%	23096-01-EMC1	ASME VIII Div.2 Ed 2021 Cl.2	Contractual doc.s & code	Approval stamp	10/04/24	H		R		A/R		R		R		==	HLN/DAD/PED/263 iss.1 DATED 17/07/24
3	Drawings	Approval	100%	23096-01-EGA1	ASME VIII Div.2 Ed 2021 Cl.2	Contractual doc.s & code	Approval stamp	10/04/24	H		R		A/R		R		R		==	
4	Welding book	Approval	100%	23096-01-TWB1	ASME VIII Div.2 Ed 2021	Contractual doc.s & code	Approval stamp	31/04/24	H		A		A/R		R		R		==	
5	NDE Operators qualification	Approval	100%	000 NDE 21	ASME IX Ed 2021	EN473 / ISO9712 lev.2	Approval stamp	05/04/24	H		A		A/R		R		R		==	
6	NDE procedures	Approval	100%	23096-QNDE	ASME V Ed 2021	Contractual doc.s & code	Approval stamp	02/04/24	H		A		A/R		R		R		==	
Step N°	CHAPTER 2 - Material identification & Receivment inspection																			
7	NON PRESSURE Plates	VT,DC & marking check	100%	140 MIT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME II/A & Material purchase specification	Mat'l test report 2.2		H		R		M/R						==	
8	Plates	VT,DC & marking check	100%	140 MIT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME II/A & Material purchase specification	Mat'l test report 3.1	29/03/24	H		R		M/R		R	17. SEP. 2024	R	17. SEP. 2024		
9	Forgings	VT,DC & marking check	100%	140 MIT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME II/A & Material purchase specification	Mat'l test report 3.1	03/04/24	H		R		M/R		R	17. SEP. 2024	R	17. SEP. 2024		
10	Gaskets	VT,DC & marking check	100%	140 MIT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME II/A & Material purchase specification	Mat'l test report 3.1	30/06/24	H		R		M/R		R	17. SEP. 2024	R	17. SEP. 2024		
11	Bolts & nuts	VT,DC & marking check	100%	140 MIT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME II/A & Material purchase specification	Mat'l test report 3.1	30/06/24	H		R		M/R		R	17. SEP. 2024	R	17. SEP. 2024		
12	Welding Consumables	VT,DC & marking check	100%	203 CWC 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME II/C	Mat'l test report 3.1		H		R		M/R				R	17. SEP. 2024	==	

1723001756-QC-DB-00017_02 - V25001A

QUALITY CONTROL PLAN

Doc.N°:	23096-01-QCPA
Albignasego - Padova (Italy)	Sheet: 4 of 13

Project	Crosswind Hollande Kust Noord Wind Park Project	Job N°	23096	Dwg N° :	23096-01-EGA1
Owner	CROSSWIND	P.O. N°	1723001756 123A90A		
Purchaser	ROSETTI MARINO	Item N°	V25001 A-F A		
Vendor	B&R	Serial N°	23096-01-SNA-F A		

	Activities/Fabrication Steps	Test/Inspection	Extent of Inspection	B&R Reference Doc.	Client spec.	Acceptance Criteria	Doc. Required	Involved Party: Date	V: Point	B&R Sign	P: Point	ROSETTI Sign	O: Point	CROSSWIND Sign	C1: Point	ASME Inspector Sign	C2: Point	PED Inspector Sign	Report N°	REMARKS
Step N°	CHAPTER 3 - Saddles (by supplier)																			
13	Saddles complete	VT	100%	Construction drawing	Doc.N° 123A90-DDL-MAC-SP-50026	==== ASME V - Art.9	====	21/06/24	H	B&R	R		M/R				R 17. SEP. 2024		
14	Saddles complete	Dimensional Check	100%	006 DC 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2	Test report	21/06/24	H	B&R	R		M/R				R 17. SEP. 2024	23096-01-SNA-DC	03
Step N°	CHAPTER 3 - Right & Left Head - Hot formed																			
15	Formed head	Hot Forming	100%	206 HF	Doc.N°23096-QHF	==== ==	Forming Declaration	15/04/24	H	B&R	R		M/R		R		R	==		By supplier
16	Formed head	VT	100%	206 HF	Doc.N° 123A90-DDL-MAC-SP-50026	No seizing ASME V - Art.9	Test report	09/04/24	H	B&R	R		M/R		W		R 23/04/2024	23096-01-SNA-VT	01	
17	Formed head	DC	100%	206 HF	Doc.N° 123A90-DDL-MAC-SP-50026	Asme VIII/2 4.3.2.2	Test report	09/04/24	H	B&R	R		M/R		W/R		R 23/04/2024	23096-01-SNA-DC	01-02	
	Nozzle M1-1N-5N to Left Head																			
18	Complete equipment	MT on temporary attachment welds before lifting	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	16/04/24	H	B&R	R		M/R		R 17. SEP. 2024		R 17. SEP. 2024	23096-01-SNA-MT	1A	
19	Weld bevel	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	16/04/24	H	B&R	R		M/R		R 17. SEP. 2024		R 17. SEP. 2024	23096-01-SNA-MT	01	
20	Fit-up	VT	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.2.2 ASME V - Art.9	====		H	B&R			W/R		W/R		R 20/05/2024	==		JOINT NOZZLE 1 M1
21	Welding parameters	Monitoring	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME IX	Report	15/05/24	H	B&R	R		W/R		R		R	==		
22	Complete base welding	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	21/05/24	H	B&R	WFO		W/R		R 17. SEP. 2024		R 17. SEP. 2024	23096-01-SNA-MT	02	
23	Complete equipment	UT on nozzle joint M1-1N-5N	100%	004 UTA 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.4.2 ASME V - Art.4		21/05/24	H	B&R	WFO		W/R		R 17. SEP. 2024		R 17. SEP. 2024	23096-01-SNA-UT	01	
24	Weld repair (if any)		100%	Relevant WPS		==	==		H	N.A.	W	N.A.	W	N.A	W/R					2 26/02/25

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QUALITY CONTROL PLAN

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Project	Crosswind Hollande Kust Noord Wind Park Project	Job N°	23096	Dwg N° :	23096-01-EGA1
Owner	CROSSWIND	P.O. N°	1723001756 123A90A		
Purchaser	ROSETTI MARINO	Item N°	V25001 A~~F~~A		
Vendor	B&R	Serial N°	23096-01-SNA~~F~~A		

	Activities/Fabrication Steps	Test/Inspection	Extent of Inspection	B&R Reference Doc.	Client spec.	Acceptance Criteria	Doc. Required	Involved Party: Date	V: Point	B&R Sign	P: Point	ROSETTI Sign	O: Point	CROSSWIND Sign	C1: Point	ASME Inspector Sign	C2: Point	PED Inspector Sign	Report N°	REMARKS
	Nozzle M2 to Right Head																			
25	Complete equipment	MT on temporary attachment welds before lifting	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	16/04/24	H		R		M/R		R	17. SEP. 2024	R	17. SEP. 2024	23096-01-SNA-MT-	1A
26	Weld bevel	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	16/04/24	H		R		M/R		R	17. SEP. 2024	R	17 SEP 2024	23096-01-SNA-MT-	01
27	Fit-up	VT	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.2.2 ASME V - Art.9	====	06/05/24	H				W/R		W/R		R		==	1
28	Welding parameters	Monitoring	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME IX	Report		H		R		W/R		R		R		==	
29	Complete base welding	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report		H		R		W/R		R	17. SEP. 2024	R	17 SEP 2024	23096-01-SNA-MT-	03
30	Complete equipment	UT on nozzle joint M2	100%	004 UTA 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.4.2 ASME V - Art.4		24/05/24	H		R		W/R		R	17. SEP. 2024	R	17. SEP. 2024	23096-01-SNA-UT-	02
31	Weld repair (if any)		100%	Relevant WPS		==	==		H	N.A.	W	N.A.	W	N.A.	W/R					2
Step N°	CHAPTER 4 - SHELL ASSEMBLY - Before PWHT																			
	Longitudinal welds - Course 1 to Course 5 - Weld L1/L2/L3/L4/L5																			
32	Weld bevel	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	13/03/24 21/04/24	H		R		WFO /M/R		R	17. SEP. 2024	R	17 SEP 2024	23096-01-SNA-MT-	04
33	Fit-up	VT	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.2.2 ASME V - Art.9	====	13/03/24 21/04/24	H				WFO /M/R		W/R		R		==	WELD L3
34	Welding parameters	Monitoring	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME IX	Report	13/03/24 21/04/24	H		R		WFO /M/R		R		R		==	
35	Complete base welding	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	13/04/24	H		R		WFO /M/R		R	17. SEP. 2024	R	17. SEP. 2024	23096-01-SNA-MT-	05
36	Complete base welding	RT on welds L1/L2/L3/L4/L5	100%	001 RT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.3.2 ASME V - Art.2	Test report	21/03/24	H		R		WFO /M/R		R		R		23096-01-SNA-RT-	01
37	Weld repair (if any)		100%	Relevant WPS		==	==		H	N.A.	W	N.A.	W	N.A.	W/R					2

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QUALITY CONTROL PLAN

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Project	*Crosswind Hollande Kust Noord Wind Park Project*	Job N°	*23096*	Dwg N° :	*23096-01-EGA1*
Owner	*CROSSWIND*	P.O. N°	*1723001756 123A90A*		
Purchaser	*ROSETTI MARINO*	Item N°	*V25001 A-FA*		
Vendor	*B&R*	Serial N°	*23096-01-SNA-FA*		

	Activities/Fabrication Steps	Test/Inspection	Extent of Inspection	B&R Reference Doc.	Client spec.	Acceptance Criteria	Doc. Required	Involved Party: Date	V: Point	B&R Sign	P: Point	ROSETTI Sign	O: Point	CROSSWIND Sign	C1: Point	ASME Inspector Sign	C2: Point	PED Inspector Sign	Report N°	REMARKS
	Nozzles 2N/3N/4N/K1/K2 to Shell course 5																			
38	Weld bevel	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	==		H		R		WFO /M/R		R	17 SEP. 2024	R	17 SEP. 2024	23096-01-SNA-06	==
39	Fit-up	VT	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.2.2 ASME V - Art.9	====	23/05/24	H				WFO /M/R		W/R		R		==	1
40	Welding parameters	Monitoring	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME IX	Report		H		R		WFO /M/R		R		R		==	
41	Complete base welding	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	04/06/24	H		R		WFO /M/R		R	17 SEP. 2024	R	17 SEP. 2024	23096-01-SNA-MT-07	
42	Complete equipment	UT on nozzles joints 2N/3N/4N/K1/K2	100%	004 UTA 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.4.2 ASME V - Art.4	Test report		H		R		WFO /M/R		R	17 SEP. 2024	R	17 SEP. 2024	23096-01-SNA-UT-03	
43	Weld repair (if any)		100%	Relevant WPS		==	==		H	N.A.	W	N.A.	W	N.A.	W/R					2
	Circumferential welds - Course 1 to Course 5 - Weld C2/C3/C4/C5																			
44	Weld bevel	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report		H		R		WFO /M/R		R	17 SEP. 2024	R	17 SEP. 2024	23096-01-SNA-MT-08	
45	Fit-up	VT	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.2.2 ASME V - Art.9	====	04/06/24	H				WFO /M/R		W/R	12/06/2024	R	12/06/2024	==	Joint C5&C2
46	Welding parameters	Monitoring	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME IX	Report		H		R		WFO /M/R		R		R		==	
47	Complete base welding	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	04/06/24	H		R		WFO /M/R		R	17 SEP. 2024	R	17 SEP. 2024	23096-01-SNA-MT-09	
48	Complete base welding	RT on welds C2/C3/C4/C5	100%	001 RT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.3.2 ASME V - Art.2	Test report	13/05/24	H		R		WFO /M/R		R	09/08/2024	R	09/08/2024	23096-01-SNA-RT-01	
49	Weld repair (if any)		100%	Relevant WPS		==	==		H	N.A.	W	N.A.	W	N.A.	W/R					

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Project	Crosswind Hollande Kust Noord Wind Park Project	Job N°	23096	Dwg N° :	23096-01-EGA1
Owner	CROSSWIND	P.O. N°	1723001756 123A90A		
Purchaser	ROSETTI MARINO	Item N°	V25001 A~~F~~ A		
Vendor	B&R	Serial N°	23096-01-SNA~~F~~ A		

	Activities/Fabrication Steps	Test/Inspection	Extent of Inspection	B&R Reference Doc.	Client spec.	Acceptance Criteria	Doc. Required	Involved Party: Date	V: Point	B&R Sign	P: Point	ROSETTI Sign	O: Point	CROSSWIND Sign	C1: Point	ASME Inspector Sign	C2: Point	PED Inspector	Report N°	REMARKS
	Right & Left head to Shell - Weld C1/C6																			
50	Weld bevel	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	01/07/24	H	B&R	R		WFO /M/R		R	LRQA 17. SEP. 2024	R	LRQA 17. SEP. 2024	23096-01-SNA-MT-	10
51	Fit-up	VT	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.2.2 ASME V - Art.9	====	01/07/24	H	B&R			WFO /M/R		W/R	LRQA	R	LRQA	==	
52	Welding parameters	Monitoring	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME IX	Report		H	B&R	R		WFO /M/R		R	LRQA	R	LRQA	==	
53	Complete base welding	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report		H	B&R	R		WFO /M/R		R	17. SEP. 2024 LRQA	R	17. SEP. 2024 LRQA	23096-01-SNA-MT-	11
54	Complete base welding	RT on weld C1/C6	100%	001 RT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.3.2 ASME V - Art.2	Test report		H	B&R	R		WFO /M/R		R	LRQA 05/08/2024	R	0054 LRQA 09/08/2024	23096-01-SNA-RT-	01
55	Weld repair (if any)		100%	Relevant WPS		==	==		H	N.A.	W	N.A.	W	N.A.	W/R					
	Internal & External attachments assembly (including saddles and lifting devices)																			
56	Weld bevel	MT	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	17/06/24	H	B&R	R		M/R		R	LRQA 17. SEP. 2024	R	LRQA 17. SEP. 2024	23096-01-SNA-MT-	12
57	Fit-up	VT	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.2.2 ASME V - Art.9	====	18/06/24	H	B&R	R		M/R		W/R	LRQA	R	LRQA	==	
58	Welding parameters	Monitoring	100%	Relevant WPS	Doc.N° 123A90-DDL-MAC-SP-50026	ASME IX	Report	21/06/24	H	B&R	R		M/R		R	LRQA	R	LRQA	==	
59	Complete equipment	MT on internal & external attachment welds	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report		H	B&R	R		M/R		R	17. SEP. 2024 LRQA	R	17. SEP. 2024 LRQA	23096-01-SNA-MT-	13
Step N°	**CHAPTER 5 - NDE - Before PWHT**																			
60	Complete equipment	Internal & External visual inspection	100%	007 VT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.2.2 ASME V - Art.9	Test report	25/07/24	H	B&R	R		W/R		H	25/07 LRQA	H	25/07 LRQA	23096-01-SNA-VT-	02
61	Complete equipment	Dimensional check	100%	006 DC 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 Approved drawings	Test report	25/07/24	H	B&R	R		W/R		W	25/07 LRQA	H	25-07 LRQA	23096-01-SNA-DC-	04

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Project	Crosswind Hollande Kust Noord Wind Park Project	Job N°	23096	Dwg N° :	23096-01-EGA1
Owner	CROSSWIND	P.O. N°	1723001756 123A90A		
Purchaser	ROSETTI MARINO	Item N°	V25001 A÷F A		
Vendor	B&R	Serial N°	23096-01-SNA÷F A		

	Activities/Fabrication Steps	Test/Inspection	Extent of Inspection	B&R Reference Doc.	Client spec.	Acceptance Criteria	Doc. Required	Involved Party: Date	V: Point	B&R Sign	P: Point	ROSETTI Sign	O: Point	CROSSWIND Sign	C1: Point	ASME Inspector Sign	C2: Point	PED Inspector Sign	Report N°	REMARKS
62	Complete equipment	MT on removed att.s areas	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	25/07/24	H		R		W/R		R		R		23096-01-SNA-MT -	14
63	Complete equipment	UT on lifting devices (if full penetration)	100%	004 UTA 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.4.2 ASME V - Art.4	Test report	25/07/24	H		R		W/R		R		R7		23096-01-SNA-UT-	04
64	Production test plates	Preparation & Welding	100%	23096-TPTP	Doc.N° 123A90-DDL-MAC-SP-50026	Const. DWG	AI & Stamp		H	N.A.	W	N.A.	W/R	N.A.	R	N.A.	R	N.A.	==	if any
Step N°	CHAPTER 6 - PWHT																			
65	PWHT	Thermocouples placement	100%	Relevant HTCF	Doc.N° 123A90-DDL-MAC-SP-50026	Asme VIII/2 6.6.6.2	Heat treatment record chart	26/07/24	H		W R		M/R		R		R		==	
66	PWHT	Shell and PTP in furnace	100%	22131-TPWF	Doc.N° 123A90-DDL-MAC-SP-50026	Asme VIII/2 6.6.6.2	Heat treatment record chart		H		W R		M/R		R		R		==	
Step N°	CHAPTER 7 - NDE after PWHT																			
67	Complete equipment	Internal & External visual inspection	100%	007 VT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.2.2 ASME V - Art.9	Test report	05/08/24 02/08/24	H		H		W/R		H		H		23096-01-SNA-VT -	03
68	Complete equipment	Dimensional Check	100%	006 DC 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 Approved drawings	Test report	05/08/24 02/08/24	H		H		W/R		H		H		23096-01-SNA-DC -	05
69	Complete equipment	MT on all butt joints	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	02/08/24	H		W R		W/R		R		R		23096-01-SNA-MT - A	A-1
70	Complete equipment	MT on removed att.s areas	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	02/08/24	H		W R		W/R		R		R		23096-01-SNA-MT - A	A-1
71	Complete equipment	MT on attachments welds	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	02/08/24	H		W R		W/R		R		R		23096-01-SNA-MT - A	A-1
72	Complete equipment	UT on nozzles joints	100%	004 UTA 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.4.2 ASME V - Art.4	Test report	02/08/24	H		W R		W/R		R		R		23096-01-SNA-UT - A	A-1
73	Complete equipment	UT on welds C1/C2/C3/C4/C5/C6/L1/L2/L3/L4/L5	100%	004 UTA 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.4.2 ASME V - Art.4	Test report	02/08/24	H		W R		W/R		R		R		23096-01-SNA-UT - A	A-2

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Project	*Crosswind Hollande Kust Noord Wind Park Project*	Job N°	*23096*	Dwg N° :	*23096-01-EGA1*
Owner	*CROSSWIND*	P.O. N°	*1723001756 123A90A*		
Purchaser	*ROSETTI MARINO*	Item N°	*V25001 A-F* A		
Vendor	*B&R*	Serial N°	*23096-01-SNA-F* A		

	Activities/Fabrication Steps	Test/Inspection	Extent of Inspection	B&R Reference Doc.	Client spec.	Acceptance Criteria	Doc. Required	Involved Party: Date	V: Point	B&R Sign	P: Point	ROSETTI Sign	O: Point	CROSSWIND Sign	C1: Point	ASME Inspector Sign	C2: Point	PED Inspector Sign	Report N°	REMARKS
74	Complete equipment	UT on lifting devices (if full penetration)	100%	004 UTA 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.4.2 ASME V - Art.4	Test report	01/08/24	H		W/R		W/R		R		R		23096-01-SNA-UT-	A-3
75	Complete equipment	HT on all welds	100%	008 HB	Doc.N° 123A90-DDL-MAC-SP-50026	BM, HAZ & WM By MIC-10 instrument	Test report	21/08/24	H		W/R		W/R		R		R		23096-01-SNA-HB-	C-1
76	Complete equipment	Mechanical test on PTP ITEM F ONLY	100%	23096-TPTP	Doc.N° 123A90-DDL-MAC-SP-50026	Asme VIII/2 3.11.8.4 Asme VIII/2 3.11.8.2	Labo. test report		H	N.A.	H	N.A.	W/R	N.A.	R	N.A.	R	N.A.	==	if any
Step N°	CHAPTER 8 - Hydrostatic tests (1)																			
77	Complete equipment in pressure		100%	100 HPT 21	Doc.N° 123A90-DDL-MAC-SP-50026	No leaks or permanent deformations ASME VIII/2 - 8.2	Test report	09/08/24	H		H		W/R		H		H			
78	Drain immediately after final hydrostatic test		100%	100 HPT 21	Doc.N° 123A90-DDL-MAC-SP-50026	No ristagno acqua / No water allowed	====	09/08/24	H						R		R		==	
Step N°	CHAPTER 9 - NDE after HYDROTEST																			
79	Complete equipment	VT	100%	007 VT 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.2.2 ASME V - Art.9	Test report	09/08/24	H		W/R		W/R		W		W/R		23096-01-SNA-VT-	04
80	Complete equipment	MT on all butt joints external side	100%	003 MT 21 003 MTD 21	Doc.N° 123A90-DDL-MAC-SP-50026	ASME VIII/2 7.5.6.2 ASME V - Art.7	Test report	09/08/24	H		W/R		W/R		R		R		23096-01-SNA-MT-	H-1
Step N°	CHAPTER 10 - Final Inspections																			
81	Final inspection	Shot blast cleaning	100%	23096-QSP	Doc.N° 123A90-DDL-MAC-SP-50026	SSPC PA2 ==	Test rept by sub-contractor	22/08/24	H		W		M/R						==	3
82	Final inspection	Dry film thickness inspection	100%	23096-QSP	Doc.N° 123A90-DDL-MAC-SP-50026	SSPC PA2 ==	Test rept by sub-contractor	13/09/24 05/09/24	H		W		M/R						==	3
83	Final inspection	Asme name plate review	100%	Client spec.	Doc.N° 123A90-DDL-MAC-SP-50026	23096-01-SNA/Ax ==	Name plate copy	18/09/24	H		R		M/R						==	
84	Final inspection	Name plate review	100%	Purchase order	Doc.N° 123A90-DDL-MAC-SP-50026	Asme VIII/2 - Annex 2F ==	Name plate copy	18/09/24	H		R		M/R						==	
85	Final inspection	UDS + Manufacturer's Design Report	100%	====	Doc.N° 123A90-DDL-MAC-SP-50026	Asme VIII/2 - Annex 2C ==	Asme MDR form	18/09/24	H		R		R		R		R		==	

(1) ALL THE ACTIVITIES AFTER PWHT HAVE BEEN PERFORMED SUCCESFULLY. THE EQUIPMENT IS RELEASED FOR HYDROTEST. 08/08/2024

17230017756-QC-DB-00017_02 - V25001A

PAGE 310/1016

QUALITY CONTROL PLAN

Doc.N°:	23096-01-QCPA
Albignasego - Padova (Italy)	Sheet: 10 of 13

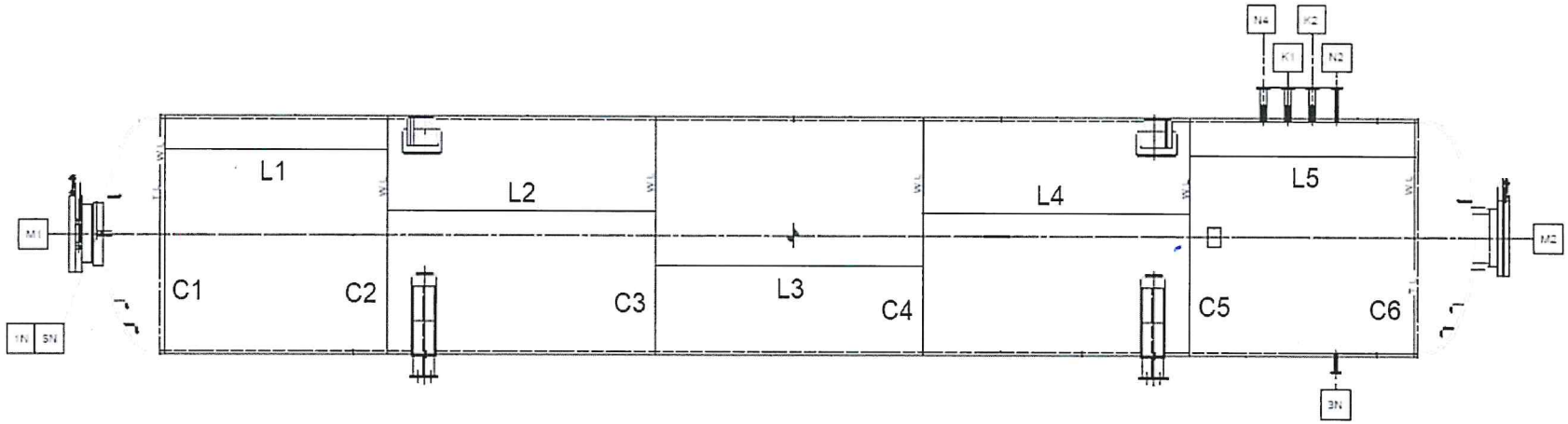
Project	*Crosswind Hollande Kust Noord Wind Park Project*	Job N°	*23096*	Dwg N° :	*23096-01-EGA1*
Owner	*CROSSWIND*	P.O. N°	*1723001756 123A90A*		
Purchaser	*ROSETTI MARINO*	Item N°	*V25001 A÷F* A		
Vendor	*B&R*	Serial N°	*23096-01-SNA÷F* A		

	Activities/Fabrication Steps	Test/Inspection	Extent of Inspection	B&R Reference Doc.	Client spec.	Acceptance Criteria	Doc. Required	Involved Party												Report N°	REMARKS
								Date	V:	B&R	P:	ROSETTI	O:	CROSSWIND	C1:	ASME Inspector	C2:	PED Inspector			
									Point	Sign	Point	Sign	Point	Sign	Point	Sign	Point	Sign			
86	Final inspection	Issue of Asme MDR	100%	====	Doc.N° 123A90-DDL-MAC-SP-50026	Asme VIII/2 - Annex 2C ==	Asme MDR form	18/09/24	H		R		R		H					==	
87	Final inspection	Issue of declaration of compliance to 2014/68/EU	100%	Purchase order	Doc.N° 123A90-DDL-MAC-SP-50026	Contractual doc.s & code ==	==		H		H		R				H			==	
88	Manufacturing and Technical book	Review and Assessment	100%	Purchase order	Doc.N° 123A90-DDL-MAC-SP-50026	Purchase order ==	MDB		H		A		R		R		H/R			==	
89	Final inspection	Commissioning & spare parts	100%	23096/T	Doc.N° 123A90-DDL-MAC-SP-50026	Purchase order ==	Packing List		H		A		M/R							==	
90	Final inspection	Packing & Marking check & Preparation for shipment	100%	Asme VIII/2 - Annex 2C	Doc.N° 123A90-DDL-MAC-SP-50026	V25001 A÷F/Ax ==	Client spec.	13/09/24	H		W		M/R							==	
91	Manufacturing and Technical book review	Issue of Release Certificate (IRC)	100%	Asme VIII/2 - Annex 2F	Doc.N° 123A90-DDL-MAC-SP-50026	at least B&R, S.N., Year ==	Marking rubbing		H		H		M/R							==	

1723001756-QC-DB-00017_02 - V25001A

Project	*Crosswind Hollande Kust Noord Wind Park Project*	Job N°	*23096*	Dwg N° :	*23096-01-EGA1*
Owner	*CROSSWIND*	P.O. N°	*1723001756 123A90A*		
Purchaser	*ROSETTI MARINO*	Item N°	*V25001 A-FA*		
Vendor	*B&R*	Serial N°	*23096-01-SNA-FA*		

NDE PLAN



17. SEP. 2024

LRQA Verification Limited
☐ Witnessed ☒ Reviewed
Mattia Civellari
Authorized Inspector N.B. No. 1719
Milan Office 17. SEP. 2024

1723001756-QC-DB-00017_02 - V25001A

QUALITY CONTROL PLAN

Doc.N°:	23096-01-QCPA
Albignasego - Padova (Italy)	Sheet 12 of 13

Project	*Crosswind Hollande Kust Noord Wind Park Project*	**Job N°**	*23096*	**Dwg N°** :	*23096-01-EGA1*
Owner	*CROSSWIND*	**P.O. N°**	*1723001756 123A90A*		
Purchaser	*ROSETTI MARINO*	**Item N°**	*V25001 A~~F~~A*		
Vendor	*B&R*	**Serial N°**	*23096-01-SNA~~F~~A*		

NDE PLAN

NDE	B&R proc. Technique	Acceptance Criteria	EXTENT OF EXAMINATION (%)			REF. NO
			AS WELDED	AFTER PWHT	AFTER HYDROTEST	
VT	*23096-QVT1*	*ASME VIII/2 7.5.2.2 ASME V - Art.9*	100%	100%	100%	*C1-C2-C3-C4-C5-C6-L1-L2-L3-L4-L5-1N-2N-3N-4N-5N-K1-K2-M1-M2*
PT	*23096-QPT1*	*ASME VIII/2 7.5.7.2 ASME V - Art.6*	100%	100%		
MT	*23096-QMT1*	*ASME VIII/2 7.5.6.2 ASME V - Art.7*	100%	100%	100%	*C1-C2-C3-C4-C5-C6-L1-L2-L3-L4-L5-1N-2N-3N-4N-5N-K1-K2-M1-M2*
RT	*23096-QRT1*	*ASME VIII/2 7.5.3.2 ASME V - Art.2*	100%			*C1-C2-C3-C4-C5-C6-L1-L2-L3-L4-L5*
UT	*23096-QUT1*	*ASME VIII/2 7.5.4.2 ASME V - Art.4*		100%		*C1-C2-C3-C4-C5-C6-L1-L2-L3-L4-L5-1N-2N-3N-4N-5N-K1-K2-M1-M2*
TOFD	*23096-QTD1*	*ASME VIII/2 7.5.4.2 ASME V - Art.4*				
PA	*23096-QPA1*	*ASME VIII/2 7.5.4.2 ASME V - Art.4*				
HT	*23096-QHT1*	*BM,HAZ & WM*		100%		*C1-C2-C3-C4-C5-C6-L1-L2-L3-L4-L5-1N-2N-3N-4N-5N-K1-K2-M1-M2*
PMI	*23096-QPMI1*	*ASME II/A&B*				

REMARKS

1)	*Dimensional verification, Orientation, Levelness and Projection shall be verified*	7)	
2)	*After repair perform MT and UT*	8)	
3)	*For additional tests to be carried out on the painting see doc.23096-QSP*	9)	
4)		10)	
5)		11)	
6)		12)	

1723001756-QC-DB-00017_02 - V25001A

PAGE 313/1016

QUALITY CONTROL PLAN

Albignasego - Padova (Italy)

Doc.N°:	23096-01-QCPA
Sheet	13 of 13

Project	Crosswind Hollande Kust Noord Wind Park Project	Job N°	23096	Dwg N°	23096-01-EGA1	
Owner	CROSSWIND	P.O. N°	1723001756 123A90A			
Purchaser	ROSETTI MARINO	Item N°	V25001 A ~~E~~ A			
Vendor	B&R	Serial N°	23096-01-SNA ~~E~~ A			

Monitoring of welding activities

JOINT	Weld bevel and fit-up				Weld monitoring				PT/MT on back gouging				Welder Stamp	JOINT	Weld bevel and fit-up				Weld monitoring				PT/MT on back gouging				Welder Stamp
	B&R	ROSETTI	CROSSWIND	ASME & Client Inspector	B&R	ROSETTI	CROSSWIND	ASME & Client Inspector	B&R	ROSETTI	CROSSWIND	ASME & Client Inspector			B&R	ROSETTI	CROSSWIND	ASME Inspector	B&R	ROSETTI	CROSSWIND	ASME Inspector	B&R	ROSETTI	CROSSWIND	ASME Inspector	
C1	H				H				H																	
C2	H				H				H																	
C3	H				H				H																	
C4	H				H				H																	
C5	H				H				H																	
C6	H				H				H																	
L1	H				H				H																	
L2	H				H				H																	
L3	H				H				H																	
L4	H				H				H																	
L5	H				H				H																	
1N	H				H				H																	
2N	H				H				H																	
3N	H				H				H																	
4N	H				H				H																	
5N	H				H				H																	
K1	H				H				H																	
K2	H				H				H																	
M1	H				H				H																	
M2	H				H				H																	

17. SEP. 2024

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 1719
Milan Office 17 SEP 2024

1723001756-QC-DB-00017_02 - V25001A

Fabrication site: Albignasego – PD – ITALY

Section 6

List of utilized materials / PMA / Material certificates and test coupon certificate, including welding material certificates

QUALITY CONTROL DEPARTMENT

LIST OF MATERIALS
(materials summary certificates)

No Documento Document No	23096-SNA / ML
Pagina Page	1 of 3

Cliente Customer	Rosetti Marino	**Ordine No** P.O. No	1723001756 123A90
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	HOLLANDSE KUST NOORD WIND PARK	**N° Fabbrica** Serial Number	23096-01-SNA
Sigla Item	V-25001A	**P.C.Q. No** ITP No	23096-01-QCPA Step n.a.

DESCRIPTION	DWG. POSIT	THK mm	MATERIAL	HEAT No. TEST No.	CERTIFICATE No.	SUPPLIER	CERT N°
LEFT HEAD	01	40	SA 516 GR60	858209 230888/1	F1009650 Rev.A	Voestalpine	01
RIGHT HEAD	02	40	SA 516 GR60	858209 230888/1	F1009650 Rev.A	Voestalpine	01
1ST SHELL COURSE	03	44	SA 516 GR60	762981 235602/1	Q0545389	Voestalpine	02
2ND SHELL COURSE	04	44	SA 516 GR60	956678 239032/1	Q0545608	Voestalpine	03
3RD SHELL COURSE	05	44	SA 516 GR60	956678 239037/1	Q0545608	Voestalpine	03
4TH SHELL COURSE	06	44	SA 516 GR60	956679 239039/1	Q0545608	Voestalpine	03
5TH SHELL COURSE	07	44	SA 516 GR60	762981 235594/1	Q0545608	Voestalpine	03
FORGING M1	08	46.05	SA 350 LF2 CL1	S85062	KS24-0124-02	KS FITTING	05
BLIND FLANGE M1 24" 300#	09	69.8	SA 350 LF2 CL1	S85062	KS24-0124-02	KS FITTING	05
STUD BOLT 260Lg	10	1 ½"	SA 193 GR B7	296162 P1638825	3166884 Rev.0	PRESSBOLT	12
NUTS	10	1 ½"	SA 194 GR 2H	565697 P1621714	3166884 Rev.0	PRESSBOLT	12
FORGING M2	12	46.05	SA 350 LF2 CL1	S85062	KS24-0124-02	KS FITTING	05
BLIND FLANGE M2 24" 300#	13	69.8	SA 350 LF2 CL1	S85062	KS24-0124-02	KS FITTING	05
STUD BOLT 260Lg	14	1 ½"	SA 193 GR B7	296162 P1638825	3166884 Rev.0	PRESSBOLT	12
NUTS	14	1 ½"	SA 194 GR 2H	565697 P1621714	3166884 Rev.0	PRESSBOLT	12
LWN FLANGE 1N 1" 300# - 266Lg	16	14.3	SA 350 LF2 CL1	A266550	KS24-0124-01	KS FITTING	04
LWN FLANGE 5N 1" 300# - 266Lg	17	14.3	SA 350 LF2 CL1	A266550	KS24-0124-01	KS FITTING	04

BREMBANA&ROLLE S.p.A.

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
22 JUL 2024
- Q.C.M. -

INSPECTION AGENCY

LRQA
17 SEP 2024

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 1719
Milan Office 17 SEP 2024

QUALITY CONTROL DEPARTMENT

LIST OF MATERIALS
(materials summary certificates)

No Documento / Document No	23096-SNA / ML
Pagina / Page	2 of 3

Cliente / Customer	Rosetti Marino	**Ordine No** / P.O. No	1723001756 123A90
Commessa / Mfr' work No.	23096	**Disegno** / Drawing	23096-01-EGA1
Progetto / Project	HOLLANDSE KUST NOORD WIND PARK	**N° Fabbrica** / Serial Number	23096-01-SNA
Sigla / Item	V-25001A	**P.C.Q. No** / ITP No	23096-01-QCPA Step n.a.

DESCRIPTION	DWG. POSIT	THK mm	MATERIAL	HEAT No. TEST No.	CERTIFICATE No.	SUPPLIER	CERT N°
LWN FLANGE K1 1" 300# - 414Lg	19	14.3	SA 350 LF2 CL1	A266550	KS24-0124-01	KS FITTING	04
LWN FLANGE K2 1" 300# - 414Lg	20	14.3	SA 350 LF2 CL1	A266550	KS24-0124-01	KS FITTING	04
LWN FLANGE 2N 1" 300# - 414Lg	21	14.3	SA 350 LF2 CL1	A266550	KS24-0124-01	KS FITTING	04
LWN FLANGE 2N 1" 300# - 244Lg	22	14.3	SA 350 LF2 CL1	A266550	KS24-0124-01	KS FITTING	04
ROD - HANDLE	23	20	P275 NL2 EN10028-3	SSAA770204A	588604	Metinvest	09
ROD – RUNG	24	20	P275 NL2 EN10028-3	SSAA770204A	588604	Metinvest	09
LIFTING LUG	25	30	SA 516 GR70	20EP008757	16020286889	Marcegaglia	06
REINFORCING PLATE	26	25	SA 516 GR60	SSAA770204A	588590	Metinvest	10
PLATE FOR LIFTING LUG	28	30	SA 516 GR70	20EP008757	16020286889	Metinvest	06
NAMEPLATE SUPPORT	29	5	SA 240 316L	049010	21K0006900-01 V-01	Aperam	08
WEAR PLATE	31	20	SA 516 GR60	12143 456875002	2022-105545	MANNI SIPRE	11
FLANGE 4N	41	22.1	SA 350 LF2 CL1	T36272 T.237	24_0066_01	Forgia di Ospiate	13
BLIND FLANGE 3N 1" 300#	47	17.5	SA 350 LF2 CL1	T36272 T.237	24_0066_01	Forgia di Ospiate	13
STUD BOLT 85Lg	48	5/8"	SA 193 GR B7	103540 P1630612	3166884 Rev.0	PRESSBOLT	12
NUTS	48	5/8"	SA 194 GR 2H	58195 P1648702	3166884 Rev.0	PRESSBOLT	12

BREMBANA&ROLLE S.p.A.

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
22 JUL 2024
- Q.C.M. -

INSPECTION AGENCY

On Behalf
L. D'Alessandro
☐ W ☐ R

0096
17 SEP 2024

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorised Inspector N.B. No. 17119
Milan Office 17. SEP. 2024

QUALITY CONTROL DEPARTMENT

LIST OF MATERIALS
(materials summary certificates)

No Documento Document No	23096-SNA / ML
Pagina Page	3 of 3

Cliente Customer	Rosetti Marino	**Ordine No** P.O. No	1723001756 123A90
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	HOLLANDSE KUST NOORD WIND PARK	**N° Fabbrica** Serial Number	23096-01-SNA
Sigla Item	V-25001A	**P.C.Q. No** ITP No	23096-01-QCPA Step n.a.

DESCRIPTION	DWG. POSIT	THK mm	MATERIAL	HEAT No. TEST No.	CERTIFICATE No.	SUPPLIER	CERT N°
23096-01-ED02							
PLATE	1	40	SA 516 Gr.70	62879 473614 1	478535	ROLLA TRAVERSO	14
ROD	13	15	From plate SA 516 Gr.60	1TBA53 1TBA530105A	538207	MANNI SIPRE	15

BREMBANA&ROLLE S.p.A.

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
- Q.C.M. - 22 JUL 2024

INSPECTION AGENCY

0084
17. SEP. 2024

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 17. SEP. 2024

QUALITY CONTROL DEPARTMENT

LIST OF MATERIALS
(materials summary certificates)

No Documento / Document No	23096-SNA÷F / ML
Pagina / Page	1 of 1

Cliente / Customer	Rosetti Marino	**Ordine No** / P.O. No	1723001756 123A90
Commessa / Mfr' work No.	23096	**Disegno** / Drawing	23096-01-EGA1
Progetto / Project	HOLLANDSE KUST NOORD WIND PARK	**N° Fabbrica** / Serial Number	23096-01-SNA
Sigla / Item	V-25001A÷F	**P.C.Q. No** / ITP No	23096-01-QCPA Step n.a.

DESCRIPTION	DWG. POSIT	THK mm	MATERIAL	HEAT No. TEST No.	CERTIFICATE No.	SUPPLIER	CERT N°
GASKETS as per 23096-01-EBMN Rev.3							
GASKET M1 Ø24"-300#-RF	11	4.5	S.W SS316	0449982	24-779 / 24-1198	ABO	101
			Inner ring SS316	523031	24780 / 24-1199		102
			Outer ring C.S.	0057917057	24-781 / 24-1200		103
			Graphite filler	-	24-782 / 24-1201		104
GASKET M2 Ø24"-300#-RF	15	4.5	S.W SS316	0449982	24-779 / 24-1198	ABO	101
			Inner ring SS316	523031	24780 / 24-1199		102
			Outer ring C.S.	0057917057	24-781 / 24-1200		103
			Graphite filler	-	24-782 / 24-1201		104
GASKET 3N Ø1"-300#-RF	49	4.5	S.W SS316	0449982	24-779 / 24-1198	ABO	101
			Inner ring SS316	523031	24780 / 24-1199		102
			Outer ring C.S.	0057917057	24-781 / 24-1200		103
			Graphite filler	-	24-782 / 24-1201		104
Fixed and sliding saddles as per 23096-01-EBMN Rev.3							
SADDLE PLATE	32÷35 42÷45	14	SA 516 Gr.60	805197 B3	1111	Manni sipre	105
BASE PLATE	36-37	25	SA 516 Gr.60	SSAA770204A	588590	Metinvest	10
SHIM PLATES	46	3	SA 240 304	SA 240 304L	63576	Outokumpu	106

BREMBANA&ROLLE S.p.A.

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
25 FEB 2025
- Q.C.M. -

INSPECTION AGENCY

29/04/24

voestalpine Grobblech GmbH
voestalpine-Straße 3
4020 Linz, Austria
www.voestalpine.com/grobblech

A02 Inspection certificate

EN 10204 - 3.1

Z02 Date: 25-04-2024

A04 manufacturer's work symbol: voestalpine

A03 Document number	F1009650 Rev. A	A08 Order-No.:	9805710	A07 OrderDat.	26-02-2024

F

A06 Customer	BREMBANA & ROLLE SPA Via Villino 1 I-24030 VALBREMBO (BG)	B01 Product	semi-ellipt. head 2:1	B03 Norm of head	* ASME SECT. VIII Div 1 : ED.2021
A07 OrderNo.	23096-ODA23-3058 Rev. 1	B02 Material	SA516 Grade 60	B03 Standard	ASME SA-516/SA-516M : ED.2021
A06 Consignee	BREMBANA & ROLLE - ZANON SCHIO WORKSHOP Via Vicenza, 113 I-36015 Schio	B04 Delivery condition	normalised		
		B04 Production method	hot formed		

A10 - Supplementary information
Drawing :
23096
Made in Austria

B03 - Supplementary requirements
ASME SA-20 / SA-20M of ASME Section II, Part A, Ed.2021 // NACE MR0175 Ed.2021 // PED 2014/68/EC // ASME VIII DIV.2 ED.2021
Specification: 23096-EMRS-101 Rev.01

D01 - Visual Examination and dimensional checking: satisfactory. The results of tests performed are in compliance with the requirements.

LRQA verification ltd ☐ 0094 ☐
☐ Witnessed ☐ Monitored ☑ Reviewed LRQA
MATTIA CRIVELLARI
Ref. No.
Office: Milan 30. APR. 2024

Detail of supply

B07 head	B07 Heat No.	B06 Plate No	Dimensions Item	B10 - DKz	B09 Thickness mm	B09 - ØKZ	B10 - diameter mm	B11 - flange	B12 theor. Mass kg	reference no.	
CE/05710/10/7	858208	230888/1	10	MW	40,000	ØI	2800,00	50,00	3497	V-25001AF	ITEM D POS. 1
CE/05710/10/8	858208	230888/1	10	MW	40,000	ØI	2800,00	50,00	3497	V-25001AF	ITEM C POS. 2
CE/05710/10/9	858209	230890/1	10	MW	40,000	ØI	2800,00	50,00	3497	V-25001AF	ITEM A POS 1
CE/05710/10/10	858209	230890/1	10	MW	40,000	ØI	2800,00	50,00	3497	V-25001AF	ITEM A POS 2
CE/05710/10/11	946290	230886/1	10	MW	40,000	ØI	2800,00	50,00	3497	V-25001AF	ITEM B POS. 1
CE/05710/10/12	946290	230886/1	10	MW	40,000	ØI	2800,00	50,00	3497	V-25001AF	ITEM B POS. 2
								Sum	20982		

Cert. No. 01

* IN ACCORDANCE WITH THE REQUIREMENTS OF THE MATERIAL SPECIFICATION AND ALL SPECIAL REQUIREMENTS OF PART 3 OF ASME SECTION VIII DIV 2 AS PER VOESTALPINE ADDITIONAL NOTE DECLARATION AT PAGE 9 OF 13 OF THIS CERTIFICATE.

Z02
Inspection representative voestalpine
Reisinger Patrick

LRQA Verification Limited
☐ Witnessed ☑ Reviewed LRQA
Mattia Crivellari
Authorized Inspector N.B. No. 1719
Milan Office 30. APR. 2024

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
29 APR 2024

29/04/24

voestalpine
ONE STEP AHEAD.

A03 Document number **F1009650 Rev. A** A08 Order-No.: **9805710** Z02 Date 25-04-2024

B14 - Supplementary information

B09;ØKZ: type of diameter
ØI: inner diameter
B10;DKz: type of thickness requirement
MW: min. wall thickness
Surface acc. EN 10163/05

heattreatment heads and if applicable customer test coupons
normalizing at 920°C, holding time: 45 min., cooling on still air
Welding repair is not permitted

Chemical composition (Heat analysis)

B07

Heat No.	C %	Si %	Mn %	P %	S %	Al %	Cr %	Ni %	Mo %	Cu %	V %	Nb %	Ti %	N %	B %	Cae %	LF03 %	LF15 %
>=		.150	.850															
Set values <=	.230	.400	1.200	.015	.0030		.300	.400	.120	.400	.030	.014	.030		.0010	.35	1.000	.320
858208	.085	.399	1.190	.006	.0007	.035	.070	.270	.030	.161	.003	.013	.003	.0046	.0002	.33	.531	.100
858209	.083	.392	1.180	.007	.0007	.039	.060	.280	.055	.162	.003	.012	.002	.0047	.0002	.33	.557	.115
946290	.085	.389	1.150	.006	.0006	.041	.043	.270	.042	.158	.002	.013	.001	.0042	.0002	.32	.513	.085

C99 - Supplementary information

Cae: C+(Mn/6)+(Cr+Mo+V)/5+(Ni+Cu)/15
LF03: Cr+Ni+Cu+Mo
LF15: Cr+Mo

Cert. No. 01

Z02
Inspection representative voestalpine
Reisinger Patrick

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
RECEIVED AND ACCEPTED
29 APR 2024

voestalpine
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1723001756-QC-DB-00017_02 - V25001A

A03 Document number **F1009650 Rev. A** A08 Order-No.: **9805710** Z02 Date 25-04-2024

Test results: C10-C29 Tensile Test at room temperature acc. ASTM/ASME A370/SA370

B07 head	C41 Width	SpThickn MM	C01 loc.	PosTh.	C02 Dir	C11 Rp0,2 MPa	C12 Rm MPa	L0	C13 E %	Sim.htm	WBH
>=						220	415		25.0		
Set values <=						380	550				
CE/05710/10/7	Ø	12.52	F	V	T	311	447	L2"	41.4		
	Ø	12.46	F	V	T	320	441	L2"	40.8	001	1
	Ø	12.52	F	V	T	308	434	L2"	42.4	002	1
CE/05710/10/8	Ø	12.52	F	V	T	311	447	L2"	41.4		
	Ø	12.46	F	V	T	320	441	L2"	40.8	001	1
	Ø	12.52	F	V	T	308	434	L2"	42.4	002	1
CE/05710/10/9	Ø	12.52	F	V	T	315	444	L2"	41.5		
	Ø	12.52	F	V	T	308	440	L2"	42.4	001	1
	Ø	12.52	F	V	T	312	436	L2"	42.4	002	1
CE/05710/10/10	Ø	12.52	F	V	T	315	444	L2"	41.5		
	Ø	12.52	F	V	T	308	440	L2"	42.4	001	1
	Ø	12.52	F	V	T	312	436	L2"	42.4	002	1
CE/05710/10/11	Ø	12.52	F	V	T	325	449	L2"	42.7		
	Ø	12.51	F	V	T	326	445	L2"	42.5	001	1
	Ø	12.52	F	V	T	316	441	L2"	42.1	002	1
CE/05710/10/12	Ø	12.52	F	V	T	325	449	L2"	42.7		
	Ø	12.51	F	V	T	326	445	L2"	42.5	001	1
	Ø	12.52	F	V	T	316	441	L2"	42.1	002	1

SpThickn: specimen thickness
C01;loc.:
F: Bottom
PosTh.: Pos Thickness
V: ¼ t
C02;Dir:
T: transverse

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1723001756-QC-DB-00017_02 - V25001A

A03 Document number **F1009650 Rev. A** A08 Order-No.: **9805710** Z02 Date 25-04-2024

Test results: C10-C29 Tensile Test at room temperature acc. ASTM/ASME A370/SA370

B07 head	C41 Width	SpThickn MM	C01 loc.	PosTh.	C02 Dir	C11 Rp0,2 MPa	C12 Rm MPa	L0	C13 E %	Sim.htm	WBH

C11;Rp0,2: Yield Strength
C12; Rm: Tensile Strength
L0: gauge
  L2": Length = 50mm
  L2": Length = 50mm
C13;E: elongation
Sim.htm: sim. heat treatment
  001: Sim.htm group #1
  002: Sim.htm group #2
WBH: sim. heat treatment

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1723001756-QC-DB-00017_02 - V25001A

A03 Document number **F1009650 Rev. A** A08 Order-No.: **9805710** Z02 Date 25-04-2024

Test results: C40-C49 Impact Test acc. ASTM/ASME A370/SA370

B07 head	C40 shape	C01 loc.	PosTh.	C02 Dir	C03 temp °C	C42 SV J	C42 SV J	C42 SV J	C43 AV J	Sim.htm	WBH
>=					-46	27	27	27	27		
Set values <=											
CE/05710/10/7	CV 10x10	F	V	T	-46	388	397	393	393		
	CV 10x10	F	V	T	-46	391	391	390	391	001	1
	CV 10x10	F	V	T	-46	391	391	392	391	002	1
CE/05710/10/8	CV 10x10	F	V	T	-46	388	397	393	393		
	CV 10x10	F	V	T	-46	391	391	390	391	001	1
	CV 10x10	F	V	T	-46	391	391	392	391	002	1
CE/05710/10/9	CV 10x10	F	V	T	-46	388	399	391	393		
	CV 10x10	F	V	T	-46	387	389	389	388	001	1
	CV 10x10	F	V	T	-46	393	390	385	389	002	1
CE/05710/10/10	CV 10x10	F	V	T	-46	388	399	391	393		
	CV 10x10	F	V	T	-46	387	389	389	388	001	1
	CV 10x10	F	V	T	-46	393	390	385	389	002	1
CE/05710/10/11	CV 10x10	F	V	T	-46	389	388	402	393		
	CV 10x10	F	V	T	-46	400	392	397	396	001	1
	CV 10x10	F	V	T	-46	396	401	399	399	002	1
CE/05710/10/12	CV 10x10	F	V	T	-46	389	388	402	393		
	CV 10x10	F	V	T	-46	400	392	397	396	001	1
	CV 10x10	F	V	T	-46	396	401	399	399	002	1

C40;shape:
CV 10x10: Test shape , Dimensions
C01;loc.:
F: Bottom
PosTh.: Pos Thickness
V: ¼ t
C02;Dir:

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1723001756-QC-DB-00017_02 - V25001A

A03 Document number **F1009650 Rev. A** A08 Order-No.: **9805710** Z02 Date 25-04-2024

Test results: C40-C49 Impact Test acc. ASTM/ASME A370/SA370

B07 head	C40 shape	C01 loc.	PosTh.	C02 Dir	C03 temp °C	C42 SV J	C42 SV J	C42 SV J	C43 AV J	Sim.htm	WBH

T: transverse
C03; temp: Test temperature
C42;SV: single value
C43;AV: average value
Sim.htm: sim. heat treatment
001: Sim.htm group #1
002: Sim.htm group #2
WBH: sim. heat treatment

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1723001756-QC-DB-00017_02 - V25001A

A03 Document number **F1009650 Rev. A** A08 Order-No.: **9805710** Z02 Date 25-04-2024

Test results: C30-C39 Hardness Test Vickers

B07 head	C01 loc.	PosTh.	Hard.	C31 HV	C31 HV	C31 HV	Sim.htm	WBH
>= Set values <=				190	190	190		
CE/05710/10/7	F	OS	HV10	128	129	129		
	F	OS	HV10	130	128	130	001	1
	F	OS	HV10	127	128	131	002	1
CE/05710/10/8	F	OS	HV10	128	129	129		
	F	OS	HV10	130	128	130	001	1
	F	OS	HV10	127	128	131	002	1
CE/05710/10/9	F	OS	HV10	126	129	127		
	F	OS	HV10	129	130	130	001	1
	F	OS	HV10	128	128	127	002	1
CE/05710/10/10	F	OS	HV10	126	129	127		
	F	OS	HV10	129	130	130	001	1
	F	OS	HV10	128	128	127	002	1
CE/05710/10/11	F	OS	HV10	129	128	127		
	F	OS	HV10	132	129	130	001	1
	F	OS	HV10	128	129	127	002	1
CE/05710/10/12	F	OS	HV10	129	128	127		
	F	OS	HV10	132	129	130	001	1
	F	OS	HV10	128	129	127	002	1

C01;loc.:
F: Bottom
PosTh.: Pos Thickness
OS: upper side
Hard.: stress
Sim.htm: sim. heat treatment
001: Sim.htm group #1

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1723001756-QC-DB-00017_02 - V25001A

A03 Document number **F1009650 Rev. A** A08 Order-No.: **9805710** Z02 Date 25-04-2024

Test results: C30-C39 Hardness Test Vickers

B07 head	C01 loc.	PosTh.	Hard.	C31 HV	C31 HV	C31 HV	Sim.htm	WBH

002: Sim.htm group #2
WBH: sim. heat treatment

Chemical composition (Product analysis)

B07 Heat No.	C %	Si %	Mn %	P %	S %	Al %	Cr %	Ni %	Mo %	Cu %	V %	Nb %	Ti %	N %	B %	Cae %	LF03 %	LF15 %
>=		.130	.790															
Set values <=	.230	.450	1.300	.015	.0030		.340	.430	.130	.430	.040	.014	.040		.0015	.35		
858208	.083	.390	1.170	.006	.0004	.036	.061	.270	.036	.160	.003	.012	.002	.0040	.0002	.33	.527	.097
858209	.083	.377	1.160	.007	.0006	.039	.050	.270	.058	.161	.003	.012	.002	.0044	.0002	.33	.539	.108
946290	.083	.389	1.190	.006	.0003	.040	.049	.270	.048	.157	.003	.012	.002	.0046	.0002	.33	.524	.097

C99 - Supplementary information
Cae: C+(Mn/6)+(Cr+Mo+V)/5+(Ni+Cu)/15
LF03: Cr+Ni+Cu+Mo
LF15: Cr+Mo

Remarks

Simulated heat treatment of test coupons:

Item 10:
001/1: 1 cycle(s) sim. PWHT: furnace charge temperature at max. 425 °C, heating with max. 70 °C/h up to 610 °C, +10 °C/-10 °C, holding time 180 minutes, cooling with max. 70 °C/h down to 425 °C, final cooling in calm air.
002/1: 1 cycle(s) sim. PWHT: furnace charge temperature at max. 425 °C, heating with max. 70 °C/h up to 610 °C, +10 °C/-10 °C, holding time 720 minutes, cooling with max. 70 °C/h down to 425 °C, final cooling in calm air.

We confirm that the delivered material complies with the terms of order.

C70 - Method of steelmaking: Basic oxygen furnace (BOF) steelmaking, continuous casting with soft reduction, steel is fully killed, vacuum degassed and melted by fine grain practice, austenitic grain size 5 or finer acc. to para. 8.3.2 of ASME SA 20/SA 20M

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1723001756-QC-DB-00017_02 - V25001A

A03 Document number **F1009650 Rev. A**

A08 Order-No.: **9805710**

Z02 Date 25-04-2024

Remarks

We hereby certify, that the material has been manufactured, sampled and tested in accordance with the requirements of the material specification, and the results meet the requirements.

HIC testing of the base material was carried out with satisfactory results. All determined values are within the acceptance limits and stated on separate test report.

We hereby certify, that the material mentioned herein, has been manufactured, sampled and tested in accordance with the requirements of the material specification and all special requirements of Part 3 of ASME Section VIII Division 2, which are to be fulfilled by the materials manufacturer, have been complied with.

The signature of the inspection representative from voestalpine Grobblech GmbH is substituted by an electronic signature, because the certificates of voestalpine Grobblech GmbH are prepared by a suitable data processing system (EN 10204, Pt.5).

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Reisinger Patrick

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1723001756-QC-DB-00017_02 - V25001A

A03 Document number **F1009650 Rev. A** A08 Order-No.: **9805710** Z02 Date 25-04-2024

D02-D50 - ULTRASONIC EXAMINATION PLATE(S)

SPECIFICATION

Ultrasonic test acc. ASME SA-578/SA-578M, ASME SA 578 Level C /Body, 100% Test, S1 - scanning 100% of plate surface, ASME SA 578 Level C /Edge Zone; satisfactory

VALID TEST EQUIPMENT
mechanized ultrasonic "In-Line testing system" (Manufacturer: NDT-Systems & Services) and
mechanized ultrasonic "off-line - testing system" (manufacturer: Windhoff Bahn- und Anlagentechnik GmbH) and
MUT (optional): Sonatest D20 no. 90006523 or Sonatest D20 no. 90007346 or Sonatest D50 no. 90010231 or GE - USM 36 no. 90010775 or Sonatest Wave no. 90015462 or Sonatest Wave no. 90015464

PROBE
(in-line AUT): 3STSE 18.3/8 P5, SEZ5R10RS, SE3 18.3/10 5A, (5MHz)
(off-line AUT): S140 (4MHz) 3T/1R
(MUT): SEB4E (4MHz), SEB4E0° (4MHz), MSEB4E (4MHz), B2SO (2MHz)
watergapcoupling

SURFACE CONDITION
Scaled surface - cleaned surface and free of loose scale.

RESULT
Plate(s) comply with the specification.

INSPECTION OPERATOR
Operators Level 2: qualified and certified according EN ISO 9712 (since 01.01.2013) respectively according the Written Practice „NDT-WP" (in accordance to Recommended Practice SNT-TC-1A). Operators Level 2 for ASME/ASTM.

INSPECTION SUPERVISOR
Responsible Level 3: Bindreiter Erich

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Inspection representative voestalpine
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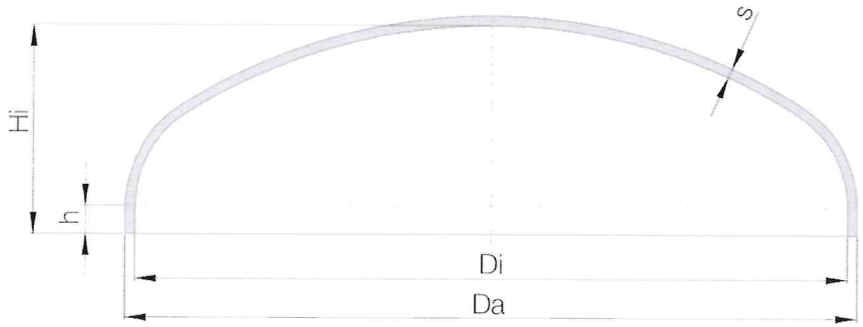
1723001756-QC-DB-00017_02 - V25001A

A08 Werksauftragsnr. / Manufacturer`s works order no.: A9805710 Positionsnr. / Item no.: 10 Z02 Datum / Date 13-03-2024

D01: Kennzeichnung, Identifizierung, Oberfläche, Form und Maße
D01: Marking and identification, surface appearance shape and dimensional properties

Semi-ellipt. Boden 2:1 / Semi-ellipt. Heads 2:1 Di: 2800 x 40(MW) mm



s	= Wanddicke / wall thickness
Da/Di	= äußerer / innerer Durchmesser / outside / inside diameter
Ri	= Wölbungsradius / dish radius
r	= Krempenradius / knuckle radius
h	= Bordhöhe / height of straight flange
Hi	= Gesamthöhe innen / total height inside
Ua/Ui	= äußerer / innerer Umfang / outside / inside circumference
AB	= Ausbrand / center hole / cut out
KF	= Kantenform Borkante / edge preparation straight flange
VO	= Visuelle Oberflächenprüfung / visual testing
BP	= Bodenpaar / by pair
Y	= Bestanden / satisfactory
HRK	= Höhe roh / height raw
Ov	= Unrundheit / out of roundness
sAW	= Plattierungsdicke / cladding inside
Sh	= Form mit Schablone / Shape by template

KF = plan / square

Part No.	Ui	Di	Ov	Hi	HRK	h	s	KF	VO	Sh
set value	mm	mm	mm	mm	mm	mm	mm			
>=	8770			750		50,00	40,00			
<=	8822		14	785		70,00				
CE/05710/10/7	8801	2801 - 2803	2	760	790	53 - 55	43,40 - 48,10	Y	Y	Y
CE/05710/10/8	8801	2800 - 2804	4	760	790	52 - 56	43,30 - 47,80	Y	Y	Y
CE/05710/10/9	8802	2799 - 2805	6	760	790	53 - 55	42,80 - 47,10	Y	Y	Y

A04
Herstellerzeichen
Symbol of the manufacturer`s work
voestalpine

Z02
Abnahmebeauftragter voestalpine
Grobblech
Inspection representative voestalpine
Grobblech
Engelmann Georg

voestalpine
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29 APR 2024

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1723001756-QC-DB-00017_02 - V25001A

A08 Werksauftragsnr. / Manufacturer`s works order no.: A9805710 Positionsnr. / Item no.: 10 Z02 Datum / Date 13-03-2024

D01: Kennzeichnung, Identifizierung, Oberfläche, Form und Maße
D01: Marking and identification, surface appearance shape and dimensional properties

Part No.	Ui	Di	Ov	Hi	HRK	h	s	KF	VO	Sh
set value	mm	mm	mm	mm	mm	mm	mm			
>=	8770			750		50,00	40,00			
<=	8822		14	785		70,00				
CE/05710/10/10	8805	2801 - 2805	4	760	790	53 - 56	43,30 - 48,30	Y	Y	Y
CE/05710/10/11	8805	2802 - 2805	3	760	790	53 - 55	43,30 - 48,20	Y	Y	Y
CE/05710/10/12	8806	2802 - 2804	2	761	791	53 - 57	43,10 - 48,10	Y	Y	Y

Formtoleranz: ASME Sec.VIII Div.1 UG81

Oberflächenbehandlung
Innen: gestrahlt Sa 2 1/2 - ISO 8501-1
Aussen: gestrahlt Sa 2 1/2 - ISO 8501-1
Oberflächenbeschaffenheit
Innen: SA-20 pt. 9
Aussen: SA-20 pt. 9
Kante: ISO 9013-442

Ergebnis der visuellen Prüfung und Maßkontrolle gemäß D01: Y

Shape tolerance: ASME Sec.VIII Div.1 UG81

Surface treatment
Inside: blasted Sa 2 1/2 - ISO 8501-1
Outside: blasted Sa 2 1/2 - ISO 8501-1
Surface condition
Inside: SA-20 pt. 9
Outside: SA-20 pt. 9
Edge: ISO 9013-442

Result of visual and dimensional inspection according to D01: Y

A04
Herstellerzeichen
Symbol of the manufacturer`s work
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Grobblech
Inspection representative voestalpine
Grobblech
Engelmann Georg

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A08 Werksauftragsnr. / Manufacturer`s works order no.: A9805710 Positionsnr. / Item no.: 10 Z02 Datum / Date 13-03-2024

B06: Kennzeichnung des Erzeugnisses (durch spannungsarmes Prägemarkieren mit farbigem Rahmen)
B06: Marking of the product (by low stress stamping with a coloured frame)

voestalpine
CE/05710/10/..
SA516 Grade 60 HIC
Schmelze
Blech Nr.
UTA 578-C +S1
MT LTV

voestalpine
CE/05710/10/..
SA516 Grade 60 HIC
Heat No.
Plate No.
UTA 578-C +S1
MT LTV

A04
Herstellerzeichen
Symbol of the manufacturer`s work
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Abnahmebeauftragter voestalpine Grobblech
Inspection representative voestalpine Grobblech
Engelmann Georg

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Cert. No. 01

voestalpine Stahl GmbH

Material Testing and Analysis
Microstructure and Surface Analysis
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F. +43/50304/55-0
www.voestalpine.com/stahl

Legal form: Gesellschaft mit beschraenkter Haftung
Headquarters: Linz/Austria
FN 78052h at the Provincial Court of Linz as
Commercial Court having jurisdiction
DVR 0546658
UID No. ATU 36905408

To

Mr. Joachim Zuschrader

Quality Department
voestalpine Grobblech GmbH

Test report *Microstructure and Surface Analysis*
Accredited Testing Laboratories

Test report	TSP-B / 2024-0001-72
Subject	HIC-Hydrogen-Induced Cracking-Test

Job Information

Client	voestalpine Grobblech GmbH		
Order number	9805710	**Order date**	Februar 22nd, 2024
Laboratory group	voestalpine Stahl, TSP – Microstructure and Surface Analysis		
Referee	Michaela Altenhofer	**Phone, Fax**	0043/664 8362916
e-mail	Michaela.Altenhofer@voestalpine.com		
Distribution list	2024-0001		

Description of Test

Specification(s)	NACE TM0284:2016; NACE TM0177:2016 Solution A; ASTM F21:2020;
Simulated PWHT Parameter	1 mal Sim. PWHT von 425 °C aufheizen mit 70 °C/h auf 610 °C (±10 °C) HZ 180 min abkühlen mit 70 °C/h auf 425 °C ,dann Ruhiger Luft

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15 APR 2024

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voestalpine Stahl GmbH

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Legal form: Gesellschaft mit beschraenkter Haftung
Headquarters: Linz/Austria
FN 78052h at the Provincial Court of Linz as
Commercial Court having jurisdiction
DVR 0546658
UID No. ATU 36905408

To

Mr. Joachim Zuschrader

Quality Department
voestalpine Grobblech GmbH

Test report *Microstructure and Surface Analysis*
Accredited Testing Laboratories

Test report	TSP-B / 2024-0001-72
Subject	HIC-Hydrogen-Induced Cracking-Test

Job Information

Client	voestalpine Grobblech GmbH		
Order number	9805710	**Order date**	Februar 22nd, 2024
Laboratory group	voestalpine Stahl, TSP – Microstructure and Surface Analysis		
Referee	Michaela Altenhofer	**Phone, Fax**	0043/664 8362916
e-mail	Michaela.Altenhofer@voestalpine.com		
Distribution list	2024-0001		

Description of Test

Specification(s)	NACE TM0284:2016; NACE TM0177:2016 Solution A; ASTM F21:2020;
Simulated PWHT Parameter	1 mal Sim. PWHT von 425 °C aufheizen mit 70 °C/h auf 610 °C (±10 °C) HZ 180 min abkühlen mit 70 °C/h auf 425 °C ,dann Ruhiger Luft

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ACCEPTED
15 APR 2024

Cert. No. 01

Acceptance Limits:

Values based on average of three faces from each specimen

CLR: ≤15%
CTR: ≤5%
CSR: ≤2%
ICR_MAX* ---

Test procedure:

The specimens were cut from the test plate in the middle of the width [1](A) and/or near the outer edges on the left (VL, RL) or right (VR, RR) depending on the plate thickness staggered across the plate thickness on the centreline [3](K) and near both surfaces (OS and US) or in between (DZ and SZ). The degreasing of the samples was tested according to the method of ASTM F21. Nitrogen (99.9990) was used for purging and H2S (99.5) for saturation. Three sections of each specimen were examined and the values CLR, CSR and CTR (optional CAR and/or *max. individual crack length) were determined. Sections were taken at three equivalent distances. Pictures were taken using a Zeiss Observer microscope. A control sample to demonstrate HIC crack sensitivity was used for the test. (Except for test solution N02). The average Crack Length Ratio (CLR) shall exceed 20% after testing.

Test conditions:

Vessel	Solution	Duration [h]	Start date [mm.dd.yyyy]	End date [mm.dd.yyyy]
5	N01	96	02.29.2024	03.04.2024

N01..... Nace TM0177 Sol.A; N02..... Nace TM0284 Sol.B; N03..... Nace TM0284 Sol.A; N04..... Nace TM0177 Sol.B;

Initial pH of solution	Initial Temp. [°C]	Start pH	End pH of solution	End Temp. [°C]	Start H2S-concentration [ppm]	End H2S-concentration [ppm]	Vessel
2,70	24	3,00	3,80	24	2923	2701	5

Samples were taken from the following plates:

Order Number	Plate No.	Heat No.	Material
9805710	571010/MPH4	858209	SA516Grade60

Control Sample No.	Plate No.	Material Quality	Width [mm]	Thickness [mm]	CLR [%]	Test Vessel
24-52	108573	SA516GRADE70	19,86	30,42	62,00	5

Dimension of specimen in mm:

Specimen No.	(1)	(2)	(3)	(4)	Plate No.	Width [mm]	Thickness [mm]	Test Vessel
PDNZ11G(19)	A	L	K	F	571010/MPH4	19,69	29,08	5
PDNZ11G(9	A	L	OS	F	571010/MPH4	19,73	29,12	5
PDNZ11G(10)	A	L	US	F	571010/MPH4	19,71	29,15	5

[2]L.....longitudinal to the rolling direction; Q....transverse to the rolling direction; [4]F.....Leading End of Plate; K.....Tailing End of Plate; Length of specimen....100mm;

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Results:

Specimen No.	Plate No.	CLR %	CSR %	CTR %	ICR_MAX mm
PDNZ11G(19)/A	571010/MPH4	0,0	0,0	0,0	0
PDNZ11G(19)/B	571010/MPH4	0,0	0,0	0,0	0
PDNZ11G(19)/C	571010/MPH4	0,0	0,0	0,0	0
PDNZ11G(19)/Avg A-C	571010/MPH4	0,0	0,0	0,0	
PDNZ11G(9)/A	571010/MPH4	0,0	0,0	0,0	0
PDNZ11G(9)/B	571010/MPH4	0,0	0,0	0,0	0
PDNZ11G(9)/C	571010/MPH4	0,0	0,0	0,0	0
PDNZ11G(9)/Avg A-C	571010/MPH4	0,0	0,0	0,0	
PDNZ11G(10)/A	571010/MPH4	0,0	0,0	0,0	0
PDNZ11G(10)/B	571010/MPH4	0,0	0,0	0,0	0
PDNZ11G(10)/C	571010/MPH4	0,0	0,0	0,0	0
PDNZ11G(10)/Avg A-C	571010/MPH4	0,0	0,0	0,0	

The test results relate only to the items tested! The laboratory is not responsible for the sampling-parts and assumes no responsibility for any information from transmitted data or data that was not generated independently.
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Enclosures:
Pictures of specimens and/or control sample pages 4-10
For actual magnification of pictures please refer to micrometer scale in the pictures.

Test Crew:

Referee: Michaela Altenhofer

Laboratory Head: Andreas Schoenauer

voestalpine Stahl GmbH
Microstructure and Surface Analysis

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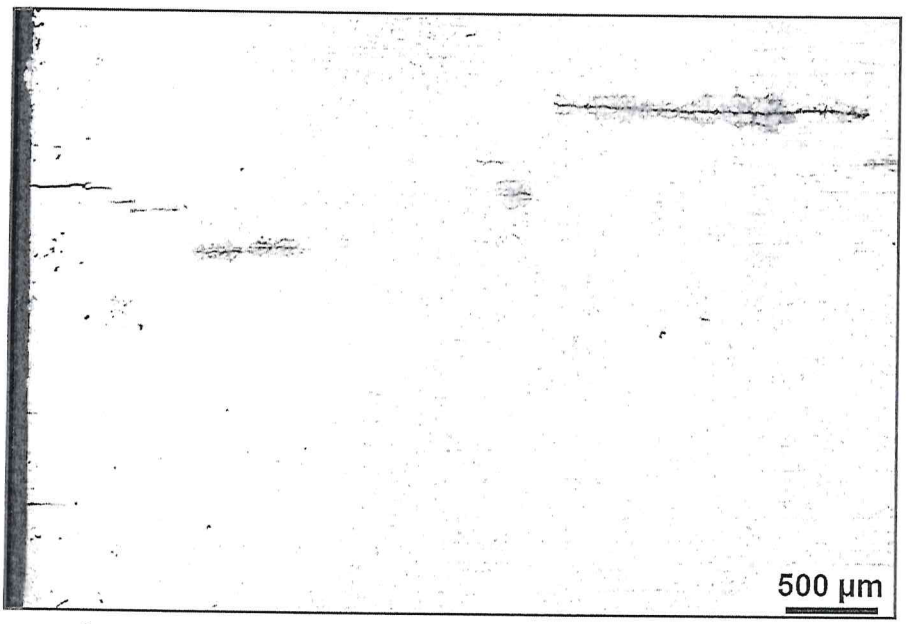
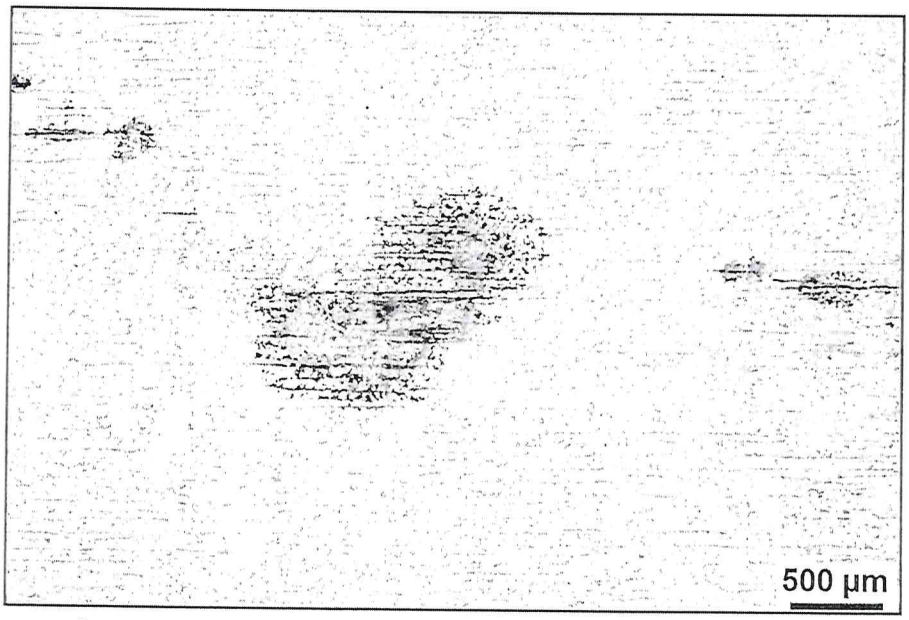


Device: Observer2
Description: 108573 L 24-52 1

Image: 2024_0021984
Face A Top[-] Center[X] Bottom[-]

Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-52 2

Image: 2024_0021987
Face A Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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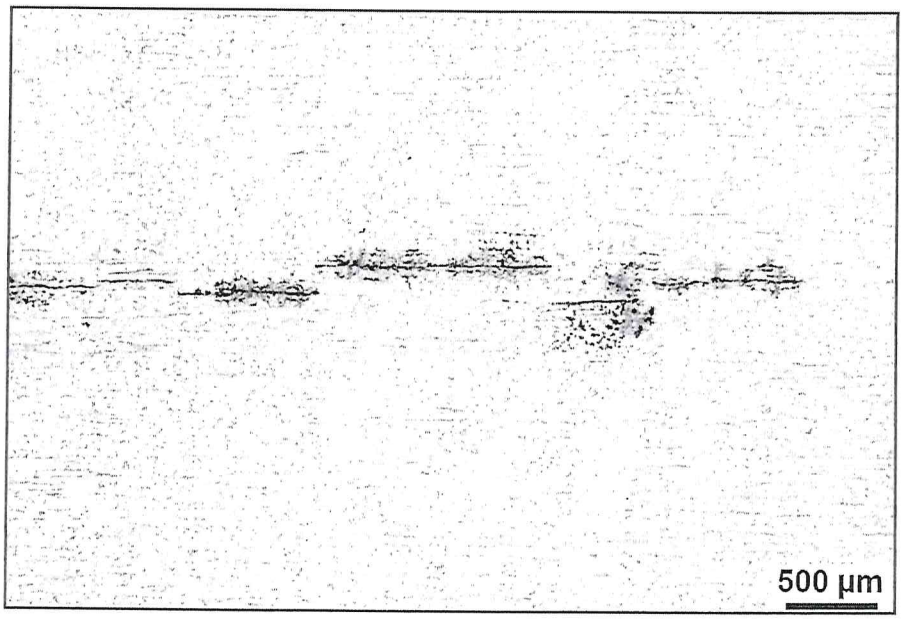
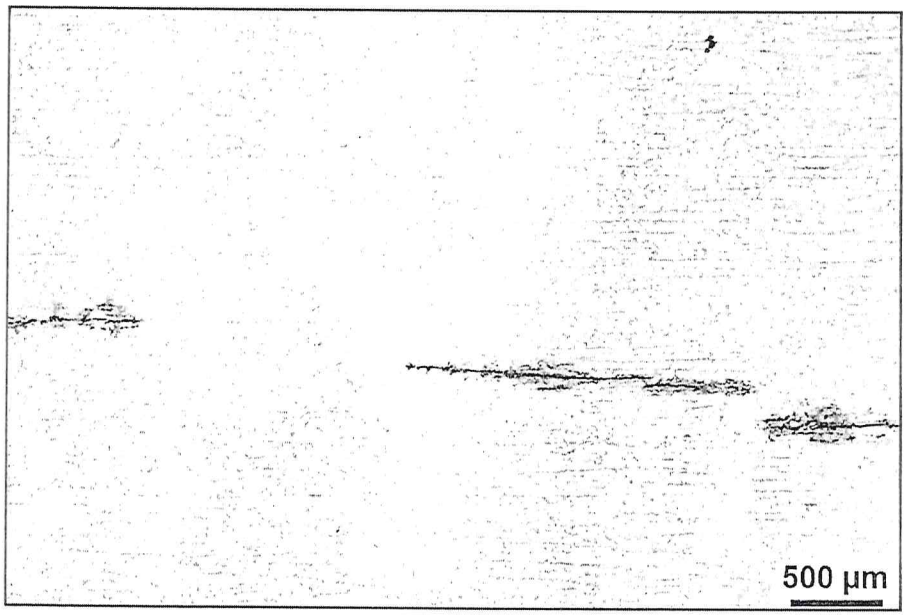


Device: Observer2 Image: 2024_0021988 Caustic: Nital 2%
Description: 108573 L 24-52 3 Face A Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0021989 Caustic: Nital 2%
Description: 108573 L 24-52 4 Face A Top[-] Center[X] Bottom[-]

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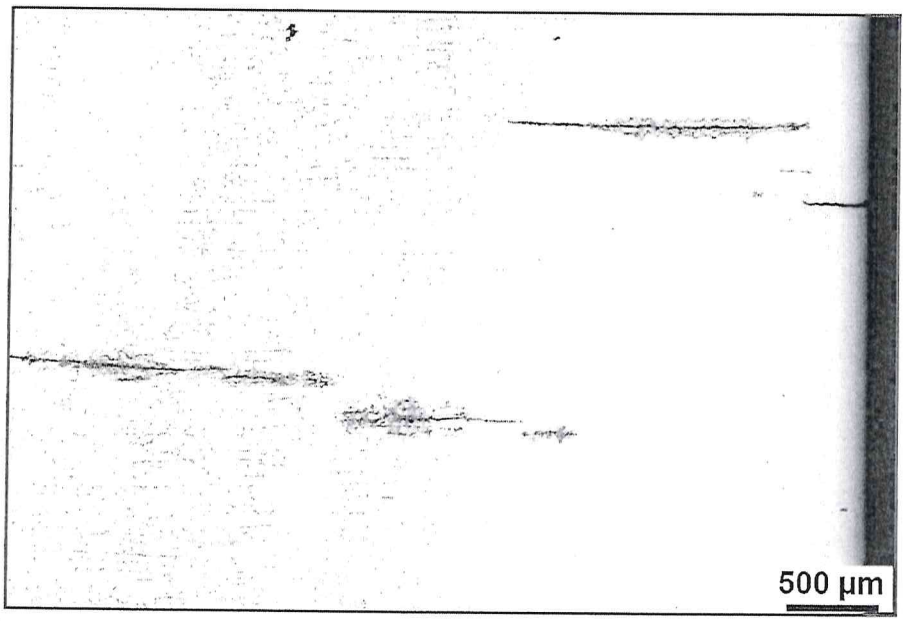
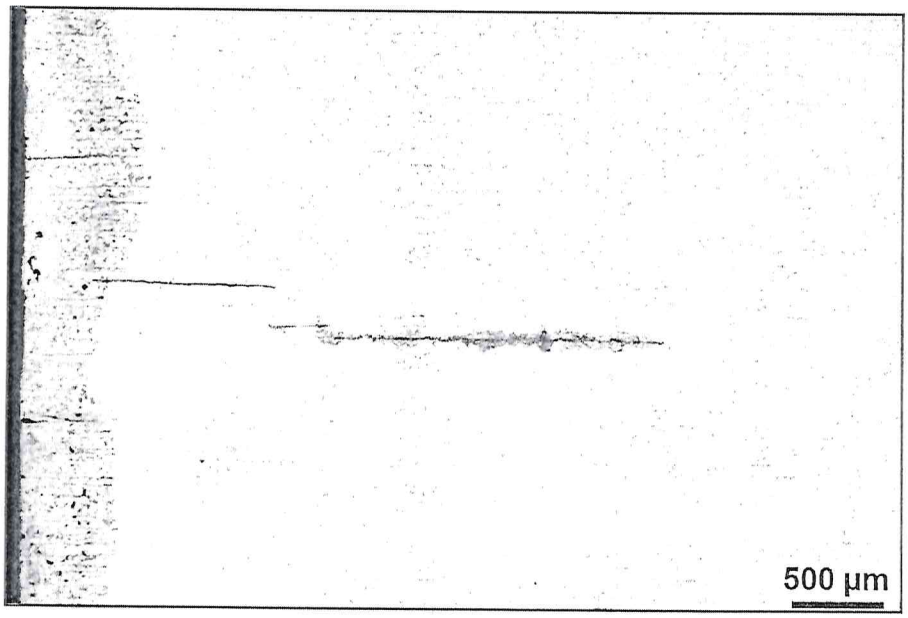


Device: Observer2 Image: 2024_0021990 Caustic: Nital 2%
Description: 108573 L 24-52 5 Face A Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0021991 Caustic: Nital 2%
Description: 108573 L 24-52 Face B Top[-] Center[X] Bottom[-]

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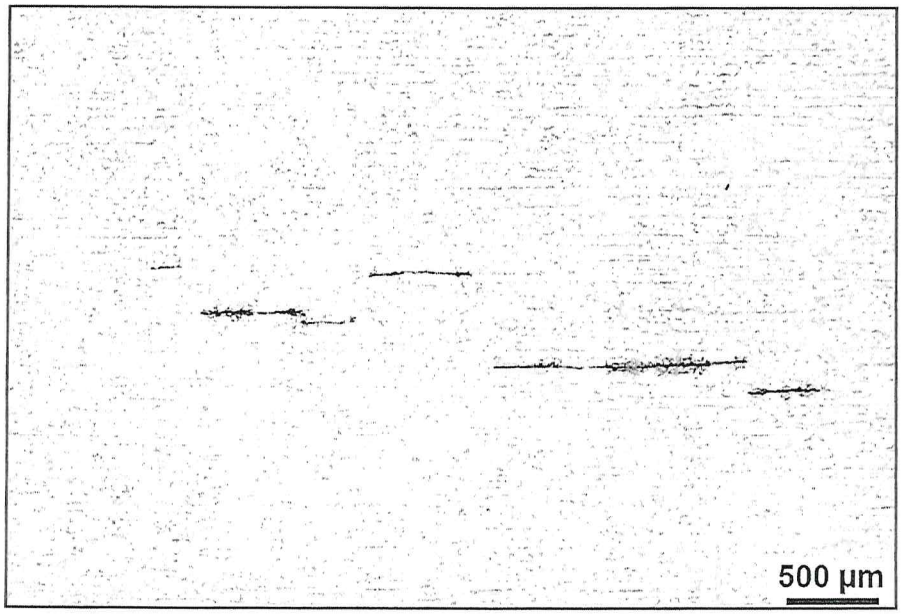
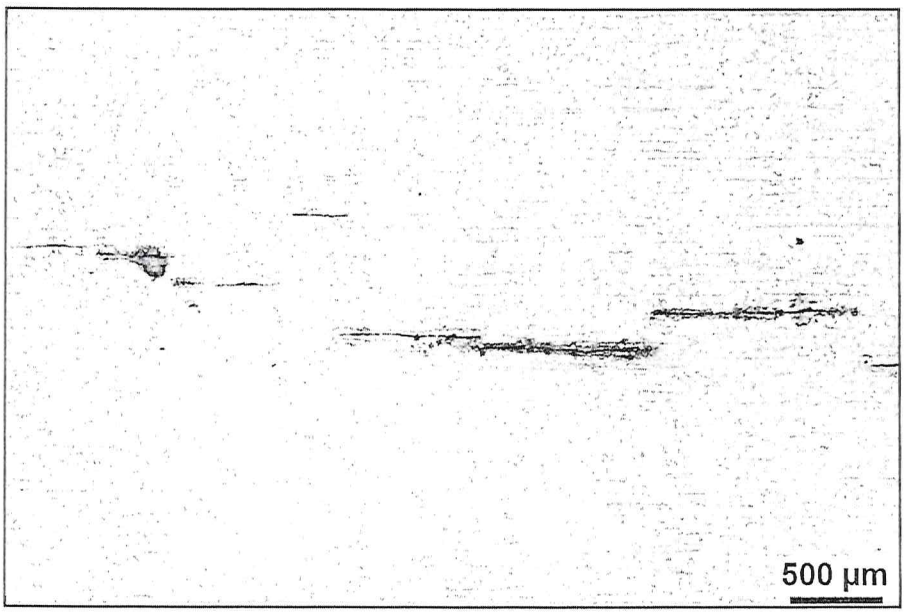


Device: Observer2 Image: 2024_0021994 Caustic: Nital 2%
Description: 108573 L 24-52 Face B Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0021996 Caustic: Nital 2%
Description: 108573 L 24-52 1 Face B Top[-] Center[X] Bottom[-]

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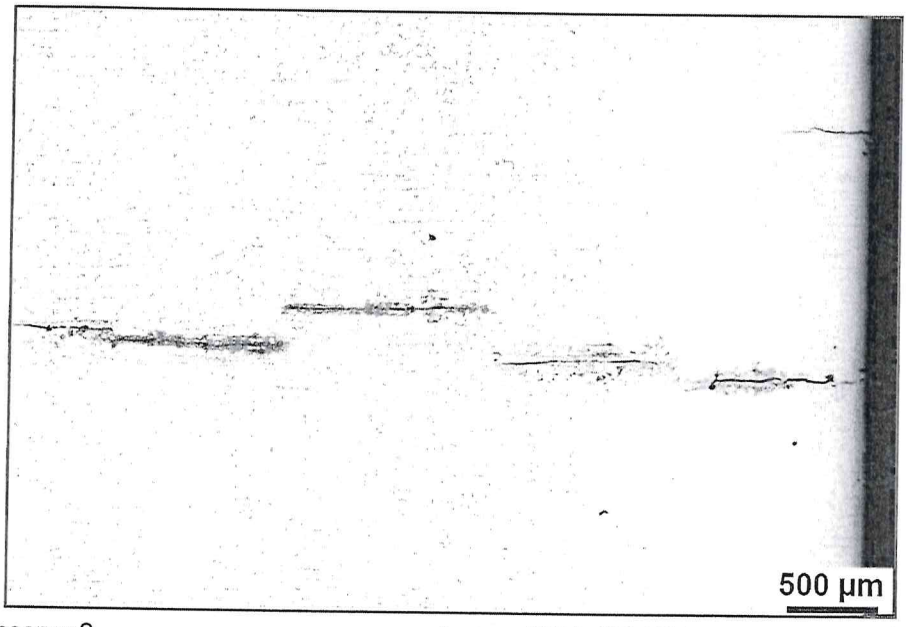
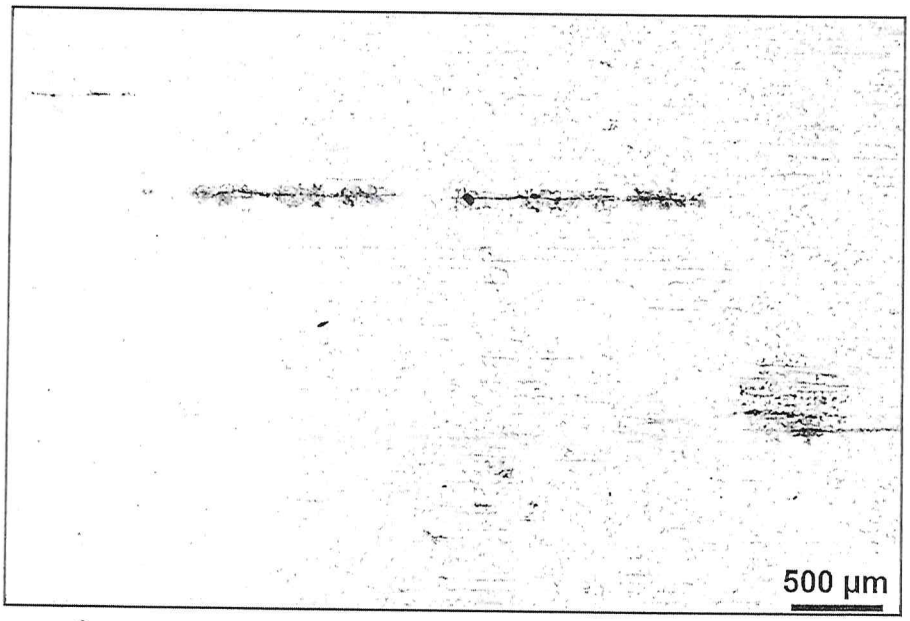


Device: Observer2
Description: 108573 L 24-52 2

Image: 2024_0021998
Face B Top[-] Center[X] Bottom[-]

Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-52 1

Image: 2024_0021999
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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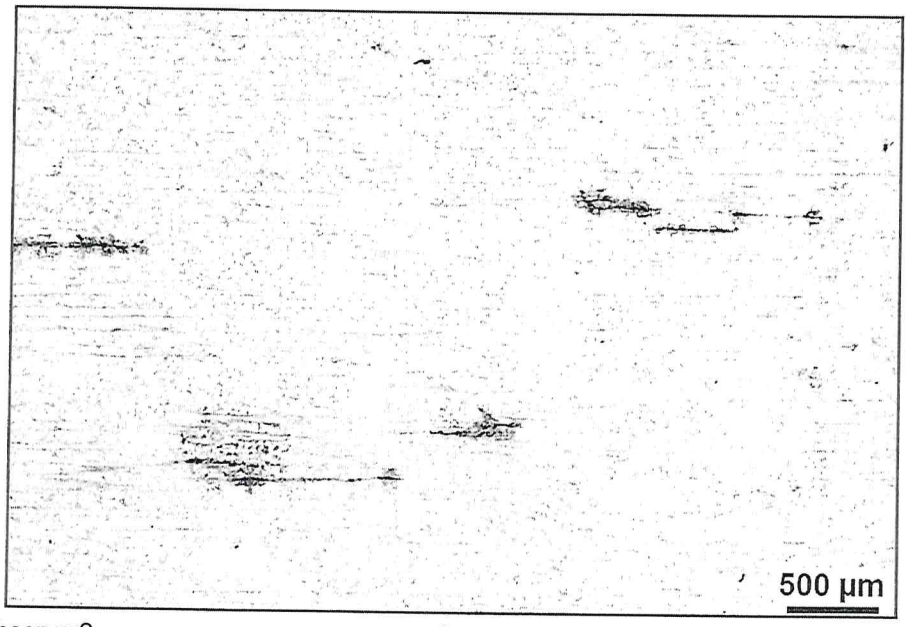
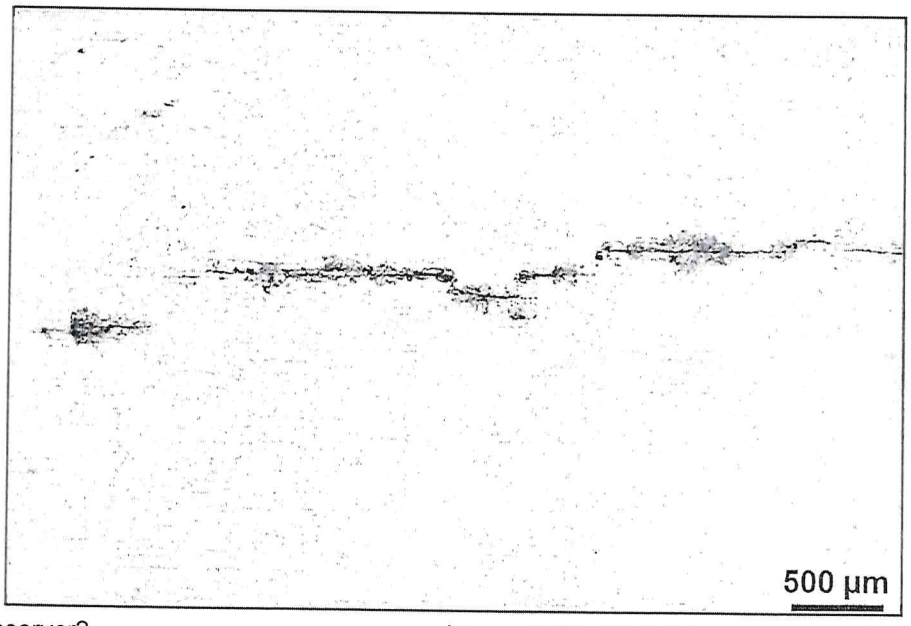


Device: Observer2
Description: 108573 L 24-52 2

Image: 2024_0022000
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-52 1

Image: 2024_0022001
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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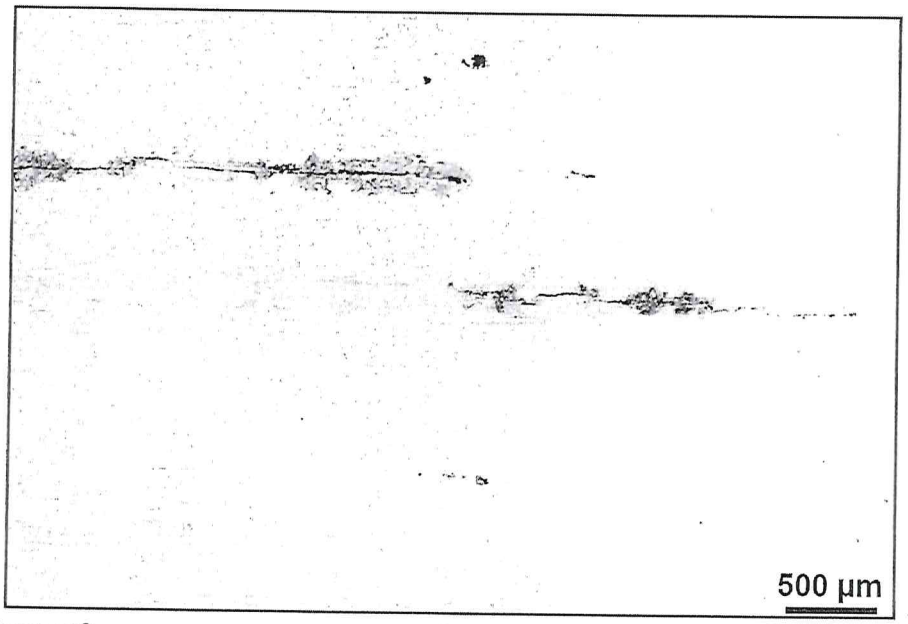

Device: Observer2
Description: 108573 L 24-52 2

Image: 2024_0022002
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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voestalpine-Straße 3
4020 Linz, Austria
www.voestalpine.com/grobblech

A02 Inspection certificate
EN 10204 - 3.1

Z02 Date 22-02-2024

A04 manufacturer's work symbol
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A03 Document number	Q0545389	A08 Order-No.:	3501486	A07 OrderDat.	02-11-2023
A06 Customer	BREMBANA & ROLLE SPA Via Villino 1 I-24030 VALBREMBO (BG)	B01 Product	Plate	Date of dispatch	16-02-2024 400F
A07 OrderNo.	23096-ODA23-003052	B02 Material	SA516 Grade 60	B03 Standard	ASME SA-516/SA-516M : ED.2021
A06 Consignee	BREMBANA & ROLLE SPA Via Villino 1 I-24030 VALBREMBO (BG)	Supplementary requirements	normalised		
		B04 Delivery condition	normalised		

B03 - Supplementary requirements
ASME SECT. II, PART A, ED. 2021 // MATERIAL IS SUITABLE FOR 2014/68/EC DIRECTIVE ANNEX 1 PAR. 4.3 APPLICATION // FINE GRAINED, VACUUM DEGASSED AND FULLY KILLED. // ISO15156-1 / NACE MR0175 ED.2020 // MATERIAL IS ACC. TO SPEC. 23096-EMRS-101 REV.1

D01 - Visual Examination and dimensional checking: satisfactory. The results of tests performed are in compliance with the requirements.

Detail of supply

B07 Heat No.	B06 Plate No	Item	Dimensions B09 Thickness mm	B10 Width mm	B11 Length mm	B08 Piece	B12 theor. Mass kg	B13 act. Mass kg	A09 Disp-No 130 42	reference no.
762981	235595/1 MK3	10	44,00	2800,0	9200	1		9.176	41825	23096-PLATE MK.9002
762981	235596/1 MK3	10	44,00	2800,0	9200	1		9.176	41825	23096-PLATE MK.9002
762981	235598/1 D MK3	10	44,00	2800,0	9200	1		9.171	41825	23096-PLATE MK.9002
762981	235599/1 F MK3	10	44,00	2800,0	9200	1		9.177	41825	23096-PLATE MK.9002
762981	235602/1 A MK3	10	44,00	2800,0	9200	1		9.173	41825	23096-PLATE MK.9002
762981	235603/1 B MK3	10	44,00	2800,0	9200	1		9.188	41825	23096-PLATE MK.9002
	Sum					6		55.061		

B07 Heat No.	B06 Plate No	temp. °C	Time MIN	kind of cooling
762981	235595/1	920	41	AL
762981	235596/1	920	41	AL

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B07 Heat No.	B06 Plate No	temp. °C	Time MIN	kind of cooling
762981	235598/1	920	41	AL
762981	235599/1	920	41	AL
762981	235602/1	920	41	AL
762981	235603/1	920	41	AL

B14 - Supplementary information

temp.:
Time:
kind of cooling:
AL: cooling on air
Tolerances acc. ASME SA 20/SA 20M
Shape tolerance acc. ASME SA 20/SA 20M
Repair-welding not permitted
Thickness tolerance acc. ASME SA 20/SA 20M only plus

Chemical composition (Heat analysis)

B07 Heat No.		C %	Si %	Mn %	P %	S %	Al %	Cr %	Ni %	Mo %	Cu %	V %	Nb %	Ti %	N %	B %	Cae %	LF03 %	LF15 %
	>=		.150	.850															
Set values	<=	.230	.400	1.200	.015	.0030		.300	.400	.120	.400	.030	.014	.030		.0010	.35	1.000	.320
762981		.084	.368	1.170	.008	.0006	.039	.074	.270	.054	.163	.005	.011	.002	.0044	.0002	.33	.561	.128

C99 - Supplementary information

Cae: C+(Mn/6)+(Cr+Mo+V)/5+(Ni+Cu)/15
LF03: Cr+Ni+Cu+Mo
LF15: Cr+Mo

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Test results: C10-C29 Tensile Test at room temperature acc. ASTM/ASME A370/SA370

B06 Plate No	C41 Width	SpThickn MM	C01 loc.	PosTh.	C02 Dir	C11 Rp0,2 MPa	C12 Rm MPa	L0	C13 E %	Sim.htm	WBH
>= Set values <=						220 / 380	415 / 550		25.0		
235595	Ø	12.53	F	V	T	330	464	L2"	39.5		
	Ø	12.50	F	V	T	332	454	L2"	40.2	001	1
	Ø	12.50	F	V	T	326	450	L2"	40.4	002	1
235596	Ø	12.53	F	V	T	327	462	L2"	39.1		
	Ø	12.50	F	V	T	327	453	L2"	40.3	001	1
	Ø	12.50	F	V	T	322	448	L2"	40.9	002	1
235598	Ø	12.55	F	V	T	327	460	L2"	40.2		
	Ø	12.51	F	V	T	323	454	L2"	38.9	001	1
	Ø	12.51	F	V	T	324	450	L2"	40.0	002	1
235599	Ø	12.54	F	V	T	320	462	L2"	39.8		
	Ø	12.52	F	V	T	327	454	L2"	39.9	001	1
	Ø	12.50	F	V	T	325	450	L2"	39.9	002	1
235602	Ø	12.55	F	V	T	324	462	L2"	38.8		
	Ø	12.50	F	V	T	319	455	L2"	40.2	001	1
	Ø	12.52	F	V	T	328	449	L2"	39.9	002	1
235603	Ø	12.54	F	V	T	330	463	L2"	39.2		
	Ø	12.50	F	V	T	328	456	L2"	39.6	001	1
	Ø	12.50	F	V	T	322	452	L2"	40.9	002	1

SpThickn: specimen thickness
C01;loc.:
F: Bottom
PosTh.: Pos Thickness
V: ¼ t
C02;Dir:
T: transverse

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Test results: C10-C29 Tensile Test at room temperature acc. ASTM/ASME A370/SA370

B06 Plate No	C41 Width	SpThickn MM	C01 loc.	PosTh.	C02 Dir	C11 Rp0,2 MPa	C12 Rm MPa	L0	C13 E %	Sim.htm	WBH

C11;Rp0,2: Yield Strength
C12; Rm: Tensile Strength
L0: gauge
  L2": Length = 50mm
C13;E: elongation
Sim.htm: sim. heat treatment
  001: Sim.htm group #1
  002: Sim.htm group #2
WBH: sim. heat treatment

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Test results: C40-C49 Impact Test acc. ASTM/ASME A370/SA370

B06 Plate No	C40 shape	C01 loc.	PosTh.	C02 Dir	C03 temp °C	C42 SV J	C42 SV J	C42 SV J	C43 AV J	Sim.htm	WBH
Set values >=					-46	27	27	27	27		
235595	CV 10x10	F	V	T	-46	394	396	391	394		
	CV 10x10	F	V	T	-46	401	405	408	405	001	1
	CV 10x10	F	V	T	-46	402	393	413	403	002	1
235596	CV 10x10	F	V	T	-46	397	395	399	397		
	CV 10x10	F	V	T	-46	404	407	412	408	001	1
	CV 10x10	F	V	T	-46	405	405	411	407	002	1
235598	CV 10x10	F	V	T	-46	401	400	402	401		
	CV 10x10	F	V	T	-46	398	404	401	401	001	1
	CV 10x10	F	V	T	-46	400	403	402	401	002	1
235599	CV 10x10	F	V	T	-46	395	396	397	396		
	CV 10x10	F	V	T	-46	403	403	404	404	001	1
	CV 10x10	F	V	T	-46	403	405	406	405	002	1
235602	CV 10x10	F	V	T	-46	399	400	395	398		
	CV 10x10	F	V	T	-46	401	417	405	407	001	1
	CV 10x10	F	V	T	-46	401	403	404	403	002	1
235603	CV 10x10	F	V	T	-46	401	402	398	400		
	CV 10x10	F	V	T	-46	402	401	405	403	001	1
	CV 10x10	F	V	T	-46	404	402	405	404	002	1

C40;shape:
CV 10x10: Test shape , Dimensions
C01;loc.:
F: Bottom
PosTh.: Pos Thickness
V: ¼ t
C02;Dir:

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Test results: C40-C49 Impact Test acc. ASTM/ASME A370/SA370

B06 Plate No	C40 shape	C01 loc.	PosTh.	C02 Dir	C03 temp °C	C42 SV J	C42 SV J	C42 SV J	C43 AV J	Sim.htm	WBH

T: transverse
C03; temp: Test temperature
C42;SV: single value
C43;AV: average value
Sim.htm: sim. heat treatment
001: Sim.htm group #1
002: Sim.htm group #2
WBH: sim. heat treatment

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Test results: C30-C39 Hardness Test Vickers

B06 Plate No	PosTh.	Hard.	C31 HV	C31 HV	C31 HV	Sim.htm	WBH
>= Set values <=			190	190	190		
235595	OS	HV10	137	137	136		
	OS	HV10	132	136	133	001	1
	OS	HV10	132	131	134	002	1
235596	OS	HV10	138	140	141		
	OS	HV10	133	133	135	001	1
	OS	HV10	132	135	132	002	1
235598	OS	HV10	141	147	139		
	OS	HV10	135	135	135	001	1
	OS	HV10	137	133	134	002	1
235599	OS	HV10	140	139	154		
	OS	HV10	136	135	133	001	1
	OS	HV10	137	137	135	002	1
235602	OS	HV10	136	137	136		
	OS	HV10	135	135	135	001	1
	OS	HV10	137	135	136	002	1
235603	OS	HV10	139	138	138		
	OS	HV10	135	137	141	001	1
	OS	HV10	138	136	135	002	1

PosTh.: Pos Thickness
OS: upper side
Hard.: stress
Sim.htm: sim. heat treatment
001: Sim.htm group #1
002: Sim.htm group #2
WBH: sim. heat treatment

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Chemical composition (Product analysis)

B07 Heat No.	C %	Si %	Mn %	P %	S %	Al %	Cr %	Ni %	Mo %	Cu %	V %	Nb %	Ti %	N %	B %	Cae %	LF03 %	LF15 %
>=		.130	.790															
Set values <=	.230	.450	1.300	.015	.0030		.340	.430	.130	.430	.040	.014	.040		.0015	.35		
762981	.086	.364	1.180	.008	.0008	.038	.074	.270	.055	.164	.005	.011	.002	.0052	.0003	.34	.563	.129

C99 - Supplementary information

Cae: C+(Mn/6)+(Cr+Mo+V)/5+(Ni+Cu)/15
LF03: Cr+Ni+Cu+Mo
LF15: Cr+Mo

Remarks

Simulated heat treatment of test coupons:

Item 10:
001/1: 1 cycle(s) sim. PWHT: furnace charge temperature at max. 425 °C, heating with max. 70 °C/h up to 610 °C, +10 °C/-10 °C, holding time 180 minutes, cooling with max. 70 °C/h down to 425 °C, final cooling in calm air.
002/1: 1 cycle(s) sim. PWHT: furnace charge temperature at max. 425 °C, heating with max. 70 °C/h up to 610 °C, +10 °C/-10 °C, holding time 720 minutes, cooling with max. 70 °C/h down to 425 °C, final cooling in calm air.

We confirm that the delivered material complies with the terms of order.

C70 - Method of steelmaking: Basic oxygen furnace (BOF) steelmaking, continuous casting with soft reduction, steel is fully killed, vacuum degassed and melted by fine grain practice, austenitic grain size 5 or finer acc. to para. 8.3.2 of ASME SA 20/SA 20M

We hereby certify, that the material has been manufactured, sampled and tested in accordance with the requirements of the material specification, and the results meet the requirements.

HIC testing of the base material was carried out with satisfactory results. All determined values are within the acceptance limits and stated on separate test report.

The signature of the inspection representative from voestalpine Grobblech GmbH is substituted by an electronic signature, because the certificates of voestalpine Grobblech GmbH are prepared by a suitable data processing system (EN 10204, Pt.5).

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Reisinger Patrick

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D02-D50 - ULTRASONIC EXAMINATION PLATE(S)

SPECIFICATION

Ultrasonic test acc. ASME SA-578/SA-578M, ASME SA 578 Level C /Body, 100% Test, S1 - scanning 100% of plate surface, ASME SA 578 Level C /Edge Zone, Edge zone longitudinal 50 mm, Edge zone transverse 50 mm; satisfactory

VALID TEST EQUIPMENT
mechanized ultrasonic "In-Line testing system" (Manufacturer: NDT-Systems & Services) and
mechanized ultrasonic "off-line - testing system" (manufacturer: Windhoff Bahn- und Anlagentechnik GmbH) and
MUT (optional): Sonatest D20 no. 90006523 or Sonatest D20 no. 90007346 or Sonatest D50 no. 90010231 or GE - USM 36 no. 90010775 or Sonatest Wave no. 90015462 or Sonatest Wave no. 90015464

PROBE
(in-line AUT): 3STSE 18.3/8 P5, SEZ5R10RS, SE3 18.3/10 5A, (5MHz)
(off-line AUT): S140 (4MHz) 3T/1R
(MUT): SEB4E (4MHz), SEB4E0° (4MHz), MSEB4E (4MHz), B2SO (2MHz)
watergapcoupling

SURFACE CONDITION
Scaled surface - cleaned surface and free of loose scale.

RESULT
Plate(s) comply with the specification.

INSPECTION OPERATOR
Operators Level 2: qualified and certified according EN ISO 9712 (since 01.01.2013) respectively according the Written Practice „NDT-WP" (in accordance to Recommended Practice SNT-TC-1A). Operators Level 2 for ASME/ASTM.

INSPECTION SUPERVISOR
Responsible Level 3: Bindreiter Erich

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Inspection representative voestalpine
Reisinger Patrick

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voestalpine Stahl GmbH

Material Testing and Analysis
Microstructure and Surface Analysis
voestalpine-Strasse 3
4020 Linz, Austria
T. +43/50304/15-0
F. +43/50304/55-0
www.voestalpine.com/stahl

Legal form: Gesellschaft mit beschraenkter Haftung
Headquarters: Linz/Austria
FN 78052h at the Provincial Court of Linz as
Commercial Court having jurisdiction
DVR 0546658
UID No. ATU 36905408

To

Mr. Joachim Zuschrader

Quality Department
voestalpine Grobblech GmbH

Test report *Microstructure and Surface Analysis*
Accredited Testing Laboratories

Test report	TSP-B / 2024-0001-60
Subject	HIC-Hydrogen-Induced Cracking-Test

Job Information

Client	voestalpine Grobblech GmbH		
Order number	3501486	**Order date**	January 27th, 2024
Laboratory group	voestalpine Stahl, TSP – Microstructure and Surface Analysis		
Referee	Michaela Altenhofer	**Phone, Fax**	0043/664 8362916
e-mail	Michaela.Altenhofer@voestalpine.com		
Distribution list	2024-0001		

Description of Test

Specification(s)	NACE TM0284:2016 Solution A; ASTM F21:20;
Simulated PWHT Parameter	1 cycle(s) sim. PWHT from 425 °C, 70 °C/h, to 610 °C, +10 °C / -10,HT: 180 min.,cooling with 70 °C/h to 425 °C, calm air

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Acceptance Limits:

Values based on average of three faces from each specimen

CLR: ---

CTR: ---

CSR: ---

ICR_MAX* ---

Test procedure:

The specimens were cut from the test plate in the middle of the width [1](A) and/or near the outer edges on the left (VL, RL) or right (VR, RR) depending on the plate thickness staggered across the plate thickness on the centreline [3](K) and near both surfaces (OS and US) or in between (DZ and SZ). The degreasing of the samples was tested according to the method of ASTM F21. Nitrogen (99.9990) was used for purging and H2S (99.5) for saturation. Three sections of each specimen were examined and the values CLR, CSR and CTR (optional CAR and/or *max. individual crack length) were determined. Sections were taken at three equivalent distances. Pictures were taken using a Zeiss Observer microscope. A control sample to demonstrate HIC crack sensitivity was used for the test. (Except for test solution N02). The average Crack Length Ratio (CLR) shall exceed 20% after testing.

Test conditions:

Vessel	Solution	Duration [h]	Start date [mm.dd.yyyy]	End date [mm.dd.yyyy]
3	N01	96	02.02.2024	02.06.2024

N01..... Nace TM0177 Sol.A; N02..... Nace TM0284 Sol.B; N03..... Nace TM0284 Sol.A; N04..... Nace TM0177 Sol.B;

Initial pH of solution	Initial Temp. [°C]	Start pH	End pH of solution	End Temp. [°C]	Start H2S-concentration [ppm]	End H2S-concentration [ppm]	Vessel
2,70	24	3,00	3,80	24	2906	2565	3

Samples were taken from the following plates:

Order Number	Plate No.	Heat No.	Material
3501486	235595/	762981	SA516Grade60

Control Sample No.	Plate No.	Material Quality	Width [mm]	Thickness [mm]	CLR [%]	Test Vessel
24-17	108573	SA516GRADE70	19,82	30,43	88,00	3

Dimension of specimen in mm:

Specimen No.	(1)	(2)	(3)	(4)	Plate No.	Width [mm]	Thickness [mm]	Test Vessel
GsKG2G1(6)	A	L	K	F	235595/	20,25	29,48	3
GsKG2G1(4)	A	L	US	F	235595/	20,21	29,47	3
GsKG2G1(5)	A	L	OS	F	235595/	20,20	29,47	3

[2]L.....longitudinal to the rolling direction; Q....transverse to the rolling direction; [4]F.....Leading End of Plate; K.....Tailing End of Plate; Length of specimen....100mm;

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Results:

Specimen No.	Plate No.	CLR %	CSR %	CTR %	ICR_MAX mm
GsKG2G1(6)/A	235595/	0,0	0,0	0,0	0
GsKG2G1(6)/B	235595/	0,0	0,0	0,0	0
GsKG2G1(6)/C	235595/	0,0	0,0	0,0	0
GsKG2G1(6)/Avg A-C	235595/	0,0	0,0	0,0	
GsKG2G1(4)/A	235595/	0,0	0,0	0,0	0
GsKG2G1(4)/B	235595/	0,0	0,0	0,0	0
GsKG2G1(4)/C	235595/	0,0	0,0	0,0	0
GsKG2G1(4)/Avg A-C	235595/	0,0	0,0	0,0	
GsKG2G1(5)/A	235595/	0,0	0,0	0,0	0
GsKG2G1(5)/B	235595/	0,0	0,0	0,0	0
GsKG2G1(5)/C	235595/	0,0	0,0	0,0	0
GsKG2G1(5)/Avg A-C	235595/	0,0	0,0	0,0	

The test results relate only to the items tested! The laboratory is not responsible for the sampling-parts and assumes no responsibility for any information from transmitted data or data that was not generated independently.
The report shall not be reproduced incompletely except in full without the written approval of the testing laboratories!

Enclosures:
Pictures of specimens and/or control sample pages 4-11
For actual magnification of pictures please refer to micrometer scale in the pictures.

Test Crew:

Referee: Michaela Altenhofer

Laboratory Head: Andreas Schoenauer

voestalpine Stahl GmbH
Microstructure and Surface Analysis

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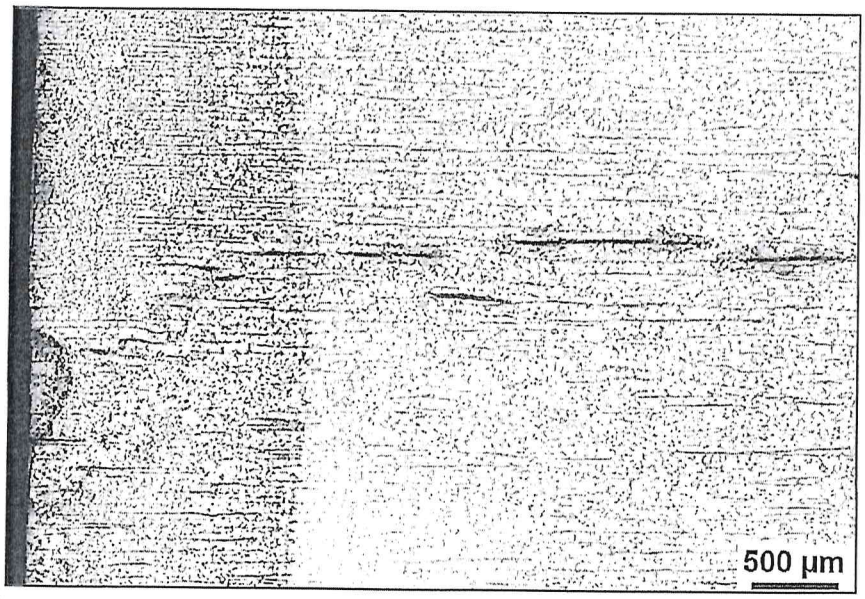
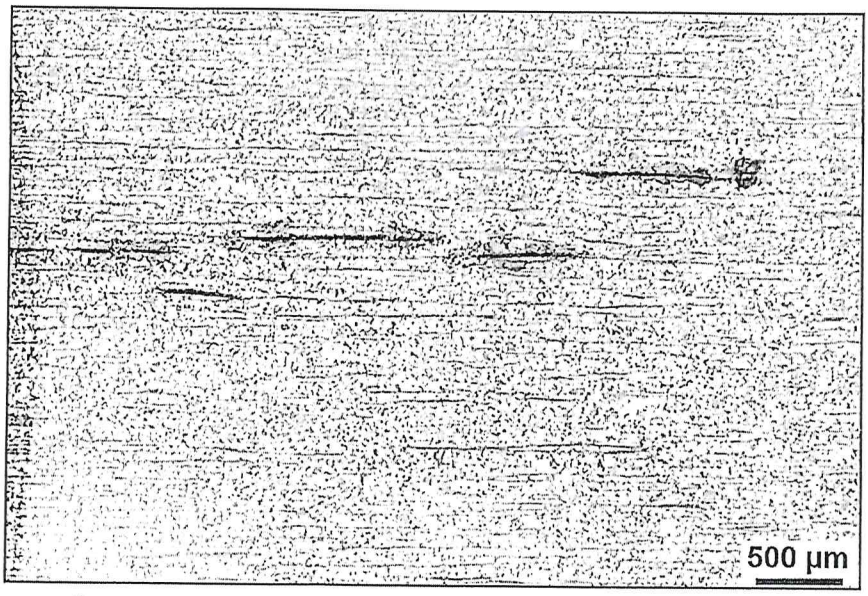


Device: Observer2 Image: 2024_0012143 Caustic: Nital 2%
Description: 108573 L 24-17 1 Face A Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0012145 Caustic: Nital 2%
Description: 108573 L 24-17 2 Face A Top[-] Center[X] Bottom[-]

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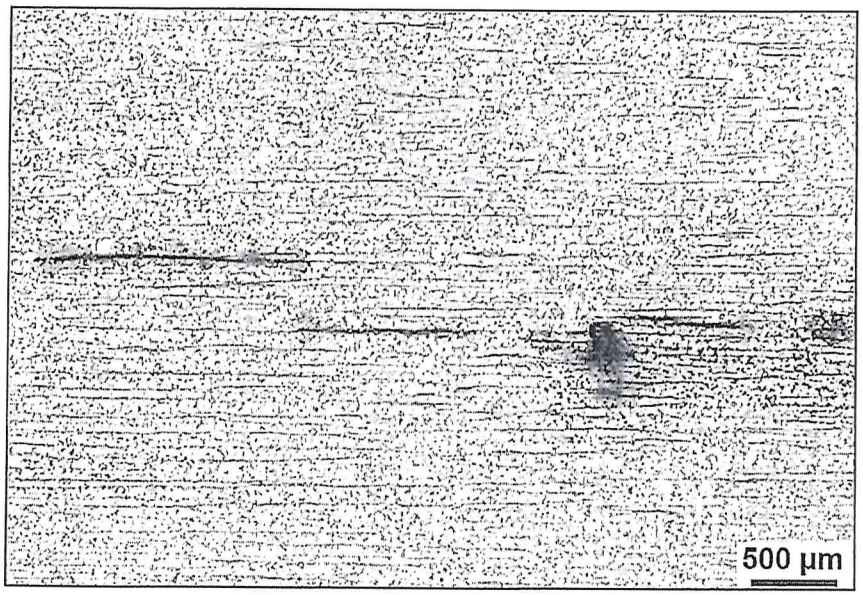
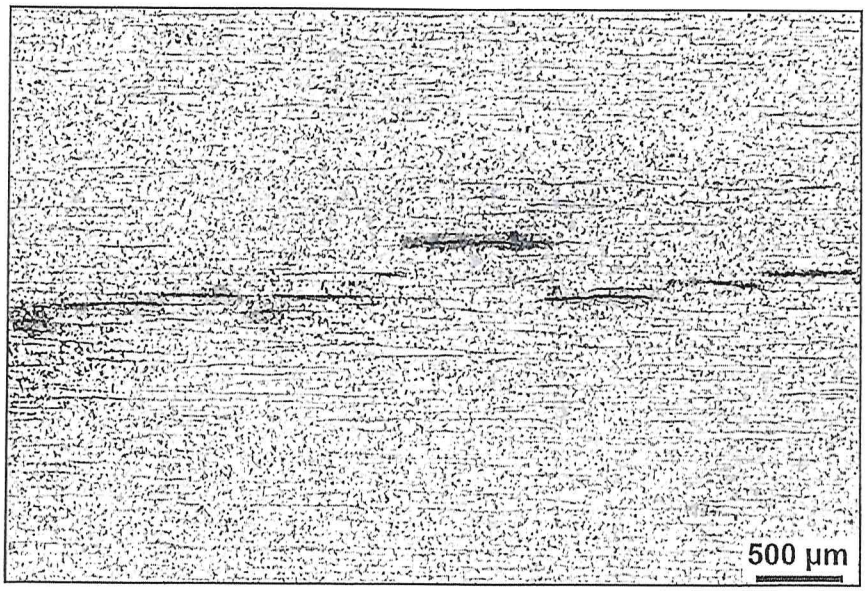


Device: Observer2 Image: 2024_0012146 Caustic: Nital 2%
Description: 108573 L 24-17 1 Face A Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0012148 Caustic: Nital 2%
Description: 108573 L 24-17 2 Face A Top[-] Center[X] Bottom[-]

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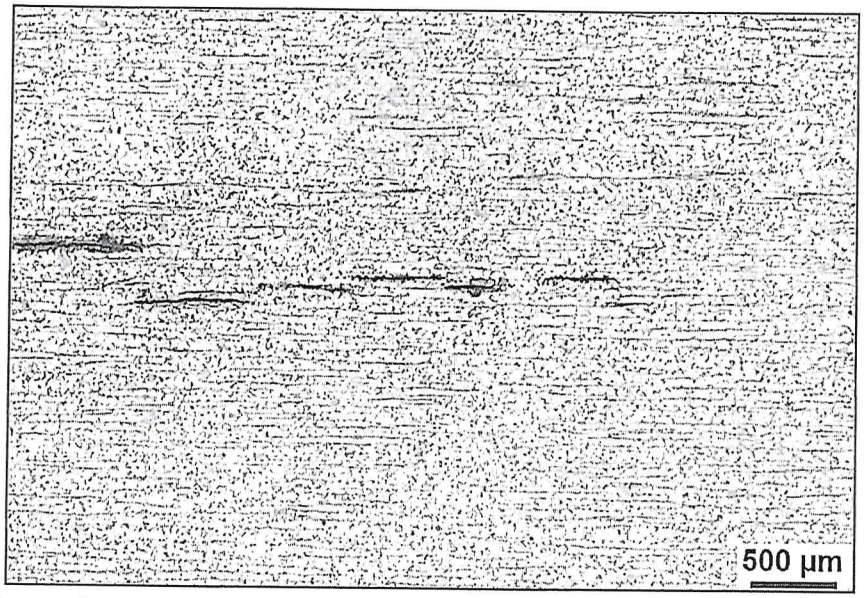
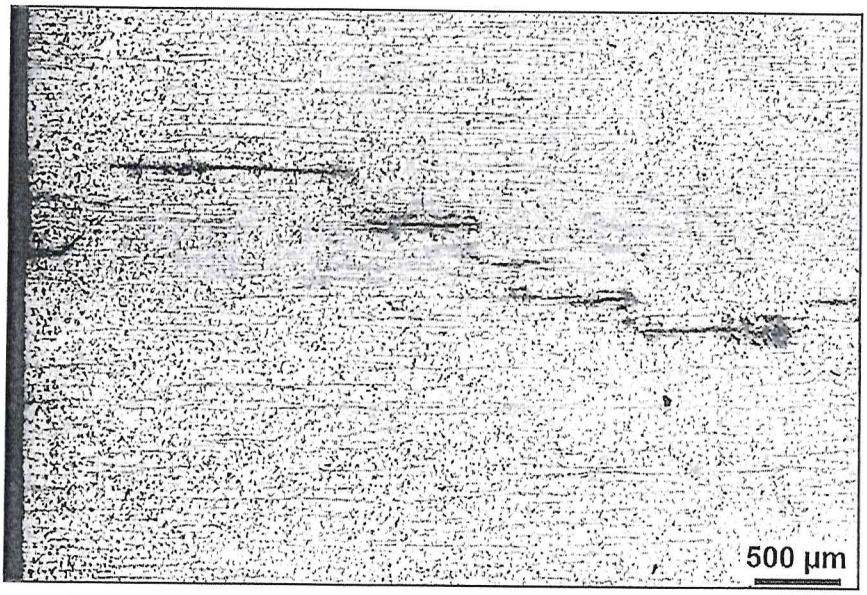


Device: Observer2 Image: 2024_0012149 Caustic: Nital 2%
Description: 108573 L 24-17 3 Face A Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0012150 Caustic: Nital 2%
Description: 108573 L 24-17 1 Face B Top[-] Center[X] Bottom[-]

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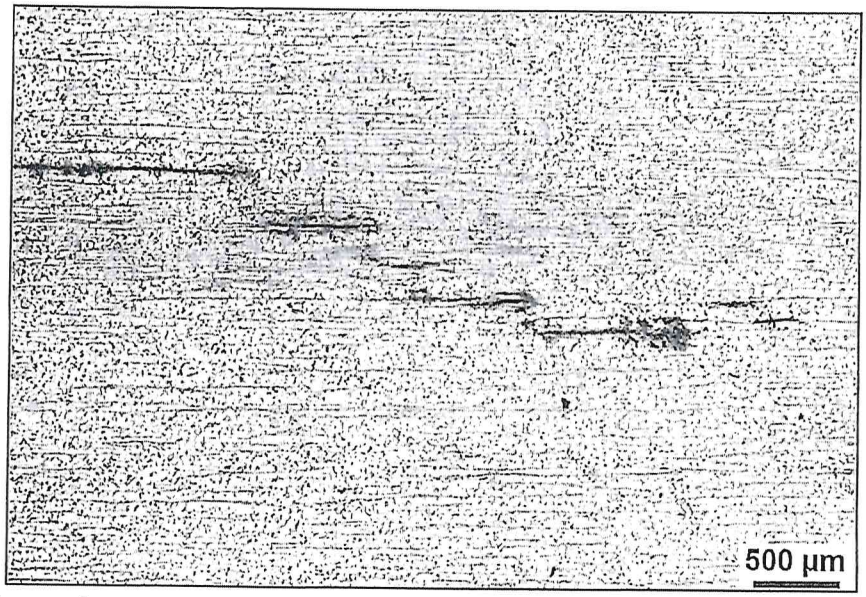
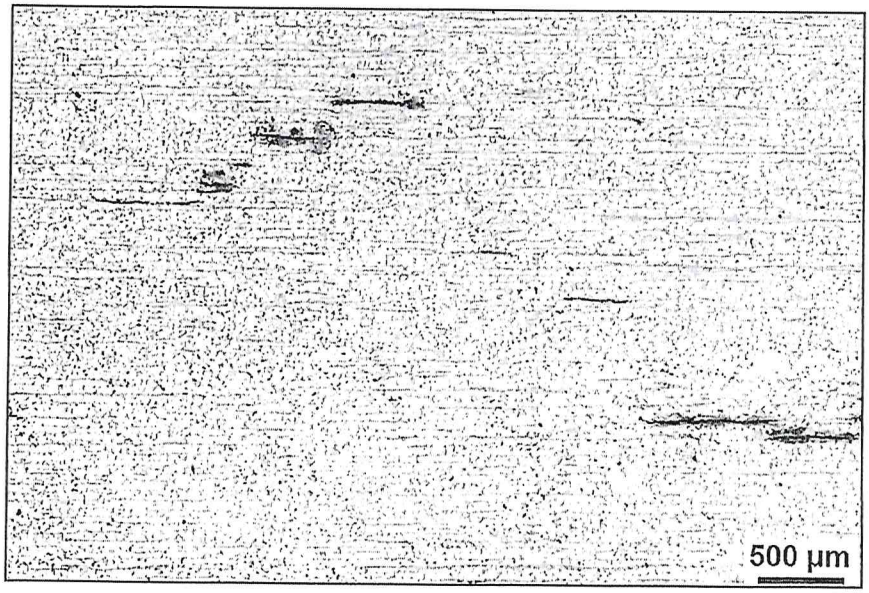


Device: Observer2 Image: 2024_0012152 Caustic: Nital 2%
Description: 108573 L 24-17 2 Face B Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0012153 Caustic: Nital 2%
Description: 108573 L 24-17 1 Face B Top[-] Center[X] Bottom[-]

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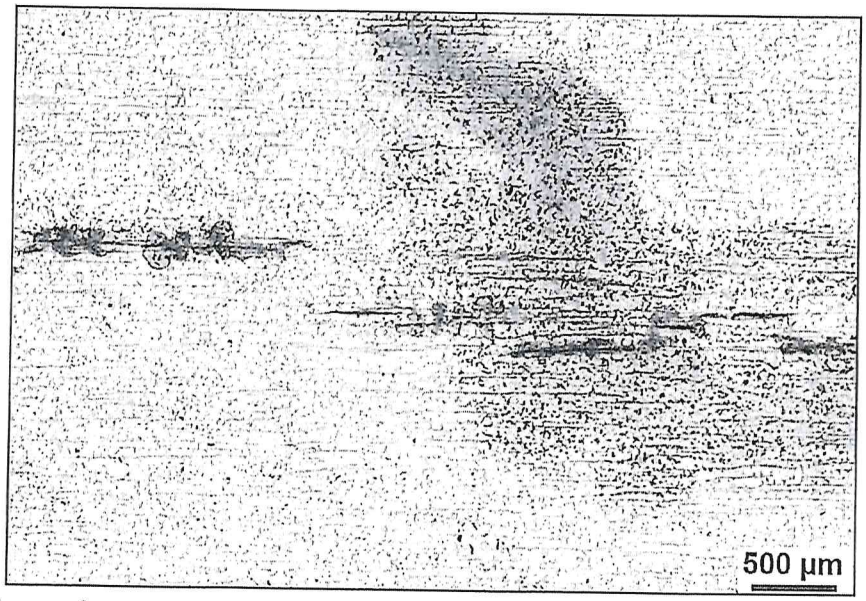
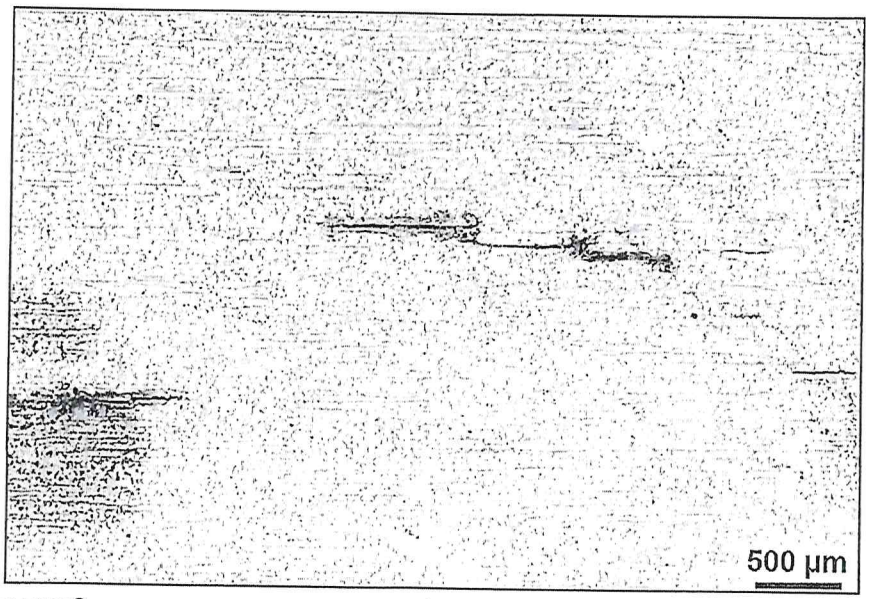


Device: Observer2
Description: 108573 L 24-17 2

Image: 2024_0012154 Face B Top[-] Center[X] Bottom[-]

Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-17 3

Image: 2024_0012157 Face B Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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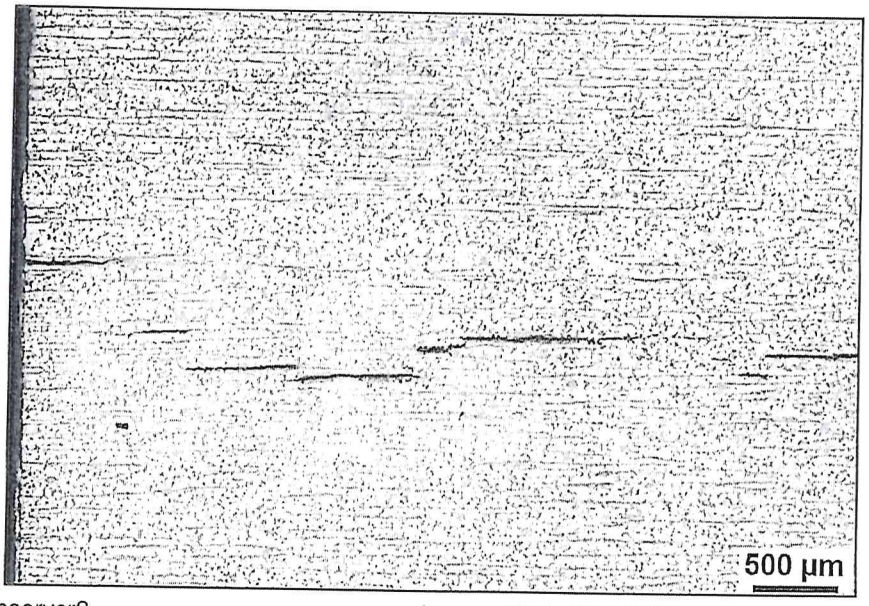
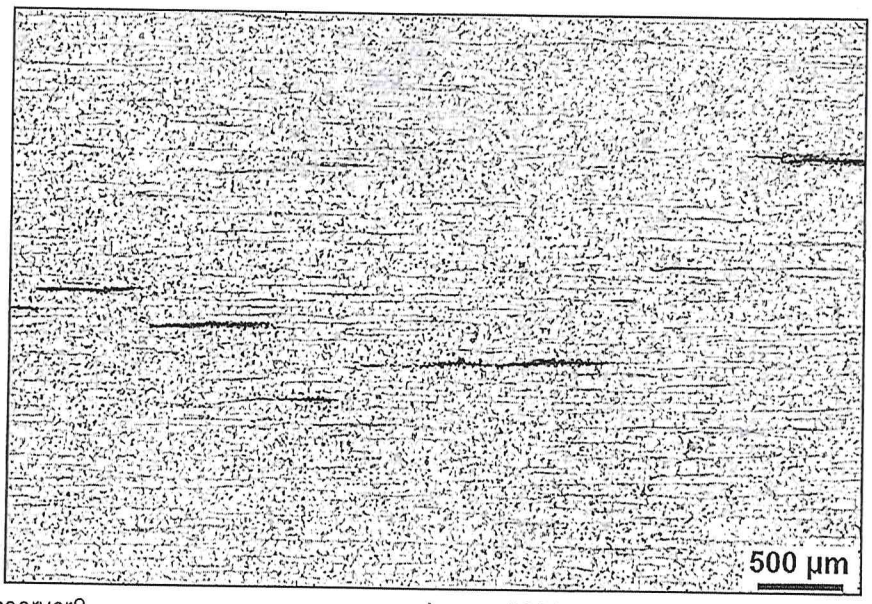


Device: Observer2
Description: 108573 L 24-17 1

Image: 2024_0012158
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-17 2

Image: 2024_0012160
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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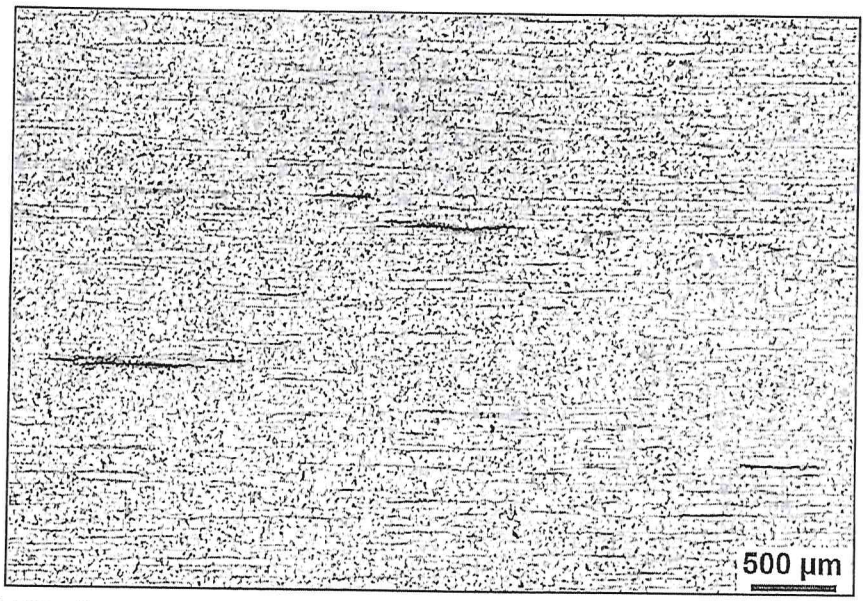
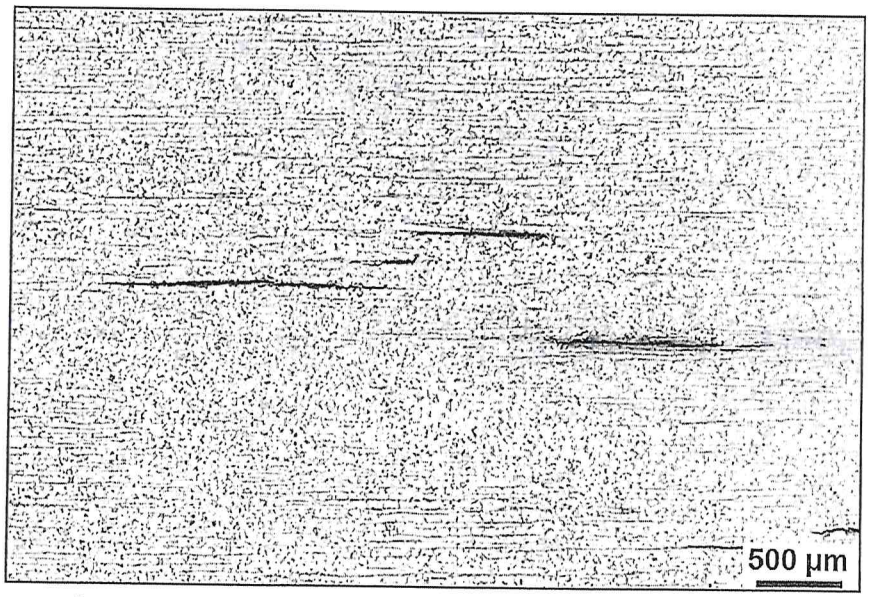


Device: Observer2
Description: 108573 L 24-17 3

Image: 2024_0012161
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-17

Image: 2024_0012162
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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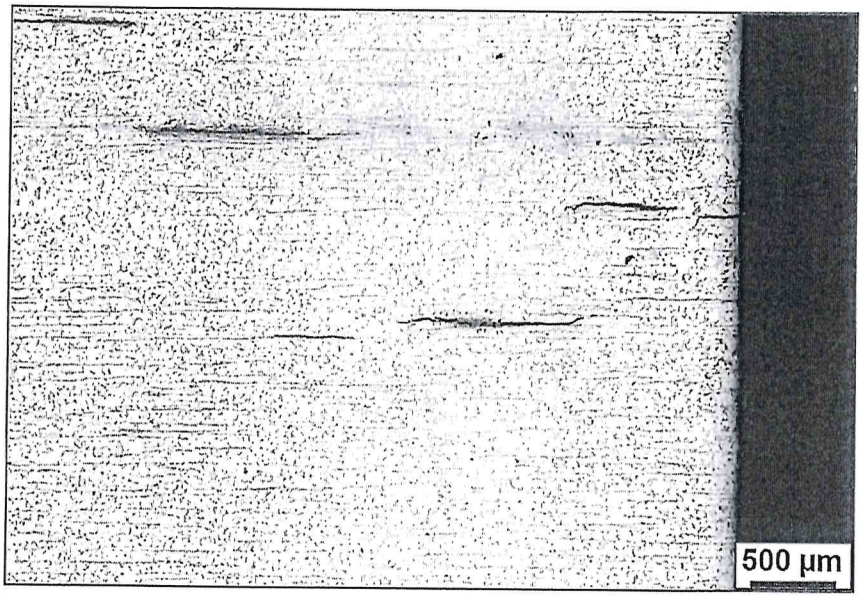

Device: Observer2 Image: 2024_0012163 Caustic: Nital 2%
Description: 108573 L 24-17 Face C Top[-] Center[X] Bottom[-]

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voestalpine Grobblech GmbH
voestalpine-Straße 3
4020 Linz, Austria
www.voestalpine.com/grobblech

A02
Inspection certificate
EN 10204 - 3.1

Z02 Date 28-02-2024

A04 manufacturer's work symbol
voestalpine

A03 Document number	Q0545608	A08 Order-No.:	3501486	A07 OrderDat.	02-11-2023

400F

A06 Customer
BREMBANA & ROLLE SPA
Via Villino 1
I-24030 VALBREMBO (BG)

A07 OrderNo.
23096-ODA23-003052

A06 Consignee
BREMBANA & ROLLE SPA
Via Villino 1
I-24030 VALBREMBO (BG)

B01 Product: Plate
B02 Material: SA516 Grade 60
B03 Standard: ASME SA-516/SA-516M : ED.2021
Supplementary requirements: normalised
B04 Delivery condition: normalised

B03 - Supplementary requirements
ASME SECT. II, PART A, ED. 2021 // MATERIAL IS SUITABLE FOR 2014/68/EC DIRECTIVE ANNEX 1 PAR. 4.3 APPLICATION // FINE GRAINED, VACUUM DEGASSED AND FULLY KILLED. // ISO15156-1 / NACE MR0175 ED. 2020 // MATERIAL IS ACC. TO SPEC. 23096-EMRS-101 REV.1

D01 - Visual Examination and dimensional checking: satisfactory. The results of tests performed are in compliance with the requirements.

Detail of supply

B07 Heat No.	B06 Plate No		Item	Dimensions B09 Thickness mm	B10 Width mm	B11 Length mm	B08 Piece	B12 theor. Mass kg	B13 act. Mass kg	A09 Disp-No 130 42	Date of dispatch	reference no.
762981	235594/1	A MK7	10	44,00	2800,0	9200	1		9.200	42091	22-02-2024	23096-PLATE MK.9002
762981	235597/1	C MK3	10	44,00	2800,0	9200	1		9.168	42091	22-02-2024	23096-PLATE MK.9002
762981	235600/1	MK3	10	44,00	2800,0	9200	1		9.159	41854	15-02-2024	23096-PLATE MK.9002
762981	235601/1	E MK3	10	44,00	2800,0	9200	1		9.202	42091	22-02-2024	23096-PLATE MK.9002
762981	235604/1	MK3	10	44,00	2800,0	9200	1		9.187	42091	22-02-2024	23096-PLATE MK.9002
762981	235605/1	MK7	10	44,00	2800,0	9200	1		9.185	42091	22-02-2024	23096-PLATE MK.9002
762981	239026/1	B MK6	20	44,00	3330,0	9200	1		10.887	42006	20-02-2024	23096-PLATE MK.9001
956678	239029/1	MK5	20	44,00	3330,0	9200	1		10.939	42006	20-02-2024	23096-PLATE MK.9001
956678	239030/1	MK5	20	44,00	3330,0	9200	1		10.898	42006	20-02-2024	23096-PLATE MK.9001
956678	239031/1	E MK6	20	44,00	3330,0	9200	1		10.921	42007	20-02-2024	23096-PLATE MK.9001
956678	239032/1	A MK4	20	44,00	3330,0	9200	1		10.928	42009	20-02-2024	23096-PLATE MK.9001
956678	239033/1	D MK4	20	44,00	3330,0	9200	1		10.908	42007	20-02-2024	23096-PLATE MK.9001
956678	239034/1	C MK4	20	44,00	3330,0	9200	1		10.909	42007	20-02-2024	23096-PLATE MK.9001
956678	239035/1	C MK6	20	44,00	3330,0	9200	1		10.913	42009	20-02-2024	23096-PLATE MK.9001

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Inspection representative voestalpine
Gabriel Marco

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Detail of supply

B07 Heat No.	B06 Plate No	Item	Dimensions B09 Thickness mm	B10 Width mm	B11 Length mm	B08 Piece	B12 theor. Mass kg	B13 act. Mass kg	A09 Disp-No 130 42	Date of dispatch	reference no.
956678	239036/1 B MK5	20	44,00	3330,0	9200	1		10.913	42006	20-02-2024	23096-PLATE MK.9001
956678	239037/1 A MK5	20	44,00	3330,0	9200	1		10.905	42009	20-02-2024	23096-PLATE MK.9001
956678	239041/1 F MK5	20	44,00	3330,0	9200	1		10.905	42008	20-02-2024	23096-PLATE MK.9001
956678	239042/1 F MK4	20	44,00	3330,0	9200	1		10.938	42008	20-02-2024	23096-PLATE MK.9001
956678	239043/1 D MK6	20	44,00	3330,0	9200	1		10.928	42007	20-02-2024	23096-PLATE MK.9001
956679	239038/1 E MK 4	20	44,00	3330,0	9200	1		10.932	42008	20-02-2024	23096-PLATE MK.9001
956679	239039/1 A MK6	20	44,00	3330,0	9200	1		10.913	42009	20-02-2024	23096-PLATE MK.9001
956679	239040/1 B MK4	20	44,00	3330,0	9200	1		10.942	42008	20-02-2024	23096-PLATE MK.9001
		Sum				22		229.780			

B07 Heat No.	B06 Plate No	temp. °C	Time MIN	kind of cooling
762981	235594/1	920	41	AL
762981	235597/1	920	41	AL
762981	235600/1	920	41	AL
762981	235601/1	920	41	AL
762981	235604/1	920	41	AL
762981	235605/1	920	41	AL
762981	239026/1	920	41	AL
956678	239029/1	920	41	AL
956678	239030/1	920	41	AL
956678	239031/1	920	41	AL
956678	239032/1	920	41	AL
956678	239033/1	920	41	AL
956678	239034/1	920	41	AL
956678	239035/1	920	41	AL
956678	239036/1	920	41	AL
956678	239037/1	920	41	AL
956678	239041/1	920	41	AL
956678	239042/1	920	41	AL
956678	239043/1	920	41	AL
956679	239038/1	920	41	AL
956679	239039/1	920	41	AL

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B07 Heat No.	B06 Plate No	temp. °C	Time MIN	kind of cooling
956679	239040/1	920	41	AL

B14 - Supplementary information

temp.:
Time:
kind of cooling:
AL: cooling on air
Tolerances acc. ASME SA 20/SA 20M
Shape tolerance acc. ASME SA 20/SA 20M
Repair-welding not permitted
Thickness tolerance acc. ASME SA 20/SA 20M only plus

Chemical composition (Heat analysis)

B07 Heat No.		C %	Si %	Mn %	P %	S %	Al %	Cr %	Ni %	Mo %	Cu %	V %	Nb %	Ti %	N %	B %	Cae %	LF03 %	LF15 %
	>=		.150	.850															
Set values	<=	.230	.400	1.200	.015	.0030		.300	.400	.120	.400	.030	.014	.030		.0010	.35	1.000	.320
762981		.084	.368	1.170	.008	.0006	.039	.074	.270	.054	.163	.005	.011	.002	.0044	.0002	.33	.561	.128
956678		.090	.382	1.160	.007	.0006	.045	.032	.270	.008	.160	.004	.012	.001	.0036	.0002	.32	.470	.040
956679		.087	.396	1.180	.006	.0006	.040	.030	.270	.010	.164	.004	.013	.002	.0035	.0002	.32	.474	.040

C99 - Supplementary information

Cae: C+(Mn/6)+(Cr+Mo+V)/5+(Ni+Cu)/15
LF03: Cr+Ni+Cu+Mo
LF15: Cr+Mo

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Test results: C10-C29 Tensile Test at room temperature acc. ASTM/ASME A370/SA370

B06 Plate No	C41 Width	SpThickn MM	C01 loc.	PosTh.	C02 Dir	C11 Rp0,2 MPa	C12 Rm MPa	L0	C13 E %	Sim.htm	WBH
>=						220	415		25.0		
Set values <=						380	550				
235594	Ø	12.55	F	V	T	329	461	L2"	39.6		
	Ø	12.51	F	V	T	329	454	L2"	40.7	001	1
	Ø	12.50	F	V	T	329	450	L2"	40.1	002	1
235597	Ø	12.55	F	V	T	330	461	L2"	39.5		
	Ø	12.51	F	V	T	325	454	L2"	39.4	001	1
	Ø	12.52	F	V	T	324	450	L2"	40.4	002	1
235600	Ø	12.48	F	V	T	326	456	L2"	39.3		
	Ø	12.54	F	V	T	314	447	L2"	41.9	001	1
	Ø	12.52	F	V	T	320	446	L2"	40.2	002	1
235601	Ø	12.55	F	V	T	326	463	L2"	40.0		
	Ø	12.51	F	V	T	330	455	L2"	39.5	001	1
	Ø	12.50	F	V	T	326	453	L2"	40.2	002	1
235604	Ø	12.55	F	V	T	331	464	L2"	40.0		
	Ø	12.50	F	V	T	329	455	L2"	40.4	001	1
	Ø	12.51	F	V	T	316	450	L2"	39.8	002	1
235605	Ø	12.54	F	V	T	323	461	L2"	40.1		
	Ø	12.51	F	V	T	323	453	L2"	39.8	001	1
	Ø	12.51	F	V	T	321	450	L2"	40.4	002	1
239026	Ø	12.48	F	V	T	331	455	L2"	39.9		
	Ø	12.52	F	V	T	324	448	L2"	40.3	001	1
	Ø	12.54	F	V	T	324	442	L2"	41.7	002	1
239029	Ø	12.46	F	V	T	317	452	L2"	39.6		
	Ø	12.49	F	V	T	321	447	L2"	40.8	001	1
	Ø	12.49	F	V	T	318	442	L2"	40.6	002	1

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Test results: C10-C29 Tensile Test at room temperature acc. ASTM/ASME A370/SA370

B06 Plate No	C41 Width	SpThickn MM	C01 loc.	PosTh.	C02 Dir	C11 Rp0,2 MPa	C12 Rm MPa	L0	C13 E %	Sim.htm	WBH
Set values >=						220	415		25.0		
Set values <=						380	550				
239030	Ø	12.47	F	V	T	313	451	L2"	39.3		
	Ø	12.49	F	V	T	322	447	L2"	40.4	001	1
	Ø	12.50	F	V	T	316	441	L2"	41.6	002	1
239031	Ø	12.46	F	V	T	314	451	L2"	40.8		
	Ø	12.49	F	V	T	320	446	L2"	40.5	001	1
	Ø	12.49	F	V	T	310	439	L2"	41.5	002	1
239032	Ø	12.48	F	V	T	338	452	L2"	39.4		
	Ø	12.52	F	V	T	317	443	L2"	40.6	001	1
	Ø	12.52	F	V	T	323	438	L2"	42.5	002	1
239033	Ø	12.47	F	V	T	313	450	L2"	40.2		
	Ø	12.50	F	V	T	320	444	L2"	40.6	001	1
	Ø	12.50	F	V	T	320	438	L2"	41.6	002	1
239034	Ø	12.47	F	V	T	320	450	L2"	39.7		
	Ø	12.51	F	V	T	320	444	L2"	41.5	001	1
	Ø	12.50	F	V	T	333	439	L2"	40.5	002	1
239035	Ø	12.48	F	V	T	317	452	L2"	39.7		
	Ø	12.51	F	V	T	315	445	L2"	40.5	001	1
	Ø	12.50	F	V	T	320	439	L2"	41.6	002	1
239036	Ø	12.47	F	V	T	322	447	L2"	39.2		
	Ø	12.50	F	V	T	319	442	L2"	40.7	001	1
	Ø	12.50	F	V	T	316	437	L2"	40.8	002	1
239037	Ø	12.48	F	V	T	334	451	L2"	39.9		
	Ø	12.51	F	V	T	316	443	L2"	41.1	001	1
	Ø	12.51	F	V	T	319	439	L2"	41.4	002	1

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Test results: C10-C29 Tensile Test at room temperature acc. ASTM/ASME A370/SA370

B06 Plate No	C41 Width	SpThickn MM	C01 loc.	PosTh.	C02 Dir	C11 Rp0,2 MPa	C12 Rm MPa	L0	C13 E %	Sim.htm	WBH
Set values >=						220	415		25.0		
Set values <=						380	550				
239038	Ø	12.48	F	V	T	317	451	L2"	39.5		
	Ø	12.50	F	V	T	316	441	L2"	42.0	001	1
	Ø	12.51	F	V	T	317	437	L2"	41.4	002	1
239039	Ø	12.48	F	V	T	319	451	L2"	39.4		
	Ø	12.51	F	V	T	317	443	L2"	41.3	001	1
	Ø	12.51	F	V	T	325	438	L2"	41.4	002	1
239040	Ø	12.48	F	V	T	315	450	L2"	40.5		
	Ø	12.51	F	V	T	321	442	L2"	41.9	001	1
	Ø	12.49	F	V	T	318	438	L2"	41.4	002	1
239041	Ø	12.48	F	V	T	318	451	L2"	39.8		
	Ø	12.50	F	V	T	336	442	L2"	40.3	001	1
	Ø	12.51	F	V	T	329	439	L2"	42.0	002	1
239042	Ø	12.48	F	V	T	315	452	L2"	39.3		
	Ø	12.49	F	V	T	321	444	L2"	40.9	001	1
	Ø	12.49	F	V	T	313	440	L2"	41.6	002	1
239043	Ø	12.47	F	V	T	314	450	L2"	39.2		
	Ø	12.51	F	V	T	327	442	L2"	41.1	001	1
	Ø	12.49	F	V	T	318	437	L2"	41.9	002	1

SpThickn: specimen thickness
C01;loc.:
F: Bottom
PosTh.: Pos Thickness
V: ¼ t
C02;Dir:
T: transverse

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Test results: C10-C29 Tensile Test at room temperature acc. ASTM/ASME A370/SA370

B06 Plate No	C41 Width	SpThickn MM	C01 loc.	PosTh.	C02 Dir	C11 Rp0,2 MPa	C12 Rm MPa	L0	C13 E %	Sim.htm	WBH

C11;Rp0,2: Yield Strength
C12; Rm: Tensile Strength
L0: gauge
  L2": Length = 50mm
  L2": Length = 50mm
C13;E: elongation
Sim.htm: sim. heat treatment
  001: Sim.htm group #1
  002: Sim.htm group #2
WBH: sim. heat treatment

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Test results: C40-C49 Impact Test acc. ASTM/ASME A370/SA370

B06 Plate No	C40 shape	C01 loc.		PosTh.	C02 Dir	C03 temp °C	C42 SV J	C42 SV J	C42 SV J	C43 AV J	Sim.htm	WBH
Set values >=						-46	27	27	27	27		
235594	CV 10x10	F	V		T	-46	397	397	396	397		
	CV 10x10	F	V		T	-46	405	404	405	405	001	1
	CV 10x10	F	V		T	-46	404	405	404	404	002	1
235597	CV 10x10	F	V		T	-46	394	402	400	399		
	CV 10x10	F	V		T	-46	402	402	403	402	001	1
	CV 10x10	F	V		T	-46	404	397	402	401	002	1
235600	CV 10x10	F	V		T	-46	391	392	391	391		
	CV 10x10	F	V		T	-46	392	393	391	392	001	1
	CV 10x10	F	V		T	-46	389	387	392	389	002	1
235601	CV 10x10	F	V		T	-46	399	394	399	397		
	CV 10x10	F	V		T	-46	405	405	404	404	001	1
	CV 10x10	F	V		T	-46	405	404	403	404	002	1
235604	CV 10x10	F	V		T	-46	397	403	397	399		
	CV 10x10	F	V		T	-46	404	402	404	404	001	1
	CV 10x10	F	V		T	-46	406	400	405	404	002	1
235605	CV 10x10	F	V		T	-46	396	399	396	397		
	CV 10x10	F	V		T	-46	401	399	33	278	001	1
	CV 10x10	F	V		T	-46	402	402	411	405	002	1
239026	CV 10x10	F	V		T	-46	390	392	394	392		
	CV 10x10	F	V		T	-46	388	390	389	389	001	1
	CV 10x10	F	V		T	-46	393	388	390	390	002	1
239029	CV 10x10	F	V		T	-46	387	387	388	387		
	CV 10x10	F	V		T	-46	391	388	392	390	001	1
	CV 10x10	F	V		T	-46	394	391	390	392	002	1

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Test results: C40-C49 Impact Test acc. ASTM/ASME A370/SA370

B06 Plate No	C40 shape	C01 loc.		PosTh.	C02 Dir	C03 temp °C	C42 SV J	C42 SV J	C42 SV J	C43 AV J	Sim.htm	WBH
Set values	>=					-46	27	27	27	27		
239030	CV 10x10	F	V		T	-46	387	381	386	384		
	CV 10x10	F	V		T	-46	392	388	386	389	001	1
	CV 10x10	F	V		T	-46	33	386	390	270	002	1
239031	CV 10x10	F	V		T	-46	386	385	383	385		
	CV 10x10	F	V		T	-46	391	392	391	391	001	1
	CV 10x10	F	V		T	-46	387	386	392	388	002	1
239032	CV 10x10	F	V		T	-46	386	389	389	388		
	CV 10x10	F	V		T	-46	394	391	382	389	001	1
	CV 10x10	F	V		T	-46	390	391	391	391	002	1
239033	CV 10x10	F	V		T	-46	386	385	389	387		
	CV 10x10	F	V		T	-46	390	388	387	388	001	1
	CV 10x10	F	V		T	-46	388	387	387	387	002	1
239034	CV 10x10	F	V		T	-46	383	384	381	383		
	CV 10x10	F	V		T	-46	390	391	390	390	001	1
	CV 10x10	F	V		T	-46	390	386	388	388	002	1
239035	CV 10x10	F	V		T	-46	389	387	382	386		
	CV 10x10	F	V		T	-46	390	391	389	390	001	1
	CV 10x10	F	V		T	-46	388	390	389	389	002	1
239036	CV 10x10	F	V		T	-46	382	383	388	384		
	CV 10x10	F	V		T	-46	386	388	384	386	001	1
	CV 10x10	F	V		T	-46	387	385	384	385	002	1
239037	CV 10x10	F	V		T	-46	388	391	385	388		
	CV 10x10	F	V		T	-46	393	389	393	391	001	1
	CV 10x10	F	V		T	-46	388	392	381	387	002	1

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Test results: C40-C49 Impact Test acc. ASTM/ASME A370/SA370

B06 Plate No	C40 shape	C01 loc.	PosTh.	C02 Dir	C03 temp °C	C42 SV J	C42 SV J	C42 SV J	C43 AV J	Sim.htm	WBH
Set values >=					-46	27	27	27	27		
239038	CV 10x10	F	V	T	-46	388	389	388	388		
	CV 10x10	F	V	T	-46	387	391	390	389	001	1
	CV 10x10	F	V	T	-46	393	392	390	392	002	1
239039	CV 10x10	F	V	T	-46	390	386	386	387		
	CV 10x10	F	V	T	-46	390	389	386	388	001	1
	CV 10x10	F	V	T	-46	389	390	388	389	002	1
239040	CV 10x10	F	V	T	-46	384	387	384	385		
	CV 10x10	F	V	T	-46	384	387	389	386	001	1
	CV 10x10	F	V	T	-46	390	388	389	389	002	1
239041	CV 10x10	F	V	T	-46	388	383	390	387		
	CV 10x10	F	V	T	-46	389	390	389	389	001	1
	CV 10x10	F	V	T	-46	387	390	387	388	002	1
239042	CV 10x10	F	V	T	-46	386	386	385	385		
	CV 10x10	F	V	T	-46	387	384	384	385	001	1
	CV 10x10	F	V	T	-46	390	390	388	389	002	1
239043	CV 10x10	F	V	T	-46	377	382	378	379		
	CV 10x10	F	V	T	-46	384	387	386	386	001	1
	CV 10x10	F	V	T	-46	386	384	385	385	002	1

C40;shape:
CV 10x10: Test shape , Dimensions
C01;loc.:
F: Bottom
PosTh.: Pos Thickness
V: ¼ t
C02;Dir:

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Test results: C40-C49 Impact Test acc. ASTM/ASME A370/SA370

B06 Plate No	C40 shape	C01 loc.	PosTh.	C02 Dir	C03 temp °C	C42 SV J	C42 SV J	C42 SV J	C43 AV J	Sim.htm	WBH

T: transverse
C03; temp: Test temperature
C42;SV: single value
C43;AV: average value
Sim.htm: sim. heat treatment
001: Sim.htm group #1
002: Sim.htm group #2
WBH: sim. heat treatment

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Test results: C30-C39 Hardness Test Vickers

B06 Plate No	PosTh.	Hard.	C31 HV	C31 HV	C31 HV	Sim.htm	WBH
Set values >= <=			190	190	190		
235594	OS	HV10	138	139	137		
	OS	HV10	136	136	136	001	1
	OS	HV10	133	137	138	002	1
235597	OS	HV10	140	138	137		
	OS	HV10	137	139	135	001	1
	OS	HV10	136	135	134	002	1
235600	OS	HV10	139	142	141		
	OS	HV10	137	140	139	001	1
	OS	HV10	142	139	135	002	1
235601	OS	HV10	138	137	142		
	OS	HV10	137	135	138	001	1
	OS	HV10	135	137	135	002	1
235604	OS	HV10	137	137	138		
	OS	HV10	135	137	135	001	1
	OS	HV10	136	135	135	002	1
235605	OS	HV10	139	137	137		
	OS	HV10	135	132	135	001	1
	OS	HV10	137	136	137	002	1
239026	OS	HV10	135	137	136		
	OS	HV10	149	150	148	001	1
	OS	HV10	140	146	149	002	1
239029	OS	HV10	132	133	133		
	OS	HV10	138	136	134	001	1
	OS	HV10	136	138	141	002	1

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Test results: C30-C39 Hardness Test Vickers

B06 Plate No	PosTh.	Hard.	C31 HV	C31 HV	C31 HV	Sim.htm	WBH
>= Set values <=			190	190	190		
239030	OS	HV10	132	132	138		
	OS	HV10	136	140	135	001	1
	OS	HV10	133	134	135	002	1
239031	OS	HV10	130	133	138		
	OS	HV10	134	134	139	001	1
	OS	HV10	135	136	139	002	1
239032	OS	HV10	134	136	140		
	OS	HV10	135	135	134	001	1
	OS	HV10	133	132	135	002	1
239033	OS	HV10	132	132	136		
	OS	HV10	135	139	141	001	1
	OS	HV10	133	131	139	002	1
239034	OS	HV10	135	138	131		
	OS	HV10	136	136	139	001	1
	OS	HV10	136	139	136	002	1
239035	OS	HV10	130	132	134		
	OS	HV10	142	141	137	001	1
	OS	HV10	138	137	133	002	1
239036	OS	HV10	138	133	134		
	OS	HV10	134	136	133	001	1
	OS	HV10	134	141	141	002	1
239037	OS	HV10	135	137	135		
	OS	HV10	136	138	134	001	1
	OS	HV10	133	132	135	002	1

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Test results: C30-C39 Hardness Test Vickers

B06 Plate No	PosTh.	Hard.	C31 HV	C31 HV	C31 HV	Sim.htm	WBH
Set values >=			190	190	190		
Set values <=							
239038	OS	HV10	140	133	132		
	OS	HV10	136	140	135	001	1
	OS	HV10	139	128	133	002	1
239039	OS	HV10	131	132	133		
	OS	HV10	134	137	140	001	1
	OS	HV10	135	139	142	002	1
239040	OS	HV10	132	137	137		
	OS	HV10	134	139	137	001	1
	OS	HV10	134	134	143	002	1
239041	OS	HV10	135	140	140		
	OS	HV10	137	134	139	001	1
	OS	HV10	135	136	136	002	1
239042	OS	HV10	129	132	126		
	OS	HV10	137	136	142	001	1
	OS	HV10	137	137	135	002	1
239043	OS	HV10	133	133	134		
	OS	HV10	138	143	142	001	1
	OS	HV10	135	134	135	002	1

PosTh.: Pos Thickness
OS: upper side
Hard.: stress
Sim.htm: sim. heat treatment
001: Sim.htm group #1
002: Sim.htm group #2
WBH: sim. heat treatment

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Chemical composition (Product analysis)

B07
Heat No.

	C %	Si %	Mn %	P %	S %	Al %	Cr %	Ni %	Mo %	Cu %	V %	Nb %	Ti %	N %	B %	Cae %	LF03 %	LF15 %
>=		.130	.790															
Set values <=	.230	.450	1.300	.015	.0030		.340	.430	.130	.430	.040	.014	.040		.0015	.35		
762981	.086	.364	1.180	.008	.0008	.038	.074	.270	.055	.164	.005	.011	.002	.0052	.0003	.34	.563	.129
956678	.086	.374	1.160	.006	.0005	.045	.031	.270	.005	.158	.004	.012	.001	.0049	.0002	.32	.464	.036
956679	.081	.380	1.160	.006	.0004	.043	.034	.270	.007	.159	.004	.012	.001	.0042	.0002	.31	.470	.041

C99 - Supplementary information
Cae: C+(Mn/6)+(Cr+Mo+V)/5+(Ni+Cu)/15
LF03: Cr+Ni+Cu+Mo
LF15: Cr+Mo

Remarks

Simulated heat treatment of test coupons:

Item 10:
001/1: 1 cycle(s) sim. PWHT: furnace charge temperature at max. 425 °C, heating with max. 70 °C/h up to 610 °C, +10 °C/-10 °C, holding time 180 minutes, cooling with max. 70 °C/h down to 425 °C, final cooling in calm air.
002/1: 1 cycle(s) sim. PWHT: furnace charge temperature at max. 425 °C, heating with max. 70 °C/h up to 610 °C, +10 °C/-10 °C, holding time 720 minutes, cooling with max. 70 °C/h down to 425 °C, final cooling in calm air.

Item 20:
001/1: 1 cycle(s) sim. PWHT: furnace charge temperature at max. 425 °C, heating with max. 70 °C/h up to 610 °C, +10 °C/-10 °C, holding time 180 minutes, cooling with max. 70 °C/h down to 425 °C, final cooling in calm air.
002/1: 1 cycle(s) sim. PWHT: furnace charge temperature at max. 425 °C, heating with max. 70 °C/h up to 610 °C, +10 °C/-10 °C, holding time 720 minutes, cooling with max. 70 °C/h down to 425 °C, final cooling in calm air.

We confirm that the delivered material complies with the terms of order.

C70 - Method of steelmaking: Basic oxygen furnace (BOF) steelmaking, continuous casting with soft reduction, steel is fully killed, vacuum degassed and melted by fine grain practice, austenitic grain size 5 or finer acc. to para. 8.3.2 of ASME SA 20/SA 20M

We hereby certify, that the material has been manufactured, sampled and tested in accordance with the requirements of the material

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Remarks

specification, and the results meet the requirements.

HIC testing of the base material was carried out with satisfactory results. All determined values are within the acceptance limits and stated on separate test report.

The signature of the inspection representative from voestalpine Grobblech GmbH is substituted by an electronic signature, because the certificates of voestalpine Grobblech GmbH are prepared by a suitable data processing system (EN 10204, Pt.5).

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D02-D50 - ULTRASONIC EXAMINATION PLATE(S)

SPECIFICATION

Ultrasonic test acc. ASME SA-578/SA-578M, ASME SA 578 Level C /Body, 100% Test, S1 - scanning 100% of plate surface, ASME SA 578 Level C /Edge Zone, Edge zone longitudinal 50 mm, Edge zone transverse 50 mm; satisfactory

VALID TEST EQUIPMENT
mechanized ultrasonic "In-Line testing system" (Manufacturer: NDT-Systems & Services) and
mechanized ultrasonic "off-line - testing system" (manufacturer: Windhoff Bahn- und Anlagentechnik GmbH) and
MUT (optional): Sonatest D20 no. 90006523 or Sonatest D20 no. 90007346 or Sonatest D50 no. 90010231 or GE - USM 36 no. 90010775 or Sonatest Wave no. 90015462 or Sonatest Wave no. 90015464

PROBE
(in-line AUT): 3STSE 18.3/8 P5, SEZ5R10RS, SE3 18.3/10 5A, (5MHz)
(off-line AUT): S140 (4MHz) 3T/1R
(MUT): SEB4E (4MHz), SEB4E0° (4MHz), MSEB4E (4MHz), B2SO (2MHz)
watergapcoupling

SURFACE CONDITION
Scaled surface - cleaned surface and free of loose scale.

RESULT
Plate(s) comply with the specification.

INSPECTION OPERATOR
Operators Level 2: qualified and certified according EN ISO 9712 (since 01.01.2013) respectively according the Written Practice „NDT-WP" (in accordance to Recommended Practice SNT-TC-1A). Operators Level 2 for ASME/ASTM.

INSPECTION SUPERVISOR
Responsible Level 3: Bindreiter Erich

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Legal form: Gesellschaft mit beschraenkter Haftung
Headquarters: Linz/Austria
FN 78052h at the Provincial Court of Linz as
Commercial Court having jurisdiction
DVR 0546658
UID No. ATU 36905408

To

Mr. Joachim Zuschrader

Quality Department
voestalpine Grobblech GmbH

Test report *Microstructure and Surface Analysis*
Accredited Testing Laboratories

Test report	TSP-B / 2024-0001-69
Subject	HIC-Hydrogen-Induced Cracking-Test

Job Information

Client	voestalpine Grobblech GmbH		
Order number	3501486	**Order date**	February 11th, 2024
Laboratory group	voestalpine Stahl, TSP – Microstructure and Surface Analysis		
Referee	Michaela Altenhofer	**Phone, Fax**	0043/664 8362916
e-mail	Michaela.Altenhofer@voestalpine.com		
Distribution list	2024-0001		

Description of Test

Specification(s)	NACE TM0284:2016 Solution A; ASTM F21:20;
Simulated PWHT Parameter	1 cycle(s) sim. PWHT from 425 °C, 70 °C/h, to 610 °C, +10 °C / -10,HT: 180 min.,cooling with 70 °C/h to 425 °C, calm air

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Acceptance Limits:

Values based on average of three faces from each specimen

CLR: ---

CTR: ---

CSR: ---

ICR_MAX* ---

Test procedure:

The specimens were cut from the test plate in the middle of the width [1](A) and/or near the outer edges on the left (VL, RL) or right (VR, RR) depending on the plate thickness staggered across the plate thickness on the centreline [3](K) and near both surfaces (OS and US) or in between (DZ and SZ). The degreasing of the samples was tested according to the method of ASTM F21. Nitrogen (99.9990) was used for purging and H2S (99.5) for saturation. Three sections of each specimen were examined and the values CLR, CSR and CTR (optional CAR and/or *max. individual crack length) were determined. Sections were taken at three equivalent distances. Pictures were taken using a Zeiss Observer microscope. A control sample to demonstrate HIC crack sensitivity was used for the test. (Except for test solution N02). The average Crack Length Ratio (CLR) shall exceed 20% after testing.

Test conditions:

Vessel	Solution	Duration [h]	Start date [mm.dd.yyyy]	End date [mm.dd.yyyy]
3	N01	96	02.19.2024	02.23.2024

N01..... Nace TM0177 Sol.A; N02..... Nace TM0284 Sol.B; N03..... Nace TM0284 Sol.A; N04..... Nace TM0177 Sol.B;

Initial pH of solution	Initial Temp. [°C]	Start pH	End pH of solution	End Temp. [°C]	Start H2S-concentration [ppm]	End H2S-concentration [ppm]	Vessel
2,70	24	3,00	3,90	24	2778	2684	3

Samples were taken from the following plates:

Order Number	Plate No.	Heat No.	Material
3501486	239036/	956678	SA516Grade60
3501486	239038/	956679	SA516Grade60

Control Sample No.	Plate No.	Material Quality	Width [mm]	Thickness [mm]	CLR [%]	Test Vessel
24-31	108573	SA516GRADE70	19,85	30,40	80,00	3

Dimension of specimen in mm:

Specimen No.	(1)	(2)	(3)	(4)	Plate No.	Width [mm]	Thickness [mm]	Test Vessel
GzB36G1(6)	A	L	K	F	239036/	19,82	29,49	3
GzB36G1(5)	A	L	OS	F	239036/	19,78	29,44	3
GzB36G1(4)	A	L	US	F	239036/	19,80	29,44	3
GzB47G1(6)	A	L	K	F	239038/	20,05	29,44	3
GzB47G1(5)	A	L	OS	F	239038/	20,16	29,43	3
GzB47G1(4)	A	L	US	F	239038/	20,03	29,44	3

[2]L.....longitudinal to the rolling direction; Q....transverse to the rolling direction; [4]F.....Leading End of Plate; K.....Tailing End of Plate; Length of specimen....100mm;

Results:

Specimen No.	Plate No.	CLR %	CSR %	CTR %	ICR_MAX mm
GzB36G1(6)/A	239036/	0,0	0,0	0,0	0
GzB36G1(6)/B	239036/	0,0	0,0	0,0	0
GzB36G1(6)/C	239036/	0,0	0,0	0,0	0

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GzB36G1(6)/Avg A-C	239036/	0,0	0,0	0,0	
GzB36G1(5)/A	239036/	0,0	0,0	0,0	0
GzB36G1(5)/B	239036/	0,0	0,0	0,0	0
GzB36G1(5)/C	239036/	0,0	0,0	0,0	0
GzB36G1(5)/Avg A-C	239036/	0,0	0,0	0,0	
GzB36G1(4)/A	239036/	0,0	0,0	0,0	0
GzB36G1(4)/B	239036/	0,0	0,0	0,0	0
GzB36G1(4)/C	239036/	0,0	0,0	0,0	0
GzB36G1(4)/Avg A-C	239036/	0,0	0,0	0,0	
GzB47G1(6)/A	239038/	0,0	0,0	0,0	0
GzB47G1(6)/B	239038/	0,0	0,0	0,0	0
GzB47G1(6)/C	239038/	0,0	0,0	0,0	0
GzB47G1(6)/Avg A-C	239038/	0,0	0,0	0,0	
GzB47G1(5)/A	239038/	0,0	0,0	0,0	0
GzB47G1(5)/B	239038/	0,0	0,0	0,0	0
GzB47G1(5)/C	239038/	0,0	0,0	0,0	0
GzB47G1(5)/Avg A-C	239038/	0,0	0,0	0,0	
GzB47G1(4)/A	239038/	0,0	0,0	0,0	0
GzB47G1(4)/B	239038/	0,0	0,0	0,0	0
GzB47G1(4)/C	239038/	0,0	0,0	0,0	0
GzB47G1(4)/Avg A-C	239038/	0,0	0,0	0,0	

The test results relate only to the items tested! The laboratory is not responsible for the sampling-parts and assumes no responsibility for any information from transmitted data or data that was not generated independently.
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Enclosures:
Pictures of specimens and/or control sample pages 4-10
For actual magnification of pictures please refer to micrometer scale in the pictures.

Test Crew:

Referee: Michaela Altenhofer

Laboratory Head: Andreas Schoenauer

voestalpine Stahl GmbH
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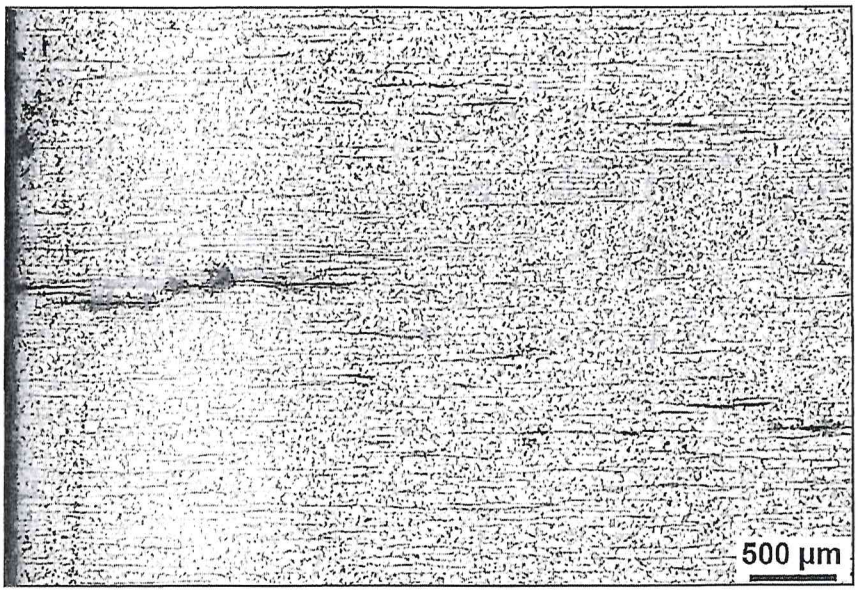
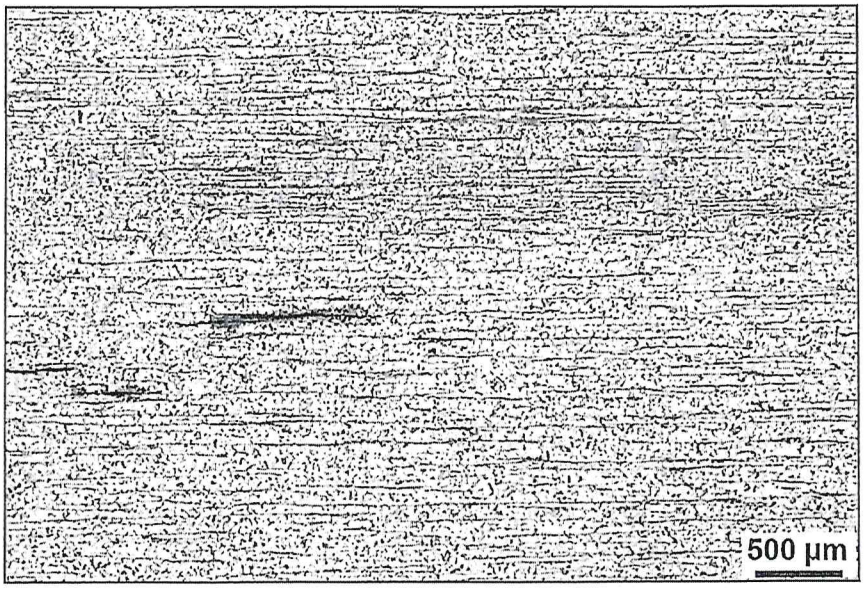


Device: Observer2 Image: 2024_0018681 Caustic: Nital 2%
Description: 108573 L 24-31 1 Face A Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0018684 Caustic: Nital 2%
Description: 108573 L 24-31 2 Face A Top[-] Center[X] Bottom[-]

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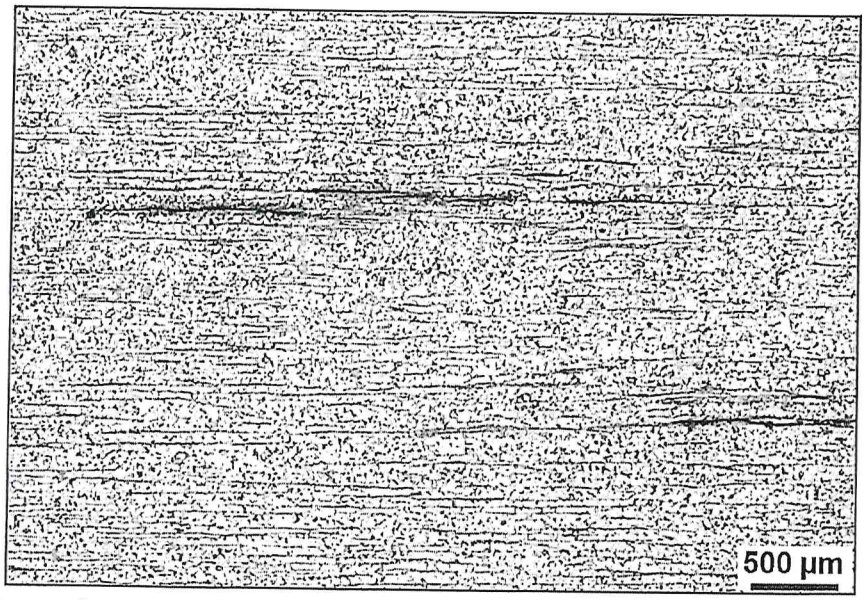

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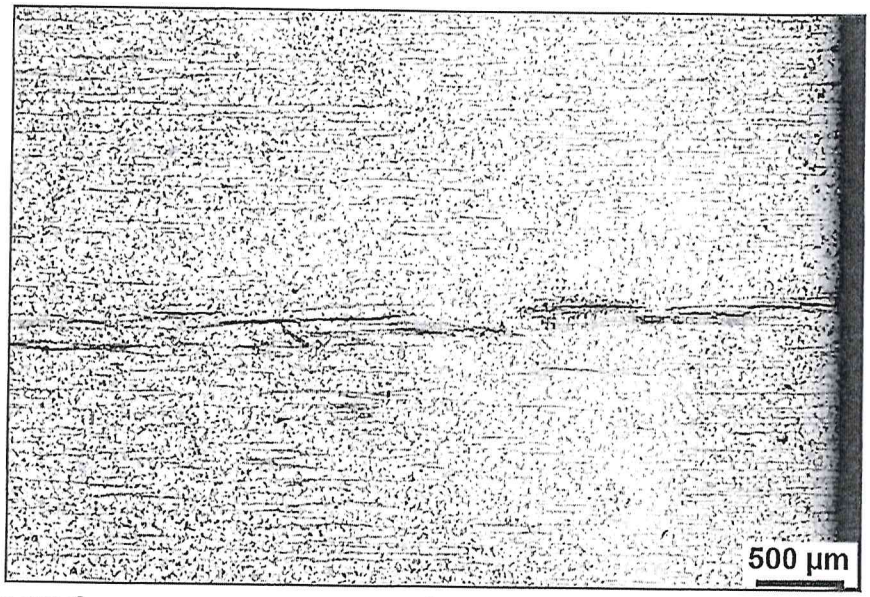

Device: Observer2 Image: 2024_0018687 Caustic: Nital 2%
Description: 108573 L 24-31 2 Face A Top[-] Center[X] Bottom[-]

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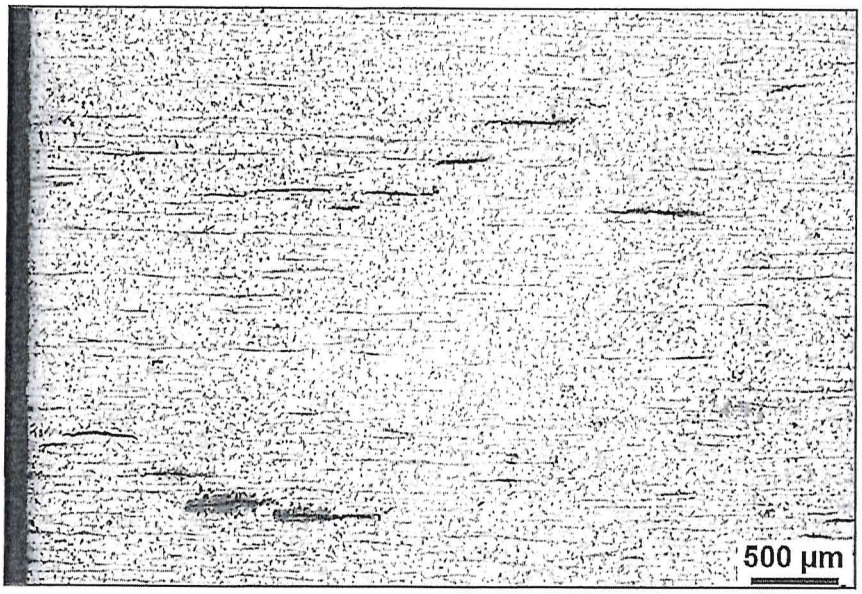
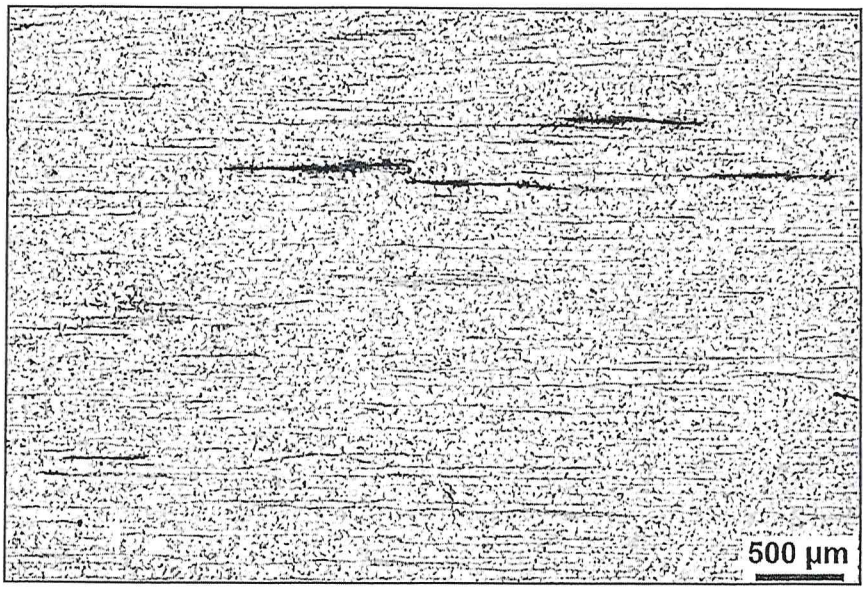


Device: Observer2 Image: 2024_0018688 Caustic: Nital 2%
Description: 108573 L 24-31 Face B Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0018693 Caustic: Nital 2%
Description: 108573 L 24-31 Face B Top[-] Center[X] Bottom[-]

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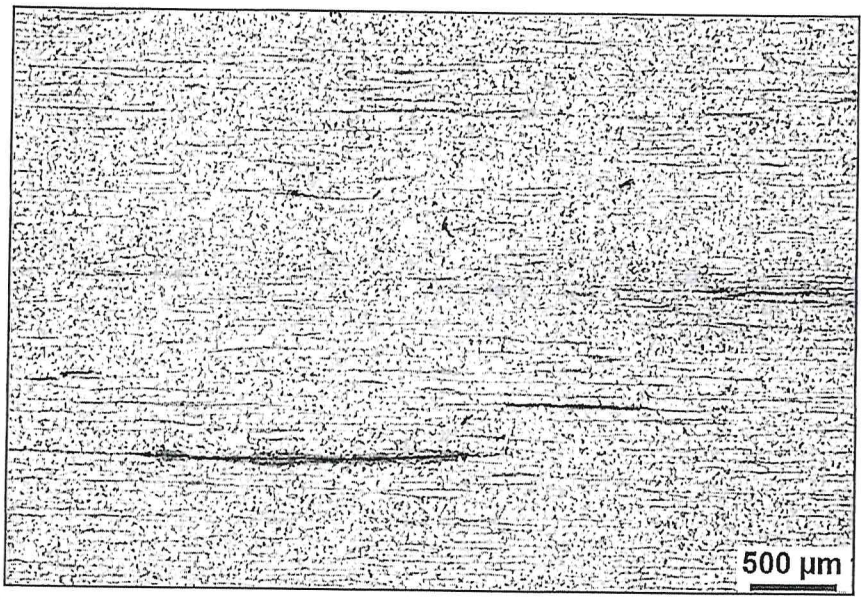
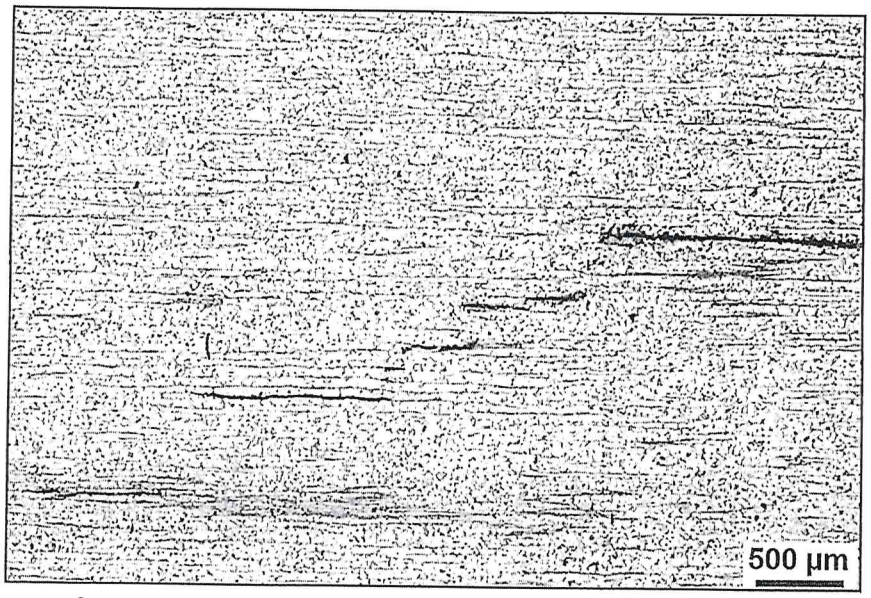


Device: Observer2 Image: 2024_0018699 Caustic: Nital 2%
Description: 108573 L 24-31 1 Face B Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0018700 Caustic: Nital 2%
Description: 108573 L 24-31 2 Face B Top[-] Center[X] Bottom[-]

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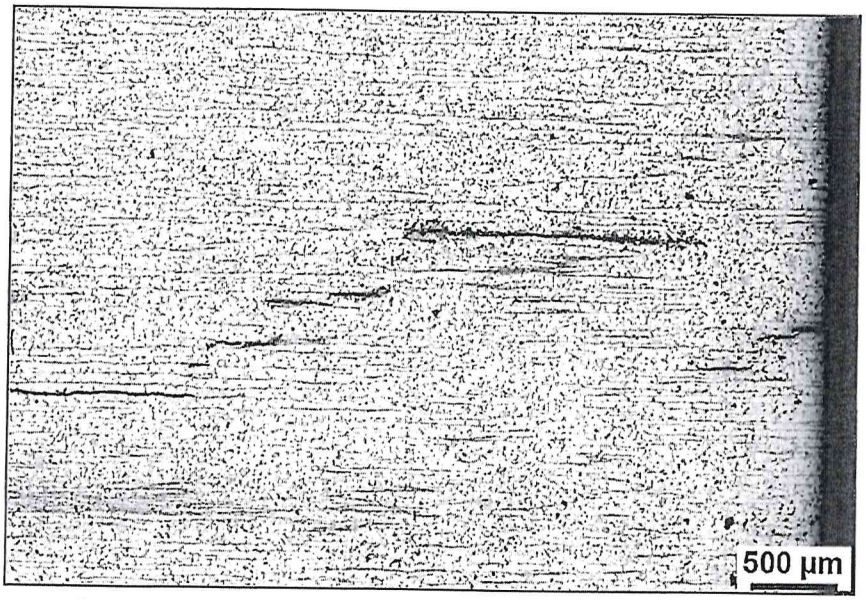
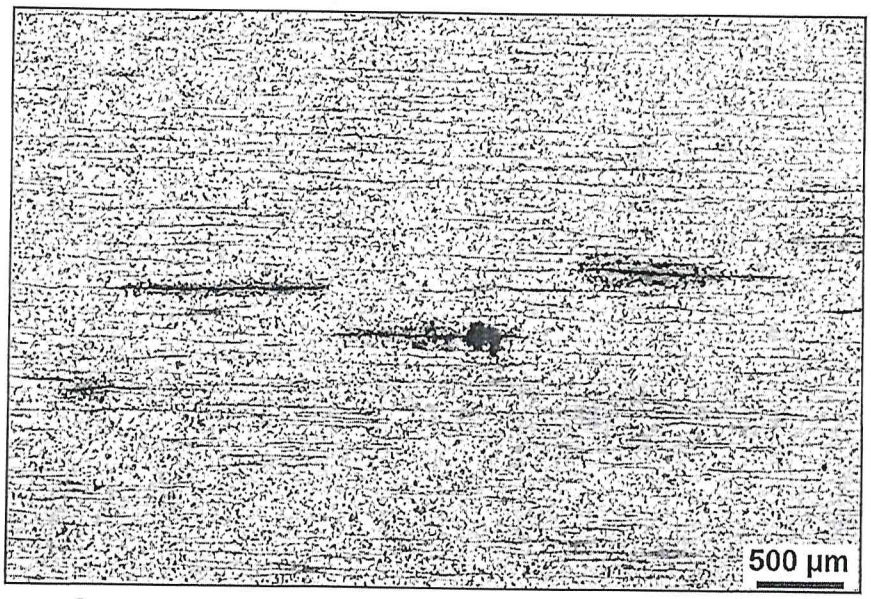


Device: Observer2 Image: 2024_0018702 Caustic: Nital 2%
Description: 108573 L 24-31 3 Face B Top[-] Center[X] Bottom[-]



Device: Observer2 Image: 2024_0018703 Caustic: Nital 2%
Description: 108573 L 24-31 1 Face C Top[-] Center[X] Bottom[-]

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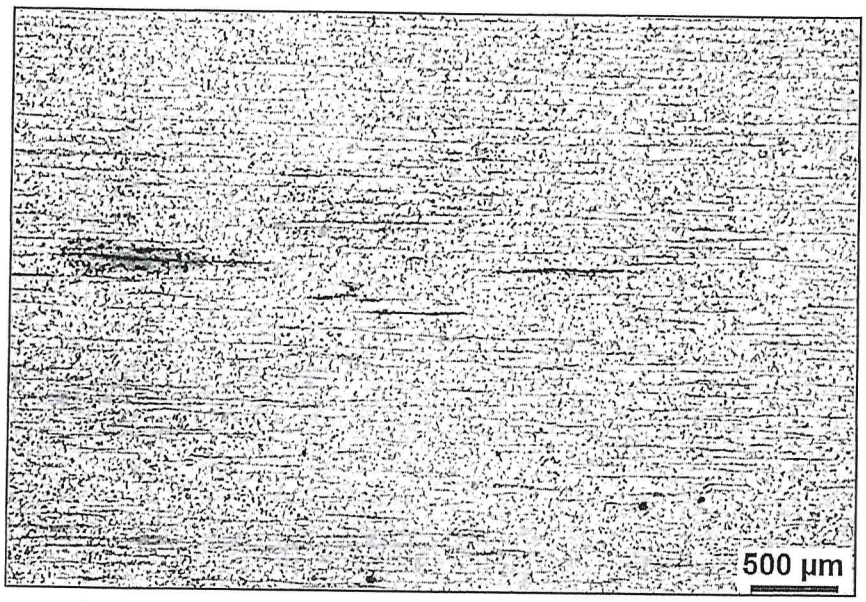
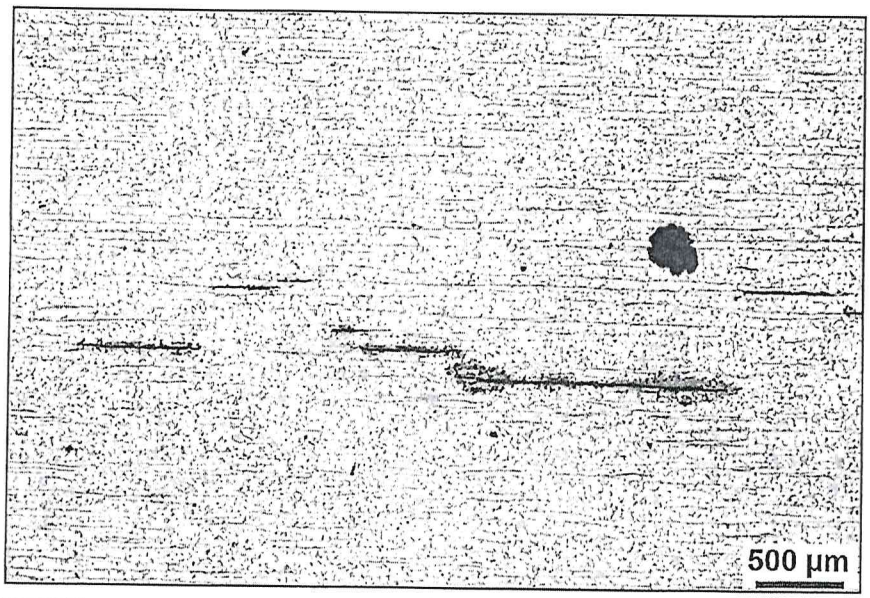


Device: Observer2
Description: 108573 L 24-31 2

Image: 2024_0018704
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-31 1

Image: 2024_0018706
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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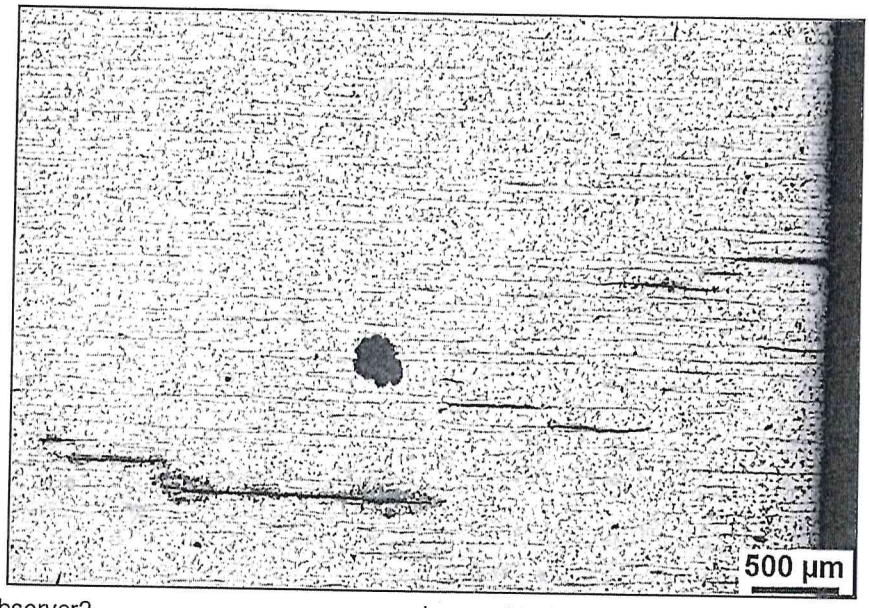

Device: Observer2
Description: 108573 L 24-31 2

Image: 2024_0018707
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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FN 78052h at the Provincial Court of Linz as
Commercial Court having jurisdiction
DVR 0546658
UID No. ATU 36905408

To

Mr. Joachim Zuschrader

Quality Department
voestalpine Grobblech GmbH

Test report *Microstructure and Surface Analysis*
Accredited Testing Laboratories

Test report	TSP-B / 2024-0001-60
Subject	HIC-Hydrogen-Induced Cracking-Test

Job Information

Client	voestalpine Grobblech GmbH		
Order number	3501486	**Order date**	January 27th, 2024
Laboratory group	voestalpine Stahl, TSP – Microstructure and Surface Analysis		
Referee	Michaela Altenhofer	**Phone, Fax**	0043/664 8362916
e-mail	Michaela.Altenhofer@voestalpine.com		
Distribution list	2024-0001		

Description of Test

Specification(s)	NACE TM0284:2016 Solution A; ASTM F21:20;
Simulated PWHT Parameter	1 cycle(s) sim. PWHT from 425 °C, 70 °C/h, to 610 °C, +10 °C / -10,HT: 180 min.,cooling with 70 °C/h to 425 °C, calm air

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Acceptance Limits:

Values based on average of three faces from each specimen

CLR: ---

CTR: ---

CSR: ---

ICR_MAX* ---

Test procedure:

The specimens were cut from the test plate in the middle of the width [1](A) and/or near the outer edges on the left (VL, RL) or right (VR, RR) depending on the plate thickness staggered across the plate thickness on the centreline [3](K) and near both surfaces (OS and US) or in between (DZ and SZ). The degreasing of the samples was tested according to the method of ASTM F21. Nitrogen (99.9990) was used for purging and H2S (99.5) for saturation. Three sections of each specimen were examined and the values CLR, CSR and CTR (optional CAR and/or *max. individual crack length) were determined. Sections were taken at three equivalent distances. Pictures were taken using a Zeiss Observer microscope. A control sample to demonstrate HIC crack sensitivity was used for the test. (Except for test solution N02). The average Crack Length Ratio (CLR) shall exceed 20% after testing.

Test conditions:

Vessel	Solution	Duration [h]	Start date [mm.dd.yyyy]	End date [mm.dd.yyyy]
3	N01	96	02.02.2024	02.06.2024

N01..... Nace TM0177 Sol.A; N02..... Nace TM0284 Sol.B; N03..... Nace TM0284 Sol.A; N04..... Nace TM0177 Sol.B;

Initial pH of solution	Initial Temp. [°C]	Start pH	End pH of solution	End Temp. [°C]	Start H2S-concentration [ppm]	End H2S-concentration [ppm]	Vessel
2,70	24	3,00	3,80	24	2906	2565	3

Samples were taken from the following plates:

Order Number	Plate No.	Heat No.	Material
3501486	235595/	762981	SA516Grade60

Control Sample No.	Plate No.	Material Quality	Width [mm]	Thickness [mm]	CLR [%]	Test Vessel
24-17	108573	SA516GRADE70	19,82	30,43	88,00	3

Dimension of specimen in mm:

Specimen No.	(1)	(2)	(3)	(4)	Plate No.	Width [mm]	Thickness [mm]	Test Vessel
GsKG2G1(6)	A	L	K	F	235595/	20,25	29,48	3
GsKG2G1(4)	A	L	US	F	235595/	20,21	29,47	3
GsKG2G1(5)	A	L	OS	F	235595/	20,20	29,47	3

[2]L.....longitudinal to the rolling direction; Q....transverse to the rolling direction; [4]F.....Leading End of Plate; K.....Tailing End of Plate; Length of specimen....100mm;

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Results:

Specimen No.	Plate No.	CLR %	CSR %	CTR %	ICR_MAX mm
GsKG2G1(6)/A	235595/	0,0	0,0	0,0	0
GsKG2G1(6)/B	235595/	0,0	0,0	0,0	0
GsKG2G1(6)/C	235595/	0,0	0,0	0,0	0
GsKG2G1(6)/Avg A-C	235595/	0,0	0,0	0,0	
GsKG2G1(4)/A	235595/	0,0	0,0	0,0	0
GsKG2G1(4)/B	235595/	0,0	0,0	0,0	0
GsKG2G1(4)/C	235595/	0,0	0,0	0,0	0
GsKG2G1(4)/Avg A-C	235595/	0,0	0,0	0,0	
GsKG2G1(5)/A	235595/	0,0	0,0	0,0	0
GsKG2G1(5)/B	235595/	0,0	0,0	0,0	0
GsKG2G1(5)/C	235595/	0,0	0,0	0,0	0
GsKG2G1(5)/Avg A-C	235595/	0,0	0,0	0,0	

The test results relate only to the items tested! The laboratory is not responsible for the sampling-parts and assumes no responsibility for any information from transmitted data or data that was not generated independently.
The report shall not be reproduced incompletely except in full without the written approval of the testing laboratories!

Enclosures:
Pictures of specimens and/or control sample pages 4-11
For actual magnification of pictures please refer to micrometer scale in the pictures.

Test Crew:

Michaela Altenhofer
Referee: Michaela Altenhofer

Laboratory Head: Andreas Schoenauer

voestalpine Stahl GmbH
Microstructure and Surface Analysis

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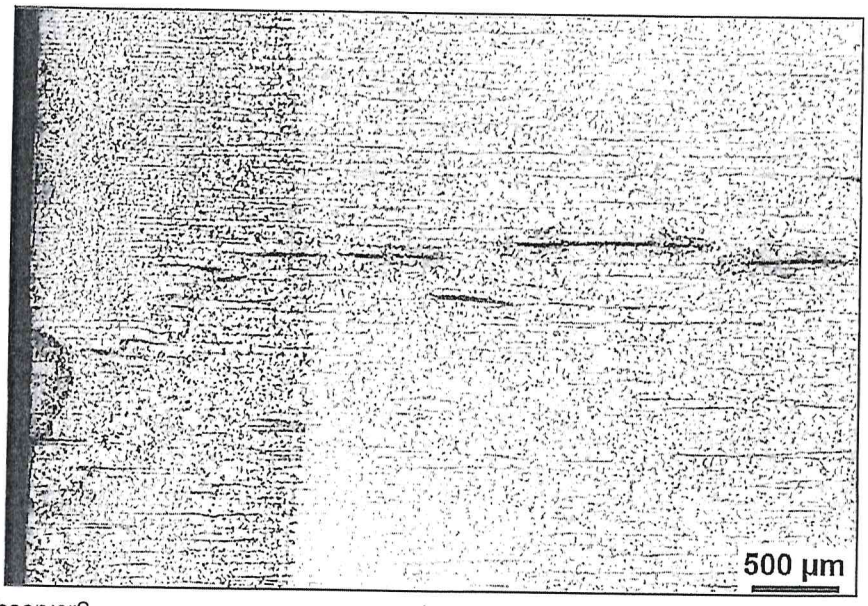
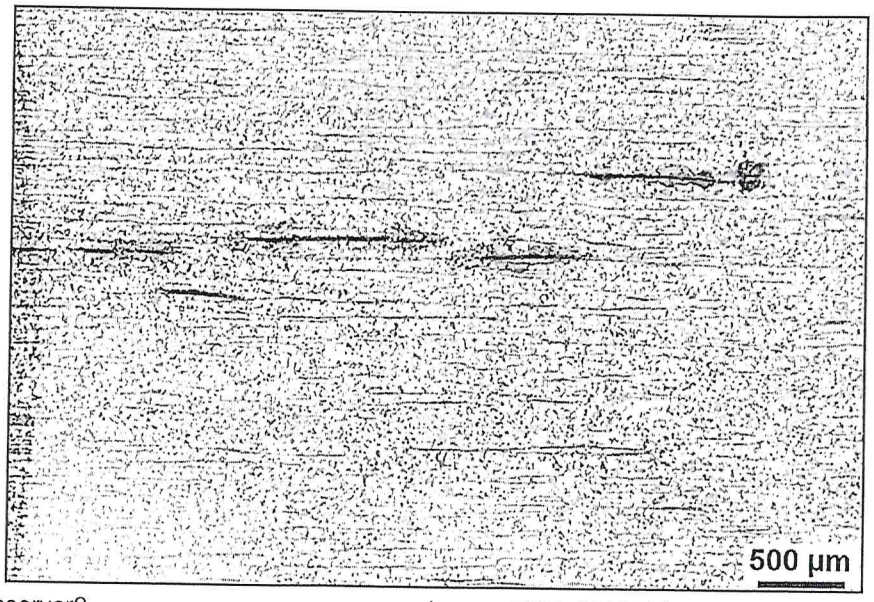


Device: Observer2
Description: 108573 L 24-17 1

Image: 2024_0012143 Caustic: Nital 2%
Face A Top[-] Center[X] Bottom[-]



Device: Observer2
Description: 108573 L 24-17 2

Image: 2024_0012145 Caustic: Nital 2%
Face A Top[-] Center[X] Bottom[-]

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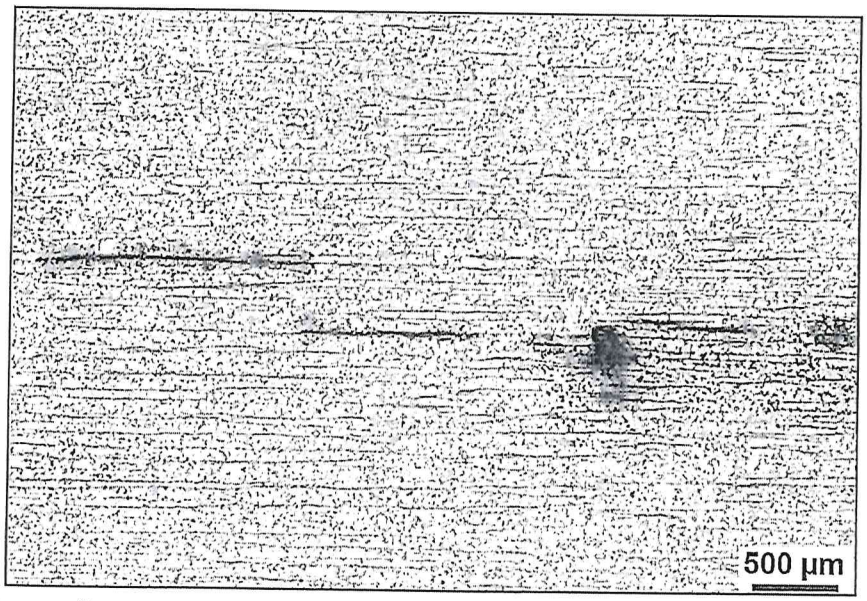

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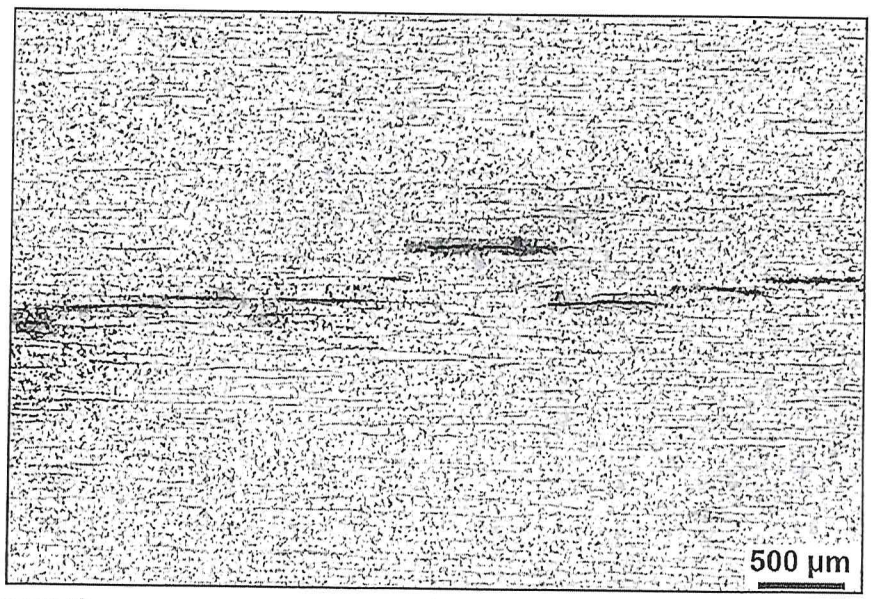
Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-17 2

Image: 2024_0012148
Face A Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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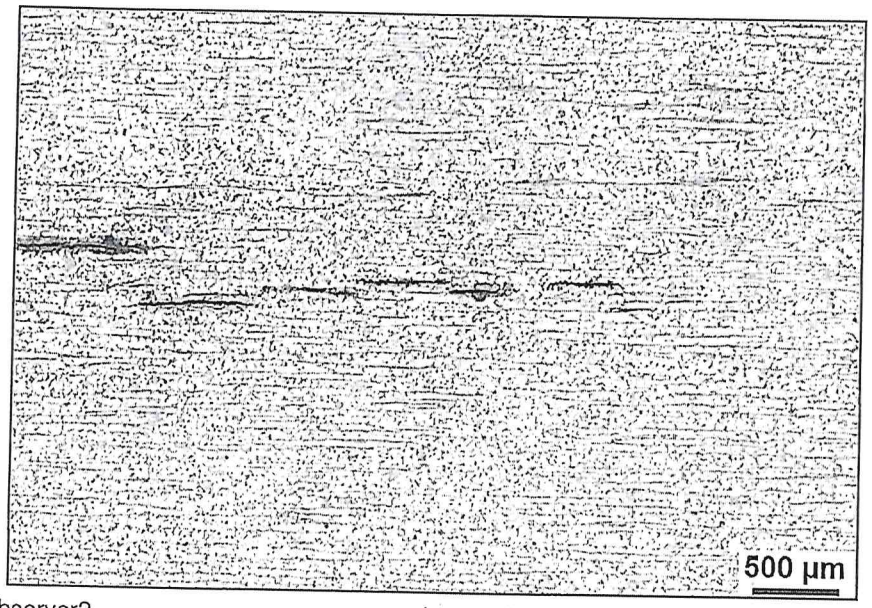
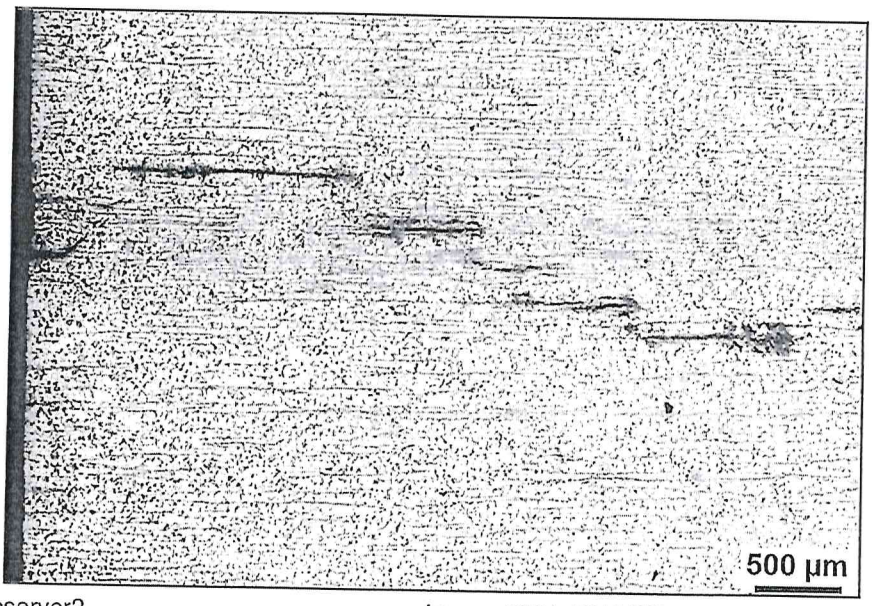


Device: Observer2
Description: 108573 L 24-17 3

Image: 2024_0012149
Face A Top[-] Center[X] Bottom[-]

Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-17 1

Image: 2024_0012150
Face B Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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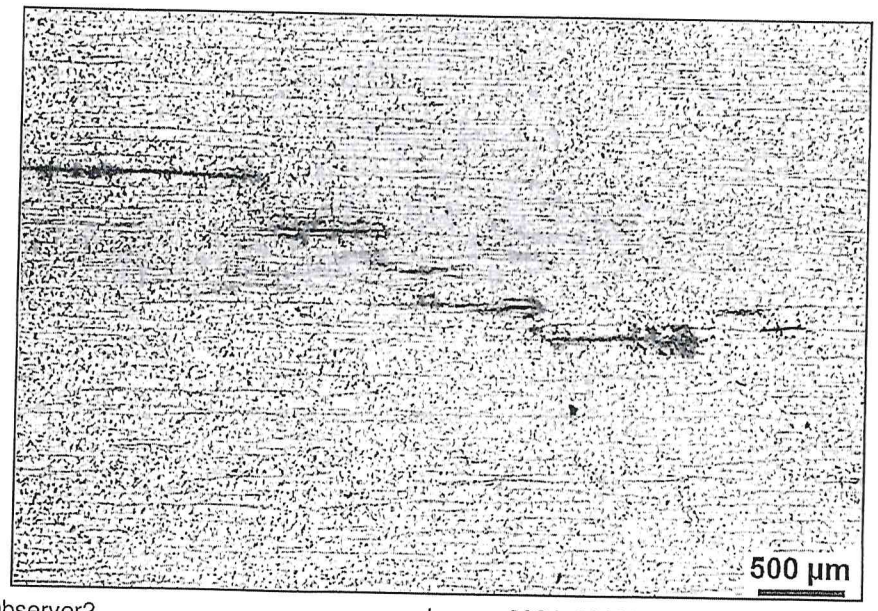

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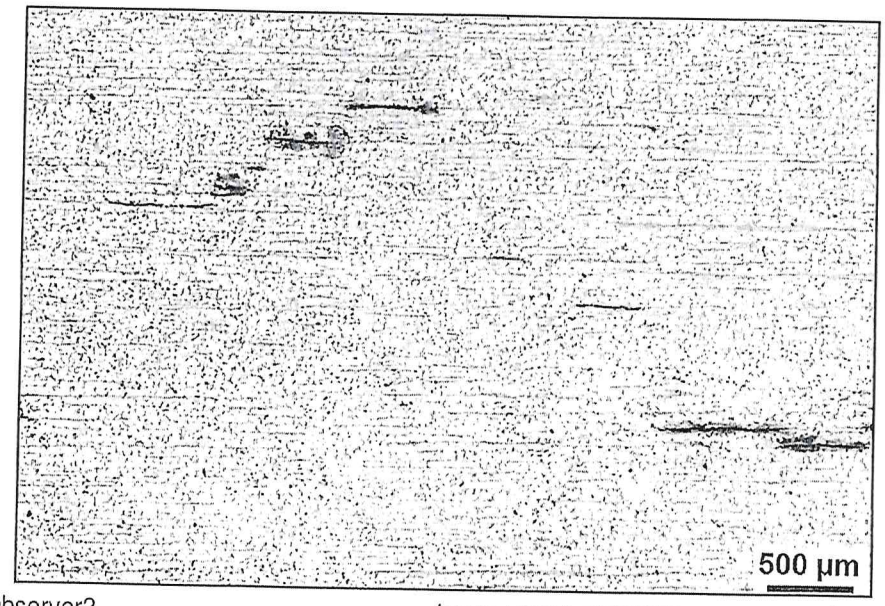
Description: 108573 L 24-17 2
Image: 2024_0012152
Face B Top[-] Center[X] Bottom[-]
Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-17 1
Image: 2024_0012153
Face B Top[-] Center[X] Bottom[-]
Caustic: Nital 2%

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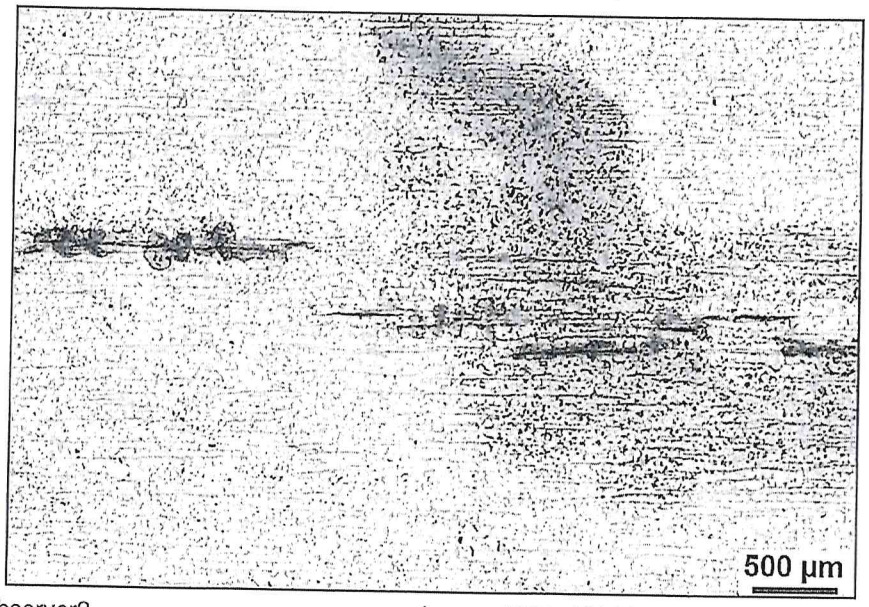

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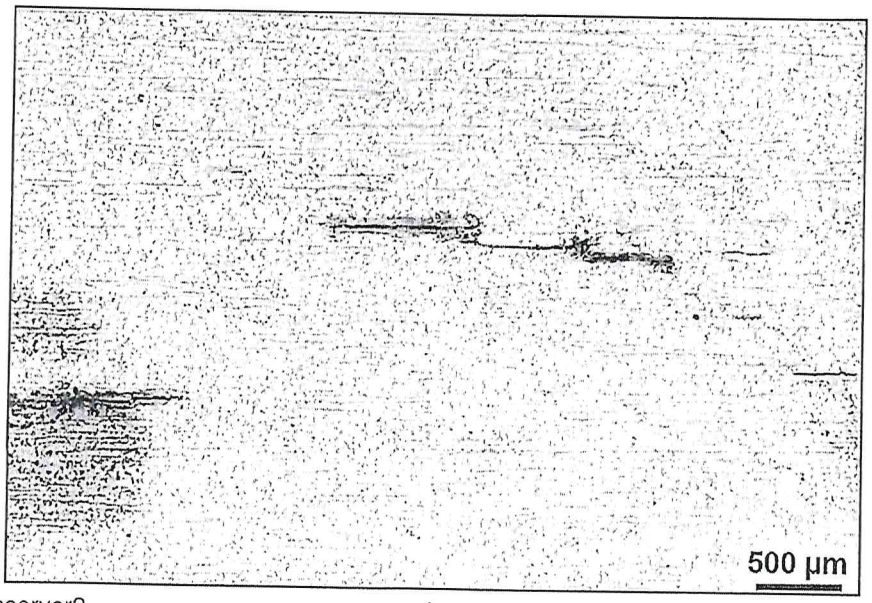
Description: 108573 L 24-17 2

Image: 2024_0012154
Face B Top[-] Center[X] Bottom[-]

Caustic: Nital 2%



Device: Observer2
Description: 108573 L 24-17 3

Image: 2024_0012157
Face B Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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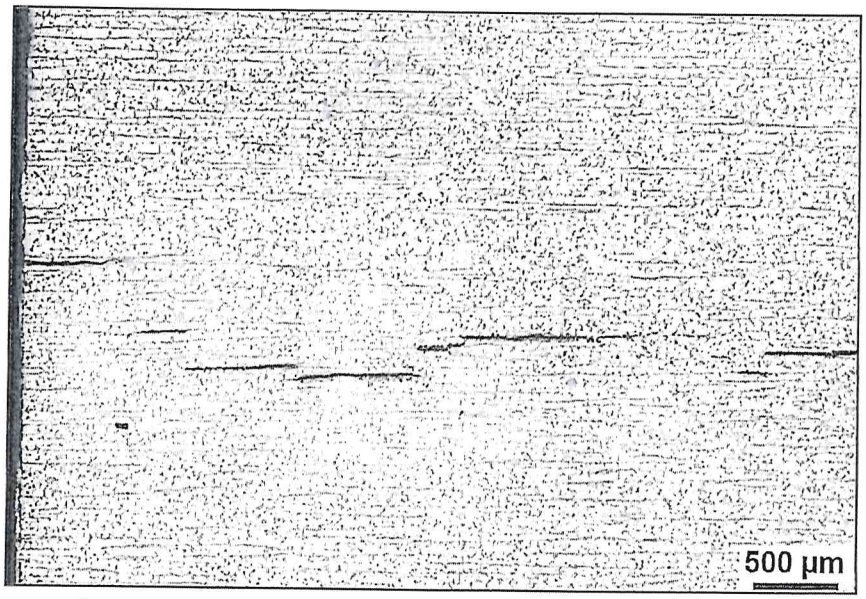
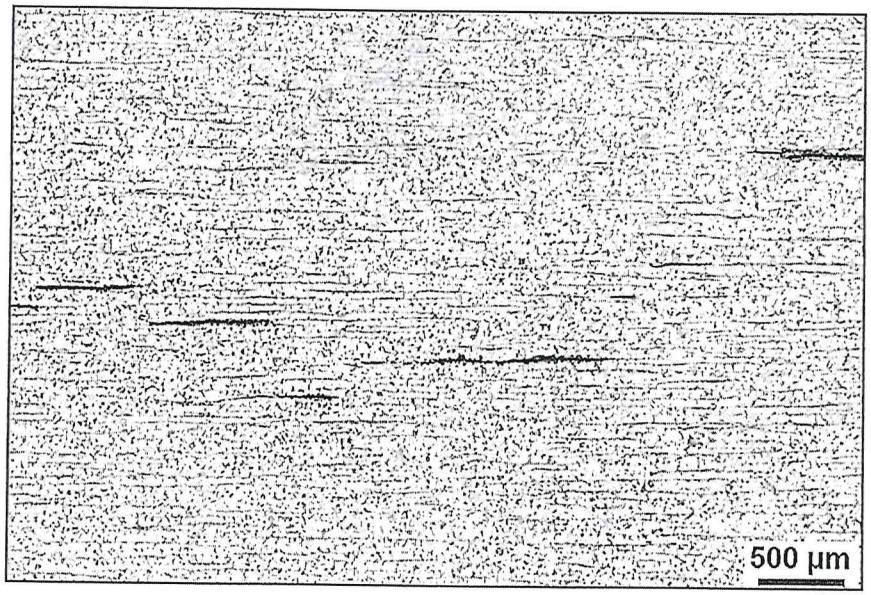


Device: Observer2
Description: 108573 L 24-17 1

Image: 2024_0012158 Caustic: Nital 2%
Face C Top[-] Center[X] Bottom[-]



Device: Observer2
Description: 108573 L 24-17 2

Image: 2024_0012160 Caustic: Nital 2%
Face C Top[-] Center[X] Bottom[-]

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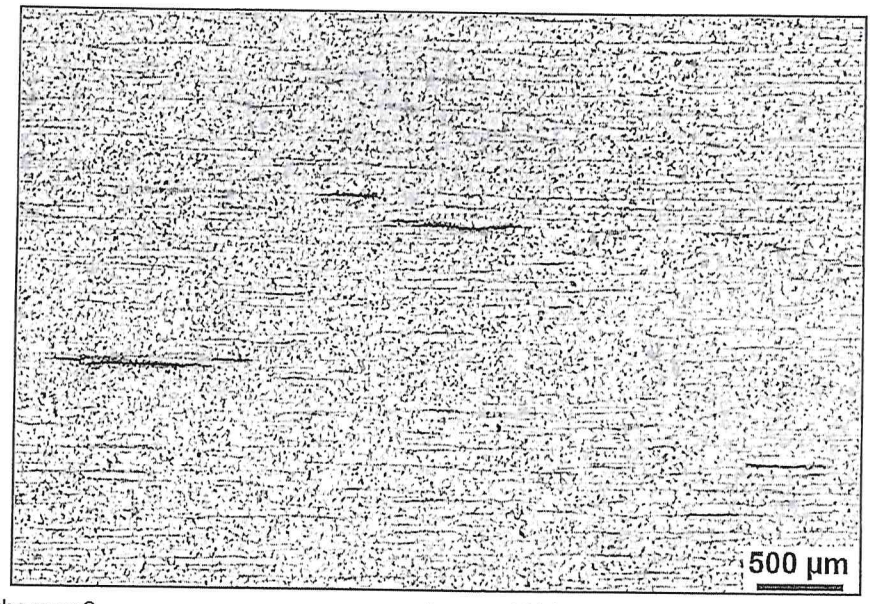
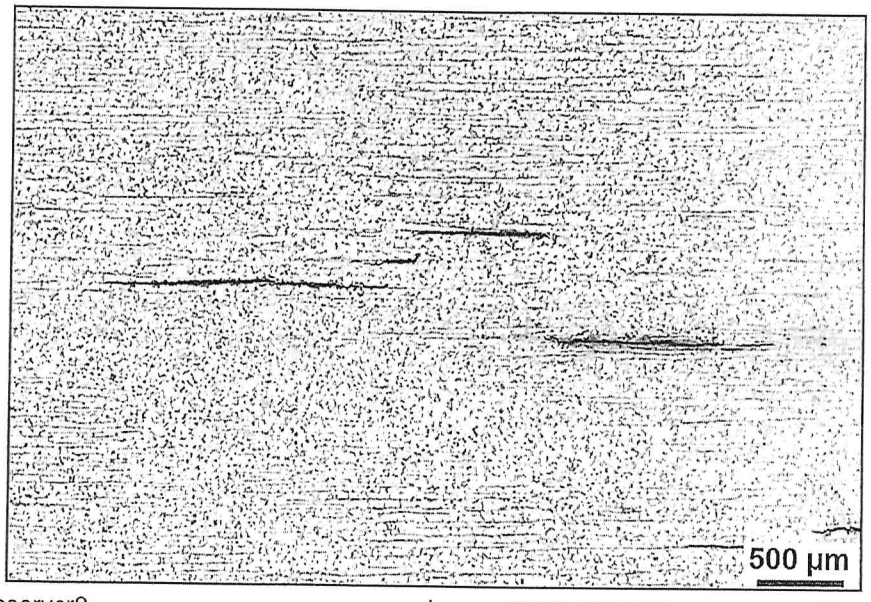


Device: Observer2
Description: 108573 L 24-17 3

Image: 2024_0012161 Caustic: Nital 2%
Face C Top[-] Center[X] Bottom[-]



Device: Observer2
Description: 108573 L 24-17

Image: 2024_0012162 Caustic: Nital 2%
Face C Top[-] Center[X] Bottom[-]

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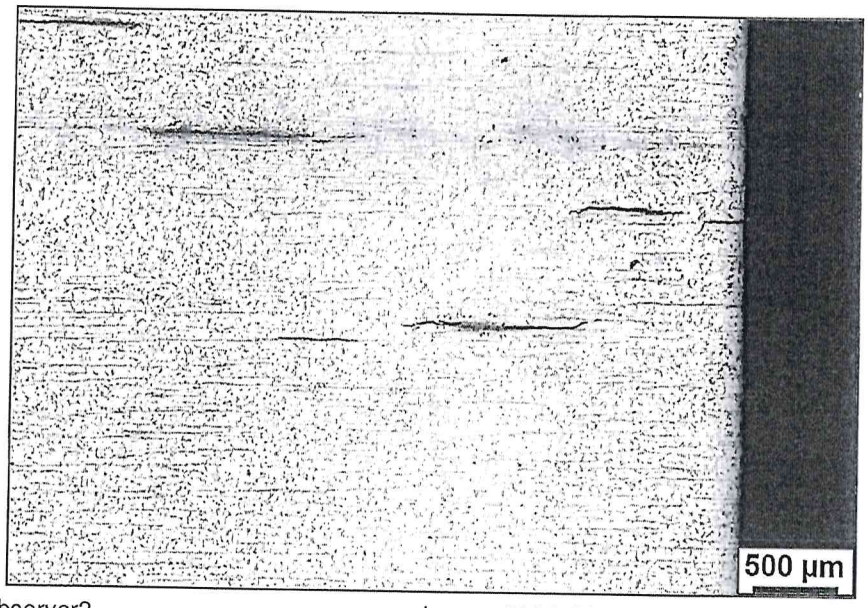

Device: Observer2
Description: 108573 L 24-17

Image: 2024_0012163
Face C Top[-] Center[X] Bottom[-]

Caustic: Nital 2%

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CERTIFIED MATERIAL TEST REPORT

KS FITTING & FLANGE CO.
#1055-2, SONGHYUN-RI, JILLYE-MYEON, GIMHAE-SI, GYEONGSANGNAM-DO, KOREA
TEL:82-51-744-3223 FAX:82-51-742-5896

EN 10204 3.2

Cert No. KS24-0124-01	Customer. Brembana & Rolle S.p.A.
Date of issue. 2024. 01. 24	PO No. 23096-ODA23-003381-REV:1
Spec for material. ASME SA350 LF2 CL1 - 2021Ed	Project.

* CHEMICAL COMPOSITION (%) *

STD	C	Mn	Si	P	S	Cr	Ni	Cu	V	Nb	Mo	N	Ti	Al	B	CE
Min		0.6	0.15													
Max	0.30	1.35	0.30	0.015	0.003	0.30	0.40	0.40	0.08	0.02	0.12					0.41
Ladle	0.18	1.19	0.25	0.011 ✓	0.002 ✓	0.10	0.04	0.09	0.002	0.001	0.01					0.4094 ✓
Product																

CHARGE NO.	STAMP NO.	QTY	HEAT TREATMENT
A266550	A266550	36EA	Normalizing 900℃ X 7.7 HRS Air Cooled

* MECHANICAL PROPERTIES *

Tension Test						Charpy Impact Test				Hardness Test (HB)
Spec for Test Piece			Yield STR (MPa)	Tensile STR (MPa)	Elongation (%)	Red Of Area (%)	Test Temp	T.P Notch	Energy[J]	
Specimen No.	Dia	G.L					-46℃	2mmV	MIN: 20J AVG: 27J	
	12.5	50	MIN 250 ✓	485-655 ✓	MIN 22	MIN 30	1)	2)	3)	AVG.	147-197
A266550	12.5	50	359.7	529.0	34.3	69.5	76.2	70.4	80.7	75.7	156/155
#1	12.5	50	314.8	515.1	33.3	70.0	89.3	94.4	83.0	88.9	153/154
#2	12.5	50	328.1	505.4	32.3	70.4	50.2	48.8	52.1	50.3	151/151 ✓

Ultrasonic Examination	Magnetic Examination	Penetrance Examination	Dimension Inspection
GOOD	GOOD	N/A	GOOD

* ITEM DESCRIPTION *

NO.1	LWNRF (MK17)#300 1" S/STD 244LG NZ. 3N	6	EA
NO.2	LWNRF (MK16) #300 1" S/STD 244LG NZ. 1N	6	EA
NO.5	LWNRF (MK22) #300 1" S/STD 244LG NZ. 3N	6	EA
NO.6	LWNRF (MK21) #300 1" S/STD 414.5LG NZ 2N	6	EA
NO.7	LWNRF (MK20) #300 1" S/STD 414.5LG NZ K2	6	EA
NO.8	LWNRF (MK19) #300 1" S/STD 414.5LG NZ K1	6	EA

QTY

* DOC NO.: 23096-EMRS-201 REV.0
* NACE MR 0175 / ISO 15156 (LATEST EDITION)
* COMPLY WITH PED (2014/68/EU) ANNEX I PARA 4.3
* FULLY KILLED STTEL
* VACUUM DEGASSING
* FINE GRAIN PRCTICE
* #1: SIMULATED P.W.H.T OF MECHANICAL TEST COUPONS :
  -HOLDING TEMP.& TIME: 610℃ x 3HRS x 1CYCLE
  -HEATING & COOLING RATE: 56℃/HR
* #2: SIMULATED P.W.H.T OF MECHANICAL TEST COUPONS :
  -HOLDING TEMP.& TIME: 610℃ x 12HRS x 1CYCLE
  -HEATING & COOLING RATE: 56℃/HR
* LOCATION OF TEST SPECIMENS : TRANSVERSE
* SIZE OF IMPACT TEST SPECIMENS : 10 X 10 X 55(mm)
* DIMENSION OF FLANGE 24" & BELOWE CORRESPOND TO ASME B16.5 (2013ED)
* GASKET SEATING SURFACE : 125~250 AARH

We hereby certify that the material herein has been made and tested in accordance with the above specification and also with the requirements called for by the above order.

Director of Quality Assurance Dep't

BREMBANA & ROLLE S.p.A.
QCM - M. GAOLI
REVIEWED / ACCEPTED
07 FEB 2024

We declare that based on satisfactory findings, the products supplied are in compliance with the requirements of the order/specifications.

Date 2024 01 24

Authorized Inspection Representative

Cert. No. 04

초 음 파 탐 상 검 사 보 고 서
Ultrasonic Examination Report

Report No.: BK-KS-U-240108-02

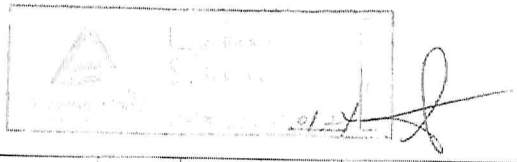
Page No. : 1 OF 2

Owner/Customer (주문주/고객) KS FITTING & FLANGE CO.	Project Name (공사명)	Project No. (공사번호) *P/O No.: 23096-ODA23-003381-REV.1
Item Name (제품명) FLNAGE & FORGING	Code (규격) ASME SA388 ASME(Ed.2021) SEC.Ⅷ DIV.2 Para 3.3.4	Procedure (절차서) N / A
Item No. (제품번호) SEE BELOW	Drawing No. (도면번호) N / A	Test Time (검사시기) ■After H.T □Before H.T
Material (재질) SA350 LF2 CL1	Surface Condition (표면상태) ■Rough Machined □Welded	Couplant(접촉매질) ■Oil □Water □CMC □
Equipment Calibration (장비 교정) ASTM E317 Fig.1, Block (S/No.:21-1334)	Standard Sensitivity (기준감도) DAC: 100 % / B1: 75 %	Scanning Sensitivity Level (탐상감도) + 6 dB Above The Primary Ref' Level
Linearity : Vertical Linearity within ±10% (직선성) :Horizontal Linearity within ±5%	Cable (고주파케이블) / Length (길이) RG174U / 2M	Test Temp (시험온도) ■ Ambient □ Elevation
Maker (제조사) G E Model (모 델) USN-60 SW Control No. (관리번호) E-20040 Due Date. (유효일자) Aug. 16 2024.	Method (검사방법) / Mode (형태) ■수직법(Straight Beam) ■사각법(Angle Beam) / ■접촉법(Contact) □수침법(Immerse) Standard Block(표준시험편) □STB-A1(SS) ■IIW-V1(S/N:B10265) Reference Block(대비시험편) □FBH □SDH ■60° V Notch ■Back Ref' Method	

Transducer 탐촉자	Type 형태	Angle 교정각도	Frequency 주파수	Size 크기	Type 형태	Angle 교정각도	Frequency 주파수	Size 크기
	TKS2.25CFN (NCFA48)	0 °	2.25 ㎒	Ø 1"	1C20X22A45 (AAXB47)	45 °	1 ㎒	20x22mm

Sketch

*EXAMINATION AREA
: ENTIRE VOLUME



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QCM M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

	Identification No. 확 인 번 호 (Item / Size)	Q.TY 수 량	Accept 합격	Reject 불합격	Interpretation 판 정	Remark 비고
1	300# LWNRF 1" x 244L S/STD	6EA	V		NO RECORDABLE INDICATION	MK17
2	300# LWNRF 1" x 244L S/STD	6EA	V		〃	MK16
3	OD915 x ID608 x 383L	6EA	V		〃	MK12
4	OD915 x ID608 x 383L	6EA	V		〃	MK8
5	300# LWNRF 1" x 244L S/STD	6EA	V		〃	MK22

SKETCH ON LINE, IF NECESSARY OR □ATTACHED 필요시 실선안에 스케치하거나 또는 첨부할 것.

Examined by 시 험 자	박 종 권 J. K. PARK	LEVEL III	Date of Examination 검사일자 Jan. 08. 2024.	Customer QA Manager	
			Date of Report 보고서 일자 Jan. 08. 2024.		
Approved by 승 인 자	김 두 진 D. J. KIM	LEVEL III	□ Witnessed by 입 회 자		
			□ Reviewed by 검 토 자		

Cert. No. 04

KMI

초 음 파 탐 상 검 사 보 고 서
Ultrasonic Examination Report

Report No.: BK-KS-U-240108-02

Page No. : 2 OF 2

	Identification No. 확 인 번 호 (Item / Size)	Q.TY 수 량	Accept 합격	Reject 불합격	Interpretation 판 정	Remark 비고
6	300# LWNRF 1" x 414L S/STD	6EA	V		NO RECORDABLE INDICATION	MK21
7	300# LWNRF 1" x 414.5L S/STD	6EA	V		〃	MK20
8	300# LWNRF 1" x 414.5L S/STD	6EA	V		〃	MK19
9	300# LWNRF 2" x 414.5L S/STD	6EA	V		〃	MK18
10	300# BLRF 24"	6EA	V		〃	MK13
11	300# BLRF 24"	6EA	V		〃	MK9
					-BLANK-	

2024.01.24

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07 FEB 2024

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자 분 탐 상 검 사 보 고 서
Magnetic Particle Examination Report

Report No.: BK - KS - M - 240122 - 01

Page No. : 1 OF 2

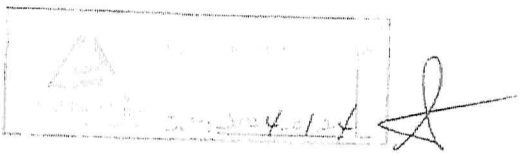
Owner/Customer (주문주/고객) KS FITTING & FLANGE CO.	Project Name (공사명)	Project No. (공사번호) *P/O No.: 23096-ODA23-003381-REV.1
Item Name (제품명) FLNAGE & FORGING	Code (규격) ASTM A275 ASME(Ed.2021) SEC.Ⅷ DIV.2 Para 3.3.5	Procedure (절차서) N / A
Item No. (제품번호) SEE BELOW	Drawing No. (도면번호) N / A	Test Time (검사시기) After Finish Machined
Material (재질) SA350 LF2 CL1	Test Block (테스트 블록) ■ Pie indicator (ASTM A 275) ■ Lifting Block (OVER 18.1 Kg)	Surface Condition (표면상태) ■ Machined ☐ Grinded ☐ Welded ☐

Equipment	Magnetization Technique	Direction of Magnetic Field	Magnetic Particle	Illuminance Meter	Black Light
☐AC (Lbs.) ■DC (40 Lbs.) Brand Kyung-Do Model No. MP-A2D Serial No. MP9710 Spacing 2 ~ 4 In Due date 2024. 03. 30.	■ Yoke ☐ Prod ☐ Coil	■ Longitudinal ☐ Circular ☐ Both	Brand : G S CHEM Model No : MMG-P Batch No : F230111P ☐ Dry ■ Wet ☐ Visible ■ Fluorescent	Brand : TES Model : TES-1330A S/N : 230607627 Due Date: 2024. 12. 28. Illumination: 조명도 MAX. 20 Lux	■ With ☐ Without Brand : NAWOO Model No. UV-LED 2P/SPR Serial No : NW0591 Intensity:Min.1000μw/cm² Due date: 2024. 03. 30. Demagnetization 탈자 ☐ Yes ■ No

Temp Meter (온도계)	Brand : TES Model : TES-1300	Serial No : 230607462 Due Date : 2024. 12 27.	Test Temp.	■Ambient ☐ Elev

Sketch

*EXAMINATION AREA
: ENTIRE SURFACE



BREMBANA & ROLLE S.p.A.
QCM. - M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

	Identification No. 확 인 번 호 (Item / Size)	Q.TY 수 량	Accept 합격	Reject 불합격	Interpretation 판 정	Remark 비고
1	300# LWNRF 1" x 244L S/STD	6EA	V		NO RECORDABLE INDICATION	MK17
2	300# LWNRF 1" x 244L S/STD	6EA	V		〃	MK16
3	OD915 x ID608 x 383L	6EA	V		〃	MK12
4	OD915 x ID608 x 383L	6EA	V		〃	MK8
5	300# LWNRF 1" x 244L S/STD	6EA	V		〃	MK22

☐ SKETCH ON DOT LINE, IF NECESSARY OR ☐ ATTACHED. 필요시 점선안에 스케치하거나 또는 첨부할것.

Examined by 시 험 자	박 종 권 J. K. PARK	LEVEL II	Date of Examination 검사일자 Jan. 22. 2024. Date of Report 보고서 일자 Jan. 22. 2024.	Customer QA Manager
Approved by 승 인 자	김 두 진 D. J. KIM	LEVEL III	☐ Witnessed by 입 회 자 ☐ Reviewed by 검 토 자	

Cert. No. 04

자 분 탐 상 검 사 보 고 서
Magnetic Particle Examination Report

Report No.: BK-KS-M-240122-01

Page No. : 2 OF 2

	Identification No. 확 인 번 호 (Item / Size)	Q.TY 수 량	Accept 합격	Reject 불합격	Interpretation 판 정	Remark 비고
6	300# LWNRF 1" x 414L S/STD	6EA	V		NO RECORDABLE INDICATION	MK21
7	300# LWNRF 1" x 414.5L S/STD	6EA	V		〃	MK20
8	300# LWNRF 1" x 414.5L S/STD	6EA	V		〃	MK19
9	300# LWNRF 2" x 414.5L S/STD	6EA	V		〃	MK18
10	300# BLRF 24"	6EA	V		〃	MK13
11	300# BLRF 24"	6EA	V		〃	MK9
					-BLANK-	

BREMBANA & ROLLE S.p.A.
QCM M.GALLI
REVIEWED / ACCEPTED
07 FEB 2024

Cert. No. 04

COPY

CERTIFICATE OF ORIGIN

issued by

THE CHAMBER OF COMMERCE & INDUSTRY
, Republic of Korea

1. Exporter (Name, address, country)

KS FITTING AND FLANGE CO.
109-35, Gomo-ro 180, Songhyeon-ri, Jillye-myeon, Gimhae,
Korea

2. Consignee (Name, address, country)

Brembana & Rolle S.p.A.
Via delle industrie 35 Albignasego (PD)
C.F.: 00226780161 VAT Reg. No.: 07348970158

3. Country of Origin

THE REPUBLIC OF KOREA

4. Transport details

FROM : BUSAN, KOREA
TO : GENOA, ITALY
BY : LUDWIGSHAFEN EXPRESS 045W
ON : 05 FEB., 2024

5. Remarks

Invoice number & date :
KS-PI231204-BR381 & 2023-12-04

6. Marks & numbers; number and kind of packages; description of goods

7. Quantity

FLANGE
N/WT 10,767.6KG
G/WT 11,292.6KG

THE EXPORTER OF THE PRODUCTS COVERED BY THIS DOCUMENT
(CUSTOMS AUTHORISATION NO:030-15-200136)
(1) DECLARES THAT, EXCEPT WHERE OTHERWISE CLEARLY INDICATED,
THESE PRODUCTS ARE OF
(2) REPUBLIC OF KOREA

//

End Of Page...

8. Declaration by the Exporter

The undersigned, as an authorized signatory, hereby declares that the above-mentioned goods were produced or manufactured in the country shown in box 3.

(Signature)

(Name) **PRESIDENT Y.S. KIM**

9. Certification

The undersigned authority hereby certifies that the goods described above originate in the country shown in box 3 to the best of its knowledge and belief.

Authorized Signatory

1/1

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

ANSI ACCREDITED
ISO/IEC 17024
Personnel Certification Program
#0644

ASNT Certification Services LLC.

Be it known that

Du Jin Kim

Has met the established and published Requirements for Certification by ASNT Certification Services LLC. as

NDT Level III

In the following Nondestructive Testing Methods:

Method	Issue Date	Expiration Date
Liquid Penetrant Testing	2/22	2/27
Magnetic Particle Testing	2/22	2/27
Radiographic Testing	2/22	2/27
Ultrasonic Testing	2/22	2/27
Visual Testing	2/22	2/27

ASNT Certification Services, LLC ASNT

BREMBANA & ROLLE S.p.A.
QCM - MGA
REVIEWED
07 FEB 2024

206623
Certificate Number

Certification Management Committee Chair

John F Kinney
ASNT Certification Services, LLC, President

Note: All ASNT NDT Level III exams are developed and maintained in accordance with ISO/IEC 17024 guidelines for certification of persons. The following exams are currently accredited by the American National Standards Institute (ANSI) - BASIC, ET, MT, PT, RT, UT, and VT. This certificate is the property of ASNT Certification Services LLC., is not official without ASNT Certification Services LLC.'s raised gold seal, and is subject to revocation prior to the listed expiration date. This certificate shall be verified on https://asntcertification.org or by contacting ASNT Certification Services LLC.

Cert. No 04

1723001756-QC-DB-00017_02 - V25001A

Certificate No: II-2013019

☐ New ■ Re

NDE CERTIFICATE

Korea Machinery Inspection E&C Co., Ltd.

That is to certify that the individual named below has successfully completed experience, training and examination requirements in accordance with the provisions of KMI E&C Co., Ltd. Procedure for NDE personnel Qualification and Certification KMIQ-P6225 (Rev.9). which meets the requirements of SNT-TC-1A & CP-189 (2016 Ed.).

Jong Kwon, Park

is hereby certified to perform the following Nondestructive Examination Method(s)

Method	Technique	Level	Limitation (if any)	Certification Date	Expiration Date
Radiographic Testing	Radiography	II	-	03/04/2022	03/03/2027
Ultrasonic Testing	Manual	II	-	03/04/2022	03/03/2027
Magnetic Particle Testing	-	II	-	03/04/2022	03/03/2027
Liquid Penetrant Testing	-	II	-	03/04/2022	03/03/2027
Visual Testing	-	II	-	03/04/2022	03/03/2027

Du Jin, Kim
(ASNT CERT NO:206623)
Qualified by Designated NDE Level III

03/04/2022
Date

Moo Ung, Yoon *m. u. Yoon*
President of KMI E&C Co., Ltd

03/04/2022
Date

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

Cert. No. 04

1723001756-QC-DB-00017_02 - V25001A
PAGE 409/1016

Cert. No. 04

검사증명서
MILL TEST CERTIFICATE

HYUNDAI STEEL

주소(제철소 : 충남 당진시 송악읍 홍우산업로 1480
: 1480 Hongwoo-ro, Songak-Eup, Dangjin-Si, Chungnam, Korea

주문번호 Order No.	: D231009267	증명서 번호 Certificate No.	: 20231123-CN-0001-001
품 명 Commodity	: Slab	고객사 Customer	: 현대아이에프씨㈜
제품규격 Specification	: ASTM A105-A350LF2	주문자 Contractor	: 현대아이에프씨㈜
		발행일자 Date of Issue	: 2023-11-23

제품치수 Dimension	수량 Quantity	중량 Weight (kg)	제강번호 Heat No.	제품번호 Product No.	화학성분 Chemical Composition(%)														탄재당량 2:×100 4:×10,000	3:×1,000 5:×100,000	
					분석 Analysis	C	Si	Mn	P	S	Cr	Ni	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol Al	CEQ
300x2000x6810	1	27,370	S95052	S9505255	L	1,992	250	968	82	55	22	11	3	9	1	2	4	1	3	3	3
300x2000x6810	1	27,370	S95052	S9505256	L	1,992	250	968	82	55	22	11	3	9	1	2	4	1	3	3	3
300x2001x6810	1	27,370	S95095	S9509501	L	1,949	233	973	114	29	2	1	3	17	0	0	41	1	1	31	304
300x2000x6810	1	27,370	S95095	S9509502	L	1,949	233	973	114	29	2	2	3	17	0	0	41	1	1	31	304
300x2000x6810	1	27,320	S95095	S9509503	L	1,949	233	973	114	29	2	2	3	17	0	0	41	1	1	31	304
300x2000x6800	1	27,320	S95068	S9506801	L	1,997	241	954	103	22	2	2	3	12	0	0	38	1	1	31	305
*** Slab Total(001) ***	5	164,1200kg																			
*** Grade Total ***	6	164,1200kg		Qty(CEQ, G=C+Mn/6+(Ni+Cu)/15+(Cr+Mo+V)/5																	
*** Last Item ***																					

Version : Final product analysis, Heating analysis

NOTE

* THE SLAB IS FULLY KILLED, FINE-GRAIN PRACTICE, BASIC OXYGEN PROCESS AND VACUUM DEGASSING PROCESS WERE APPLIED.
ANY WELDING SHALL NOT BE PERFORMED FOR THE ORDERED MATERIAL.
The Certificate has been issued in compliance with EN 10204 Type 3.1

상기의 제품은 검사에 합격했음 규격에 합격했음을 증명합니다.

WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature: Jae Hee Jeon

Head Of Steel Making Quality Team

ACCEPT
2023. 11. 23
mysco

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

본 검사증명서는 원본의 전자문서(PDF)로 출력되었으며, 출력된 서면 내용을 고객포털에서 바인딩 수 있습니다. (http://cm.hyundai-steel.com/cm/cm/login.jsp)
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You are able to check an original electronic document at hyundaisteel's customer portal(http://cm.hyundai-steel.com/cm/cm/login.jsp) : QRcode scanner App : 'QRee'
(서류상 수하사항) 본 검사증명서에 명기된 규격 외 사용시 품질손상 및 안전사고 발생할 수 있습니다.
*Caution for Use) Damage on products and safety problems may arise if used other than to the spec. stated in this Mill Test Certification.

Cert. No. 04

검 사 증 명 서
MILL TEST CERTIFICATE

HYUNDAI STEEL

당진제철소 : 충남 당진시 송악읍 부부산업로 1480
1480 Bukbusaneop-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea

주문번호 Order No. : D210704273
품 명 Commodity : Round Bar(봉강)
제품규격 Specification : A350 LF2
고객사 Customer : 용진에스티 주식회사
주문자 Contractor : 용진에스티 주식회사
증명서 번호 Certificate No. : 20211127-SN-0059-001
발행일자 Date of Issue : 2021-11-30

재강번호 Heat No.	제품번호 Product No.	제품치수 Dimension(mm) Diameter	Length	수량 Quantity (PCS/BD)	중량 Weight (KG)	열처리 Heat Treatment
A268540	HB9905003	90	6000	8	2,400	AS-ROLLED
Total				8	2,400	

화학성분 Chemical Composition(%) 단위 Unit 2 : x 100 3 : x 1,000 4 : x 10,000 5 : x 100,000

구분 Division	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	Cr+Mo	Ceq
	2	2	2	3	3	2	2	2	2	3	3	2	2
Min.		15	89										
Max.	20	30		35	40	40	40	80	12	30	20	32	47
Result	18	24	118	10	2	9	4	10	1	2	1	11	41

구분 Division	압연비 Reduction Ratio	초음파 탐상검사 Ultrasonic Inspection	표면검사 Surface Inspection
Min.			
Max.			
Result	33S	Good	Good

NOTE
* Melting Process : EAF + LF + RHWD * Surface Condition : Black Surface * No Repair Welding * Fully Killed Steel EN10204 TYPE 3.1
* Ceq : C + Mn/6 + (Ni + Cu)/15 + (Cr + Mo + V)/5

납품일자 : 2022. 2. 25.
작 성 자 : 시
화번호 :
팩스번호 :
수 강 (주)

BREMBANA & ROTA S.p.A.
QCM - W. GALLI
RECEIVED
07 FEB 2024

항기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature Y. H Kim
Chief Of Quality Assurance Team

* 본 검사증명서는 컴퓨터 관리번호(문자시와 숫자 포함)로부터 출력된 사본입니다. 원본문서의 내용은 현대제철 고객포털에서 확인하실 수 있습니다.(http://srm.hyundai-steel.com/cs/cm/login.jsp)
* This Mill Test Certificate is a copy that has been printed from original electronic document(with digital signing).
You are able to check an original electronic document at hyundaisteel's customer portal.(http://srm.hyundai-steel.com/cs/cm/login.jsp) * QRcode scanner App : 'QReal'
* [사용상 주의사항] 본 검사증명서에 명기된 규격 외 사용시 제품손상 및 안전상 문제가 발생할 수 있습니다.
* [Caution for Use] Damage on products and safety problems may arise if used other than to the spec stated in this Mill Test Certification.

Cert. No. 04

검 사 증 명 서
MILL TEST CERTIFICATE

HYUNDAI STEEL

당진제철소 : 충남 당진시 송악읍 부두산업로 1480
1480 Dubusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea

주문번호 Order No. : D210704273
품 명 Commodity : Round Bar(봉강)
제품규격 Specification : A350 LF2
고객사 Customer : 용진에스타 주식회사
주문자 Contractor : 용진에스타 주식회사
증명서 번호 Certificate No. : 20220325-SN-0471-001
발행일자 Date of Issue : 2022-03-28

제강번호 Heat No.	제품번호 Product No.	제품치수 Dimension(mm) Diameter	Length	수량 Quantity (PCS/BD)	중량 Weight (KG)	열처리 Heat Treatment
A266550	HB9601902	60	6000	17	2,276	AS-ROLLED
A266550	HB9601908	60	6000	10	1,338	AS-ROLLED
A266550	HB9601909	60	6000	11	1,474	AS-ROLLED
Total				38	5,088	

화학성분 Chemical Composition(%) 단위 Unit 2:x100 3:x1,000 4:x10,000 5:x100,000

구분 Division	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	Cr+Mo	Ceq
Min.	2	2	2	3	3	2	2	2	2	3	3	2	2
Max.	20	15	90										
Result	18	30	110	35	40	40	40	30	12	30	20	32	47
		25		11	2	9	4	11	1	2	1	12	41

구분 Division	압연비 Reduction Ratio	초음파 탐상검사 Ultrasonic Inspection	표면검사 Surface Inspection
Min.			
Max.			
Result	7.3S	Good	Good

140-81-71739
용 진 에 스 타 주 식 회 사
경기도 안산시 단원구 별망로 14
품 소 매
문순영
철강제품

External Person 2023.12.22

원본대조필

NOTE
* Melting Process : EAF + LF + RH-VD * Surface Condition : Black Surface * No Repair Welding * Fully Killed Steel EN10204 TYPE 3.1
* Ceq : C + Mn/6 + (Ni + Cu)/15 + (Cr + Mo + V)/5

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature S. W. Hong
Chief Of Quality Assurance Team

This Test Certificate is a copy that has been printed from original electronic document(with digital signing).
You are able to check an original electronic document at hyundaisteel's customer portal.(http://em.hyundai-steel.com/en/login.jsp) * Offcode scanner App : 'Offcel'
(사용상 주의사항) 본 검사증명서에 명기된 규격 외 사용시 제품손실 및 업무상 제약기 발생할 수 있습니다.
Caution to Use) Damage on products and safety problems may arise if used other than to the spec stated in this Mill Test Certification.

BREMBANA & POLTE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

Cert. No. 05

CERTIFIED MATERIAL TEST REPORT

KS FITTING & FLANGE CO.
#1055-2, SONGHYUN-RI, JILLYE-MYEON, GIMHAE-SI, GYEONGSANGNAM-DO, KOREA
TEL:82-51-744-3223 FAX:82-51-742-5896

EN 10204 3.2

Cert No. KS24-0124-02	Customer. Brembana & Rolle S.p.A.
Date of issue. 2024. 01. 24	PO No. 23096-ODA23-003381-REV:1
Spec for material. ASME SA350 LF2 CL1 - 2021Ed	Project.

* CHEMICAL COMPOSITION (%) *

STD	C	Mn	Si	P	S	Cr	Ni	Cu	V	Nb	Mo	N	Ti	Al	B	CE
Min		0.6	0.15													
Max	0.30	1.35	0.30	0.015	0.003	0.30	0.40	0.40	0.08	0.02	0.12					0.41
Ladle	0.1992	0.928	0.25	0.0082	0.0025	0.02	0.01	0.009	0.002	0.001	0.01					
Product																0.3615

CHARGE NO.	STAMP NO.	QTY	HEAT TREATMENT
S85062	S85062	24EA	Normalizing 900℃ X 7.7 HRS Air Cooled

* MECHANICAL PROPERTIES *

Tension Test						Charpy Impact Test				Hardness Test (HB)
Spec for Test Piece			Yield STR (MPa)	Tensile STR (MPa)	Elongation (%)	Red Of Area (%)	Test Temp	T.P Notch	Energy[J]	
Specimen No.	Dia	G.L					-46℃	2mmV	MIN: 20J AVG: 27J	
	12.5	50	MIN 250	485-655	MIN 22	MIN 30	1)	2)	3)	AVG.	147-197
S85062	12.5	50	333.4	532.5	31.4	69.5	145.8	121.3	116.7	127.9	158/157
#1	12.5	50	340.8	527.8	35.8	71.0	89.3	94.4	83.0	88.9	153/154
#2	12.5	50	351.2	517.1	32.4	71.8	84.8	78.1	86.8	83.2	150/151

Ultrasonic Examination	Magnetic Examination	Penetrance Examination	Dimension Inspection
GOOD	GOOD	N/A	GOOD

* ITEM DESCRIPTION *

NO.3	FORGING (MK12) OD915 ID608 383L M2	6	EA
NO.4	FORGING (MK8) OD915 ID608 383L M1	6	EA
NO.10	BLRF (MK13) #300 24" M2	6	EA
NO.11	BLRF (MK9) #300 24" M1	6	EA

QTY

* DOC NO.: 23096-EMRS-201 REV.0
* NACE MR 0175 / ISO 15156 (LATEST EDITION)
* COMPLY WITH PED (2014/68/EU) ANNEX I PARA 4.3
* FULLY KILLED STTEL
* VACUUM DEGASSING
* FINE GRAIN PRCTICE
* #1: SIMULATED P.W.H.T OF MECHANICAL TEST COUPONS :
  -HOLDING TEMP.& TIME: 610℃ x 3HRS x 1CYCLE
  -HEATING & COOLING RATE: 56℃/HR
* #2: SIMULATED P.W.H.T OF MECHANICAL TEST COUPONS :
  -HOLDING TEMP.& TIME: 610℃ x 12HRS x 1CYCLE
  -HEATING & COOLING RATE: 56℃/HR
* LOCATION OF TEST SPECIMENS : TRANSVERSE
* SIZE OF IMPACT TEST SPECIMENS : 10 X 10 X 55(mm)
* DIMENSION OF FLANGE 24" & BELOWE CORRESPOND TO ASME B16.5 (2013ED)
* GASKET SEATING SURFACE : 125-250 AARH

We hereby certify that the material herein has been made and tested in accordance with the above specification and also with the requirements called for by the above order.

Director of Quality Assurance Dep't

BREMBANA & ROLLE S.p.A.
QCM M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

We declare that based on satisfactory findings, the products supplied are in compliance with the requirements of the order/specifications.

Date: 2024. 01. 24

Authorized Inspection Representative

Cert. No. 05

초 음 파 탐 상 검 사 보 고 서
Ultrasonic Examination Report

Report No.: BK-KS-U-240108-02

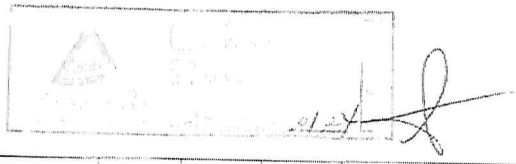
Page No. : 1 OF 2

Owner/Customer (주문주/고객) KS FITTING & FLANGE CO.	Project Name (공사명)	Project No. (공사번호) *P/O No.: 23096-ODA23-003381-REV.1
Item Name (제품명) FLNAGE & FORGING	Code (규격) ASME SA388 ASME(Ed.2021) SEC.Ⅷ DIV.2 Para 3.3.4	Procedure (절차서) N / A
Item No. (제품번호) SEE BELOW	Drawing No. (도면번호) N / A	Test Time (검사시기) ■After H.T □Before H.T
Material (재질) SA350 LF2 CL1	Surface Condition (표면상태) ■Rough Machined □Welded	Couplant(접촉매질) ■Oil □Water □CMC □
Equipment Calibration (장비 교정) ASTM E317 Fig.1, Block (S/No.:21-1334)	Standard Sensitivity (기준감도) DAC: 100 % / B1: 75 %	Scanning Sensitivity Level (탐상감도) + 6 dB Above The Primary Ref' Level
Linearity : Vertical Linearity within ±10% (직선성) :Horizontal Linearity within ±5%	Cable (고주파케이블) / Length (길이) RG174U / 2M	Test Temp (시험온도) ■ Ambient □ Elevation
Maker (제조사) G E Model (모 델) USN-60 SW Control No. (관리번호) E-20040 Due Date. (유효일자) Aug. 16 2024.	Method (검사방법) / Mode (형태) ■수직법(Straight Beam) ■사각법(Angle Beam) / ■접촉법(Contact) □수침법(Immerse) Standard Block(표준시험편) □STB-A1(SS) ■IIW-V1(S/N:B10265) Reference Block(대비시험편) □FBH □SDH ■60° V Notch ■Back Ref' Method	

Transducer 탐촉자	Type 형태	Angle 교정각도	Frequency 주파수	Size 크기	Type 형태	Angle 교정각도	Frequency 주파수	Size 크기
	TKS2.25CFN (NCFA48)	0 °	2.25 ㎒	Ø 1"	1C20X22A45 (AAXB47)	45 °	1 ㎒	20x22mm

Sketch

*EXAMINATION AREA
: ENTIRE VOLUME



BREMBANA & ROLLE S.p.A.
QCM M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

	Identification No. 확인번호 (Item / Size)	Q.TY 수량	Accept 합격	Reject 불합격	Interpretation 판정	Remark 비고
1	300# LWNRF 1" x 244L S/STD	6EA	V		NO RECORDABLE INDICATION	MK17
2	300# LWNRF 1" x 244L S/STD	6EA	V		〃	MK16
3	OD915 x ID608 x 383L	6EA	V		〃	MK12
4	OD915 x ID608 x 383L	6EA	V		〃	MK8
5	300# LWNRF 1" x 244L S/STD	6EA	V		〃	MK22

SKETCH ON LINE, IF NECESSARY OR □ATTACHED 필요시 실선안에 스케치하거나 또는 첨부할 것.

Examined by 시험자	박 종 권 J. K. PARK	LEVEL III	Date of Examination 검사일자 Jan. 08. 2024.	Customer QA Manager
			Date of Report 보고서 일자 Jan. 08. 2024.	
Approved by 승인자	김 두 진 D. J. KIM	LEVEL III	□ Witnessed by 입회자	
			□ Reviewed by 검토자	

Cert. No. 05

초 음 파 탐 상 검 사 보 고 서
Ultrasonic Examination Report

Report No.: BK-KS-U-240108-02

Page No. : 2 OF 2

	Identification No. 확 인 번 호 (Item / Size)	Q.TY 수 량	Accept 합격	Reject 불합격	Interpretation 판 정	Remark 비고
6	300# LWNRF 1" x 414L S/STD	6EA	V		NO RECORDABLE INDICATION	MK21
7	300# LWNRF 1" x 414.5L S/STD	6EA	V		〃	MK20
8	300# LWNRF 1" x 414.5L S/STD	6EA	V		〃	MK19
9	300# LWNRF 2" x 414.5L S/STD	6EA	V		〃	MK18
10	300# BLRF 24"	6EA	V		〃	MK13
11	300# BLRF 24"	6EA	V		〃	MK9
					-BLANK-	

2024 01 24

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

Korea Machinery Inspection E&C CO., LTD. TEL : 051-294-0885 FAX : 051-294-0886

Cert. No. 05

자 분 탐 상 검 사 보 고 서
Magnetic Particle Examination Report

Report No.: BK - KS - M - 240122 - 01

Page No. : 1 OF 2

Owner/Customer (주문주/고객) KS FITTING & FLANGE CO.	Project Name (공사명)	Project No. (공사번호) *P/O No.: 23096-ODA23-003381-REV.1
Item Name (제품명) FLNAGE & FORGING	Code (규격) ASTM A275 ASME(Ed.2021) SEC.Ⅷ DIV.2 Para 3.3.5	Procedure (절차서) N / A
Item No. (제품번호) SEE BELOW	Drawing No. (도면번호) N / A	Test Time (검사시기) After Finish Machined
Material (재질) SA350 LF2 CL1	Test Block (테스트 블록) ■ Pie indicator (ASTM A 275) ■ Lifting Block (OVER 18.1 Kg)	Surface Condition (표면상태) ■ Machined ☐ Grinded ☐ Welded ☐

Equipment	Magnetization Technique	Direction of Magnetic Field	Magnetic Particle	Illuminance Meter	Black Light
☐AC (Lbs.) ■DC (40 Lbs.) Brand Kyung-Do Model No. MP--A2D Serial No. MP9710 Spacing 2 ~ 4 In Due date 2024. 03. 30.	■ Yoke ☐ Prod ☐ Coil	■ Longitudinal ☐ Circular ☐ Both	Brand : G S CHEM Model No : MMG-P Batch No : F230111P ☐ Dry ■ Wet ☐ Visible ■ Fluorescent	Brand : TES Model : TES-1330A S/N : 230607627 Due Date: 2024. 12. 28. Illumination: 조명도 MAX. 20 Lux	■ With ☐ Without Brand : NAWOO Model No. UV-LED 2P/SPR Serial No : NW0591 Intensity:Min.1000μw/cm² Due date: 2024. 03. 30. Demagnetization 탈자 ☐ Yes ■ No

Temp Meter (온도계)	Brand : TES Model : TES-1300	Serial No : 230607462 Due Date : 2024. 12. 27.	Test Temp.	■Ambient ☐ Elev

Sketch

*EXAMINATION AREA
: ENTIRE SURFACE



BREMBANA & ROLLE S.p.A.
QCM. - M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

	Identification No. 확 인 번 호 (Item / Size)	Q.TY 수 량	Accept 합격	Reject 불합격	Interpretation 판 정	Remark 비고
1	300# LWNRF 1" x 244L S/STD	6EA	V		NO RECORDABLE INDICATION	MK17
2	300# LWNRF 1" x 244L S/STD	6EA	V		〃	MK16
3	OD915 x ID608 x 383L	6EA	V		〃	MK12
4	OD915 x ID608 x 383L	6EA	V		〃	MK8
5	300# LWNRF 1" x 244L S/STD	6EA	V		〃	MK22

☐ SKETCH ON DOT LINE, IF NECESSARY OR ☐ ATTACHED. 필요시 점선인에 스케치하거나 또는 첨부할것.

Examined by 시 험 자	박 종 권 J. K. PARK	LEVEL II	Date of Examination 검사일자 Jan. 22. 2024. Date of Report 보고서 일자 Jan. 22. 2024.	Customer QA Manager
Approved by 승 인 자	김 두 진 D. J. KIM	LEVEL III	☐ Witnessed by 입 회 자 ☐ Reviewed by 검 토 자	

Cert. No. 05

자 분 탐 상 검 사 보 고 서
Magnetic Particle Examination Report

Report No.: BK-KS-M-240122-01

Page No. : 2 OF 2

	Identification No. 확 인 번 호 (Item / Size)	Q.TY 수 량	Accept 합격	Reject 불합격	Interpretation 판 정	Remark 비고
6	300# LWNRF 1" x 414L S/STD	6EA	V		NO RECORDABLE INDICATION	MK21
7	300# LWNRF 1" x 414.5L S/STD	6EA	V		〃	MK20
8	300# LWNRF 1" x 414.5L S/STD	6EA	V		〃	MK19
9	300# LWNRF 2" x 414.5L S/STD	6EA	V		〃	MK18
10	300# BLRF 24"	6EA	V		〃	MK13
11	300# BLRF 24"	6EA	V		〃	MK9
					-BLANK-	

2024.01.24

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

Korea Machinery Inspection E&C CO., LTD. TEL : 051-294-0885 FAX : 051-294-0886

Cert. No. 05

COPY

CERTIFICATE OF ORIGIN

issued by

THE CHAMBER OF COMMERCE & INDUSTRY

, Republic of Korea

1. Exporter (Name, address, country)

KS FITTING AND FLANGE CO.
109-35, Gomo-ro 180, Songhyeon-ri, Jillye-myeon, Gimhae, Korea

2. Consignee (Name, address, country)

Brembana & Rolle S.p.A.
Via delle industrie 35 Albignasego (PD)
C.F.: 00226780161 VAT Reg. No.: 07348970158

3. Country of Origin

THE REPUBLIC OF KOREA

4. Transport details

FROM : BUSAN, KOREA
TO : GENOA, ITALY
BY : LUDWIGSHAFEN EXPRESS 045W
ON : 05 FEB, 2024

5. Remarks

Invoice number & date :
KS-PI231204-BR381 & 2023-12-04

6. Marks & numbers; number and kind of packages; description of goods

FLANGE
N/WT 10,767.6KG
G/WT 11,292.6KG

THE EXPORTER OF THE PRODUCTS COVERED BY THIS DOCUMENT
(CUSTOMS AUTHORISATION NO:030-15-200136)
(1) DECLARES THAT, EXCEPT WHERE OTHERWISE CLEARLY INDICATED,
THESE PRODUCTS ARE OF
(2) REPUBLIC OF KOREA

//

7. Quantity

End Of Page...

8. Declaration by the Exporter

The undersigned, as an authorized signatory, hereby declares that the above-mentioned goods were produced or manufactured in the country shown in box 3.

(Signature)

(Name) **PRESIDENT Y.S. KIM**

9. Certification

The undersigned authority hereby certifies that the goods described above originate in the country shown in box 3 to the best of its knowledge and belief.

Authorized Signatory

1/1

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

ANSI ACCREDITED
ISO/IEC 17024
Personnel Certification Program
#0644

ASNT Certification Services LLC.

Be it known that

Du Jin Kim

Has met the established and published Requirements for Certification by ASNT Certification Services LLC. as

NDT Level III

In the following Nondestructive Testing Methods:

Method	Issue Date	Expiration Date
Liquid Penetrant Testing	2/22	2/27
Magnetic Particle Testing	2/22	2/27
Radiographic Testing	2/22	2/27
Ultrasonic Testing	2/22	2/27
Visual Testing	2/22	2/27

BREMBANA & ROLLE S.p.A.
QCM - M...
REVIEWED
07 FEB 2024

206623
Certificate Number

Certification Management Committee Chair

John F Kinney
ASNT Certification Services, LLC, President

Cert. No. 05

Note: All ASNT NDT Level III exams are developed and maintained in accordance with ISO/IEC 17024 guidelines for certification of persons. The following exams are currently accredited by the American National Standards Institute (ANSI) - BASIC, ET, MT, PT, RT, UT, and VT. This certificate is the property of ASNT Certification Services LLC., is not official without ASNT Certification Services LLC.'s raised gold seal, and is subject to revocation prior to the listed expiration date. This certificate shall be verified on https://asntcertification.org or by contacting ASNT Certification Services LLC.

1723001756-QC-DB-00017_02 - V25001A

Certificate No: II-2013019

☐ New ■ Re

NDE CERTIFICATE

Korea Machinery Inspection E&C Co., Ltd.

That is to certify that the individual named below has successfully completed experience, training and examination requirements in accordance with the provisions of KMI E&C Co., Ltd. Procedure for NDE personnel Qualification and Certification KMIQ-P6225 (Rev.9). which meets the requirements of SNT-TC-1A & CP-189 (2016 Ed.).

Jong Kwon, Park

is hereby certified to perform the following Nondestructive Examination Method(s)

Method	Technique	Level	Limitation (if any)	Certification Date	Expiration Date
Radiographic Testing	Radiography	II	-	03/04/2022	03/03/2027
Ultrasonic Testing	Manual	II	-	03/04/2022	03/03/2027
Magnetic Particle Testing	-	II	-	03/04/2022	03/03/2027
Liquid Penetrant Testing	-	II	-	03/04/2022	03/03/2027
Visual Testing	-	II	-	03/04/2022	03/03/2027

Du Jin, Kim
(ASNT CERT NO:206623)
Qualified by Designated NDE Level III

03/04/2022
Date

Moo Ung, Yoon
President of KMI E&C Co., Ltd

03/04/2022
Date

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
07 FEB 2024

Cert. No. 05

1723001756-QC-DB-00017_02 - V25001A

Cert. No. 03

검 사 증 명 서
MILL TEST CERTIFICATE

HYUNDAI STEEL

공장계량소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songtak-Eup, Dangjin-Si, Chungnam, Korea

BREMBANA & ROLLE S.p.A.
QCM - M.GALLI
DEVIATION ACCEPTED
07 FEB 2024

주문번호 Order No. : D231009267
품 명 Commodity : Slab
제품규격 Specification : ASTM A105-A350LF2
고객사 Customer : 현대아이에프씨㈜
주문자 Contractor : 현대아이에프씨㈜
증명서 번호 Certificate No. : 20231123-CN-0001-001
발행일자 Date of Issue : 2023-11-23

제품치수 Dimension	수량 Quantity	중량 Weight (Kg)	제강번호 Heat No.	제품번호 Product No.	화학성분 Chemical Composition(%) 단위 Unit 2:x100 3:x1,000 4:x10,000 5:x100,000																	
					Direction	C	S	Mn	P	S	Cr	M	B	Ca	Cu	Mo	N	Nb	Ti	V	Sol -Al	CEQ
						4	3	3	4	4	2	2	4	4	3	2	4	3	3	3	3	3
300x2000x5810	1	27,370	S85062	S85062 55	L	1,992	230	928	82	25	2	1	3	3	9	1	48	1	1	2	34	382
300x2000x5810	1	27,370	S85062	S85062 56	L	1,992	230	928	82	25	2	1	3	3	9	1	48	1	1	2	34	382
300x2000x5810	1	27,370	S85065	S85065 01	L	1,918	233	973	114	29	2	2	3	1	17	0	41	1	1	3	31	384
300x2000x5810	1	27,370	S85065	S85065 02	L	1,918	233	973	114	29	2	2	3	1	17	0	41	1	1	3	31	384
300x2000x5800	1	27,320	S85065	S85065 03	L	1,918	233	973	114	29	2	2	3	1	17	0	41	1	1	3	31	384
300x2000x5800	1	27,320	S85068	S85068 01	L	1,997	241	954	103	22	2	2	3	1	12	0	38	1	1	3	33	386

*** Sub Total(001) *** 6 164,120(Kg)

*** Grade Total *** 6 164,120(Kg) Ceq(CEV). G=C+Mn/6+(Ni+Cu)/15+(Cr+Mo+V)/5

*** Last Item ***

KS FITTING & FLANGE CO.

ACCEPT
2023. 11. 23
QUALITY DEPT.
mysco

NOTE
* Division : H:Product analysis, T:Ladle analysis
* THE SLAB IS FULLY KILLED, FINE-GRAIN PRACTICE. BASIC OXYGEN PROCESS AND VACUUM DEGASSING PROCESS WERE APPLIED.
* ANY WELDING SHALL NOT BE PERFORMED FOR THE ORDERED MATERIAL.
* The Certificate has been issued in compliance with EN 10204 Type 3.1

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature Ju. Hee Jeon
Chief Of Steel Making Quality Team

* 본 검사증명서는 원본의 전자문서(전자서명 정보 포함)로부터 출력된 사본입니다. 전자문서의 내용은 현대제철 고객포탈에서 확인하실 수 있습니다 (http://cm.hyundai-steel.com/cs/cm/login.jsp)
* This Mill Test Certificate is a copy that has been printed from original electronic document(with digital signing)
You are able to check an original electronic document at hyundaisteel's customer portal(http://cm.hyundai-steel.com/cs/cm/login.jsp) * QRcode scanner App : 'QReal'
* [사용상 주의사항] 본 검사증명서에 명기된 규격 외 사용시 제품손상 및 안전상 문제가 발생할 수 있습니다.
* [Caution for Use] Damage on products and safety problems may arise if used other than to the spec stated in this Mill Test Certification.

Cert. No. 05

검 사 증 명 서
MILL TEST CERTIFICATE

HYUNDAI STEEL

당진제철소 : 충남 당진시 송악읍 부부산업로 1480
1480 Bukbusaneop-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea

주문번호 Order No. : D210704273
품 명 Commodity : Round Bar(봉강)
제품규격 Specification : A350 LF2
고객사 Customer : 용진에스티 주식회사
주문자 Contractor : 용진에스티 주식회사
증명서 번호 Certificate No. : 20211127-SN-0059-001
발행일자 Date of Issue : 2021-11-30

제강번호 Heat No.	제품번호 Product No.	제품치수 Dimension(mm) Diameter	Length	수량 Quantity (PCS/BD)	중량 Weight (KG)	열처리 Heat Treatment
A268540	H29905003	90	8000	8	2,400	AS-ROLLED
Total				8	2,400	

화학성분 Chemical Composition(%) 단위 Unit 2 : x 100 3 : x 1,000 4 : x 10,000 5 : x 100,000

구분 Division	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	Cr+Mo	Ceq
	2	2	2	3	3	2	2	2	2	3	3	2	2
Min.		15	90										
Max.	20	30		35	40	40	40	30	12	30	20	32	47
Result	18	24	118	10	2	9	4	10	1	2	1	11	41

구분 Division	압연비 Reduction Ratio	초음파 탐상검사 Ultrasonic Inspection	표면검사 Surface Inspection
Min.			
Max.			
Result	33S	Good	Good

AS FITTING & FLANGE CO.

납품일자 : 2022 . 2 . 25 .
작 성 자 : 시
화번호 : 0
팩스번호
수 량 (주) 1200 20

NOTE
- Melting Process : EAF + LF + RH-VD
- Surface Condition : Black Surface
- No Repair Welding
- Fully Killed Steel
- EN10204 TYPE 3.1
- Ceq : C + Mn/6 + (Ni + Cu)/15 + (Cr + Mo + V)/5

BREMBANA & ROLLE S.p.A. QC'NE - M. GALLI RECEIVED 07 FEB 2024

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다.
WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

Signature Y. H Kim
Chief Of Quality Assurance Team

- 본 검사증명서는 원본의 전자문서(증지서명 등도 포함)로부터 출력된 사본입니다. 증지문서의 내용은 현대제철 고객포털에서 확인하실 수 있습니다.(http://sm.hyundai-steel.com/cs/cm/login.jsp)
- This Mill Test Certificate is a copy that has been printed from original electronic document(with digital signing).
You are able to check an original electronic document at hyundaisteel's customer portal.(http://sm.hyundai-steel.com/cs/cm/login.jsp) + QRcode scanner App : 'QReal'
- (사용상 주의사항) 본 검사증명서에 명기된 규격 외 사용시 제품손실 및 안전상 문제가 발생할 수 있습니다.
- [Caution for Use] Damage on products and safety problems may arise if used other than to the spec stated in this Mill Test Certification.

Cert. No. 05

검사증명서
MILL TEST CERTIFICATE

HYUNDAI STEEL

당진제철소 : 충남 당진시 송악읍 북부산업로 1480
1480 Bukbusanup-Ro, Songak-Eup, Dangjin-Si, Chungnam, Korea

주문번호 Order No. : D21070427J
품 명 Commodity : Round Bar(원강)
제품규격 Specification : A350 LF2

고객사 Customer : 용진엑스티 주식회사
주문자 Contractor : 용진엑스티 주식회사

증명서 번호 Certificate No. : 20220325-SN-0471-001
발행일자 Date of Issue : 2022-03-28

제강번호 Heat No.	제품번호 Product No.	제품치수 Dimension(mm)		수량 Quantity (PCS/EA)	중량 Weight (KG)	열처리 Heat Treatment	규격 Division	화학성분 Chemical Composition(%)												탄소 당량			
		Diameter	Length					C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	Ti	2 : x100	3 : x1,000	4 : x10,000	5 : x100,000
A266550	H39001902	60	6000	17	2,276	AS-ROLLED	Min.	2	2	2													
A266550	H39001903	60	6000	10	1,339	AS-ROLLED	Max.	20	15	30	3	3	2	40	40	11	50	12	1	30	2	20	1
A266550	H39001909	60	6000	11	1,474	AS-ROLLED	Heat	18	25	110	11	35	2	40	9	4	40	11	1	2	1	32	12

4/4/24 CMI SP.30

E302 MK 3

MARCEGAGLIA PLATES

Marcegaglia
46040 via Bresciani 16-Gazoldo degli Ippoliti Mantova-Italy
Tel. +39 - 0376 685 1 Fax. +39 - 0376 685 600
www.marcegaglia.com

Stab. di S.Giorgio di Nogaro:
via Enrico Fermi 33, 33058 S.Giorgio di Nogaro-Udine
tel+390431624111 fax 0431624222

Type: Inspection Certificate 3.1 EN 10204

THIS DOCUMENT WAS PRODUCED AUTOMATICALLY AND IS VALID WITHOUT SIGNATURE

Number: 16020286889

Product: Hot Rolled Heavy Plates
Standard: ASME-SA516
Steel Grade: GR-70N

MANNI SIPRE STEEL ENGINEERING
UFFICIO CERTIFICATI - COPIA INFORMATICA CONFORME ORIGINALE
NS. CONFERMA: 0000110978
RIF. ORDINE: 4134/20
DDT: 0000114635
PLACCA/COLATA: 20EP008757

Customer
MANNI SIPRE S.P.A.
VIA A. RIGHI 7
37135 VERONA IT

Code: 0000004816

Del. Address
MANNI SIPRE S.P.A.
VIA MEDIANA
37060 MOZZECANE IT

Delivery Nn: 8260822066
Of: 13/05/2020
Delivery note nr: 1060004883

Quality Control: Q.M.D./Q.M. M.Quargnali
Plant S. Giorgio di Nogaro

Pages: 1/1

Material: LTS

Description: LTS 2500,0X10000,0X 30,00 GR-70N

Surface Quality: EN10163-2 CL B2
Flatness: rif EN 10029 cl. N (STANDARD)
Tolerances: EN10029 CLASSE B

Delivery Condition: Normalized In Furnace
Steel Making Process: BO= Basic oxigen

Order Nr: 1191176371/170
Part Number:
Client Order: OSC2010097
Client Date: 20/02/2020

Item	Identification Nr	Heat	Quantity KG	Quantity PZZ
1	20EP008757	2000834	6000	1
2	20EP008760	2000834	6000	1
3	20EP008863	2000834	6000	1

Remarks:
ULTRASONIC TEST: EN 10160 S1E1
Mechanical tests acc. to: ASTM A370 - 19e1, PETROJET tech. Specification
Fully Killed Steel - Fine Grain Steel
ASME SA516 BPVC.II.A - Ed.2019 / Markings: acc. to SA20 Par. 12.1.7 & 13.1 "LTV" SA516"MT"
Manufacturer has a Quality-Assurance System with specific assessment for materials 2014/68/EU - ANNEX I - SECTION 4.3 Certified by TÜV Rheinland®A/SA20 Supplementary Requirements S5: Charpy V-Notch Impact
TestHeat treatment : temperature 910 +/- 10°C, soaking time: 30 min/inc , cooling in still air

VERIFIED TO ASME SECT. II PART. A ED. 21 +ADD. 1 & FOUND CONFORMING

Identification Nr	C (%)	Mn (%)	Si (%)	S (%)	P (%)	Cr (%)	Ni (%)	Cu (%)	Al (%)	Mo (%)	Nb (%)	V (%)	Ti (%)	N (%)	B (%)	Ceq (%)
	0.27	0.85 1.5	0.15 0.4	0.025		0.3	0.4	0.4	0.02	0.12	0.05	0.02	0.03	0.012		0.43
20EP008757	.160	1.490	.190	.0030	.0130	.030	.020	.020	.045	.0050	.025	.005	.0050	.0070	.0000	.42
20EP008760	.160	1.490	.190	.0030	.0130	.030	.020	.020	.045	.0050	.025	.005	.0050	.0070	.0000	.42
20EP008863	.160	1.490	.190	.0030	.0130	.030	.020	.020	.045	.0050	.025	.005	.0050	.0070	.0000	.42

Identification Nr	Forma	(1)	(2)	(3)	Tst [°C]	Rm [N/mmq]	Rp 0.2 [N/mmq]	A% (%)	(1b	(2b	(3b	T [°C]	Kv1 [J]	Kv2 [J]	Kv3 [J]	Kv^a [J]	HB	TESTN
					20	485	260	21										
					20	620												
20EP008757	P	1	P	T	20	540	403	30.0	1	P	L	-40	243	247	245	245	163	20-6750N
20EP008760	P	1	P	T	20	539	395	27.0	1	P	L	-40	247	244	250	247	163	20-6742N
20EP008863	P	1	P	T	20	546	407	33.0	1	P	L	-40	250	239	237	242	165	20-6781N

Ultrasonic control

Equipment	Serial number	Surface conditions	Couplant	Procedure	Calibration
Gilardoni RDG/700	I001288	As Rolled	Water	According To Specification	According To Specification

Item	Standard of refernce	Acceptance criteria	Result	Indications	Reticle	Edges	Probe	Frequency	Angle
1	EN10160	CL.S1 E1	Ok	Not founded	200x200mm	50	BDD20/4	4 MHz	0°
2	EN10160	CL.S1 E1	Ok	Not founded	200x200mm	50	BDD20/4	4 MHz	0°
3	EN10160	CL.S1 E1	Ok	Not founded	200x200mm	50	BDD20/4	4 MHz	0°

- Material Free of radioactive contamination
- Dimensional check and visual examination of the surface condition: without objection
- We Declare that the above mentioned plates are in compliance with the order prescription

Firma
III Liv. EN/ISO 9712
Q.M.D. M.Quargnali

MARCEGAGLIA PLATES

(1)Location: 1=Top; 2=Bottom (2)Location: 1/2=1/2 thickness; P=sourface; 1/4=1/4 thickness (3)Direction: L=Longitudinal; T=Trasverse

DescrizioneMarchi

BREMBANA & ROLLE S.p.A.
QCM - M.GALLI
REVIEWED/ACCEPTED
3 MAY 2024

Cert. No. 06

Seriale Certificato 00000000000000475615 File R:\A0002\00000000000000475615_ART_ICOL_10NA03504000030.TIF

31297

Cert. No. 08

VERIFIED TO ASME SECT. II PART. A ED. 21 +ADD. 1 & FOUND CONFORMING

A04

aperam

Correspondentieadres:
Aperam Genk
Swinnenwijerweg 5, Poort Genk 7523
3600 Genk, Belgium
Tel. +32 (0)89 30 21 11

A01

MILL CERTIFICATE BS EN 10204/3.1
CERTIFICAT DE RECEPTION NF EN 10204/3.1
ABNAHMEPRUEFZEUGNIS DIN EN 10204/3.1

A02

Certified acc.PED 2014/68/EU Annex I 4.3 by Certification Body.0036 of TUV SUD Industrie Service GmbH with cert.No.:314/2007/MUC.Renounced of counter signature agreed byTÜV SÜD (9/5/2007).Approved acc.AD 2000-Merkblatt W0/TRD 100 by TÜV SÜD Industrie Service GmbH.Confirmation letter from TÜVSÜD Industrie Service GmbH of 07/05/2010 about the uniformity of coils acc.AD2000 W2 4.1.1

Tech.Req.:AD 2000 W2 – AD 2000 W10 – EN 13445-2 Z05

N-Nr-N 21K0006900-01 V01 A03

Manufacturer's works order number
N° de la commande usine productrice
Werksauftragsnummer
80643531/07-20076/049/07 A08

Surveyor's mark
Cachet de l'expert
Stempel des Werkssachverstaendigen
GNKI Z03

Purchaser and/or consignee
Client et/ou destinataire
Besteller und/oder Empfaenger

Purchaser's order number
N° de commande client
Kundenbestellnummer
Ord. 370 Febb. A07

Product - Produit - Erzeugnis
COIL, COLD ROLLED, SHOT BLASTED
COIL, LAMINE A FROID, GRENAILLE
COIL, KALTGEWALZT, GESTRAHLT B01

Customer article number
N.article client
Artikelnummer des Kunden A09

A06

Steel designation B02
Désignation de l'acier
Stahlbezeichnung
EN 10028-7-2016 1.4404 / 1.4401
EN 10088-2-2014 1.4404 / 1.4401
ASTM A 240-2020 TYPE 316L / 316
ASME SA 240-2019 TYPE 316L / 316
EN 10088-4-2009 1.4404 / 1.4401

Finish
Présentation
Ausführung
2E
2E
NO 1
NO 1
2E

Steelmaking process C70
Mode d'élaboration de l'acier - Stahlherstellungsverfahren
Prod.proces: Electric arc furnace - VOD/AOD - Continuous casting
Proc.fabric.: Four à arc - VOD/AOD - Coulée continue
Fertigungsablauf: Elektro-Ofen - VOD/AOD - Stranggussanlage

Any supplementary requirements B03
Prescriptions supplémentaires - Zusätzliche Anforderungen
OIKI LAF 2017

Product delivery condition
Etat de livraison du produit - Lieferzustand
Solution Annealing
Hypertrempe 1050 °C
Lösungsglühen
Forced air-water/air forcé-eau
Geblaese Luft-Wasser B04

NACE MR 0175 / ISO 15156-1 / ISO 15156-3 -- NACE MR 0103 / ISO 17945 // ASTM A480 / A480M -- ASME CODE SECT.2 PT.A -- MAT MERCURY FREE // CORR. TEST: ASTM A262-E: OK // CORROSION INTERGRANULAIRE SELON ISO 3651/2:OK Z06

Identification of the product B07
Identification du produit - Identifizierung des Erzeugnisses
MELTED IN BELGIUM, MADE IN BELGIUM

Dimensions
Dimensions - Abmessungen

Thickness B09	Width B10	Length B11
Epaisseur - Staerke	Largeur - Breite	Longueur - Laenge
5.00 mm	2000.00 mm	

Number of pieces B08
Nb de pièces - Stueckzahl 1

Net weight B13
Poids net - netto Gewicht 27030 KG

Coil n.	Heat n.
N.Bobine - Band Nr.	N.Coulée - Schmelz Nr.
04901023	049010

CHEMICAL ANALYSIS - ANALYSE CHIMIQUE - CHEMISCHE ZUSAMMENSETZUNG

	C	Si	Mn	Ni	Cr	Mo	Ti	N	S	P	Cu	Co				
Required -Exigé %mini				10.00	16.50	2.00										
Anforderung. %maxi	0.030	0.75	2.00	13.00	18.00	2.50		0.100	0.015	0.045						
Cast Analysis	0.022	0.47	1.25	10.07	16.58	2.04		0.040	0.003	0.029	0.41	0.209				
Analyse coulee																
Analyse Schmelze	C71	C72	C73	C74	C75	C76	C77	C78	C79	C80	C81	C82	C83	C84	C85	C86

Positive material identification carried out : OK
Tests de vérification de la conformité de la nuance fournie : OK
Verwechslungpruefung wurde durchgefuehrt : OK C04 C93 D52

Location (1) | Direction (2) | Required Exigé Anforderung mini / maxi | Obtained Obtenu Ergebnisse

MECHANICAL PROPERTIES - PROPRIETES MECANIQUES - MECHANISCHE WERTE EN ISO 6892-1 B / A-SA 370 C20
Room temperature - Température ambiante - Raumtemperatur | Test temperature (°C) : C03

Location	Direction		Yield or proof strength Limite d'élasticité Dehngrenze MPa		Tensile Strength Résistance à la traction Zugfestigkeit MPa	Elongation after fracture Allongement après rupt. Bruchdehnung %		Hardness Dureté Haerte	Yield or proof strength Limite d'élasticité Dehngrenze MPa		Tensile str. Résist. MPa Zugfestigkeit	Elongation % Allongement. Bruchdehnung
			Rp0.2%	Rp1%	Rm	A5	50mm	HRBW	Rp0.2%	Rp1%	Rm	A5
		Required mini	240	270	530	40	40					
		maxi			680			95				
1	T	Obtained	285	328	590	53	53	81				
2		Obtenu Ergebnisse						80				
			C11	C14	C12	C13	C15	C31	C16	C17	C18	C19

Impact strength test Essai de résilience Kerbschlagzaehigkeitstest		Corrosion test Test de corrosion Korrosionstest	E0.2(T)/R(T) %						
C40	t(°c) C44		48						C05
	C42	EN ISO 3651/2 - A:OK D51	C50	C51	C52	C53	C54	C55	

Internal cleanliness: A: B: C: D: C57

Location of the sample (1)
Emplacement de l'échantillon
Lage des Probenabschnittes
1. Front - Début - Anfang
2. Back - Fin - Ende
3. Middle - Milieu - Mitte C01

Direction of the test pieces (2)
Orientation des éprouvettes
Probenrichtung
T. Transverse - Travers - Quer
L. Longitudinal - Long - Laengs C02

The delivery is in accordance with the order
La fourniture est conforme aux exigences de la commande
Die lieferung entspricht den Bestellbedingungen Z01

Packing list
Avis d'expédition
LieferscheinNummer 2021029280-20076 A10

Marking, inspection and measurement : without objection
Contrôle de marquage, d'aspect et de dimensions : satisfaisants
Pruefung der Stempelung, des Oberflaechenaspekts und der Abmessungen : ohne Beanstandung D01

Organisation inspection
Organisme et/ou service contrôle
Ueberwachungsabteilung A05

Quality Department

12/2/2021

The inspector
Le responsable
Der Werkssachverstaendige D. Raemaekers Z02

ZSQ701 - PS5

This to declare that the material as described in here as been cut to :
COIL 316/L 2000X 5,0 R.CALDO
and remarked with steelgrade, heat n°, workinspector's stamp CC

BREMBANA & ROLLES S.p.A.
QCM / M. GALLI
REVIEWED & ACCEPTED
3 MAY 2024

Cert. No. 08

Seriale Certificato 00000000000000475616

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A04

aperam

Correspondentieadres:
Aperam Genk
Swinnenwijerweg 5, Poort Genk 7523
3600 Genk, Belgium
Tel. +32 (0)89 30 21 11

A01

MILL CERTIFICATE BS EN 10204/3.1
CERTIFICAT DE RECEPTION NF EN 10204/3.1
ABNAHMEPRUEFZEUGNIS DIN EN 10204/3.1

A02

Factory Production Control certified by TUV SUD Industrie Service Gmbh
with certificate nr 0036-CPR-M-043-2011.
In compliance with the Construction Product Regulation Nr 305/2011/EU.

Z05

N-Nr-N 21K0006900-CE V01 A03

Manufacturer's works order number
N° de la commande usine productrice
Werksauftragsnummer
80643531/07-20076/049/07

A08

Surveyor's mark
Cachet de l'expert
Stempel des Werkssachverstaendigen
GNKI

Z03

Purchaser and/or consignee
Client et/ou destinataire
Besteller und/oder Empfaenger

A06

Purchaser's order number
N° de commande client
Kundenbestellnummer
Ord. 370 Febb.

A07

Product - Produit - Erzeugnis
COIL, COLD ROLLED, SHOT BLASTED
COIL, LAMINE A FROID, GRENAILLE
COIL, KALTGEWALZT, GESTRAHLT

B01

Customer article number
N.article client
Artikelnummer des Kunden

A09

Steel designation B02
Désignation de l'acier
Stahlbezeichnung
EN 10088-4-2009 1.4404/1.4401

Finish
Présentation
Ausfuehrung
2E

Steelmaking process C70
Mode d'élaboration de l'acier - Stahlherstellungverfahren
Prod.proces: Electric arc furnace - VOD/AOD - Continuous casting
Proc.fabric.: Four à arc - VOD/AOD - Coulée continue
Fertigungsablauf: Elektro-Ofen - VOD/AOD - Stranggussanlage

Any supplementary requirements B03
Prescriptions supplémentaires - Zusätzliche Anforderungen
OIKI LAF 2017

Product delivery condition
Etat de livraison du produit - Lieferzustand
Solution Annealing
Hypertrempe 1050 °C
Lösungsglühen
Forced air-water/air forcé-eau
Geblaese Luft-Wasser

B04

Z06

Identification of the product B07
Identification du produit - Identifizierung des Erzeugnisses
MELTED IN BELGIUM, MADE IN BELGIUM

Dimensions
Dimensions - Abmessungen

Thickness B09	Width B10	Length B11
Epaisseur - Staerke	Largeur - Breite	Longueur - Laenge
5.00 mm	2000.00 mm	

Number of pieces B08
Nb de pièces - Stueckzahl: 1

Net weight B13
Poids net - netto Gewicht: 27030 KG

Coil n.	Heat n.
N.Bobine - Band Nr.	N.Coulée - Schmelz Nr.
04901023	049010

CHEMICAL ANALYSIS - ANALYSE CHIMIQUE - CHEMISCHE ZUSAMMENSETZUNG

	C	Si	Mn	Ni	Cr	Mo	Ti	N	S	P	Cu	Co				
Required - Exigé %mini				10.00	16.50	2.00										
Anforderung. %maxi	0.030	0.75	2.00	13.00	18.00	2.50		0.100	0.015	0.045						
Cast Analysis	0.022	0.47	1.25	10.07	16.58	2.04		0.040	0.003	0.029	0.41	0.209				
Analyse coulee																
Analyse Schmelze	C71	C72	C73	C74	C75	C76	C77	C78	C79	C80	C81	C82	C83	C84	C85	C86

Positive material identification carried out : OK
Tests de vérification de la conformité de la nuance fournie : OK
Verwechslungpruefung wurde durchgefuehrt : OK

C04 C93 D52

MECHANICAL PROPERTIES - PROPRIETES MECANIQUES - MECHANISCHE WERTE EN ISO 6892-1 B / A-SA 370 C20

Room temperature - Température ambiante - Raumtemperatur | Test temperature (°C) : C03

Location (1)	Direction (2)		Yield or proof strength Limite d'élasticité Dehngrenze MPa		Tensile Strength Résistance à la traction Zugfestigkeit MPa	Elongation after fracture Allongement après rupt. Bruchdehnung %		Hardness Dureté Haerte	Yield or proof strength Limite d'élasticité Dehngrenze MPa		Tensile str. Résist. MPa Zugfestigkeit	Elongation % Allongement. Bruchdehnung
		Required Exigé Anforderung	Rp0.2%	Rp1%	Rm	A5	50mm	HRBW	Rp0.2%	Rp1%	Rm	A5
		mini	240	270	530	40	40					
		maxi			680			95				
1	T	Obtained Obtenu	285	328	590	53	53	81				
2		Ergebnisse	C11	C14	C12	C13	C15	80 C31	C16	C17	C18	C19

Impact strength test Essai de résilience Kerbschlagzaehigkeitstest			Corrosion test Test de corrosion Korrosionstest	E0.2(T)/R(T) %						
C40	t(°c)	C44		48						
		C42	EN ISO 3651/2 - A:OK D51	C50	C51	C52	C53	C54	C55	C05

Internal cleanliness: A: B: C: D: C57

Location of the sample (1)
Emplacement de l'échantillon
Lage des Probenabschnittes
1. Front - Début - Anfang
2. Back - Fin - Ende
3. Middle - Milieu - Mitte
C01

Direction of the test pieces (2)
Orientation des éprouvettes
Probenrichtung
T. Transverse - Travers - Quer
L. Longitudinal - Long - Laengs
C02

The delivery is in accordance with the order
La fourniture est conforme aux exigences de la commande
Die lieferung entspricht den Bestellbedingungen
Z01

Packing list
Avis d'expédition 2021029280-20076
LieferscheinNummer
A10

Marking, inspection and measurement : without objection
Contrôle de marquage, d'aspect et de dimensions : satisfaisants
Pruefung der Stempelung, des Oberflaechenaspekts und der Abmessungen : ohne Beanstandung
D01

Organisation inspection
Organisme et/ou service contrôle
Ueberwachungsabteilung
A05

Quality Department

12/2/2021

The inspector
Le responsable
Der Werkssachverstaendige
D. Raemaekers
Z02

ZSQ701 - PS5

This to declare that the material as described in here as been cut to :
COIL 316/L 2000X 5,0 R.CALDO
and remarked with steelgrade, heat n°, workinspector's stamp CC

BREMBANA & ROLLE S.p.A.
QCM M. GALLI
REVIEWED / ACCEPTED
3 MAY 2024

Cert. No. 08

Seriale Certificato 00000000000000475617

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aperam

Correspondance address
Adresse de correspondance - Adresse für briefwechsel

Swinnenwijerweg 5, Poort Genk 7523
3600 Genk, Belgium
CE01

Annex to certificate 21K0006900-01 V01
Annexe du CCPU
Anlage Zum Zeugnis
CE02

Certificate
CCPU - Zeugnis
21K0006900-CE V01
CE05

Certificate of Production Control Number
Numéro du certificat de contrôle de la production
Zeugnisnummer von Produktionskontrolle
0036-CPD-43-2011
CE03

CE 0036
CE06

Year 11
Année
Jahr
CE04

Manufacturer's works order number
N° de la commande usine productrice
Werksauftragsnummer

80643531/07-20076/049/07
CE07

Purchaser and/or consignee
Client et/ou destinataire
Besteller und/oder Empfaenger
CE08

Purchaser's order number
N° de commande client
Kundenbestellnummer
Ord. 370 Febb.
CE09

Customer article number
N° d'article client
Artikelnummer des Kundes
CE10

Identification of the product
Identification du produit - Identifizierung des Erzeugnisses

Dimensions
Dimensions - Abmessungen

Coil n°
N° de bobine - Band Nr
04901023
CE11

Thickness
Epaisseur - Dicke
5.00 mm
CE12

Width
Largeur - Breite
2000.00 mm
CE13

Length
Longueur - Laenge
CE14

Stainless steel / Acier inoxydable / Rostfreier Stahl
CE15

EN10088-4
CE16

Intended uses : building constructions or civil engineering
Usages prévus : construction immobilière ou génie civil
Vorgesehene Verwendungen : Hochbauten und Ingenieurbauwerke
CE17

Declaration of performance :
Déclaration des performances : DOP.Nr.GNK.08.01/GNK.10.01
Leistungserklärung :
DoP available on website Aperam : https://www.aperam.com/documentation
CE18

Steel
Acier 1.4404/1.4401
Werkstoff
CE19

Cold rolled
Laminé à froid
Kaltgewalzt
CE20

Coil / bobine / Band
CE21

Elongation / Allongement / Bruchdehnung
Tensile strength / Résistance à la traction / Zugfestigkeit
Yield strength / Limite d'élasticité / Dehngrenze
Impact strength / Résistance au choc / Kerbschlagzähigkeit
Weldability / Aptitude au soudage / Schweisseignung
Durability / Durabilité / Dauerhaftigkeit
Characteristics expressed as indicated in the above mentioned DOP
Tolerances on dimension and shape / Tolérances sur les dimensions et sur forme / Grenzabmasse unf Formtoleranzen : EN ISO 9445
CE22

Regulated substance : no performance determined
Substance réglementée : aucune performance déterminée
Regulierter Stoff: keine Leistung festgestellt
CE23

This to declare that the material as described in here as been cut to :
COIL 316/L 2000X 5,0 R.CALDO
and remarked with steelgrade, heat n°, workinspector's stamp CC

BREMBANA & ROLLE S.p.A.
QCIP. M.GALLI
REVISION ACCEPTED
3 MAY 2024

Cert. No. 09

CERTIFICATO DI CONTROLLO 3.1 / INSPECTION CERTIFICATE 3.1 - EN 10204:2004

METINVEST
METINVEST TRAMETAL SPA

A01
Società per azioni con socio unico soggetta a direzione e coordinamento di Metinvest B.V
Registered office: Via XII Ottobre 1, 5° piano - 16121 Genova, Italy
Phone +39 010 5762911 - Fax +39 010 5762990
Works: Via E. Fermi, 44 - 33058 San Giorgio di Nogaro UD, Italy
Phone +39 0431 629989 - Fax +39 0431 629985
Cap. Soc. Euro 300.120.000,00 i.v.
C.F., P.IVA e Iscr. Reg. Imp. GE 05956630965 - REA 437720/GE
http://trametal.metinvestholding.com

(A) PROCESSO DI ELABORAZIONE / STEELMAKING PROCESS: E = ELECTRIC ; BO = B
(B) STATO DI FORNITURA / DELIVERY CONDITION: AR = GREZZO DI LAMINAZIONE / N° = LAMINAZIONE A TEMPERATURA CONTROLLATA / NORMALIZING ROLLING ; N = NORMALIZZATO / NORMALIZED at 910°C, 1,5 min/mm ; ARIA CALMA / STILL AIR; R = RICOTTO / ANNEALED; N+R = NORMALIZZATO + RINVENUTO / NORMALIZED + TEMPERED
(C) TRATTAMENTO TERMICO DEL CAMPIONE / HEAT TREATMENT OF SAMPLE: N = 910°C, 1,5 min/mm ; ARIA CALMA / STILL AIR; R = 650°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
(D) Ceq_1 = C + Mn/6 ; Ceq_2 = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 ; Pcm = C + Si/30 + (Mn + Cu + Cr)/20 + NI/60 + Mo/15 + V/10 + B*5
(1) POSIZIONE / LOCATION: 1 = TESTA / TOP ; 2 = PIEDE / BOTTOM
(2) POSIZIONE / LOCATION: C = CUORE / 1/2 THICKNESS ; P = PELLE / SURFACE ; D = 1/4 SPESSORE / THICKNESS
(3) DIREZIONE / DIRECTION: L = LONGITUDINALE / LONGITUDINAL ; T = TRASVERSALE / TRANSVERSE
(4) FORMA DEL PROVINO / SHAPE OF TEST PIECE: P = PRISMATICO / PRISMATIC ; C = CILINDRICO / CYLINDRICAL
(5) ESITO PROVA DI PIEGA / RESULT: OK = COMPLYING ; NO = NOT COMPLYING

MANNI SIPRE S.P.A. STEEL ENGINEERING
UFFICIO CERTIFICATI - COPIA INFORMATICA CONFORME DI ORIGINALE
NS. CONFERMA. 0000467907
RIF. ORDINE: ORD. 5789/24
DDT: 0000107288
PLACCA/COLATA: SSAA770204A

A06 Cliente / Customer

MANNI SIPRE S.P.A.

Via Righi
37135 VERONA 37135 IT
VR ITALIA

A03 N° Certificato / Certificate no.	A02 Data / Date
588604	04/08/2023
A00 N° Ordine Trametal / Works order	**A07 N° Ordine cliente / Customer's order**
32303575	OSC2310145
DDT	del / date
BOL 32314895	03/08/2023
Pratica / File no.	del / date

B06 Marcatura di prodotto / Marking of the product
LAMIERA/ORDINE/N° INFORNAMENTO/DIMENSIONI/QUALITÀ/MARCHIO DEL PRODUTTORE
PLATE/ORDER/INTERNAL N°/DIMENSIONS/STEEL GRADE/MANUFACTURER'S MARK

B01,B02,B03

Prodotto / Product	Lamiere / Hot rolled plates
Qualità / Steel grade	P275NH - AD2000W1
Normativa / Specification	EN10028-3:2017

B07 ITEM	B07 LAMIERA PLATE	B07 N° INFORN. INTERNAL NUMBER	B09/B11 DIMENSIONI DIMENSIONS [mm]	B12 MASSA TEORICA [t] THEORICAL WEIGHT	B07 LOTTO BATCH NO.	C70 PROCESSO ELAB. (A) STEELMAKING PROCESS	B04 STATO FORNITURA LAMIERA (B) DELIVERY CONDITION	C00 CAMPIONE SAMPLE	B05 TRATT. CAMPIONE (C) HEAT TREATMENT	C00 CAMPIONE PWHT SAMPLE	B05 PWHT TEMPERATURA INIZIO °C BEGINNING TEMPERATURE	VELOCITA' RISCALDO C/h HEATING RATE	TEMPERATURA TRATTAMENTO °C TEMPERATURE TREATMENT	PERMANENZA Min HOLDING TIME	VELOCITA' RAFFREDDAMENTO °C/h COOLING RATE	TEMPERATURA FINE °C END TEMPERATURE	N° CICLI / CYCLES	C00 CAMPIONE Q+T SAMPLE	B05 Q+T TEMPERATURA (Q) °C TEMPERATURE	PERMANENZA (Q) Min HOLDING TIME	RAFFREDDAMENTO COOLING	TEMPERATURA (T) °C TEMPERATURE	PERMANENZA (T) Min HOLDING TIME	RAFFREDDAMENTO COOLING
11	SSAA770204A	1881251	25.00X3000X12000	7,07	768234	BO	N	GI659																	

C71/C92 COMPOSIZIONE CHIMICA DI COLATA / HEAT CHEMICAL ANALYSIS

B07 COLATA HEAT	C71 C %	C72 Mn %	C73 Si %	C74 P %	C75 S %	C76 Cu %	C77 Ni %	C78 Cr %	C79 Mo %	C80 Al %	C81 V %	C82 Nb %	C83 Ti %	C84 Sn %	C85 Ca %	C86 N %	C87 B %	C88 H %	C89 Ceq1 % (D)	C90 Ceq2 % (D)	C91 Pcm % (D)
Ordine Min 11																					
Ordine Max 11		1,20																			
P275NH Min 6.00 - 100.00		0,80								0,020										0,40	
P275NH Max 6.00 - 100.00	0,16	1,50	0,40	0,025	0,010	0,300	0,500	0,300	0,080		0,050	0,050	0,030			0,0120				0,40	
SSAA77	0,15	1,03	0,23	0,007	0,001	0,010	0,010	0,010	<0.005	0,037	0,001	0,002	0,003	<0.005	0,0000	0,0019	<0.0005	0,0000	0,32	0,33	0,21

C00 CAMPIONE SAMPLE	C01 POSIZIONE (1) LOCATION SPESSORE LAMIERA PLATE THICKNESS	PROVA DI TRAZIONE TENSILE TEST: C01 POSIZIONE (2) LOCATION	C02 DIREZIONE (3) ORIENTATION	C03 TEMPERATURA [°C] TEST TEMPERATURE	C11 ReH [Mpa] YIELD STRENGTH	C12 Rm [Mpa] TENSILE STRENGTH	C13 A% ELONGATION	C14 Rp 0.2 [Mpa] PROOF/YIELD STRENGTH	C10 FORMA PROVINO (4) SHAPE OF TEST PIECE	PROVA DI RESILIENZA IMPACT TEST - CHARPY V-NOTCH TEST: C41 LARGHEZZA [mm] WIDTH	C02 DIREZIONE (3) ORIENTATION	C03 TEMPERATURA [°C] TEST TEMPERATURE	C01 POSIZIONE (2) LOCATION	C42 SINGOLI VALORI [J] INDIVIDUAL VALUES	C43 MEDIA [J] MEAN VALUE	PROVA DI PIEGA BEND TEST: C02 DIREZIONE (3) ORIENTATION	C51 MANDRINO [mm] MANDREL	C52 ANGOLO [°] ANGLE	C50 ESITO (5) RESULT	PROVA DI DUREZZA HARDNESS TEST: C01 POSIZIONE (2) LOCATION	C30 METODO TEST METHOD	C31 SINGOLI VALORI INDIVIDUAL VALUES	C32 MEDIA MEAN VALUE	PROVA DI STRIZIONE Z% TEST: C53 Z% SINGOLI VALORI Z% INDIVIDUAL VALUES	C54 Z% VALORE MEDIO Z% MEAN VALUE
ORDINE Min 11											L	-51		14	18											
P275NH Min 16.10 - 40.00				20	265	390	24,0																			
P275NH Max 16.10 - 40.00				20		510																				
P275NH Min 6.00 - 999.00											T	-20			30											

BREMBANA & ROLLE S.p.A.
QCM M. GALLI
Accepted
3 MAY 2024

			PROVA DI TRAZIONE TENSILE TEST								PROVA DI RESILIENZA IMPACT TEST - CHARPY V-NOTCH TEST						PROVA DI PIEGA BEND TEST				PROVA DI DUREZZA HARDNESS TEST				PROVA DI STRIZIONE Z% TEST	
C00		C01	C01	C02	C03	C11	C12		C13	C14	C10	C41	C02	C03	C01	C42	C43	C02	C51	C52	C50	C01	C30	C31	C32	C53	C54
CAMPIONE SAMPLE	SPESSORE LAMIERA PLATE THICKNESS	POSIZIONE LOCATION (1)	POSIZIONE LOCATION (2)	DIREZIONE ORIENTATION (3)	TEMPERATURA TEST TEMPERATURE [°C]	ReH [Mpa] YIELD STRENGTH	Rm [Mpa] TENSILE STRENGTH	ReH/Rm	A% ELONGATION	Rp 0.2 [Mpa] PROOF/YIELD STRENGTH	FORMA PROVINO (4) SHAPE OF TEST PIECE	LARGHEZZA [mm] WIDTH	DIREZIONE ORIENTATION (3)	TEMPERATURA [°C] TEST TEMPERATURE	POSIZIONE LOCATION (2)	SINGOLI VALORI [J] INDIVIDUAL VALUES	MEDIA [J] MEAN VALUE	DIREZIONE ORIENTATION (3)	MANDRINO [mm] MANDREL	ANGOLO [°] ANGLE	ESITO (5) RESULT	POSIZIONE (2) LOCATION	METODO TEST METHOD	SINGOLI VALORI INDIVIDUAL VALUES	MEDIA MEAN VALUE	Z% SINGOLI VALORI Z% INDIVIDUAL VALUES	Z% VALORE MEDIO Z% MEAN VALUE
GI659	25,00	2	P	T	20	339	470	0,72	35,3		P	10,00	T	-50	P	93 98 94	95						HRC <	22			
GI659	25,00	2										10,00	T	-20	P	207 129 141	159										
GI659	25,00	2										10,00	L	-51	P	250 262 259	257										

C10

UNI EN ISO 6892-1:2020 / UNI EN ISO 148-1:2016

Z01

ITEM		TOLLERANZA DI SPESSORE TOLERANCE ON THICKNESS	TOLLERANZE DI LARGHEZZA TOLERANCE ON WIDTH	TOLLERANZE DI LUNGHEZZA TOLERANCE ON LENGTH	CONDIZIONI SUPERFICIALI SURFACE FINISH	PLANARITÀ FLATNESS
11		EN 10029 CL.B	-0+100 MM	-0+200 MM	EN 10163/2 CL B2	EN 10029 CL. N

CERTIFICHIAMO che le lamiere elencate sono conformi alla prescrizione dell'ordine, che i controlli della marcatura, dell'aspetto superficiale e dimensionale hanno dato esito positivo.
WE CERTIFY that the above mentioned plates are consistent with the order prescriptions: marking, inspection and measurement without objection.
DICHIARIAMO CHE LE LAMIERE SONO STATE CONTROLLATE IN ACCORDO ALLA NORMATIVA VIGENTE E CHE LE RADIAZIONI IONIZZANTI NON ECCEDONO IL VALORE DEL FONDO NATURALE.
WE DECLARE THAT THE PLATES WERE CONTROLLED ACCORDING TO STANDARD AND RADIATION DO NOT EXCEED THE NATURAL RADIATION.

Z06

FULLY KILLED FINE GRAIN STEEL

HARDNESS IN ACC. TO NACE MR 0175 / ISO15156

The waiver of verification of yield strength at elevated temperature is made in accordance with

AD2000W1 clause 3.3 resp. 3.4 with the approval of TÜV Süd Industrie Service GmbH

(letter of confirmation dated 2017-12-01).

IN ACC. TO MATERIAL SPECIFICATION VDTUV-WB352/1

Z07	Z03 ENTE COLLAUDO / INSPECTION BODY	Z02
Ausgestellt im Einvernehmen mit dem TUV Bayern Hessen Sachsen Sudwest e.V. (August 1997) **Plates acc. to PED 2014/68/EU**	TIMBRO DELL'ISPETTORE STAMP OF THE INSPECTION REPRESENTATIVE	**METINVEST TRAMETAL S.p.A.** **F. Andrian** **CQ Manager**

BREMBANA & ROLLS S.p.A.
QC10 - M.GALLI
REVIEWED / ACCEPTED
3 MAY 2024

Cert. No 09

CERTIFICATO DI CONTROLLO 3.1 / INSPECTION CERTIFICATE 3.1 - EN 10204:2004

METINVEST
METINVEST TRAMETAL SPA

A01
Società per azioni con socio unico soggetta a direzione e coordinamento di Metinvest B.V
Registered office: Via XII Ottobre 1, 5° piano - 16121 Genova, Italy
Phone +39 010 5762911 - Fax +39 010 5762990
Works: Via E. Fermi, 44 - 33058 San Giorgio di Nogaro UD, Italy
Phone +39 0431 629989 - Fax +39 0431 629985
Cap. Soc. Euro 300.120.000,00 i.v.
C.F., P.IVA e Iscr. Reg. Imp. GE 05956630965 - REA 437720/GE
http://trametal.metinvestholding.com

(A) PROCESSO DI ELABORAZIONE / STEELMAKING PROCESS: E = ELECTRIC ; BO = B
(B) STATO DI FORNITURA / DELIVERY CONDITION: AR = GREZZO DI LAMINAZIONE / A
N° = LAMINAZIONE A TEMPERATURA CONTROLLATA / NORMALIZING ROLLING ;
N = NORMALIZZATO / NORMALIZED at 910°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
R = RICOTTO / ANNEALED;
N+R = NORMALIZZATO + RINVENUTO / NORMALIZED + TEMPERED
(C) TRATTAMENTO TERMICO DEL CAMPIONE / HEAT TREATMENT OF SAMPLE:
N = 910°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
R = 650°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
(D) Ceq_1 = C + Mn/6 ; Ceq_2 = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 ;
Pcm = C + Si/30 + (Mn + Cu + Cr)/20 + Ni/60 + Mo/15 + V/10 + B*5
(1) POSIZIONE / LOCATION: 1 = TESTA / TOP ; 2 = PIEDE / BOTTOM
(2) POSIZIONE / LOCATION: C = CUORE / 1/2 THICKNESS ; P = PELLE / SURFACE ; D = 1/4 SPESSORE / THICKNESS
(3) DIREZIONE / DIRECTION: L = LONGITUDINALE / LONGITUDINAL ; T = TRASVERSALE / TRANSVERSE
(4) FORMA DEL PROVINO / SHAPE OF TEST PIECE: P = PRISMATICO / PRISMATIC ; C = CILINDRICO / CYLINDRICAL
(5) ESITO PROVA DI PIEGA / RESULT: OK = COMPLYING ; NO = NOT COMPLYING

MANNI SIPRE STEEL ENGINEERING
UFFICIO CERTIFICATI - COPIA INFORMATICA CONFORME DI ORIGINALE
NS. CONFERMA: 0000467907
RIF. ORDINE: ORD. 5769/24
DDT: 0000107285
PLACCA/COLATA: SSAA770204A

A03 N° Certificato / Certificate no.	A02 Data / Date
588599	04/08/2023
A00 N° Ordine Trametal / Works order	**A07 N° Ordine cliente / Customer's order**
32303575	OSC2310145
DDT	del / date
BOL 32314895	03/08/2023
Pratica / File no.	
del / date	

A06 Cliente / Customer

MANNI SIPRE S.P.A.

Via Righi
37135 VERONA 37135 IT
VR ITALIA

B01/B02/B03

Prodotto / Product	Lamiere / Hot rolled plates
Qualità / Steel grade	P275NL2
Normativa / Specification	EN10028-3:2017

B06 Marcatura di prodotto / Marking of the product
LAMIERA/ORDINE/N° INFORNAMENTO/DIMENSIONI/QUALITÀ/MARCHIO DEL PRODUTTORE
PLATE/ORDER/INTERNAL N°/DIMENSIONS/STEEL GRADE/MANUFACTURER'S MARK

B07 ITEM	B07 LAMIERA PLATE	B07 N° INFORN. INTERNAL NUMBER	B09/B11 DIMENSIONI DIMENSIONS [mm]	B12 MASSA TEORICA [t] THEORICAL WEIGHT	B07 LOTTO BATCH NO.	C70 PROCESSO ELAB. (A) STEELMAKING PROCESS	B04 STATO FORNITURA LAMIERA (B) DELIVERY CONDITION	C00 CAMPIONE SAMPLE	B05 TRATT. CAMPIONE (C) HEAT TREATMENT	C00 CAMPIONE PWHT SAMPLE	B05 PWHT BEGINNING TEMPERATURE °C	B05 PWHT TEMPERATURA INIZIO °C	B05 PWHT VELOCITA' RISCALDO °C/h HEATING RATE	B05 PWHT TEMPERATURA TRATTAMENTO °C TEMPERATURE TREATMENT	B05 PWHT HOLDING TIME	B05 PWHT PERMANENZA Min	B05 PWHT COOLING RATE	B05 PWHT VELOCITA' RAFFREDDAMENTO °C/h	B05 PWHT TEMPERATURA FINE °C END TEMPERATURE	C00 N° CICLI / CYCLES	C00 CAMPIONE Q+T SAMPLE	B05 Q+T TEMPERATURE (Q) °C	B05 Q+T HOLDING TIME (Q) Min	B05 Q+T PERMANENZA (Q) COOLING	B05 Q+T RAFFREDDAMENTO	B05 Q+T TEMPERATURE (T) °C	B05 Q+T HOLDING TIME (T) Min	B05 Q+T PERMANENZA (T) COOLING	B05 Q+T RAFFREDDAMENTO
11	SSAA770204A	1881251	25.00X3000X12000	7,07	768234	BO	N	GI659																					

C71/C92 COMPOSIZIONE CHIMICA DI COLATA / HEAT CHEMICAL ANALYSIS

B07 COLATA HEAT	C71 C %	C72 Mn %	C73 Si %	C74 P %	C75 S %	C76 Cu %	C77 Ni %	C78 Cr %	C79 Mo %	C80 Al %	C81 V %	C82 Nb %	C83 Ti %	C84 Sn %	C85 Ca %	C86 N %	C87 B %	C88 H %	C89 Ceq1 % (D)	C90 Ceq2 % (D)	C91 Pcm % (D)
Ordine Min 11																					
Ordine Max 11		1,20																			
P275NL2 Min 6.00 - 100.00		0,80								0,020										0,40	
P275NL2 Max 6.00 - 100.00	0,16	1,50	0,40	0,020	0,005	0,300	0,500	0,300	0,080		0,050	0,050	0,030			0,0120				0,40	
SSAA77	0,15	1,03	0,23	0,007	0,001	0,010	0,010	0,010	<0.005	0,037	0,001	0,002	0,003	<0.005	0,0000	0,0019	<0.0005	0,0000	0,32	0,33	0,21

C00 CAMPIONE SAMPLE	C01 SPESSORE LAMIERA PLATE THICKNESS	C01 POSIZIONE (1) LOCATION	PROVA DI TRAZIONE TENSILE TEST: C01 POSIZIONE (2) LOCATION	C02 DIREZIONE (3) ORIENTATION	C03 TEMPERATURA [°C] TEST TEMPERATURE	C11 ReH [Mpa] YIELD STRENGTH	C12 Rm [Mpa] TENSILE STRENGTH	C13 ReH/Rm	C14 A% ELONGATION	C10 Rp 0,2 [Mpa] PROOF/YIELD STRENGTH	C10 FORMA PROVINO (4) SHAPE OF TEST PIECE	PROVA DI RESILIENZA IMPACT TEST - CHARPY V-NOTCH TEST: C41 LARGHEZZA [mm] WIDTH	C02 DIREZIONE (3) ORIENTATION	C03 TEMPERATURA [°C] TEST TEMPERATURE	C01 POSIZIONE (2) LOCATION	C42 INDIVIDUAL VALUES [J] SINGOLI VALORI	C43 MEDIA [J] MEAN VALUE	PROVA DI PIEGA BEND TEST: C02 DIREZIONE (3) ORIENTATION	C51 MANDREL [mm] MANDRINO	C52 ANGOLO [°] ANGLE	C50 ESITO (5) RESULT	PROVA DI DUREZZA HARDNESS TEST: C01 POSIZIONE (2) LOCATION	C30 METODO TEST METHOD	C31 SINGOLI VALORI INDIVIDUAL VALUES	C32 MEDIA MEAN VALUE	PROVA DI STRIZIONE Z% TEST: C53 Z% SINGOLI VALORI Z% INDIVIDUAL VALUES	C54 Z% VALORE MEDIO Z% MEAN VALUE
ORDINE Min 11													L	-51		14	18										
P275NL2 Min 16.10 - 40.00					20	265	390		24,0																		
P275NL2 Max 16.10 - 40.00					20		510																				
P275NL2 Min 6.00 - 999.00													T	-50			27										

BREMBANA & ROTA S.p.A.
QCM / M. GALLI
REVIEWED ACCEPTED
3 MAY 2024

			PROVA DI TRAZIONE TENSILE TEST								PROVA DI RESILIENZA IMPACT TEST - CHARPY V-NOTCH TEST						PROVA DI PIEGA BEND TEST				PROVA DI DUREZZA HARDNESS TEST				PROVA DI STRIZIONE Z% TEST	
C00		C01	C01	C02	C03	C11	C12		C13	C14	C10	C41	C02	C03	C01	C42	C43	C02	C51	C52	C50	C01	C30	C31	C32	C53	C54
CAMPIONE SAMPLE	SPESSORE LAMIERA PLATE THICKNESS	POSIZIONE LOCATION (1)	POSIZIONE LOCATION (2)	DIREZIONE ORIENTATION (3)	TEMPERATURA TEST TEMPERATURE [°C]	ReH [Mpa] YIELD STRENGTH	Rm [Mpa] TENSILE STRENGTH	ReH/Rm	A% ELONGATION	Rp 0,2 [Mpa] PROOF/YIELD STRENGTH	FORMA PROVINO (4) SHAPE OF TEST PIECE	LARGHEZZA [mm] WIDTH	DIREZIONE ORIENTATION (3)	TEMPERATURA [°C] TEST TEMPERATURE	POSIZIONE LOCATION (2)	SINGOLI VALORI [J] INDIVIDUAL VALUES	MEDIA [J] MEAN VALUE	DIREZIONE ORIENTATION (3)	MANDRINO [mm] MANDREL	ANGOLO [°] ANGLE	ESITO (5) RESULT	POSIZIONE (2) LOCATION	METODO TEST METHOD	SINGOLI VALORI INDIVIDUAL VALUES	MEDIA MEAN VALUE	Z% SINGOLI VALORI Z% INDIVIDUAL VALUES	Z% VALORE MEDIO Z% MEAN VALUE
GI659	25,00	2	P	T	20	339	470	0,72	35,3		P	10,00	T	-50	P	93 98 94	95						HRC <	22			
GI659	25,00	2										10,00	T	-20	P	207 129 141	159										
GI659	25,00	2										10,00	L	-51	P	250 262 259	257										

C10

UNI EN ISO 6892-1:2020 / UNI EN ISO 148-1:2016

Z01

ITEM		TOLLERANZA DI SPESSORE TOLERANCE ON THICKNESS	TOLLERANZE DI LARGHEZZA TOLERANCE ON WIDTH	TOLLERANZE DI LUNGHEZZA TOLERANCE ON LENGTH	CONDIZIONI SUPERFICIALI SURFACE FINISH	PLANARITÀ FLATNESS
11		EN 10029 CL.B	-0+100 MM	-0+200 MM	EN 10163/2 CL B2	EN 10029 CL. N

CERTIFICHIAMO che le lamiere elencate sono conformi alla prescrizione dell'ordine, che i controlli della marcatura, dell'aspetto superficiale e dimensionale hanno dato esito positivo.
WE CERTIFY that the above mentioned plates are consistent with the order prescriptions: marking, inspection and measurement without objection.
DICHIARIAMO CHE LE LAMIERE SONO STATE CONTROLLATE IN ACCORDO ALLA NORMATIVA VIGENTE E CHE LE RADIAZIONI IONIZZANTI NON ECCEDONO IL VALORE DEL FONDO NATURALE.
WE DECLARE THAT THE PLATES WERE CONTROLLED ACCORDING TO STANDARD AND RADIATION DO NOT EXCEED THE NATURAL RADIATION.

Z06

FULLY KILLED FINE GRAIN STEEL

HARDNESS IN ACC. TO NACE MR 0175 / ISO15156

Z07	Z03 ENTE COLLAUDO / INSPECTION BODY	Z02
Plates acc. to PED 2014/68/EU	TIMBRO DELL'ISPETTORE STAMP OF THE INSPECTION REPRESENTATIVE	METINVEST TRAMETAL S.p.a. F. Andrian CQ Manager

BREMBANA & ROTA S.p.A.
QCM - MICALI
REVIEWED / ACCEPTED
3 MAY 2024

Cert. No. 10

CERTIFICATO DI CONTROLLO 3.1 / INSPECTION CERTIFICATE 3.1 - EN 10204:2004

METINVEST
METINVEST TRAMETAL SPA

Società per azioni con socio unico soggetta a direzione e coordinamento di Metinvest B.V
Registered office: Via XII Ottobre 1, 5° piano - 16121 Genova, Italy
Phone +39 010 5762911 - Fax +39 010 5762990
Works: Via E. Fermi, 44 - 33058 San Giorgio di Nogaro UD, Italy
Phone +39 0431 629989 - Fax +39 0431 629985
Cap. Soc. Euro 300.120.000,00 i.v.
C.F., P.IVA e Iscr. Reg. Imp. GE 05956630965 - REA 437720/GE
http://trametal.metinvestholding.com

(A) PROCESSO DI ELABORAZIONE / STEELMAKING PROCESS: E = ELECTRIC ; BO = B
(B) STATO DI FORNITURA / DELIVERY CONDITION: AR = GREZZO DI LAMINAZIONE / A
N° = LAMINAZIONE A TEMPERATURA CONTROLLATA / NORMALIZING ROLLING ;
N = NORMALIZZATO / NORMALIZED at 910°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
R = RICOTTO / ANNEALED;
N+R = NORMALIZZATO + RINVENUTO / NORMALIZED + TEMPERED
(C) TRATTAMENTO TERMICO DEL CAMPIONE / HEAT TREATMENT OF SAMPLE:
N = 910°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
R = 650°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
(D) Ceq_1 = C + Mn/6 ; Ceq_2 = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 ;
Pcm = C + Si/30 + (Mn + Cu + Cr)/20 + Ni/60 + Mo/15 + V/10 + B*5
(1) POSIZIONE / LOCATION: 1 = TESTA / TOP ; 2 = PIEDE / BOTTOM
(2) POSIZIONE / LOCATION: C = CUORE / 1/2 THICKNESS ; P = PELLE / SURFACE ; D = 1/4 SPESSORE / THICKNESS
(3) DIREZIONE / DIRECTION: L = LONGITUDINALE / LONGITUDINAL ; T = TRASVERSALE / TRANSVERSE
(4) FORMA DEL PROVINO / SHAPE OF TEST PIECE: P = PRISMATICO / PRISMATIC ; C = CILINDRICO / CYLINDRICAL
(5) ESITO PROVA DI PIEGA / RESULT: OK = COMPLYING ; NO = NOT COMPLYING

MANNI SIPRE S.P.A. STEEL ENGINEERING
UFFICIO CERTIFICATI - SERVIZI INFORMATIVA CONFERME ORDINI
NS. CONFERMA: 0000467907
RIF. ORDINE: ORD. 5769/24
DDT: 0000107269
PLACCA/COLATA: SSAA770204A

A05 Cliente / Customer

MANNI SIPRE S.P.A.

Via Righi
37135 VERONA 37135 IT
VR ITALIA

A03 N° Certificato / Certificate no.	Z02 Data / Date
588590	04/08/2023
A05 N° Ordine Trametal / Works order	**A07 N° Ordine cliente / Customer's order**
32303575	OSC2310145
DDT	del / date
BOL 32314895	03/08/2023
Pratica / File no.	
del / date	

B06 Marcatura di prodotto / Marking of the product
LAMIERA/ORDINE/N° INFORNAMENTO/DIMENSIONI/QUALITÀ/MARCHIO DEL PRODUTTORE
PLATE/ORDER/INTERNAL N°/DIMENSIONS/STEEL GRADE/MANUFACTURER'S MARK

B01/B02/B03

Prodotto / Product	Lamiere / Hot rolled plates
Qualità / Steel grade	SA516GR60MT/LTV
Normativa / Specification	ASME

B07 ITEM	B07 LAMIERA PLATE	B07 N° INFORN. INTERNAL NUMBER	B09/B11 DIMENSIONI DIMENSIONS [mm]	B12 MASSA TEORICA [t] THEORICAL WEIGHT	B07 LOTTO BATCH NO.	C70 PROCESSO ELAB. (A) STEELMAKING PROCESS	B04 STATO FORNITURA LAMIERA (B) DELIVERY CONDITION	C00 CAMPIONE SAMPLE	B05 TRATT. CAMPIONE (C) HEAT TREATMENT	C00 CAMPIONE PWHT SAMPLE	B05 PWHT TEMPERATURA INIZIO °C BEGINNING TEMPERATURE	VELOCITA' RISCALDO C/h HEATING RATE	TEMPERATURA TRATTAMENTO °C TEMPERATURE TREATMENT	PERMANENZA Min HOLDING TIME	VELOCITA' RAFFREDDAMENTO °C/h COOLING RATE	TEMPERATURA FINE °C END TEMPERATURE	N° CICLI / CYCLES	C00 CAMPIONE Q+T SAMPLE	B05 Q+T TEMPERATURA (Q) °C TEMPERATURE	PERMANENZA (Q) Min HOLDING TIME	RAFFREDDAMENTO COOLING	TEMPERATURA (T) °C TEMPERATURE	PERMANENZA (T) Min HOLDING TIME	RAFFREDDAMENTO COOLING
11	SSAA770204A	1881251	25.00X3000X12000	7,07	768234	BO	N	GI659																	

C71/C92 COMPOSIZIONE CHIMICA DI COLATA / HEAT CHEMICAL ANALYSIS

B07 COLATA HEAT	C71 C %	C72 Mn %	C73 Si %	C74 P %	C75 S %	C76 Cu %	C77 Ni %	C78 Cr %	C79 Mo %	C80 Al %	C81 V %	C82 Nb %	C83 Ti %	C84 Sn %	C85 Ca %	C86 N %	C87 B %	C88 H %	C89 Ceq1 % (D)	C90 Ceq2 % (D)	C91 Pcm % (D)
Ordine Min 11																					
Ordine Max 11		1,20																		0,40	
SA51660LTV Min 12.60 - 50.00		0,85	0,15																		
SA51660LTV Max 12.60 - 50.00	0,23	1,20	0,40	0,025	0,025																
SSAA77	0,15	1,03	0,23	0,007	0,001	0,010	0,010	0,010	<0.005	0,037	0,001	0,002	0,003	<0.005	0,0000	0,0019	<0.0005	0,0000	0,32	0,33	0,21

C00 CAMPIONE SAMPLE	C01 POSIZIONE (1) LOCATION SPESSORE LAMIERA PLATE THICKNESS	PROVA DI TRAZIONE TENSILE TEST: C01 POSIZIONE (2) LOCATION	C02 DIREZIONE (3) ORIENTATION	C03 TEMPERATURA [°C] TEST TEMPERATURE	C11 ReH [Mpa] YIELD STRENGTH	C12 Rm [Mpa] TENSILE STRENGTH	ReH/Rm	C13 A2" ELONGATION	C14 Rp 0.2 [Mpa] PROOF/YIELD STRENGTH	C10 FORMA PROVINO (4) SHAPE OF TEST PIECE	PROVA DI RESILIENZA IMPACT TEST - CHARPY V-NOTCH TEST: C41 LARGHEZZA [mm] WIDTH	C02 DIREZIONE (3) ORIENTATION	C03 TEMPERATURA [°C] TEST TEMPERATURE	C01 POSIZIONE (2) LOCATION	C42 SINGOLI VALORI [J] INDIVIDUAL VALUES	C43 MEDIA [J] MEAN VALUE	PROVA DI PIEGA BEND TEST: C02 DIREZIONE (3) ORIENTATION	C51 MANDRINO [mm] MANDREL	C52 ANGOLO [°] ANGLE	C50 ESITO (5) RESULT	PROVA DI DUREZZA HARDNESS TEST: C01 POSIZIONE (2) LOCATION	C30 METODO TEST METHOD	C31 SINGOLI VALORI INDIVIDUAL VALUES	C32 MEDIA MEAN VALUE	PROVA DI STRIZIONE Z% TEST: C53 Z% SINGOLI VALORI Z% INDIVIDUAL VALUES	C54 Z% VALORE MEDIO Z% MEAN VALUE
ORDINE Min 11												L	-51		14	18											
SA51660LTV Min 0.00 - 25.00												L	-51			18											
SA51660LTV Min 20.10 - 120.00				20		415		25,0	220																		
SA51660LTV Max 20.10 - 120.00				20		550																					

QC M. GALLI
REVIEWED / ACCEPTED
3 MAY 2024

Cert. No. 10

			PROVA DI TRAZIONE TENSILE TEST								PROVA DI RESILIENZA IMPACT TEST - CHARPY V-NOTCH TEST						PROVA DI PIEGA BEND TEST				PROVA DI DUREZZA HARDNESS TEST				PROVA DI STRIZIONE Z% TEST	
C00		C01	C01	C02	C03	C11	C12		C13	C14	C10	C41	C02	C03	C01	C42	C43	C02	C51	C52	C50	C01	C30	C31	C32	C53	C54
CAMPIONE SAMPLE	SPESSORE LAMIERA PLATE THICKNESS	POSIZIONE LOCATION (1)	POSIZIONE LOCATION (2)	DIREZIONE ORIENTATION (3)	TEMPERATURA TEST TEMPERATURE [°C]	ReH [Mpa] YIELD STRENGTH	Rm [Mpa] TENSILE STRENGTH	ReH/Rm	A2" ELONGATION	Rp 0.2 [Mpa] PROOF/YIELD STRENGTH	FORMA PROVINO (4) SHAPE OF TEST PIECE	LARGHEZZA [mm] WIDTH	DIREZIONE ORIENTATION (3)	TEMPERATURA [°C] TEST TEMPERATURE	POSIZIONE LOCATION (2)	SINGOLI VALORI [J] INDIVIDUAL VALUES	MEDIA [J] MEAN VALUE	DIREZIONE ORIENTATION (3)	MANDRINO [mm] MANDREL	ANGOLO [°] ANGLE	ESITO (5) RESULT	POSIZIONE (2) LOCATION	METODO TEST METHOD	SINGOLI VALORI INDIVIDUAL VALUES	MEDIA MEAN VALUE	Z% SINGOLI VALORI Z% INDIVIDUAL VALUES	Z% VALORE MEDIO Z% MEAN VALUE
GI659	25,00	2	P	T	20		470		35,3	334	P	10,00	T	-50	P	93 98 94	95										
GI659	25,00	2										10,00	T	-20	P	207 129 141	159						HRC <	22			
GI659	25,00	2										10,00	L	-51	P	250 262 259	257										

C10

ASME SA-370 FIG. 3 AND FIG. 10 / 11 - SAMPLE TAKEN AFTER PLATE HEAT TREATMENT

Z01

ITEM		TOLLERANZA DI SPESSORE TOLERANCE ON THICKNESS	TOLLERANZE DI LARGHEZZA TOLERANCE ON WIDTH	TOLLERANZE DI LUNGHEZZA TOLERANCE ON LENGTH	CONDIZIONI SUPERFICIALI SURFACE FINISH	PLANARITÀ FLATNESS
11		EN 10029 CL.B	-0+100 MM	-0+200 MM	EN 10163/2 CL B2	EN 10029 CL. N

CERTIFICHIAMO che le lamiere elencate sono conformi alla prescrizione dell'ordine, che i controlli della marcatura, dell'aspetto superficiale e dimensionale hanno dato esito positivo.
WE CERTIFY that the above mentioned plates are consistent with the order prescriptions: marking, inspection and measurement without objection.
DICHIARIAMO CHE LE LAMIERE SONO STATE CONTROLLATE IN ACCORDO ALLA NORMATIVA VIGENTE E CHE LE RADIAZIONI IONIZZANTI NON ECCEDONO IL VALORE DEL FONDO NATURALE.
WE DECLARE THAT THE PLATES WERE CONTROLLED ACCORDING TO STANDARD AND RADIATION DO NOT EXCEED THE NATURAL RADIATION.

Z06

FULLY KILLED FINE GRAIN STEEL

HARDNESS IN ACC. TO NACE MR 0175 / ISO15156

Z07	Z03 ENTE COLLAUDO / INSPECTION BODY	Z02
PRODUCED FROM CONTINOUS CAST SLAB AND HAVE A MINIMUN REDUCTION RATIO OF 3 TO 1. ACCORDING TO ASME II PART A ED. 2021. FULLY KILLED, FINE GRAIN STEEL. Value of Mn maximun in derogation permitted up to 1.50% **Plates acc. to PED 2014/68/EU**	TIMBRO DELL'ISPETTORE STAMP OF THE INSPECTION REPRESENTATIVE	**METINVEST TRAMETAL S.p.A.** **F. Andrian** **CQ Manager**

BREMBANA & ROLLETT S.p.A.
QCM M. GALLI
REVIEWED / ACCEPTED
3 MAY 2024

C

Cert. No. 11

CERTIFICAT DE RECEPTION 3.1 / EN 10204:2004
Inspection Certificate 3.1 / EN 10204:2004
Prüfbescheinigung 3.1 / EN 10204:2004

Numéro de document Rev 00
Document number
Bescheinigungnummer
2022-105545

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Cert. No.

ArcelorMittal

Client - Purchaser - Besteller: BREMBANA & ROLLE SPA

Référence client - Purchase order - Kaufauftrag: 4250-ODA21-001602 Job4250

Projet - Project - Projekt: Repère poste - - 90

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + MAQ REV00 du 04/05/2018
ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + QAM REV00 of 04/05/2018

Produit - Product - Erzeugnis: Plate(s)

Commande / Poste - Internal order - Werksbestellung: 1088177 / 000090

Bordereau de livraison - Delivery note - Lieferungsdokument: 80401280

#010 - PRODUITS LIVRES - DELIVERED PRODUCTS - GELIEFERTEN GEGENSTANDE

Nuance - Grade - Werkstoff	SA 516 Gr 60/Gr 415 + S5 (HIC)	Selon norme - According to - Entsprechend	ASME IIA ED. 2021 SA 516/M		
Epaisseur - Thickness - Dicke	20.00 mm	Largeur - Width - Breite	2,500 mm	Longueur - Length - Länge	9,600 mm

Spécification - Specification - Spezifikation

4250MRS104 REV.2 - 14/12/2021
ACCORDING TO ASME II ED. 2019
ACCORDING TO ACCEPTED TARO

https://eservices.industeel.be

Thermique de livraison - Heat treatment state of delivery - Wärmebehandlung Lieferzustand

Normalisation (920 °C - 1 min/mm) - Normalization - Normalisierung

Procédé d'élaboration - Melting process - Erschmelzungsart

Electric-arc furnace - Vacuum degassed - Fully killed - Fine grain practice

Nbre Nbr Stz	N° produit Product Erzeugnis	N° de coulée Ladle nr. Schmelze nr.	N° de lot de contrôle Inspection lot nr. Prüflos nr.	Nbre Nbr Stz	N° produit Product Erzeugnis	N° de coulée Ladle nr. Schmelze nr.	N° de lot de contrôle Inspection lot nr. Prüflos nr.
01	456875002	12143	456869.5001 / 456872.4001 / 456875.1002				

Total - Total - Gesamtzahl 001

VERIFIED TO ASME
SECT. II PART. A ED. 21 + ADD. A
& FOUND CONFORMING

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BREMBANA & ROLLE S.p.A.
REVIEWED/ACCEPTED
02 MAY 2022

JEANINE FILEE
07/03/2022
Gestionnaire Commande
Mill inspector
Werksbeauftragte

Cert. No. 11

CERTIFICAT DE RECEPTION 3.1 / EN 10204:2004
Inspection Certificate 3.1 / EN 10204:2004
Prüfbescheinigung 3.1 / EN 10204:2004

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Document number
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2022-105545

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No. _____

ArcelorMittal

Client - Purchaser - Besteller: BREMBANA & ROLLE SPA

Référence client - Purchase order - Kaufauftrag: 4250-ODA21-001602 Job4250

Projet - Project - Projekt: Repère poste - - 90

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + MAQ REV 00 du 04/05/2018
ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + QAM REV 00 of 04/05/2018

Produit - Product - Erzeugnis: Plate(s)

Commande / Poste - Internal order - Werksbestellung: 1088177 / 000090

Bordereau de livraison - Delivery note - Lieferungsdokument: 80401280

#020 - ANALYSE CHIMIQUE DE COULEE - HEAT CHEMICAL COMPOSITION - SCHMELZE CHEMISCHE ZUSAMMENSETZUNG

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
	%	%	%	%	%	%	%	%	%
Min.		0.850			0.150				
12143	0.173	1.191	0.0051	0.0007	0.390	0.028	0.046	0.049	0.002
Max.	0.200	1.200	0.0100	0.0010	0.400	0.200	0.300	0.200	0.120
	Al	Nb	V	Ti	(01)	(02)	B	O tot	(03)
	%	%	%	%			%	%	
Min.	0.020								
12143	0.029	0.01	0.000	0.002	0.126	0.051	0.0002	0.0005	0.387
Max.		0.01	0.010	0.010	1.000	0.320	0.0005	0.0025	0.419

(01) F(104) = Cu+Ni+Cr+Mo
(02) F(143) = Cr+Mo
(03) Ceq = C+(Mn/6)+((Cu+Ni)/15)+((Cr+Mo+V)/5)

#030 - ANALYSES PRODUITS - PRODUCTS ANALYSIS - STUCKANALYSEN

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
	%	%	%	%	%	%	%	%	%
Min.		0.790			0.130				
456872.4001	0.167	1.197	0.0043	0.0009	0.399	0.021	0.049	0.042	0.004
Max.	0.200	1.200	0.0100	0.0010	0.450	0.200	0.300	0.200	0.130
	Al	Nb	V	Ti	(01)	(02)	B	O tot	(03)
	%	%	%	%			%	%	
Min.	0.020								
456872.4001	0.031	0.01	0.003	0.004	0.116	0.046	0.0002	0.0006	0.381
Max.		0.01	0.010	0.010	1.000	0.320	0.0005	0.0025	0.419

(01) F(104) = Cu+Ni+Cr+Mo
(02) F(143) = Cr+Mo
(03) Ceq = C+(Mn/6)+((Cu+Ni)/15)+((Cr+Mo+V)/5)

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BREMBANA & ROLLE S.p.A.
ZAELI
CHECKED / ACCEPTED
02 MAY 2022

JEANINE FILEE
07/03/2022
Gestionnaire Commande
Mill inspector
Werksbeauftragte

Cert. No. 11

CERTIFICAT DE RECEPTION 3.1 / EN 10204:2004
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2022-105545

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ArcelorMittal

Client - Purchaser - Besteller: BREMBANA & ROLLE SPA

Référence client - Purchase order - Kaufauftrag: 4250-ODA21-001602 Job4250

Projet - Project - Projekt: Repère poste - - 90

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + MAQ REV 00 du 04/05/2018
ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + QAM REV 00 of 04/05/2018

Produit - Product - Erzeugnis: Plate(s)

Commande / Poste - Internal order - Werksbestellung: 1088177 / 000090

Bordereau de livraison - Delivery note - Lieferungsdokument: 80401280

#072 ESSAIS MECANIQUES - MECHANICAL TESTS - MECHANISCHE PRÜFUNGEN

DURETE SUR COUPON - HARDNESS ON SAMPLE - HÄRTE AUF COUPON

Brinell HB – Brinell HB

N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac		HB10 Ind	HB10 Ind	HB10 Ind	HB10 Aver
							Uni	HB	HB	HB	HB
							Min				
							Max	170	170	170	170
456875.1002	000	T3/4	PSS	20	°C			147	147	143	146

DURETE SUR COUPON - HARDNESS ON SAMPLE - HÄRTE AUF COUPON

NACE MR0103 / ISO 17945 – NACE MR0103 / ISO 17945

lot QM	Etat	Loc	Epr.	T°	Uni	Mac
456875.1002	000	T3/4	PSS	20	°C	

Test result: HRC < 22

DURETE SUR COUPON - HARDNESS ON SAMPLE - HÄRTE AUF COUPON

Brinell HB – Brinell HB

N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac		HB10 Ind	HB10 Ind	HB10 Ind	HB10 Aver
							Uni	HB	HB	HB	HB
							Min				
							Max	170	170	170	170
456875.1002	001	T3/4	PSS	20	°C			142	138	140	140

DURETE SUR COUPON - HARDNESS ON SAMPLE - HÄRTE AUF COUPON

Brinell HB – Brinell HB

N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac		HB10 Ind	HB10 Ind	HB10 Ind	HB10 Aver
							Uni	HB	HB	HB	HB
							Min				
							Max	170	170	170	170
456875.1002	002	T3/4	PSS	20	°C			138	135	135	136

. ION A L' AMBIANTE - ROOM TEMPERATURE TENSILE TEST - ZUGVERSUCH BEI RT

Traction – Tensile test – Zugversuch

N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac		Rp 0,2%	Rm	A Lo=200mm
							Uni	MPa	MPa	%
							Min	220	415	21
							Max		550	
456875.1002	000	T3/4	PST	20	°C			334	494	21

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BREMBANA & ROLLE S.p.A.
REVIEW DATA ACCEPTED
02 MAY 2022

JEANINE FILEE
07/03/2022
Gestionnaire Commande
Mill inspector
Werksbeauftragte

Cert. No. 11

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Client - Purchaser - Besteller: BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag: 4250-ODA21-001602 Job4250
Projet - Project - Projekt: Repère poste - - 90

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + MAQ REV00 du 04/05/2018
ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + QAM REV00 of 04/05/2018

Produit - Product - Erzeugnis: Plate(s)
Commande / Poste - Internal order - Werksbestellung: 1088177 / 000090
Bordereau de livraison - Delivery note - Lieferungsdokument: 80401280

TRACTION A L' AMBIANTE - ROOM TEMPERATURE TENSILE TEST - ZUGVERSUCH BEI RT

Traction – Tensile test – Zugversuch								Rp 0.2%	Rm	A Lo=20Cm m									
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	MPa	MPa	%									
							Min	220	415	21									
							Max		550										
456875.1002	001	T3/4	PST	20	°C			324	477	24									

TRACTION A L' AMBIANTE - ROOM TEMPERATURE TENSILE TEST - ZUGVERSUCH BEI RT

Traction – Tensile test – Zugversuch								Rp 0.2%	Rm	A Lo=200m m									
lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	MPa	MPa	%									
							Min	220	415	21									
							Max		550										
456875.1002	002	T3/4	PST	20	°C			316	464	21									

RESILIENCE - TOUGHNESS - KERBSCHLAGZÄHIGKEIT

KCV ASTM 10X10mm – KCV ASTM 10X10mm – KCV ASTM 10X10mm								Energ Ind	Energ Ind	Energ Ind	Energ Ave	LatEx Ind	LatEx Ind	LatEx Ind	LatEx Ave	%Sh.area Ind	%Sh.area Ind	%Sh.area Ind	%Sh.area Ave
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	J	J	J	J	Mils	Mils	Mils	Mils	%	%	%	%
							Min	34	34	34	51								
							Max												
456875.1002	000	T3/4	1/4ST	-2	°C			177	196	196	190	79.00	79.00	75.00	78.00	85	85	85	85.0

RESILIENCE - TOUGHNESS - KERBSCHLAGZÄHIGKEIT

KCV ASTM 10X10mm – KCV ASTM 10X10mm – KCV ASTM 10X10mm								Energ Ind	Energ Ind	Energ Ind	Energ Ave	LatEx Ind	LatEx Ind	LatEx Ind	LatEx Ave	%Sh.area Ind	%Sh.area Ind	%Sh.area Ind	%Sh.area Ave
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	J	J	J	J	Mils	Mils	Mils	Mils	%	%	%	%
							Min	34	34	34	51								
							Max												
456875.1002	001	T3/4	1/4ST	-2	°C			165	187	169	174	79.00	71.00	75.00	75.00	85	85	85	85.0

RESILIENCE - TOUGHNESS - KERBSCHLAGZÄHIGKEIT

KCV ASTM 10X10mm – KCV ASTM 10X10mm – KCV ASTM 10X10mm								Energ Ind	Energ Ind	Energ Ind	Energ Ave	LatEx Ind	LatEx Ind	LatEx Ind	LatEx Ave	%Sh.area Ind	%Sh.area Ind	%Sh.area Ind	%Sh.area Ave
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	J	J	J	J	Mils	Mils	Mils	Mils	%	%	%	%
							Min	34	34	34	51								
							Max												
456875.1002	002	T3/4	1/4ST	-2	°C			173	155	163	164	71.00	63.00	67.00	67.00	75	75	75	75.0

Loc	3/4	Trois-Quart - 3/4 Width - 3/4 Breite
Loc	T	Tête - Top - Kopf
Epr. Epaisseur	1/4	Quart épaisseur - 1/4 Thickness - 1/4 Dicke
Epr. Epaisseur	P	Peau - Rolled Surface - Walzfläche
Epr. Face	S	Supérieure - Upper face - obere
Epr. Sens	S	Standard - Standard - Standard
Epr. Sens	T	Travers - Transverse - Quer
Etat	000	Etat thermique de livraison - Heat treatment state of delivery - Wärmebehandlung Lieferustand

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande,
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BREMBANA & ROLLE S.p.A.
QC
REVIEWED / ACCEPTED
02 MAY 2022

JEANINE FILEE
07/03/2022
Gestionnaire Commande
Mill inspector
Werksbeauftragte

Cert. No. 11

CERTIFICAT DE RECEPTION 3.1 / EN 10204:2004
Inspection Certificate 3.1 / EN 10204:2004
Prüfbescheinigung 3.1 / EN 10204:2004

Numéro de document Rev 00
Document number
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2022-105545

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ArcelorMittal

Client - Purchaser - Besteller	BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag	4250-ODA21-001602 Job4250
Projet - Project - Projekt	Repère poste -- 90

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + MAQ REV 00 du 04/05/2018
ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + QAM REV 00 of 04/05/2018

Produit - Product - Erzeugnis	Plate(s)
Commande / Poste - Internal order - Werksbestellung	1088177 / 000090
Bordereau de livraison - Delivery note - Lieferungsdokument	80401280

Etat	001	PWHT - PWHT (From 425 °C at 90 °C/h to 631 °C (-10/+10) (min: 3 h) - Down to 425 °C at 90 °C/h - 1 Cycle) - PWHT
Etat	002	PWHT - PWHT (From 425 °C at 90 °C/h to 631 °C (-10/+10) (min: 12 h) - Down to 425 °C at 90 °C/h - 1 Cycle) - PWHT
Epr.Ep./Face/Sens	1/4ST	Quart épaisseur - 1/4 Thickness - 1/4 Dicke / Supérieure - Upper face - obere / Travers - Transverse - Quer
Epr.Ep./Face/Sens	PSS	Peau - Rolled Surface - Walzfläche / Supérieure - Upper face - obere / Standard - Standard - Standard
Epr.Ep./Face/Sens	PST	Peau - Rolled Surface - Walzfläche / Supérieure - Upper face - obere / Travers - Transverse - Quer

#082 ESSAIS TECHNOLOGIQUES - TECHNOLOGICAL TESTS - TECHNOLOGISCHE PRÜFUNGEN

GRAIN - GRAIN - KORN

MCQUAID-EHN ASTM E112/EN ISO 643
MCQUAID-EHN ASTM E112/EN ISO 643 - MCQUAID-EHN ASTM E112/EN ISO 643

N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	Grain
							Min	5
							Max	
456872.4001	000	T3/4	SSS	20	°C			9

Test result: Satisfactory as per specification

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BREMBANA & ROLLE S.p.A.
QUALITY MANAGER
REVIEWED / ACCEPTED
02 MAY 2022

JEANINE FILEE
07/03/2022
Gestionnaire Commande
Mill inspector
Werksbeauftragte

Cert. No. 11

CERTIFICAT DE RECEPTION 3.1 / EN 10204:2004 Inspection Certificate 3.1 / EN 10204:2004 Prüfbescheinigung 3.1 / EN 10204:2004	Numéro de document / Document number / Bescheinigungnummer: 2022-105545 Rev 00	Page / Sheet / Seite: 006 / 010	Cert. No. ____

ArcelorMittal

Client - Purchaser - Besteller	BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag	4250-ODA21-001602 Job4250
Projet - Project - Projekt	Repère poste - - 90

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert 2019/86320.3, Valid 02/05/2023) + MAQ REV 00 du 04/05/2018
ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + QAM REV 00 of 04/05/2018

Produit - Product - Erzeugnis	Plate(s)
Commande / Poste - Internal order - Werksbestellung	1088177 / 000090
Bordereau de livraison - Delivery note - Lieferungsdokument	80401280

HIC - HIC - HIC

ESSAI HIC SELON NACE TM0284
HIC NACE TM0284 - HIC NACE TM0284

N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac		T° solution	Initial H2S	Final H2S	Initial T°	Final T°	Initial pH	Final pH	pH solution	Nbr cracks	Longest crack		
							Uni	°C	ppm	ppm	°C	°C				Number	mm		
							Min	22	2,300	2,300	22	22	2.70		2.60				
							Max	28			28	28	3.30	4.00	2.80		5.000		
456869.5001	001	T3/4	SSL	20	°C			23	2,780	2,722	24	23	3.05	3.76	2.66	0	0		

Standard	NACE TM0284 ed.2016
Specimen surface preparation	320-grit polishing
Degreasing	Acetone + Check according to ASTM F21
Solution	A
	at 1/2 width
Result	Compliant with Standards
Inert Gas Used	Azote

Size of Specimen - Dimensions de l'échantillon - Probengrösse					
Length - Longueur - Länge	Unit - Unité - Einheit	Width - Largeur - Breite	Unit - Unité - Einheit	Thickness - Epaisseur - Dicke	Unit - Unité - Einheit
100.00	mm	20.00	mm	15.00	mm
Total area - Surface de l'échantillon - Probenoberfläche			76.00	cm2	

Start of Test - Début de test - Testenbeginn	10/02/2022 11:00
End of Test - fin de test - Testenende	14/02/2022 11:00
Test duration in h Durée du test - Testendauer	96.00

N°	Location - Localisation - Lage	Picture - Image - Bild	Magnification - Grossissement - Vergrößerung
01	Top Surface	AN_0001088177_000020_456869001_001(1)	1X
02	Bottom Surface	AN_0001088177_000020_456869001_001(2)	1X
03	Microstructure unetched	AN_0001088177_000020_456869001_001(3)	200X
04	Microstructure etched	AN_0001088177_000020_456869001_001(4)	200X

Blisters whose dimensions are < 1,0 mm are not taken into account

	1st specimen					2nd specimen					3rd specimen											
Number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0							
Diameter in mm	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5							

	1st specimen				2nd specimen				3rd specimen			
	S1.1	S1.2	S1.3	S1 Aver.	S2.1	S2.2	S2.3	S2 Aver.	S3.1	S3.2	S3.3	S3 Aver.
CLR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CTR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CSR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Aver.	Max requirements		
		Per sect	Per spec	Aver.
CLR	0.000		6.999	5.000
CTR	0.000		1.999	1.500
CSR	0.000		0.699	0.500

Loc	3/4	Trois-Quart - 3/4 Width - 3/4 Breite
Loc	T	Tête - Top - Kopf
Epr. Epaisseur	S	Standard - Standard - Standard
Epr. Face	S	Supérieure - Upper face - obere
Epr. Sens	L	Long - Longitudinal - Längs

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BREMBANA & ROLLE S.p.A.
QCM
REVIEWED / ACCEPTED
02 MAY 2022

JEANINE FILEE
07/03/2022
Gestionnaire Commande
Mill inspector
Werksbeauftragte

Cert. No. 11

CERTIFICAT DE RECEPTION 3.1 / EN 10204:2004 Inspection Certificate 3.1 / EN 10204:2004 Prüfbescheinigung 3.1 / EN 10204:2004	Numéro de document Rev 00 Document number Bescheinigungnummer 2022-105545	Page 007 Sheet / Seite 010	Cert. No. ____

ArcelorMittal

Client - Purchaser - Besteller	BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag	4250-ODA21-001602 Job4250
Projet - Project - Projekt	Repère poste - - 90
Industeel Belgium Site : Rue de Châtelet 266 6030 Marchienne-au-Pont	ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + MAQ REV00 du 04/05/2018 ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + QAM REV00 of 04/05/2018
Produit - Product - Erzeugnis	Plate(s)
Commande / Poste - Internal order - Werksbestellung	1088177 / 000090
Bordereau de livraison - Delivery note - Lieferungsdokument	80401280

Epr. Sens	S	Standard - Standard - Standard
Etat	000	Etat thermique de livraison - Heat treatment state of delivery - Wärmebehandlung Lieferustand
Etat	001	PWHT - PWHT (From 425 °C at 90 °C/h to 631 °C (-10/+10) (min: 3 h) - Down to 425 °C at 90 °C/h - 1 Cycle) - PWHT
Epr.Ep./Face/Sens	SSL	Standard - Standard - Standard / Supérieure - Upper face - obere / Long - Longitudinal - Längs
Epr.Ep./Face/Sens	SSS	Standard - Standard - Standard / Supérieure - Upper face - obere / Standard - Standard - Standard

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BREMBANA & ROLLE S.p.A.
QCI
REVIEWED / ACCEPTED
02 MAY 2022

JEANINE FILEE
07/03/2022
Gestionnaire Commande
Mill inspector
Werksbeauftragte

Cert. No. 11

CERTIFICAT DE RECEPTION 3.1 / EN 10204:2004 Inspection Certificate 3.1 / EN 10204:2004 Prüfbescheinigung 3.1 / EN 10204:2004	Numéro de document Document number Bescheinigungnummer 2022-105545	Rev 00	Page / Sheet / Seite 008 / 010

Cert. No. _____

ArcelorMittal

Client - Purchaser - Besteller	BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag	4250-ODA21-001602 Job4250
Projet - Project - Projekt	Repère poste - - 90
Industeel Belgium Site : Rue de Châtelet 266 6030 Marchienne-au-Pont	ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + MAQ REV 00 du 04/05/2018 ISO 9001 (Cert 2019/86320.3, Valid 02/06/2023) + QAM REV 00 of 04/05/2018
Produit - Product - Erzeugnis	Plate(s)
Commande / Poste - Internal order - Werksbestellung	1088177 / 000090
Bordereau de livraison - Delivery note - Lieferungsdokument	80401280

#141 – CONTROLE US - ULTRASONIC EXAMINATION - ULTRACHALLPRÜFUNGSBESCHEINIGUNG

Norme applicable 1 - Applicable standard 1 -	ASME SA 578 C+S1 100% + overlaping 10%
Résultat du contrôle - Examination result - Prüfergebnis	

Conforme aux spécifications précitées - Conforming to above specifications - Entspricht der vorgenannten vorschriften

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

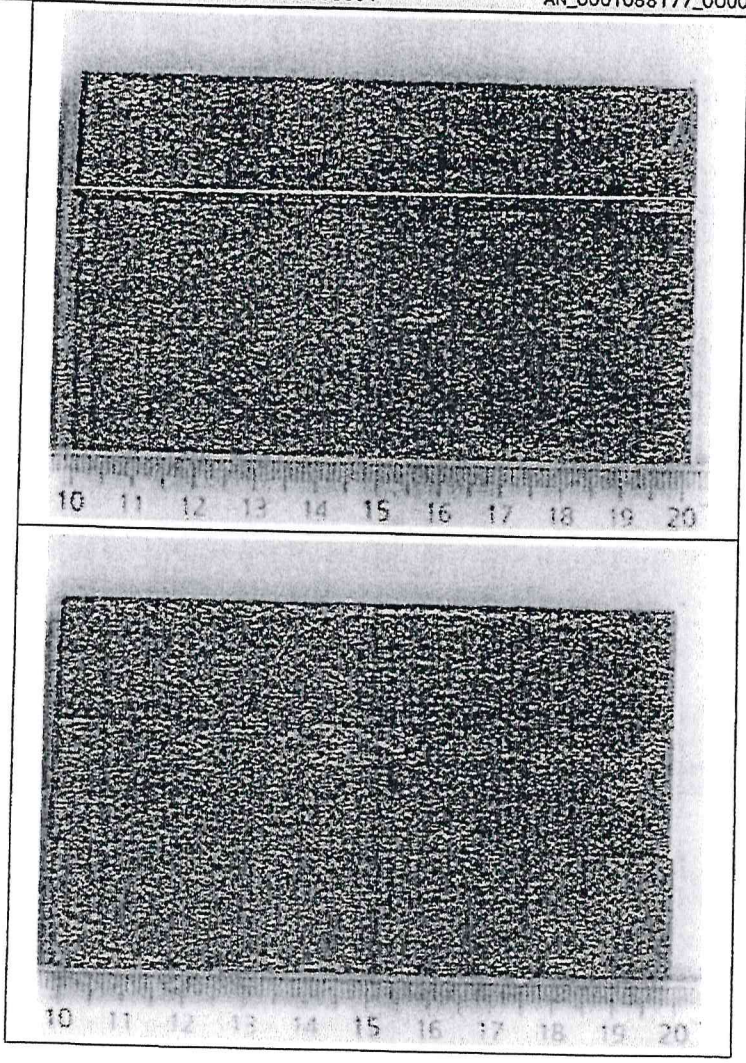
BREMBANA & ROLLE S.p.A.
CLAUDIO GALLI
REVIEWED / ACCEPTED
02 MAY 2022

JEANINE FILEE
07/03/2022
Gestionnaire Commande
Mill inspector
Werksbeauftragte

CERTIFICAT DE RECEPTION 3.1 / EN 10204:2004 Inspection Certificate 3.1 / EN 10204:2004 Prüfbescheinigung 3.1 / EN 10204:2004 Inspection Number :	Numéro de document Rev 00 Document number Bescheinigungnummer 2022-105545	Page 009 Sheet / Seite 010	Cert. No. 11
Client - Purchaser - Besteller	BREMBANA & ROLLE SPA		
Référence client - Purchase order - Kaufauftrag	4250-ODA21-001602 Job4250		
Projet - Project - Projekt	Repère poste - - 90		

ArcelorMittal

ANNEXES - APPENDIX - ANLAGEN 456869001 AN_0001088177_000020_456869001_001

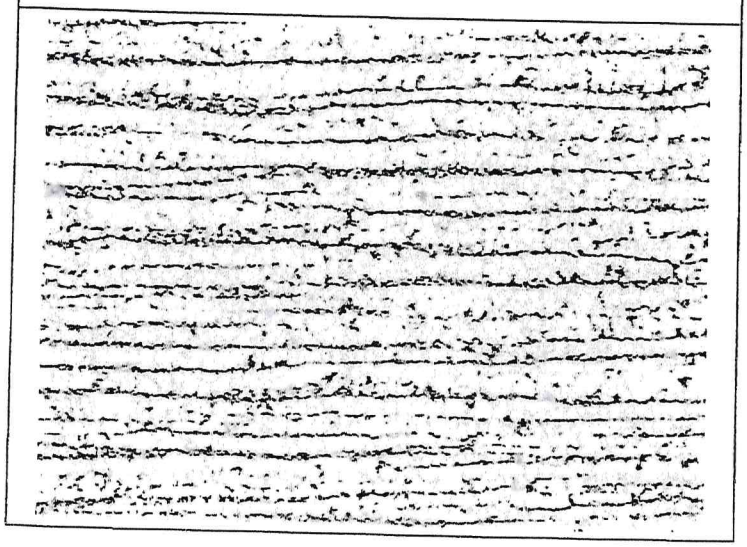


JEANINE FILEE
07/03/2022
Gestionnaire Commande
Mill inspector
Werksbeauftragte

REVIEWED / ACCEPTED
02 MAY 2022

CERTIFICAT DE RECEPTION 3.1 / EN 10204:2004 Inspection Certificate 3.1 / EN 10204:2004 Prüfbescheinigung 3.1 / EN 10204:2004 Inspection Number :	Numéro de document Rev 00 Document number Bescheinigungnummer 2022-105545	Page 010 Sheet / Seite 010	Cert. No. 11 ArcelorMittal
Client - Purchaser - Besteller	BREMBANA & ROLLE SPA		
Référence client - Purchase order - Kaufauftrag	4250-ODA21-001602 Job4250		
Projet - Project - Projekt	Repère poste - - 90		

ANNEXES - APPENDIX - ANLAGEN 456869001 AN_0001088177_000020_456869001_001



BREMBANA & ROLLE S.p.A.
Ing. M. BALLI
REVIEWED / ACCEPTED
02 MAY 2022

JEANINE FILEE
07/03/2022
Gestionnaire Commande
Mill inspector
Werksbeauftragte

Cert. No. 12

N

Pressbolt s.r.l. con unico socio
Partita Iva 03231770136
Via dell'Artigianato, 12 - 22078 - Turate (CO)
Tel. +39 02 96.97.98.50 - Fax +39 02 96.97.98.29
email qualita@pressbolt.com

Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	10 MK10	Item	10
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7
Impact Test KV -50 C

Item Description	Heat Treatment
STUDBOLT ASME B16.5 A/SA 193 B7 1.1/2"-8 UNX0260	QUENCHED Min 830 C AND TEMPERED Min 593 C

Heat	Quantity	Lot	Job PB
296162	144	P1638825	0001220218

Chemical Analysis '%'

	C	Mn	Si	P	S	Cr	Mo	
Required	0.38-0.48	0.75 - 1	0.15-0.35	max 0.035	max 0.04	0.8 - 1.1	0.15-0.25	
Actual	0.419	0.820	0.281	0.015	0.010	1.026	0.215	

Tensile Test

	Rm "Mpa"	Rp02 "Mpa"	A "%"	Z "%"
Required	Min 860	Min 720	min 16	min 50
Actual	955.2	858	20	57.4

	Hardness "HB"	Impact Test -50C "J"
Required	max 321	Min. 40J
Actual	280;279;278	51;41;46

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.r.l.

Davide Feggi
Laboratory manager

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 00000036884 Rev. 000 of 09 July 2024 - Page 1/2

Cert. No. 12

Pressbolt s.r.l. con unico socio
Partita Iva 03231770136
Via dell'Artigianato, 12 - 22078 - Turate (CO)
Tel. +39 02 96.97.98.50 - Fax +39 02 96.97.98.29
email qualita@pressbolt.com

Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	10 TIK 10	Item	10
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7

Item Description
STUDBOLT ASME B16.5
A/SA 193 B7
1.1/2"-8 UNX0260

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
296162	296162	144	100%	P1638825	0001220218

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712

FEGGI DAVIDE

○ UT
◉ MT
○ PT
○ VT

Cert N° 27927/PND/C

BREMBANA & ROLLE S.p.A.
QCM - M.G.M.T.
REVIEWED / ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 000003166884 Rev. 000 of 09 July 2024 - Page 2/24

Cert. No. 12

PRESSBOLT
Pressbolt s.r.l. con unico socio
Partita Iva 03231770136
Via dell'Artigianato, 12 - 22078 - Turate (CO)
Tel. +39 02 96.97.98.50 - Fax +39 02 96.97.98.29
email qualita@pressbolt.com

Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	10 TAK 10	Item	20
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H
Impact Test KV -50 C

Item Description	Heat Treatment
HEAVY HEX NUT H=d ASME B18.2.2. Tab 10 A/SA 194 2H 1.1/2"-8 UN	QUENCHED Min 820 AND TEMPERED Min 455 C

Heat	Quantity	Lot	Job PB
565697	288	P1621714	0001220219

Chemical Analysis "%"

	C	Mn	Si	P	S
Required	Min 0.4	Max 1	max 0.4	max 0.04	max 0.05
Actual	0.430	0.730	0.210	0.013	0.024

	Proof Load	Hardness "HB"	Impact Test -50C "J"
Required	Positive	248 - 327	Min 27
Actual	Positive	312;315;311	31;30;30
Required	Hardness test after Termical Tr		
Actual	Min. 179 254;234;255		

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

BREMBANA & ROLLE S.p.A.
QCMO M. GALLI
REVIEWED AND ACCEPTED
24 JUL 2024

QUALITY DEPARTMENT PRESSBOLT S.r.l.

Davide Feggi
Laboratory manager

Pressbolt s.r.l. con unico socio - Certificate N 0000003166884 Rev. 000 of 09 July 2024 - Page 3/24

Cert. No. 12

Pressbolt s.r.l. con unico socio
Partita Iva 03231770136
Via dell'Artigianato, 12 - 22078 - Turate (CO)
Tel. +39 02 96.97.98.50 - Fax +39 02 96.97.98.29
email qualita@pressbolt.com

Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	10 11K 10	Item	20
Job		Shipping ref.	3411093 of 09 July 2024

Standard: ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H

Item Description: HEAVY HEX NUT H=d ASME B18.2.2. Tab 10
A/SA 194 2H
1.1/2"-8 UN

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
565697	565697	288	100%	P1621714	0001220219

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

BREMBANA & ROLLE S.p.A.
(CN) - MODULI
RECEIVED / ACCEPTED
24 JUL 2024

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712

FEGGI DAVIDE

○ UT
● MT Cert N° 27927/PND/C
○ PT
○ VT

Pressbolt s.r.l. con unico socio - Certificate N 000003.06884 Rev. 000 of 09 July 2024 - Page 4/24

Cert. No. 12

Pressbolt s.r.l. con unico socio
Partita Iva 03231770136
Via dell'Artigianato, 12 - 22078 - Turate (CO)
Tel. +39 02 96.97.98.50 - Fax +39 02 96.97.98.29
email qualita@pressbolt.com

Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	20	Item	30
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7
Impact Test KV -50 C

Item Description	Heat Treatment
STUDBOLT ASME B16.5 A/SA 193 B7 1.1/2"-8 UNX0260	QUENCHED Min 830 C AND TEMPERED Min 593 C

Heat	Quantity	Lot	Job PB
296162	30	P1638825	0001220220

Chemical Analysis "%"

	C	Mn	Si	P	S	Cr	Mo	
Required	0.38-0.48	0.75 - 1	0.15-0.35	max 0.035	max 0.04	0.8 - 1.1	0.15-0.25	
Actual	0.419	0.820	0.281	0.015	0.010	1.026	0.215	

Tensile Test

	Rm "Mpa"	Rp02 "Mpa"	A "%"	Z "%"
Required	Min 860	Min 720	min 16	min 50
Actual	955.2	858	20	57.4

	Hardness "HB"	Impact Test -50C "J"
Required	max 321	Min. 40J
Actual	280;279;278	51;41;46

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

BREMBANA & ROLLE S.p.A.
ACM - MILANO
RECEIVED - ACCEPTED
24 JUL 2024

QUALITY DEPARTMENT PRESSBOLT

Davide Feggi
Laboratory manager

Pressbolt s.r.l. con unico socio - Certificate N 0000036884 Rev. 000 of 09 July 2024 - Page 5/24

Cert. No. 12

Pressbolt s.r.l. con unico socio
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email qualita@pressbolt.com

Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	20 Mk 10	Item	30
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7

Item Description
STUDBOLT ASME B16.5
A/SA 193 B7
1.1/2"-8 UNX0260

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
296162	296162	30	100%	P1638825	0001220220

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712

FEGGI DAVIDE

○ UT
◉ MT Cert N° 27927/PND/C
○ PT
○ VT

BREMBANA & ROLLE S.p.A.
QCM M. GALLI
REVIEWED / ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 00000366884 Rev. 000 of 09 July 2024 - Page 6/27

Cert. No. 12

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VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	20 Yok 10	Item	40
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H
Impact Test KV -50 C

Item Description	Heat Treatment
HEAVY HEX NUT H=d ASME B18.2.2. Tab 10 A/SA 194 2H 1.1/2"-8 UN	QUENCHED Min 820 AND TEMPERED Min 455 C

Heat	Quantity	Lot	Job PB
565697	60	P1621714	0001220221

Chemical Analysis "%"

	C	Mn	Si	P	S
Required	Min 0.4	Max 1	max 0.4	max 0.04	max 0.05
Actual	0.430	0.730	0.210	0.013	0.024

	Proof Load	Hardness "HB"	Impact Test -50C "J"
Required	Positive	248 - 327	Min 27
Actual	Positive	312;315;311	31;30;30
Required	Hardness test after Termical Tr		
Actual	Min. 179 254;234;255		

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

BREMBANA & ROLLE S.p.A.
QCM - M.GALLI
REVIEWED / ACCEPTED
24 JUL 2024

QUALITY DEPARTMENT PRESSBOLT

Davide Feggi
Laboratory manager

Pressbolt s.r.l. con unico socio - Certificate N 000003166884 Rev. 000 of 09 July 2024 - Page 7/24

Cert. No. 12

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Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	20 HK 10	Item	40
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H

Item Description
HEAVY HEX NUT H=d ASME B18.2.2. Tab 10
A/SA 194 2H
1.1/2"-8 UN

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
565697	565697	60	100%	P1621714	0001220221

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712
FEGGI DAVIDE

o UT
* MT
o PT
o VT

Cert N° 27927/PND/C

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
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24 JUL 2024

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Cert. No. 12

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Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	30 Mk14	Item	50
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7
Impact Test KV -50 C

Item Description	Heat Treatment
STUDBOLT ASME B16.5 A/SA 193 B7 1.1/2"-8 UNX0260	QUENCHED Min 830 C AND TEMPERED Min 593 C

Heat	Quantity	Lot	Job PB
296162	144	P1638825	0001220222

Chemical Analysis '%'

	C	Mn	Si	P	S	Cr	Mo	
Required	0.38-0.48	0.75 - 1	0.15-0.35	max 0.035	max 0.04	0.8 - 1.1	0.15-0.25	
Actual	0.419	0.820	0.281	0.015	0.010	1.026	0.215	

Tensile Test

	Rm "Mpa"	Rp02 "Mpa"	A "%"	Z "%"
Required	Min 860	Min 720	min 16	min 50
Actual	955.2	858	20	57.4

	Hardness "HB"	Impact Test -50C "J"
Required	max 321	Min. 40J
Actual	280;279;278	51;41;46

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

Davide Feggi
Laboratory manager

BREMBANA & ROLLE S.p.A.
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REVIEWED & ACCEPTED
24 JUL 2024

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MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	30 TK 14	Item	50
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7

Item Description
STUDBOLT ASME B16.5
A/SA 193 B7
1.1/2"-8 UNX0260

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
296162	296162	144	100%	P1638825	0001220222

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712
FEGGI DAVIDE

○ UT
● MT
○ PT
○ VT

Cert N° 27927/PND/C

BREMBANA & ROLLE S.p.A.
QCM
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24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 000003166884 Rev. 000 of 09 July 2024 - Page 10/24

Cert. No. 12

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Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	30 Thk 14	Item	60
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H
Impact Test KV -50 C

Item Description	Heat Treatment
HEAVY HEX NUT H=d ASME B18.2.2. Tab 10 A/SA 194 2H 1.1/2"-8 UN	QUENCHED Min 820 AND TEMPERED Min 455 C

Heat	Quantity	Lot	Job PB
565697	288	P1621714	0001220223

Chemical Analysis "%"

	C	Mn	Si	P	S
Required	Min 0.4	Max 1	max 0.4	max 0.04	max 0.05
Actual	0.430	0.730	0.210	0.013	0.024

	Proof Load	Hardness "HB"	Impact Test -50C "J"
Required	Positive	248 - 327	Min 27
Actual	Positive	312;315;311	31;30;30
Required	Hardness test after Termical Tr		
Actual	Min. 179 254;234;255		

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT

Davide Feggi
Laboratory manager

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED & ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 0000036884 Rev. 000 of 09 July 2024 - Page 11/2

Cert. No. 12

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35020 - ALBIGNASEGO(PD)

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	30	Item	60
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H

Item Description
HEAVY HEX NUT H=d ASME B18.2.2. Tab 10
A/SA 194 2H
1.1/2"-8 UN

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
565697	565697	288	100%	P1621714	0001220223

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
24 JUL 2024

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712
FEGGI DAVIDE

○ UT
● MT Cert N° 27927/PND/C
○ PT
○ VT

Pressbolt s.r.l. con unico socio - Certificate N 000003166884 Rev. 000 of 09 July 2024 - Page 12/24

Cert. No. 12

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Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	40 MK 1/4	Item	70
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7
Impact Test KV -50 C

Item Description	Heat Treatment
STUDBOLT ASME B16.5 A/SA 193 B7 1.1/2"-8 UNX0260	QUENCHED Min 830 C AND TEMPERED Min 593 C

Heat	Quantity	Lot	Job PB
296162	30	P1638825	0001220224

Chemical Analysis "%"

	C	Mn	Si	P	S	Cr	Mo	
Required	0.38-0.48	0.75 - 1	0.15-0.35	max 0.035	max 0.04	0.8 - 1.1	0.15-0.25	
Actual	0.419	0.820	0.281	0.015	0.010	1.026	0.215	

Tensile Test

	Rm "Mpa"	Rp02 "Mpa"	A "%"	Z "%"
Required	Min 860	Min 720	min 16	min 50
Actual	955.2	858	20	57.4

	Hardness "HB"	Impact Test -50C "J"
Required	max 321	Min. 40J
Actual	280;279;278	51;41;46

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

BREMBANA & ROLLE S.p.A.
ORIGINAL DOCUMENT
REVISION ACCEPTED
24 JUL 2024

QUALITY DEPARTMENT PRESSBOLT

Davide Feggi
Laboratory manager

Pressbolt s.r.l. con unico socio - Certificate N 0000036884 Rev. 000 of 09 July 2024 - Page 13/24

Cert. No. 12

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VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	40 MK 14	Item	70
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7

Item Description
STUDBOLT ASME B16.5
A/SA 193 B7
1.1/2"-8 UNX0260

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
296162	296162	30	100%	P1638825	0001220224

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712
FEGGI DAVIDE

○ UT
● MT
○ PT
○ VT

Cert N° 27927/PND/C

BREMBANA & ROLLE S.p.A.
QCM G.M. CELLI
REVIEW ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 000003166884 Rev. 000 of 09 July 2024 - Page 14/2

Cert. No. 12

PRESSBOLT

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Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	40	Item	80
Job		Shipping ref.	3411093 of 09 July 2024

Standard

ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H

Impact Test KV -50 C

Item Description	Heat Treatment
HEAVY HEX NUT H=d ASME B18.2.2. Tab 10 A/SA 194 2H 1.1/2"-8 UN	QUENCHED Min 820 AND TEMPERED Min 455 C

Heat	Quantity	Lot	Job PB
565697	60	P1621714	0001220225

Chemical Analysis '%'

	C	Mn	Si	P	S
Required	Min 0.4	Max 1	max 0.4	max 0.04	max 0.05
Actual	0.430	0.730	0.210	0.013	0.024

Required	Proof Load	Hardness "HB"	Impact Test -50C "J"
Actual	Positive Positive	248 - 327 312;315;311	Min 27 31;30;30
Required	Hardness test after Termical Tr		
Actual	Min. 179 254;234;255		

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.r.l.

Davide Feggi
Laboratory manager

BREMBANA & ROLLE S.p.A.
QCM M. GAL
REVIEWED / ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 0000036884 Rev. 000 of 09 July 2024 - Page 15/21

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Cert. No. 12

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	40 Mic 1 L	Item	80
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H

Item Description
HEAVY HEX NUT H=d ASME B18.2.2. Tab 10
A/SA 194 2H
1.1/2"-8 UN

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
565697	565697	60	100%	P1621714	0001220225

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712

FEGGI DAVIDE

○ UT
● MT
○ PT
○ VT

Cert N° 27927/PND/C

BREMBANA & ROLLE S.p.A.
QCM M.GALLI
REVIEWED ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 0000036884 Rev. 000 of 09 July 2024 - Page 16/21

Cert. No. 12

Pressbolt s.r.l. con unico socio
Partita Iva 03231770136
Via dell'Artigianato, 12 - 22078 - Turate (CO)
Tel. +39 02 96.97.98.50 - Fax +39 02 96.97.98.29
email qualita@pressbolt.com

Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	50 MK 46	Item	90
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7
Impact Test KV -50 C

Item Description	Heat Treatment
STUDBOLT ASME B16.5 A/SA 193 B7 5/8"-11 UNCX0085	QUENCHED Min 830 C AND TEMPERED Min 593 C

Heat	Quantity	Lot	Job PB
103540	24	P1630612	0001220226

Chemical Analysis "%"

	C	Mn	Si	P	S	Cr	Mo	
Required	0.38-0.48	0.75 - 1	0.15-0.35	max 0.035	max 0.04	0.8 - 1.1	0.15-0.25	
Actual	0.412	0.770	0.219	0.012	0.025	1.047	0.172	

Tensile Test

	Rm "Mpa"	Rp02 "Mpa"	A "%"	Z "%"
Required	Min 860	Min 720	min 16	min 50
Actual	1001	796	23.6	60.3

	Hardness "HB"	Impact Test -50C "J"
Required	max 321	Min. 40J
Actual	301;300;299	49;42;46

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT

Davide Feggi
Laboratory manager

BREMBANA & ROLLE S.p.A.
QCM / M.GALLI
REVIEWED / ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 0000003166884 Rev. 000 of 09 July 2024 - Page 17/24

Cert. No. 12

PRESSBOLT

Pressbolt s.r.l. con unico socio
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Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	50 HK 48	Item	90
Job		Shipping ref.	3411093 of 09 July 2024

Standard: ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7

Item Description:
STUDBOLT ASME B16.5
A/SA 193 B7
5/8"-11 UNCX0085

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
103540	103540	24	100%	P1630612	0001220226

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712

FEGGI DAVIDE

○ UT
◉ MT
○ PT
○ VT

Cert N° 27927/PND/C

BREMBANA & ROLLE S.p.A.
QUALITY MANAGEMENT
REVIEWED AND ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 0000036884 Rev. 000 of 09 July 2024 - Page 18/24

Cert. No. 12

PRESSBOLT
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Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	50	Item	100
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H
Impact Test KV -50 C

Item Description	Heat Treatment
HEAVY HEX NUT H=d ASME B18.2.2. Tab 10 A/SA 194 2H 5/8"-11 UNC	QUENCHED Min 820 AND TEMPERED Min 455 C

Heat	Quantity	Lot	Job PB
58195	48	P1648702	0001220227

Chemical Analysis '%'

	C	Mn	Si	P	S	
Required	Min 0.4	Max 1	max 0.4	max 0.04	max 0.05	
Actual	0.440	0.730	0.220	0.018	0.021	

Required	Proof Load Positive	Hardness "HB" 248 - 327	Impact Test -50C "J" Min 27
Actual	Positive	292;306;302	32;30;32
Required	Hardness test after Termical Tr Min. 179		
Actual	287;301;300		

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.r.l.

Davide Feggi
Laboratory manager

BREMBANA & ROLLE S.p.A.
QCM - MICALI
REVIEWED / ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 0000036884 Rev. 000 of 09 July 2024 - Page 19/24

Cert. No. 12

PRESSBOLT

Pressbolt s.r.l. con unico socio
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email qualita@pressbolt.com

Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	50	Item	100
Job		Shipping ref.	3411093 of 09 July 2024

Standard

ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H

Item Description

HEAVY HEX NUT H=d ASME B18.2.2. Tab 10
A/SA 194 2H
5/8"-11 UNC

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
58195	58195	48	100%	P1648702	0001220227

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712

FEGGI DAVIDE

○ UT
● MT
○ PT
○ VT

Cert N° 27927/PND/C

REVISED / ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 0000036884 Rev. 000 of 09 July 2024 - Page 20/24

Cert. No. 12

PRESSBOLT
Pressbolt s.r.l. con unico socio
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Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	60 Mc 48	Item	110
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7
Impact Test KV -50 C

Item Description	Heat Treatment
STUDBOLT ASME B16.5 A/SA 193 B7 5/8"-11 UNCX0085	QUENCHED Min 830 C AND TEMPERED Min 593 C

Heat	Quantity	Lot	Job PB
103540	24	P1630612	0001220228

Chemical Analysis "%"

	C	Mn	Si	P	S	Cr	Mo	
Required	0.38-0.48	0.75 - 1	0.15-0.35	max 0.035	max 0.04	0.8 - 1.1	0.15-0.25	
Actual	0.412	0.770	0.219	0.012	0.025	1.047	0.172	

Tensile Test

	Rm "Mpa"	Rp02 "Mpa"	A "%"	Z "%"
Required	Min 860	Min 720	min 16	min 50
Actual	1001	796	23.6	60.3

	Hardness "HB"	Impact Test -50C "J"
Required	max 321	Min. 40J
Actual	301;300;299	49;42;46

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.r.l.

Davide Feggi
Laboratory manager

BREMBANA & ROLLE S.p.A.
QCM - MICALI
REVIEWED / ACCEPTED
2 5 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N.0000036884 Rev. 000 of 09 July 2024 - Page 21/24

Cert. No. 12

PRESSBOLT
Pressbolt s.r.l. con unico socio
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email qualita@pressbolt.com

Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	60	Item	110
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A193(M)-23 / ASME SA193(M) BPVC-IIA-2021 - B7

Item Description
STUDBOLT ASME B16.5
A/SA 193 B7
5/8"-11 UNCX0085

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
103540	103540	24	100%	P1630612	0001220228

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712
FEGGI DAVIDE

○ UT
● MT
○ PT
○ VT

Cert N° 27927/PND/C

BREMBANA & ROLLE S.p.A.
QCM - M.GALLI
REVIEWED / ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 00000166884 Rev. 000 of 09 July 2024 - Page 22/24

Cert. No. 12

PRESSBOLT
Pressbolt s.r.l. con unico socio
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Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

Inspection Certificate EN 10204:2004 3.1

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	60	Item	120
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H
Impact Test KV -50 C

Item Description	Heat Treatment
HEAVY HEX NUT H=d ASME B18.2.2. Tab 10 A/SA 194 2H 5/8"-11 UNC	QUENCHED Min 820 AND TEMPERED Min 455 C

Heat	Quantity	Lot	Job PB
58195	48	P1648702	0001220229

Chemical Analysis "%"

	C	Mn	Si	P	S	
Required	Min 0.4	Max 1	max 0.4	max 0.04	max 0.05	
Actual	0.440	0.730	0.220	0.018	0.021	

Required	Proof Load	Hardness "HB"	Impact Test -50C "J"
	Positive	248 - 327	Min 27
Actual	Positive	292;306;302	32;30;32
Required	Hardness test after Termical Tr		
	Min. 179		
Actual	287;301;300		

Mechanical tests are longitudinal performed at t/2 or t/4 as a function of specimen dimension

Macroetch Examination	Positive	Visual and dimensional Test	Positive

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.r.l.

Davide Feggi
Laboratory manager

S.p.A.
REVIEWED/ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 0000036884 Rev. 000 of 09 July 2024 - Page 23/24

PRESSBOLT
Pressbolt s.r.l. con unico socio
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Messrs. BREMBANA & ROLLE S.p.A.
VIALE DELLE INDUSTRIE, 35
35020 - ALBIGNASEGO(PD)

Cert. No 12

MAGNETIC INSPECTION REPORT

Number	Rev.	Date
3166884	0	09 July 2024

Client Reference Order		Reference Order	
Number	ODA24-000575 of 29 February 2024	Number	3401676
Reference	JOB 23096		
Item	60	Item	120
Job		Shipping ref.	3411093 of 09 July 2024

Standard
ASTM A194(M)-22 / ASME SA194(M) BPVC-IIA-2021 - Gr.2H

Item Description
HEAVY HEX NUT H=d ASME B18.2.2. Tab 10
A/SA 194 2H
5/8"-11 UNC

Heat	Heat	Quantity	Tested quantity	Lot	Job PB
58195	58195	48	100%	P1648702	0001220229

Test Parameters	
Reference documents	ASME sec.V art.7
Internal procedure	I-11 PRO6 rev.2
Acceptance criteria	I-11 PRO6 rev.2 Par.10: ASME VIII div.1 app.6/ASME VIII div.2 par.3.7.2b and par.7.5.6.2/ASTM A962 sr. S57
Equipment	MAGNETIC FIXED LOCATION CGM MAGCFM1000-200 sn.11647 Fluorescent particles: TemaFlux LM 7500(exp.07/23)
Execution of Test	EXAMINATION WITH PARTICLES IN SUSPENSION - IN FINAL MACHINED CONDITION
Circular magnetisation	DC CURRENT 12÷32 A/mm of Ø
Longitudinal magnetisation	BY COILS A=35000/(L/D)+2 IF L/D>=4 - A=45000/(L/D)IF 2<L/D<4 - LD<2 NA
Temperature surface	</= 50°C
Inspection	DARK ROOM - BLACK LIGHT MIN 1000µW/cm² - WHITE LIGHT MAX 20Lux
Test result	CONFORMING TO THE SPECIFIED REQUIREMENTS

The material was manufactured, tested and checked in accordance with the specifications and additional requirements of the Purchase Order or the Agreement
No weld repair has been performed on the material

QUALITY DEPARTMENT PRESSBOLT S.R.L.

LEVEL II
UNI EN ISO 9712
FEGGI DAVIDE

○ UT
● MT
○ PT
○ VT

Cert N° 27927/PND/C

REVIEWED & ACCEPTED
24 JUL 2024

Pressbolt s.r.l. con unico socio - Certificate N 00000036884 Rev. 000 of 09 July 2024 - Page 24/24

FORGIA DI OSPIATE

Forgia di Ospiate s.r.l.

Via Eugenio Villoresi, 28/30 - 20021 Bollate (Mi) - Italy
www.forgiadiospiate.it - info@forgiadiospiate.it

Cert No. 13

Inspection Certificate EN 10204 Type 3.1

Certificate n° Certificato / Werksz. / Certificat	24_0066_01	**Customer** Cliente / Besteller / Client	Brembana & Rolle
Order Ordine / Bestellung / Commande	23096-ODA24-000304 -Rev.1 dtd. 02/02/2024	**Delivered Cond.** Stato di fornitura / Lieferezustad / Etat de livarision	Fully Machined
FDO Job n° Commessa / Werks / Réf.	240066	**Insp. Standard** Specifiche di collaudo / Anforderungen / Controle suivant normes	ASME SA350 LF2 Cl.1 ASME II Part.A Ed.2021 + 23096-EMRS-201 Rev.0
		Insp. Body Ente / Abnahme durch / Reception par	

Material Testing Certificate

Certificato prove materiali / Abnahmeprufzeugnis / Certificat d'essais des materiaux

Item Pos. / Poste	Qty	Description Descrizione / Beschreibung / Description	Heat treatment Trattamento termico /Warmebehan / Trait.term	KG As delivered/ Wie geliefert/ Tel que livré	Material Materiale / Wekstoff / Matiere	Heat n° Colata / Schmelze / Coulee	Test n° Prova / Pruf / Essais
10 NOZZLE LN	6	Forged Pieces Ø 254/101*417 23096-01-EBM1 MK.41 ITEM V25001 A/F	N+T	240	ASME SA350 LF2 Cl.1	T36272	T. 237
20 BLIND FLANGE 3N	6	Forged Pieces Ø 124*18 23096-01-EBM1 MK.47 ITEM V25001 A/F	N+T	10	ASME SA350 LF2 Cl.1	T36272	T. 237

Forgings have been manufactured, inspected and tested in accordance with requirements of the applicable product specification and PO# Suppl. agreements. We hereby certify that the delivered products fulfill the P.O. requests.
FdO srl conforms to the quality systems standard UNI EN ISO 9001:2015, and approved acc. to PED, Annex I, Para. 4.3
Material acc.to NACE MR0103 Latest Edition - Material Resistant to Sulfide Stress Crackin in Corrosive Petrleum Refining Environments and NACE MR0175 / ISO 15156 Latest Edition - Petroleum and natural gas in industries-Materials for use in H2S containing environments in oil and gas production, latest edition.

DICHIARIAMO CHE LA MERCE FORNITA E' IN ACCORDO ALLE RICHIESTE DELL'ORDINE
WIR ERKLÄREN DASS DIE LIEFERWARE SICH MIT DEN FORDERUNGEN DER BESTELLUNG VERGLEICHT
NOUS CONFIRMONS QUE LE PRODUITS FOURNIS SONT CONFORMES AUX EXIGENCES DE LA COMMANDE

Enclosures / Allegati Anlagen / Annex		**TRADE MARK** MARCHIO DI FABBRICA WERK PRUFSTEMPEL POINCON D'USINE	**Marking** / Marcatura Kennzeichnung / Marquage
1) Chemical analysis - Heat treatment			
2) Test report			
3) UT report			
4) DM/VT report			
5) MT report			

Visual & Dimensional conform to PO request
Marking on label: Material, PO number, heat number, test number, Fdo Logo

■ Conforming □ Non-conforming

Quality Control	Date	Inspection Authority
FORGIA DI OSPIATE SRL Q.C Dept. S. Filippelli	29/03/2024	BREMBANA & ROLLE S.p.A. QCM - M. BALLI REVIEWED / ACCEPTED 3 APR 2024

Cert. No. 15

FORGIA DI OSPIATE

Forgia di Ospiate s.r.l.

Via Eugenio Villoresi, 28/30 - 20021 Bollate (Mi) - Italy
www.forgiadiospiate.it - info@forgiadiospiate.it

Inspection Certificate EN 10204 Type 3.1

Certificate n° / Certificato / Werksz. / Certificat	24_0066_01	Customer / Cliente / Besteller / Client	Brembana & Rolle	Enclosure / Allegato / Annex / Anlage	1
Order / Ordine / Bestellung / Commande	23096-ODA24-000304 - Rev.1 dtd. 02/02/2024	Insp. Standard / Specifiche di collaudo / Anforderungen / Controle suivant normes	ASME SA350 LF2 Cl.1 ASME II Part.A Ed.2021 + 23096-EMRS-201 Rev.0	Heat Treat. / Tratt. Term. / Warmebehan / Trait. Term	N+T
FDO Job n° / Commessa / Werks / Réf.	240066	Test n° / Prova / Pruf / Essias	T. 237	Heat n° / Colata / Schmelze / Coulee	T36272

Chemical Analysis

Analisi Chimica / Chemischen Analyse / Analyse Chimique

Specified Chemical Composition

Element [%]

Heat No	Requirements			T36272	Requirements			T36272
T36272	Element	Min	Max	heat	Element	Min	Max	heat
Steelmaker	C	--	0,30	0,18	W	--	--	--
MORAVIA STEEL	Mn*	0,60	1,35	1,21	Ca	--	--	--
	Si	0,15	0,30	0,22	B	--	--	--
	P	--	0,015	0,012	--	--	--	--
	S	--	0,003	0,003	--	--	--	--
	Cr	--	0,30	0,07	Sb	--	--	--
	Ni	--	0,40	0,03	Co	--	--	--
	Mo	--	0,12	0,013	N	--	--	--
	Cu	--	0,40	0,030	O	--	--	--
	V	--	0,08	0,021	H	--	--	--
	Nb	--	0,02	0,019	--	--	--	--
	Al	--	--	--	F1	--	0,41	0,406
	Ti	--	--	--	F2	--	1,00	0,164
	Sn	--	--	--	F3	--	0,32	0,083
	As	--	--	--	--	--	--	--

F1	Ceq = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15
F2	Cu + Ni + Cr + Mo + V
F3	Cr + Mo
*	For each reduction of 0,01% below of specified carbon maximum (0,35%), an increase of 0,06% manganese above thespecified maximum (1,05%) will be permitted up to a maximum of 1,65%

Heat Treatment

Trattamento Termico / Warmebehan / Traitment term

Type	Entry Furnace T° [°C]	Heating Rate Max [°C/h]	Holding Temp. [°C]	Holding Time [h]	Cooling Rate Max [°C/h]	Cooling Medium		
Normalizing	200	80	900	5	--	Air		
Tempering	200	80	660	10	--	Air		

Note: *Melting Process:*
B.O.F + VD - Fully Killed - Fine Grain Practice
Forging Ratio > 1:4

Conforming ■ Non-conforming □

Quality Control	Date	Inspection Authority
FORGIA DI OSPIATE SRL Q.C Dept. S. Filippelli	29/03/2024	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED ACCEPTED 3 APR 2024

Cert. No. 13

FORGIA DI OSPIATE

Forgia di Ospiate s.r.l.

Via Eugenio Villoresi, 28/30 - 20021 Bollate (Mi) - Italy
www.forgiadiospiate.it - info@forgiadiospiate.it

Inspection Certificate EN 10204 Type 3.1

Certificate n° / Certificato / Werksz. / Certificat	24_0066_01	Customer / Cliente / Besteller / Client	Brembana & Rolle	Enclosure / Allegato / Annex / Anlage	2
Order / Ordine / Bestellung / Commande	23096-ODA24-000304 -Rev.1 dtd. 02/02/2024	Insp. Standard / Specifiche di collaudo / Anforderungen / Controle suivant normes	ASME SA350 LF2 Cl.1 ASME II Part.A Ed.2021 + 23096-EMRS-201 Rev.0	Heat Treat. / Tratt. Term. / Warmebehan / Trait. Term	N+T
FDO Job n° / Commessa / Werks / Réf.	240066	Test n° / Prova / Pruf / Essias	T. 237	Heat n° / Colata / Schmelze / Coulee	T36272

Mechanical Tests Prove Meccaniche / Mechanischen Prüfungen / Essais Mécaniques

Tensile Test Trazione - Zugversuch - Traction: ASTM A 370, Round

Impact Test - Resilienza - Kerbschlagbiegeversuch - Resilience: ASTM A 370, Kv

Tests No	Direction/Direzione Richtung/Sens	Location/Zona Ort/Lieu	Tensile: Temp. °C	Yeld-str. Snervamento streck-gren Limite elast. Rp 0,2 Mpa Min	Yeld-str. Rp 0,2 Mpa Max	Ult.tens.str. Rottura Zugfestig. Rupture Rm Mpa Min.	Rm Mpa Max	Elong./Allung. Dehn/Allong. A% Min.	Red.of area/Str. Einschn./Stric. Z% Min.	Impact Test: Temp. °C	Notch	Impact energy Energia di Rottura Schlagarbeit/Energie de rupture J Singles Val.	Averag	Lateral exp. Esp.laterale Seiten ausderung Exp.latérale mm Min.	Shear Area Area duttile Bruch Flache Cisaillement % Min.	HB 10/3000 Min.	Max	Note
Requirements	Tr.	--	20	> 250		485÷655		22	30	-46	KV	20	27	--	--	147÷200		
T. 237	Tr.	--	20	300		505		28	60	-46	KV	48-50-47	48	--	--	150-150-152		N+T
T. 237	Tr.	--	20	294		497		30	62	-46	KV	52-50-51	51	--	--	150-150-150		MIN. SPWHT
T. 237	Tr.	--	20	289		490		31	64	-46	KV	50-53-55	53	--	--	148-148-150		MAX.SPWHT

SIMULATED HEAT TREATMENT OF SPECIMENS

	HEATING RATE	HOLD TEMP. AND TIME	COOLING RATE
MIN. SPWHT	300°C ↗ 56°C/h÷75°C/h	610°C X 3 hrs	56°C/h÷75°C/h ↘ 300°C
MAX. SPWHT	300°C ↗ 56°C/h÷75°C/h	610°C X 12 hrs	56°C/h÷75°C/h ↘ 300°C

Note:

Conforming ■ Non-conforming □

Quality Control	Date	Inspection Authority
FORGIA DI OSPIATE SRL Q.C. Dept. S. Filippelli	29/03/2024	BREMBANA & ROLLE S.p.A. QCM - M. GAZLI REVIEWED / ACCEPTED 3 APR 2024

FORGIA DI OSPIATE

Forgia di Ospiate s.r.l.

Via Eugenio Villoresi, 28/30 - 20021 Bollate (Mi) - Italy
www.forgiadiospiate.it - info@forgiadiospiate.it

Cert. No. 13

Inspection Certificate EN 10204 Type 3.1

Certificate n°	24_0066_01	**Customer**	Brembana & Rolle	**Enclosure**	3
Certificato / Werksz. / Certificat		Cliente / Besteller / Client		Allegato / Annex / Anlage	
Order	23096-ODA24-000304 - Rev.1 dtd. 02/02/2024	**Insp. Standard**	ASME SA350 LF2 Cl.1 ASME II Part.A Ed.2021 + 23096-EMRS-201 Rev.0	**Heat Treat.**	N+T
Ordine / Bestellung / Commande		Specifiche di collaudo / Anforderungen / Controle suivant normes		Tratt. Term. / Warmebehan / Trait. Term	
FDO Job n°	240066	**Test n°**	T. 237	**Heat n°**	T36272
Commessa / Werks / Réf.		Prova / Pruf / Essias		Colata / Schmelze / Coulee	

Ultrasonic Testing

Controllo con ultrasuoni / Ultraschallprufung / Controle par ultrasons

Applied Specification

CONTROL METHOD - Metodo di controllo - Steurevrfahren - Procédé commande

Acceptance Criteria:	Section V-SA-388+ASME VIII Div. 2 § 3.3.4	**Surface Condition:**	Pre-machined
Criteri d'accettazione / Annahmekriterien / Critères d'acceptation		Condizione superficiale / Oberflachenzustand / Etat de surface	
Apparatus Type:	Krautkramer USM36	**Coupling:**	Cellulose
Strumentazione / Ausrüstung / Equipement		Accoppiamento / Kupplung / couplage	
Control method:	Section V-SA-388+ASME VIII Div. 2 § 3.3.4	**Calibration:**	Section V-SA-388+ASME VIII Div. 2 § 3.3.4
Metodo di controllo / Steuerverfahren / Méthode de contrôle		Taratura / Justierung / Tarage	

TEST PARAMETERS - Parametri di prova - Testparameter - Paramètres de test

Type	Probe N°	Frequency [MHz]	Dimensions [mm]	Angle [deg]	Position	Registration limit [mm / %]	Calibration sett (db)	Inspection Sett [db]
P 25-2	H704	2	Ø 24	0°	--	--	//	//
P 25-2	H704	2	Ø 24	0°	--	--	//	//

*The provided sketch is indicative only, it doesn't correspond to actual dimentions of piece.

Test Results Risultati prova Testergebnisse Résultats des tests	**Ultrasonic inspection carried out according to Section V-SA-388+ASME VIII Div. 2 § 3.3.4** **Acceptance Section V-SA-388+ASME VIII Div. 2 § 3.3.4** **No indication to report. Positive results.**

Note:

Conforming ■ Non-conforming □

Quality Control	Date	Inspection Authority
FORGIA DI OSPIATE SRL Q.C.Dept. M. CIANNI	29/03/2024	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED 3 APR 2024

FORGIA DI OSPIATE

Forgia di Ospiate s.r.l.

Via Eugenio Villoresi, 28/30 - 20021 Bollate (Mi) - Italy
www.forgiadiospiate.it - info@forgiadiospiate.it

Cert. No. 13

Inspection Certificate EN 10204 Type 3.1

Certificate n° Certificato / Werksz. / Certificat	22_0417_01 Rev.1	**Customer** Cliente / Besteller / Client	VRV	**Enclosure** Allegato / Annex / Anlage	4
Order Ordine / Bestellung / Commande	3089879 dtd. 06/09/2022	**Items** Posizioni / Poste	10	**Heat Treat.** Tratt. Term. / Warmebehan / Trait. Term	N+T
FDB Job n° Commessa / Werks / Réf.	22_0417	**Test n°** Prova / Pruf / Essias	T. 237	**Heat n°** Colata / Schmelze / Coulee	T62159

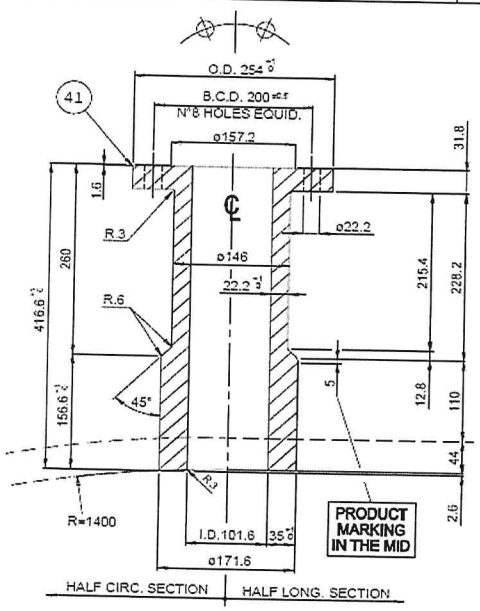
Visual & Dimensional examination

Indagine visiva/ Visuelle Umfrage / Relevé visuel

Applied Specification Specifiche applicate Anforderungen Controle suivant normes

TEST PARAMETERS - Parametri di prova - Testparameter - Paramètres de test

Acceptance Criteria: Criteri d'accettazione Annahmekriterien Critères d'acceptation	ASME V Art.9 - Free from visual difect	**Surface Condition:** Condizione superficiale Oberflachenzustand Etat de surface	Rough machined ≤ 12.5 µm
Type of examination Tipo di esame Art der Prüfung Type d'examen	Direct	**Light Intensity:** Intensità luce Lichtintensität Intensité de la lumière	≥ 1000 lux



"4N" REINF. NOZZLE FLANGE DETAIL

MISSING DIMENSIONS, DRILLING AND TOLERANCE AS PER FLANGE 4"-300# IN ACCORDANCE WITH ANSI/ASME B16.5

Pos.	Ø 254	Ø 101,6	Ø 171,6	R1400	R3	1,6	N°8 Ø 22,2 at Ø 200	156,6	260	31,8
10-1	Ø 254,1	Ø 101,5	Ø 171,7	R1400	R3	1,6	Ø 22,2	156,8	260	31,8
10-2	Ø 254,2	Ø 101,5	Ø 171,7	R1400	R3	1,6	Ø 22,2	156,8	260	31,8
10-3	Ø 254,1	Ø 101,5	Ø 171,6	R1400	R3	1,6	Ø 22,2	156,7	260	31,8
10-4	Ø 254,2	Ø 101,5	Ø 171,7	R1400	R3	1,6	Ø 22,2	156,7	260	31,8
10-5	Ø 254,2	Ø 101,5	Ø 171,7	R1400	R3	1,6	Ø 22,2	157,8	260	31,8
10-6	Ø 254,2	Ø 101,5	Ø 171,7	R1400	R3	1,6	Ø 22,2	157,7	260	1,8

Test Results Risultati prova Testergebnisse Résultats des tests: **Free of foreign matters, burs, machining tears, discoloration or other conform to drawing indications** — **Dimensions**

Note:

Ra 3.2/6.3µm: Conform to drawing

Conforming ■ Non-conforming □

Quality Control	Date	Inspection Authority
FORGIA DI OSPIATE SRL Q.C Dept. S. Filippelli	29/03/2024	BREMBANA & ROLLES S.p.A. QCD - M. GALLI REVIEWED / ACCEPTED 3 APR 2024

FORGIA DI OSPIATE

Forgia di Ospiate s.r.l.

Via Eugenio Villoresi, 28/30 - 20021 Bollate (Mi) - Italy
www.forgiadiospiate.it - info@forgiadiospiate.it

Cert. No. 13

Inspection Certificate EN 10204 Type 3.1

Certificate n° Certificato / Werksz. / Certificat	22_0417_01 Rev.1	**Customer** Cliente / Besteller / Client	VRV	**Enclosure** Allegato / Annex / Anlage	4
Order Ordine / Bestellung / Commande	3089879 dtd. 06/09/2022	**Items** Posizioni / Poste	30	**Heat Treat.** Tratt. Term. / Warmebehan / Trait. Term	N+T
FDB Job n° Commessa / Werks / Réf.	22_0417	**Test n°** Prova / Pruf / Essias	T. 237	**Heat n°** Colata / Schmelze / Coulee	T62159

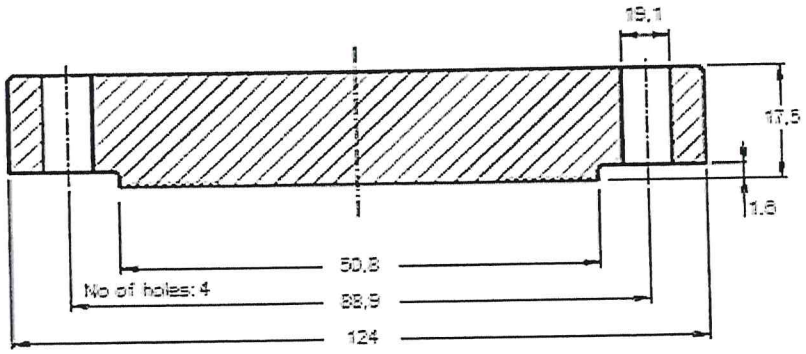
Visual & Dimensional examination

Indagine visiva/ Visuelle Umfrage / Relevé visuel

Applied Specification Specifiche applicate Anforderungen Controle suivant normes

TEST PARAMETERS - Parametri di prova - Testparameter - Paramètres de test

Acceptance Criteria: Criteri d'accettazione Annahmekriterien Critères d'acceptation	ASME V Art.9 - Free from visual difect	**Surface Condition:** Condizione superficiale Oberflachenzustand Etat de surface	Rough machined ≤ 12.5 µm
Type of examination Tipo di esame Art der Prüfung Type d'examen	Direct	**Light Intensity:** Intensità luce Lichtintensität Intensité de la lumière	≥ 1000 lux



Pos.	Ø 124	Ø 50,8	1,6	17,5			N°4 Ø 19,1 - Ø 88,9			
20-1	Ø 124,1	Ø 50,9	1,6	17,6			Ø 19,1			
20-2	Ø 124,2	Ø 50,9	1,6	17,6			Ø 19,1			
20-4	Ø 124,1	Ø 50,8	1,5	17,7			Ø 19,1			
20-4	Ø 124,1	Ø 50,9	1,6	17,6			Ø 19,1			
20-5	Ø 124,2	Ø 50,9	1,6	17,6			Ø 19,1			
20-6	Ø 124,2	Ø 50,8	1,6	17,6			Ø 19,1			

Test Results Risultati prova Testergebnisse Résultats des tests

Free of foreign matters, burs, machining tears, discoloration or other — **Dimensions conform to drawing indications**

Note:

Ra 3.2/6.3µm: Conform to drawing

Conforming ■ Non-conforming □

Quality Control	Date	Inspection Authority
FORGIA DI OSPIATE SRL Q.C Dept. S. Filippelli	29/03/2024	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED 3 APR 2024

2264

PAGE 1 SUPERSEDED FROM PAG. 2. THE CERTIFICATE STARTS FROM PAG.2

A

Cert. No. 14

ILSENBURGER GROBBLECH
Ein Unternehmen der Salzgitter Gruppe

Inspection certificate 3.1/3.1.B
Certificato Collaudo Materiali 3.1/3.1.B
DIN EN 10204
(A02)

No./N° (A03) 478535
Page/Pag 2/7
Data/Data 18.05.2007

No. (A07) Best.-Nr. : 14
Customer Rolla Traverso
Destinatario I-16153 GENOVA
(A06)

Product Heavy plate
Prodotto Lamiere laminate a caldo
(B01)

Works order No. 0000022812
N° d'ordine
(A08)
Inspection WS
Collaudo
(A05)

Steel grade and terms of delivery SA/ A 516 Gr. 70 MT LTV
Condizioni di materia e consegna SA/ A 516M Gr. 485 MT LTV
(B02-B03) ASME SA 516, SA 20
ASTM A 516- 00/04, A 20- 00/04
ASME SECT. II Part A ed.2004,add.2005
DIN EN 10029 C 10/91

Material data / Dati del materiale (B01-B99)

Item Pos.	Quantity Numero (B08)	Product No. N° prodotto (B07)	Heat No. N° Colata (B07)	Cond. of delivery Stato di fornitura (B04)	Thickness x Width x Length Spessore x Largh. x Lunghezza (B03-B11) mm x mm x mm
22	1	473388 1	62879	N	40,00 x 2500,0 x 12000
22	1	473392 1	62879	N	40,00 x 2500,0 x 12000
23	1	473611 1	62879	N	40,00 x 3000,0 x 12000
23	1	473612 1	13706	N	40,00 x 3000,0 x 12000
23	1	473613 1	13706	N	40,00 x 3000,0 x 12000
23	1	473614 1	62879	N	40,00 x 3000,0 x 12000
30	1	474730 1	13706	N	70,00 x 2500,0 x 12000
30	1	474731 1	13705	N	70,00 x 2500,0 x 12000
30	1	474732 1	13706	N	70,00 x 2500,0 x 12000
30	1	474733 1	13707	N	70,00 x 2500,0 x 12000

01	1	Weight	2.002	kgs
02	1	Peso	2.532	kg
03	3	(B12)	9.072	
04	5		14.944	
05	4		14.352	
07	4		13.904	
08	5		21.015	
10	1		3.986	
13	1		4.976	
14	2		12.953	
20	3		30.764	
22	2		19.521	
23	4		46.613	
30	4		67.754	
Σ	40		264.388	

N: normalized / normalizato

ROLLA, TRAVERSO & STORACE

Dimensional check and visual examination of the surface condition:
without objection

Controllo delle dimensioni e controllo a vista della superfice: soddisfacente

BREMBANA S.r.l.
Q.C.Ni. A. TOSTO
REVIEWED / ACCEPTED
16/7/07

We hereby certify that the delivered material complies with the terms of the order.
Viene confermato, che la consegna corrisponde alle richieste delle condizioni di consegna.
(Z01)
QM-System: Certification as per ISO 9001 since 28 February 1990

Trademark
Marchio del produttore
(A04)

Ilsenburger Grobblech GmbH
Veckenstedter Weg 10
D-38871 Ilsenburg
(A01)

Inspection Stamp
Timbro dell'ispettore
(Z03)

Inspection Representative
Perito officina
(Z02)

Cyron

Cert No. 14

ILSENBURGER GROBBLECH
Ein Unternehmen der Salzgitter Gruppe

Inspection certificate 3.1/3.1.B
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DIN EN 10204
(A02)

No./N° (A03) 478535
Page/Pag 3/7
Date/Data 18.05.2007

No. (A07) Best.-Nr. : 14
Customer Rolla Traverso
Destinatario I-16153 GENOVA
(A06)

Product Heavy plate
Prodotto Lamiere laminate a caldo
(B01)

Works order No. 0000022812
N° d'ordine
(A08)
Inspection WS
Collaudo
(A05)

Steel grade and terms of delivery SA/ A 516 Gr. 70 MT LTV
Condizioni di materia e consegna SA/ A 516M Gr. 485 MT LTV
(B02-B03) ASME SA 516, SA 20
ASTM A 516- 00/04, A 20- 00/04
ASME SECT. II Part A ed.2004,add.2005
DIN EN 10029 C 10/91

Ladle analysis / Analisi di colata (C70-C99)

Manufacturer standard / Indicazioni del fornitore

Heat No. N° Colata (B07)	C % ≤0,22	Si % 0,15 - 0,40	Mn % 0,85 - 1,20	P % ≤0,035	S % ≤0,035	N %	Al %	Cu % ≤0,40	Cr % ≤0,30	Ni % ≤0,40
13705	0,18	0,35	1,14	0,010	0,003	0,004	0,041	0,18	0,03	0,24
13706	0,18	0,34	1,16	0,013	0,002	0,003	0,038	0,21	0,03	0,25
13707	0,18	0,32	1,13	0,014	0,003	0,004	0,032	0,19	0,04	0,21
35234	0,18	0,35	1,14	0,011	0,002	0,003	0,041	0,20	0,04	0,24
62879	0,18	0,34	1,12	0,009	0,001	0,004	0,033	0,19	0,04	0,25
62938	0,17	0,32	1,11	0,013	0,001	0,003	0,033	0,19	0,04	0,25
62939	0,18	0,34	1,15	0,014	0,005	0,003	0,033	0,21	0,04	0,24
62940	0,18	0,33	1,12	0,012	0,003	0,002	0,035	0,19	0,04	0,25

Heat No. N° Colata (B07)	Mo % ≤0,12	V % ≤0,03	Nb % ≤0,02	Ti % ≤0,03	Cr+Mo %	EV1 1) %	EV2 2) %	EV3 3) % ≤0,45	C+Mn/6 %	
13705	0,01	0,00	0,02	0,00	0,04	0,46	0,02	0,41	0,37	
13706	0,00	0,00	0,02	0,00	0,03	0,49	0,02	0,41	0,37	
13707	0,01	0,01	0,02	0,00	0,05	0,45	0,03	0,41	0,37	
35234	0,01	0,00	0,02	0,01	0,05	0,49	0,03	0,41	0,37	
62879	0,01	0,00	0,02	0,00	0,05	0,49	0,02	0,41	0,37	
62938	0,00	0,01	0,02	0,00	0,04	0,48	0,03	0,39	0,36	
62939	0,01	0,00	0,02	0,00	0,05	0,50	0,02	0,41	0,37	
62940	0,01	0,00	0,02	0,00	0,05	0,49	0,02	0,41	0,37	

1) EV1 : Cr+Cu+Mo+Ni
2) EV2 : V+Nb+Ti
3) EV3 : CEV=C+Mn/6+Mo/5+Ni/15+Cr/5+V/5+Cu/15

Steelmaking process: Basic oxygen process
Procedimento di elaborazione: Proc. ossigeno
(C70)

ROLLA, TRAVERSO & STORACE

BREMBANA S.r.l.
Q.C.M. - N. TOSTO
REVIEWED/ACCEPTED
16/7/07

We hereby certify that the delivered material complies with the terms of the order.
Viene confermato, che la consegna corrisponde alle richieste delle condizioni di consegna.
(Z01)
QM-System: Certification as per ISO 9001 since 28 February 1990

Trademark
Marchio del produttore
(A04)

Ilsenburger Grobblech GmbH
Veckenstedter Weg 10
D-38871 Ilsenburg
(A01)

Inspection Stamp
Timbro dell'ispettore
(Z03)

Inspection Representative
Perito officina
(Z02)

Cyron

Cert. No. 14

ILSENBURGER GROBBLECH

Ein Unternehmen der Salzgitter Gruppe

Inspection certificate 3.1/3.1.B
Certificato Collaudo Materiali 3.1/3.1.B
DIN EN 10204
(A02)

No./N° (A03) 478535
Page/Pag 4/7
Date/Data 18.05.2007

No. (A07) Best.-Nr. : 14
Customer Rolla Traverso
Destinatario I-16153 GENOVA
(A06)

Product Heavy plate
Prodotto Lamiere laminate a caldo
(B01)

Works order No. 0000022812
N° d'ordine
(A08)
Inspection WS
Collaudo
(A05)

Steel grade and terms of delivery SA/ A 516 Gr. 70 MT LTV
Condizioni di materia e consegna SA/ A 516M Gr. 485 MT LTV
(B02-B03) ASME SA 516, SA 20
ASTM A 516- 00/04, A 20- 00/04
ASME SECT. II Part A ed.2004,add.2005
DIN EN 10029 C 10/91

ROLLA TRAVERSO & STORACE

Tensile test / Prova di trazione (C10-C29)

Specimen No. N° di provetta (C00)	Heat No. N° Colata (B07)	Location Zone (C01) 1) 2) 3)	Direct. Senso (C02) 4)	Cond. Stato (B05) 5)	Type Tipo (C10) 6)	Yield strength Snervamento (C11) Rp0,2 N/mm2 ≥260	Tensile strength Carico di rottura (C12) Rm N/mm2 485-620	Elongation Allungamento (C13) 8in % ≥17	Elongation Allungamento (C13) 2in % ≥21	
473388	62879	K6G	Q	N	P	359	521	29		
473392	62879	K6G	Q	N	P	359	520	31		
473546	13705	K6G	Q	N	P	382	543	28		
473611	62879	K6G	Q	N	P	358	527	31		
473612	13706	K6G	Q	N	P	358	530	30		
473613	13706	K6G	Q	N	P	362	524	24		
473614	62879	K6G	Q	N	P	361	524	24		
474300	35234	K6G	Q	N	P	391	550	21		
474309	62939	K6G	Q	N	P	395	549	22		
474617	62939	K6G	Q	N	P	408	546	22		
474618	35234	K6G	Q	N	P	391	551	22		
474622	13706	K6G	Q	N	P	383	539	28		
474623	13706	K6G	Q	N	P	378	537	25		
474626	13705	K6G	Q	N	P	372	533	31		
474627	13705	K6G	Q	N	P	362	532	25		
474628	13705	K6G	Q	N	P	364	528	26		
474729	35234	K6G	Q	N	P	390	548	26		
474730	13706	K6V	Q	N	C	349	528		34	
474731	13705	K6V	Q	N	C	353	520		32	
474732	13706	K6V	Q	N	C	347	521		30	
474733	13707	K6V	Q	N	C	349	528		34	
474854	35234	K6G	Q	N	P	388	544	28		
474855	35234	K6G	Q	N	P	397	547	24		
475069	35234	K6G	Q	N	P	409	557	23		
475070	62940	K6G	Q	N	P	394	548	26		
475186	62940	K6G	Q	N	P	395	550	25		
475187	35234	K6G	Q	N	P	397	549	24		
475205	62940	K6G	Q	N	P	408	552	21		
475323	62938	K6G	Q	N	P	398	546	20		
476005	35234	K6G	Q	N	P	401	560	22		

BREMBANA S.r.l.
Q.C.M. - N. TOSTO
REVIEWED/ACCERTED
16/7/07

1) K: Top / Testa
2) B: 1/6 Width / 1/6 Largh.
3) G: Thickness of product / Spessore di prodotto
V: 1/4 Thickness / 1/4 Spessore
4) Q: transversal / trasversale
5) N: normalized / normalizato
6) C: cylindric / cilindrico
P: prismatic / prismatico

We hereby certify that the delivered material complies with the terms of the order.
Viene conformato, che la consegna corrisponde alle richiestre delle condizioni di consegna.
(Z01)
QM-System: Certification as per ISO 9001 since 28 February 1990

Trademark
Marchio del produttore
(A04)

Ilsenburger Grobblech GmbH
Veckenstedter Weg 10
D-38871 Ilsenburg
(A01)

Inspection Stamp
Timbro dell'ispettore
(Z03)

Inspection Representative
Perito officina
(Z02)

Cyron

Cert. No. 14-

ILSENBURGER GROBBLECH

Ein Unternehmen der Salzgitter Gruppe

Inspection certificate 3.1/3.1.B
Certificato Collaudo Materiali 3.1/3.1.B
DIN EN 10204
(A02)

No./N° (A03) 478535
Page/Pag. 5/7
Date/Data 18.05.2007

No. (A07) Best.-Nr.. : 14
Customer Rolla Traverso
Destinatario I-16153 GENOVA
(A06)

Product Heavy plate
Prodotto Lamiere laminate a caldo
(B01)

Works order No. 0000022812
N° d'ordine
(A08)
Inspection WS
Collaudo
(A05)

Steel grade and terms of delivery SA/ A 516 Gr. 70 MT LTV
Condizioni di materia e consegna SA/ A 516M Gr. 485 MT LTV
(B02-B03) ASME SA 516, SA 20
ASTM A 516- 00/04, A 20- 00/04
ASME SECT. II Part A ed.2004,add.2005
DIN EN 10029 C 10/91

ROLLA, TRAVERSO & STORACE

Tensile test / Prova di trazione (C10-C29)

Specimen No. N° di provetta (C00)	Heat No. N° Colata (B07)	Location Zona (C01) 1) 2) 3)	Direct. Senso (C02) 4)	Cond. Stato (B05) 5)	Type Tipo (C10) 6)	Yield strength Snervamento (C11) Rp0,2 N/mm2 ≥ 250	Tensile strength Carico di rottura (C12) Rm N/mm2 485 - 620	Elongation Allungamento (C13) 8in % ≥17	Elongation Allungamento (C13) 2in % ≥21	
476006	35234	K6G	Q	N	P	411	561	20		
476670	35234	K6G	Q	N	P	408	555	19		

1) K: Top / Testa
2) 6: 1/6 Width / 1/6 Largh.
3) G: Thickness of product / Spessore di prodotto
V: 1/4 Thickness / 1/4 Spessore
4) Q: transversal / trasversale
5) N: normalized / normalizzato
6) C: cylindric / cilindrico
P: prismatic / prismatico

Impact test / Prova di resilienza (C40-C49)

Specimen No. N° di provetta (C00)	Heat No. N° Colata (B07)	Location Zona (C01) 1) 2) 3)	Direct. Senso (C02) 4)	Cond. Stato (B05) 5)	Type of specimen Tipo di provette (C40-C41)	Temperature Temperatura (C03) °C	Impact energy Energia di rottura (C42-C43) 1 J	2	3	MW 6) J
473388	62879	K6V	L	N	Charpy V-notch	-040	177	181	120	159
473392	62879	K6V	L	N	Charpy V-notch	-040	140	151	139	143
473546	13705	K6V	L	N	Charpy V-notch	-046	117	124	133	125
473611	62879	K6V	L	N	Charpy V-notch	-040	150	167	140	152
473612	13706	K6V	L	N	Charpy V-notch	-040	168	177	105	150
473613	13706	K6V	L	N	Charpy V-notch	-040	146	119	154	140
473614	62879	K6V	L	N	Charpy V-notch	-040	168	132	167	156
474300	35234	K6V	L	N	Charpy V-notch	-046	146	140	143	143
474309	62939	K6V	L	N	Charpy V-notch	-046	101	98	91	97
474617	62939	K6V	L	N	Charpy V-notch	-046	124	139	145	136
474618	35234	K6V	L	N	Charpy V-notch	-046	140	111	144	132
474622	13706	K6V	L	N	Charpy V-notch	-046	105	117	130	117

1) K: Top / Testa
2) 6: 1/6 Width / 1/6 Largh.
3) O: near surface / vicino alla superfice
V: 1/4 Thickness / 1/4 Spessore
4) L: longitudinal / longitudinale
5) N: normalized / normalizzato
6) MW: Average / Valore medio

We hereby certify that the delivered material complies with the terms of the order.
Viene confermato, che la consegna corrisponde alle richieste delle condizioni di consegna.
(Z01)
QM-System: Certification as per ISO 9001 since 28 February 1990

BREMBANA S.r.l.
Q.C.M. M. TOSTO
REVIEWED/ACCEPTED
16/7/07

Trademark
Marchio del produttore
(A04)

Ilsenburger Grobblech GmbH
Veckenstedter Weg 10
D-38871 Ilsenburg
(A01)

Inspection Stamp
Timbro dell'ispettore
(Z03)

Inspection Representative
Perito officina
(Z02)

Cyron

Cert. No. 14

ILSENBURGER GROBBLECH
Ein Unternehmen der Salzgitter Gruppe

Inspection certificate 3.1/3.1.B
Certificato Collaudo Materiali 3.1/3.1.B
DIN EN 10204
(A02)

No./N° (A03) 478535
Page/Pag 6/7
Data/Data 18.05.2007

No. (A07) Best.-Nr. : 14
Customer Rolla Traverso
Destinatario I-16153 GENOVA
(A06)

Product Heavy plate
Prodotto Lamiere laminate a caldo
(B01)

Works order No. 0000022812
N° d'ordine
(A08)
Inspection WS
Collaudo
(A05)

Steel grade and terms of delivery SA/ A 516 Gr. 70 MT LTV
Condizioni di materia e consegna SA/ A 516M Gr. 485 MT LTV
(B02-B03) ASME SA 516, SA 20
ASTM A 516- 00/04, A 20- 00/04
ASME SECT. II Part A ed.2004,add.2005
DIN EN 10029 C 10/91

ROLLA TRAVERSO & STORACE

Impact test / Prova di resilienza (C40-C49)

Specimen No. N° di provetta (C00)	Heat No. N° Colata (B07)	Location Zona (C01) 1) 2) 3)	Direct. Senso (C02) 4)	Cond. Stato (B05) 5)	Type of specimen Tipo di provetta (C40-C41)	Temperature Temperatura (C03) °C	Impact energy Energia di rottura (C42-C43) 1 J	2	3	MW 6) J
474623	13706	K6V	L	N	Charpy V-notch	-046	134	108	138	127
474626	13705	K6V	L	N	Charpy V-notch	-040	122	147	139	136
474627	13705	K6V	L	N	Charpy V-notch	-040	155	171	149	158
474628	13705	K6V	L	N	Charpy V-notch	-040	144	151	104	133
474729	35234	K6V	L	N	Charpy V-notch	-046	121	142	157	140
474730	13706	K6V	L	N	Charpy V-notch	-035	88	102	69	86
474731	13705	K6V	L	N	Charpy V-notch	-035	74	86	93	84
474732	13706	K6V	L	N	Charpy V-notch	-035	102	47	81	77
474733	13707	K6V	L	N	Charpy V-notch	-035	87	102	74	88
474854	35234	K6V	L	N	Charpy V-notch	-046	158	142	131	144
474855	35234	K6V	L	N	Charpy V-notch	-046	128	68	95	97
475069	35234	K6V	L	N	Charpy V-notch	-046	108	143	150	134
475070	62940	K6V	L	N	Charpy V-notch	-046	155	102	119	125
475186	62940	K6V	L	N	Charpy V-notch	-046	113	95	107	105
475187	35234	K6V	L	N	Charpy V-notch	-046	117	141	80	113
475205	62940	K6O	L	N	Charpy V-notch	-046	66	81	99	82
475323	62938	K6O	L	N	Charpy V-notch	-046	89	135	103	109
476005	35234	K6O	L	N	Charpy V-notch	-046	141	105	122	123
476006	35234	K6O	L	N	Charpy V-notch	-046	95	96	103	98
476670	35234	K6O	L	N	Charpy V-notch	-046	116	128	141	128

1) K: Top / Testa
2) B: 1/6 Width / 1/6 Largh.
3) O: near surface / vicino alla superfice
V: 1/4 Thickness / 1/4 Spessore
4) L: longitudinal / longitudinale
5) N: normalized / normalizato
6) MW: Average / Valore medio

Specimen size:
5,0 x 10 x 55 mm (from 5,00 mm up to 8,99 mm plate thickness)
7,5 x 10 x 55 mm (from 9,00 mm to 11,99 mm plate thickness)
10 x 10 x 55 mm (from 12,00 mm plate thickness)

dimensioni delle provette:
5,0 x 10 x 55mm (von 5,00mm bis 8,99mm spessore lamiere)
7,5 x 10 x 55mm (von 9,00mm bis 11,99mm spessore lamiere)
10 x 10 x 55mm (ab 12,00 mm spessore lamiere)

BREMBANA S.r.l.
Q.C.M. - N. TOSTO
REVIEWED/ACCERTED
16/7/07

We hereby certify that the delivered material complies with the terms of the order.
Viene confermato, che la consegna corrisponde alle richieste delle condizioni di consegna.
(Z01)
QM-System: Certification as per ISO 9001 since 28 February 1990

Trademark
Marchio del produttore
(A04)

Ilsenburger Grobblech GmbH
Veckensstedter Weg 10
D-38871 Ilsenburg
(A01)

Inspection Stamp
Timbro dell'ispettore
(Z03)

Inspection Representative
Perito officina
(Z02)

Cyron

Cert. No. 14

ILSENBURGER GROBBLECH
Ein Unternehmen der Salzgitter Gruppe

Inspection certificate 3.1/3.1.B Certificato Collaudo Materiali 3.1/3.1.B DIN EN 10204 (A02)		No./N° (A03) Page/Pag Date/Data	478535 7/7 18.05.2007
No. (A07) Customer Destinatario (A05)	Best.-Nr. : 14 Rolla Traverso I-16153 GENOVA		
Product Prodotto (B01)	Heavy plate Lamiere laminate a caldo	Works order No. N° d'ordine (A08)	0000022812
Steel grade and terms of delivery Condizioni di materia e consegna (B02-B03)	SA/ A 516 Gr. 70 MT LTV SA/ A 516M Gr. 485 MT LTV ASME SA 516, SA 20 ASTM A 516- 00/04, A 20- 00/04 ASME SECT. II Part A ed.2004,add.2005 DIN EN 10029 C 10/91	Inspection Collaudo (A05)	WS

Heat treatment: Temperature : 910 +/-10°C
Soaking time: 30 min/inch
Cooling in still air

Trattamento termico: temperatura 910+/-10°C
Tempo di mantenimento: 30 min/inch
Raffreddamento:aria ferma

ROLLA TRAVERSO & STORACE

BREMBANA S.r.l.
Q.C.M. - N. TOSTO
REVIEWED/ACCEPTED
16/7/07

We hereby certify that the delivered material complies with the terms of the order.
Viene confermato, che la consegna corrisponde alle richieste delle condizioni di consegna.
(Z01)
QM-System: Certification as per ISO 9001 since 28 February 1990

Trademark
Marchio del produttore
(A04)

Ilsenburger Grobblech GmbH
Veckenstedter Weg 10
D-38871 Ilsenburg
(A01)

Inspection Stamp
Timbra dell'ispettore
(Z03)

Inspection Representative
Perito officina
(Z02)

Cyron

4267-001014 B POS. 10

Cert. No. 15

CERTIFICATO DI CONTROLLO 3.1 / INSPECTION CERTIFICATE 3.1 - EN 10204:2004

METINVEST
METINVEST TRAMETAL SPA

MANNI SIPRE STEEL ENGINEERING
UFFICIO CERTIFICATI - COPIA INFORMATICA CONFORME ORIGINALE
NS. CONFERMA: 0000307320
RIF. ORDINE: ORD. 4267-ODA22-0010
DDT: 0000117023
PLACCA/COLATA: 1TBA530105A

(A) PROCESSO DI ELABORAZIONE / STEELMAKING PROCESS: E = ELECTRIC ; BO = B.
(B) STATO DI FORNITURA / DELIVERY CONDITION: AR = GREZZO DI LAMINAZIONE / A
N° = LAMINAZIONE A TEMPERATURA CONTROLLATA / NORMALIZING ROLLING ;
N = NORMALIZZATO / NORMALIZED at 910°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
R = RICOTTO / ANNEALED;
N+R = NORMALIZZATO + RINVENUTO / NORMALIZED + TEMPERED
(C) TRATTAMENTO TERMICO DEL CAMPIONE / HEAT TREATMENT OF SAMPLE:
N = 910°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
R = 650°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
(D) Ceq_1 = C + Mn/6 ; Ceq_2 = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 ;
Pcm = C + Si/30 + (Mn + Cu + Cr)/20 + Ni/60 + Mo/15 + V/10 + B*5
(1) POSIZIONE / LOCATION: 1 = TESTA / TOP ; 2 = PIEDE / BOTTOM
(2) POSIZIONE / LOCATION: C = CUORE / 1/2 THICKNESS ; P = PELLE / SURFACE ; D = 1/4 SPESSORE / THICKNESS
(3) DIREZIONE / DIRECTION: L = LONGITUDINALE / LONGITUDINAL ; T = TRASVERSALE / TRANSVERSE
(4) FORMA DEL PROVINO / SHAPE OF TEST PIECE: P = PRISMATICO / PRISMATIC ; C = CILINDRICO / CYLINDRICAL
(5) ESITO PROVA DI PIEGA / RESULT: OK = COMPLYING ; NO = NOT COMPLYING

A01
Società per azioni con socio unico soggetta a direzione e coordinamento di Metinvest B.V
Registered office: Via XII Ottobre, 3 - 16121 Genova, Italy
Phone +39 010 5762911 - Fax +39 010 5762990
Works: Via E. Fermi, 44 - 33058 San Giorgio di Nogaro UD, Italy
Phone +39 0431 629989 - Fax +39 0431 629985
Cap. Soc. Euro 300.120.000,00 i.v.
C.F., P.IVA e Iscr. Reg. Imp. GE 05956630965 - REA 437720/GE
http://trametal.metinvestholding.com

A06 Cliente / Customer

MANNI SIPRE S.P.A.

Via Righi 7
37135 VERONA 37135 IT
VR ITALIA

A03 N° Certificato / Certificate no.	202 Data / Date
538207	25/10/2021
A08 N° Ordine Trametal / Works order	A07 N° Ordine cliente / Customer's order
32105665	OSC2110326
DDT	del / date
BOL 32119823	22/10/2021
Pratica / File no.	del / date

B06 Marcatura di prodotto / Marking of the product
LAMIERA/ORDINE/N° INFORNAMENTO/DIMENSIONI/QUALITÀ/MARCHIO DEL PRODUTTORE
PLATE/ORDER/INTERNAL N°/DIMENSIONS/STEEL GRADE/MANUFACTURER'S MARK

B01/B02/B03

Prodotto / Product	Lamiere / Hot rolled plates
Qualità / Steel grade	SA516GR70MT/LTV
Normativa / Specification	ASME

B07 ITEM	B07 LAMIERA PLATE	B07 N° INFORN. INTERNAL NUMBER	B09/B11 DIMENSIONI [mm] DIMENSIONS	B12 MASSA TEORICA [t] THEORICAL WEIGHT	B07 LOTTO BATCH NO.	C70 STEELMAKING PROCESS PROCESSO ELAB. (A)	B04 STATO FORNITURA LAMIERA (B) DELIVERY CONDITION	C00 CAMPIONE SAMPLE	B05 TRATT. CAMPIONE HEAT TREATMENT (C)	C00 CAMPIONE PWHT SAMPLE	B05 PWHT TEMPERATURA INIZIO °C BEGINNING TEMPERATURE	VELOCITA' RISCALDO C/h HEATING RATE	TEMPERATURA TRATTAMENTO °C TEMPERATURE TREATMENT	PERMANENZA Min HOLDING TIME	VELOCITA' RAFFREDDAMENTO °C/h COOLING RATE	TEMPERATURA FINE °C END TEMPERATURE	N° CICLI / CYCLES	C00 CAMPIONE Q+T SAMPLE	B05 Q+T TEMPERATURA (Q) °C TEMPERATURE	PERMANENZA (Q) Min HOLDING TIME	RAFFREDDAMENTO COOLING	TEMPERATURA (T) °C TEMPERATURE	PERMANENZA (T) Min HOLDING TIME	RAFFREDDAMENTO COOLING
37	1TBA530105A	1737587	15.00X3000X12000	4,24	710324	BO	N	GN506																	

C71/C92 COMPOSIZIONE CHIMICA DI COLATA / HEAT CHEMICAL ANALYSIS

B07	C71	C72	C73	C74	C75	C76	C77	C78	C79	C80	C81	C82	C83	C84	C85	C86	C87	C88	C89	C90	C91
COLATA HEAT	C %	Mn %	Si %	P %	S %	Cu %	Ni %	Cr %	Mo %	Al %	V %	Nb %	Ti %	Sn %	Ca %	N %	B %	H %	Ceq1 % (D)	Ceq2 % (D)	Pcm % (D)
Ordine Min 37																					
Ordine Max 37		1,50																			
SA51670LTV Min 12.60 - 50.00		0,85	0,15																	0,43	
SA51670LTV Max 12.60 - 50.00	0,28	1,20	0,40	0,025	0,025																
1TBA53	0,17	1,46	0,20	0,018	0,002	0,040	0,020	0,040	<0.005	0,030	<0.005	0,002	<0.005	<0.005	0,0000	0,0080	<0.0005	0,0003	0,41	0,43	0,25

	PROVA DI TRAZIONE TENSILE TEST									PROVA DI RESILIENZA IMPACT TEST - CHARPY V-NOTCH TEST					PROVA DI PIEGA BEND TEST				PROVA DI DUREZZA HARDNESS TEST				PROVA DI STRIZIONE Z% TEST	
C00		C01	C01	C02	C03	C11	C12		C13	C14	C10	C41	C02	C03	C01	C42	C43	C02	C51	C52	C50	C01	C30	C31	C32	C53	C54
CAMPIONE SAMPLE	SPESSORE LAMIERA PLATE THICKNESS	POSIZIONE (1) LOCATION	POSIZIONE (2) LOCATION	DIREZIONE (3) ORIENTATION	TEMPERATURA [°C] TEST TEMPERATURE	ReH [Mpa] YIELD STRENGTH	Rm [Mpa] TENSILE STRENGTH	ReH/Rm	A% ELONGATION	Rp 0,2 [Mpa] PROOF/YIELD STRENGTH	FORMA PROVINO (4) SHAPE OF TEST PIECE	LARGHEZZA [mm] WIDTH	DIREZIONE (3) ORIENTATION	TEMPERATURA [°C] TEST TEMPERATURE	POSIZIONE (2) LOCATION	SINGOLI VALORI [J] INDIVIDUAL VALUES	MEDIA [J] MEAN VALUE	DIREZIONE (3) ORIENTATION	MANDREL [mm]	ANGOLO [°] ANGLE	ESITO (5) RESULT	POSIZIONE (2) LOCATION	METODO TEST METHOD	SINGOLI VALORI INDIVIDUAL VALUES	MEDIA MEAN VALUE	Z% VALORE MEDIO Z% MEAN VALUE	Z% SINGOLI VALORI Z% INDIVIDUAL VALUES
ORDINE Min 37													L	-46		16	20										
SA51670LTV Min 0.00 - 20.00					20		485		17,0	260																	
SA51670LTV Max 0.00 - 20.00					20		620																				
SA51670LTV Min 0.00 - 25.00													L	-46			20										

DICHIARIAMO CHE QUANTO RIPORTATO CORRISPONDE A QUANTO RICHIESTO
COM. M. ESPOSITO
REVIEWED / ACCEPTED
JUN 20 2022

Certificate No. 15

			PROVA DI TRAZIONE TENSILE TEST									PROVA DI RESILIENZA IMPACT TEST - CHARPY V-NOTCH TEST						PROVA DI PIEGA BEND TEST				PROVA DI DUREZZA HARDNESS TEST				PROVA DI STRIZIONE Z% TEST	
C00		C01	C01	C02	C03	C11	C12		C13	C14	C10	C41	C02	C03	C01	C42	C43	C02	C51	C52	C50	C01	C30	C31	C32	C53	C54
CAMPIONE SAMPLE	SPESSORE LAMIERA PLATE THICKNESS	POSIZIONE (1) LOCATION	POSIZIONE (2) LOCATION	DIREZIONE (3) ORIENTATION	TEMPERATURA [°C] TEST TEMPERATURE	ReH [Mpa] YIELD STRENGTH	Rm [Mpa] TENSILE STRENGTH	ReH/Rm	A8" ELONGATION	Rp 0.2 [Mpa] PROOF/YIELD STRENGTH	FORMA PROVINO (4) SHAPE OF TEST PIECE	LARGHEZZA [mm] WIDTH	DIREZIONE (3) ORIENTATION	TEMPERATURA [°C] TEST TEMPERATURE	POSIZIONE (2) LOCATION	SINGOLI VALORI [J] INDIVIDUAL VALUES	MEDIA [J] MEAN VALUE	DIREZIONE (3) ORIENTATION	MANDRINO [mm] MANDREL	ANGOLO [°] ANGLE	ESITO (5) RESULT	POSIZIONE (2) LOCATION	METODO TEST METHOD	SINGOLI VALORI INDIVIDUAL VALUES	MEDIA MEAN VALUE	Z% SINGOLI VALORI Z% INDIVIDUAL VALUES	Z% VALORE MEDIO Z% MEAN VALUE
GN506	15,00	2	P	T	20		527		29,8	375	P	10,00	T	-50	P	105 77 83	88						HRC <	22			
GN506	15,00	2										10,00	T	-20	P	128 191 166	162										
GN506	15,00	2										10,00	L	-46	P	228 188 247	221										

C10

ASME SA-370 FIG. 3 AND FIG. 10 / 11 - SAMPLE TAKEN AFTER PLATE HEAT TREATMENT

Z01

ITEM		TOLLERANZA DI SPESSORE TOLERANCE ON THICKNESS	TOLLERANZE DI LARGHEZZA TOLERANCE ON WIDTH	TOLLERANZE DI LUNGHEZZA TOLERANCE ON LENGTH	CONDIZIONI SUPERFICIALI SURFACE FINISH	PLANARITÀ FLATNESS
37		-0.3 +1.3 MM	-0 +100 MM	-0 +200 MM	EN 10163/2 CL B2	EN 10029 CL. N

CERTIFICHIAMO che le lamiere elencate sono conformi alla prescrizione dell'ordine, che i controlli della marcatura, dell'aspetto superficiale e dimensionale hanno dato esito positivo.
WE CERTIFY that the above mentioned plates are consistent with the order prescriptions: marking, inspection and measurement without objection.
DICHIARIAMO CHE LE LAMIERE SONO STATE CONTROLLATE IN ACCORDO ALLA NORMATIVA VIGENTE E CHE LE RADIAZIONI IONIZZANTI NON ECCEDONO IL VALORE DEL FONDO NATURALE.
WE DECLARE THAT THE PLATES WERE CONTROLLED ACCORDING TO STANDARD AND RADIATION DO NOT EXCEED THE NATURAL RADIATION.

Z06

FULLY KILLED FINE GRAIN STEEL

HARDNESS IN ACC. TO NACE MR 0175 / ISO15156

Z07	Z03 ENTE COLLAUDO / INSPECTION BODY	Z02
PRODUCED FROM CONTINOUS CAST SLAB AND HAVE A MINIMUN REDUCTION RATIO OF 3 TO 1. ACCORDING TO ASME II PART A ED. 2017. FULLY KILLED, FINE GRAIN STEEL. Value of Mn maximun in derogation permitted up to 1.50% **Plates acc. to PED 2014/68/EU**	TIMBRO DELL'ISPETTORE STAMP OF THE INSPECTION REPRESENTATIVE	**METINVEST TRAMETAL S.p.a.** **F. Andrian** **CQ Manager**

BREMBANA & ROLLES S.r.l.
QCM - M. ESPOSITO
REVIEWED / ACCEPTED
JUN 20 2022

No. 15

QUALITY CONTROL

LAB N° 1384 L

RAPPORTO DI PROVA N. *Test Report No.*	22/1346RP02	DATA *Date*	09/09/2022	CAMPIONE N. *Sample No.*	1346B	PAGINA *Page*	1	DI *of*	3

Laboratory of Medolago, Via Roma 79 - 24030 Medolago (BG) t. +39 035 901473 e-mail info@qualitycontrolgroup.com website www.qualitycontrolgroup.com

ORDINE / *Order*	D.d.t. n. STR22-000701
Data ordine / *Order date*	01/08/2022
RIFERIMENTO / *Reference*	BG/22/050
Data riferimento / *reference order*	04/05/2022
DATA DI RICEZIONE *Reception date*	02/08/2022

CLIENTE / Customer

BREMBANA & ROLLE S.p.A.
Via Villino, 1
24030 Valbrembo (BG)

DATA DI ACCETTAZIONE *Acceptance date* 03/08/2022

OGGETTO **Subject** Test su lamiera *Test on plate*

ELENCO DELLE PROVE / List of tests	Metodo / *Method*	Saggio / *Test*	Pagina / *Sheet*
Prova di resilienza su materiali metallici / *Charpy impact test on metallic materials*	ASTM A370-21	1346B	2
Prova di durezza su materiali metallici / *Hardness test on metallic materials*	ASTM E10-18	1346B	3
-	-	-	-

L'accreditamento è legato esclusivamente alle prove incluse nell'elenco allegato al certificato n° 1384L disponibile sul sito web www.accredia.it. Le prove non accreditate da Accredia sono caratterizzate dall'asterisco (*) / *The accreditation is related solely to the tests included in the list annexed to the certificate n° 1384L available on the website www.accredia.it. The tests not accredited by Accredia are characterized by asterisk (*)*

Alessandro Donadoni — Vice Direttore Tecnico / Technical Deputy Manager

La firma digitale o la firma autografa sul rapporto certifica la sua validità. L'originalità del rapporto è garantita dalla tracciabilità nel sistema PEC utilizzata per la sua consegna al cliente / *The digital or hand-written signature on report certifies its validity. The originality of the relationship is guaranteed by the traceability of the PEC system used for delivery to customer.*
La regola decisionale utilizzata dal laboratorio quando fornisce dichiarazioni di conformità a norme o specifiche è riportata nel sito web www.qualitycontrolgroup.com / *The decision rule used by the laboratory when providing declarations of compliance with standards or specifications is shown in www.qualitycontrolgroup.com website.*
Il campionamento è effettuato dal cliente e non è oggetto di accreditamento; i risultati delle prove si riferiscono al campione così come ricevuto / *Sampling is carried out by the customer and is not subject to accreditation; test results refer to the sample as received.*
Il laboratorio è responsabile di ogni informazione riportata nel presente rapporto di prova ad eccezione delle informazioni fornite dal cliente rispetto alle quali declina ogni responsabilità / *The laboratory is responsible for any information reported in this report except for the information provided by the customer with the respect to which it disclaims any responsibility*

CARATTERISTICHE DEL CAMPIONE DICHIARATE DAL CLIENTE / features of sample declared by customer

	Descrizione *Description*	Dimensioni *Dimension*	Fornitore *Supplier*	Colata/Lotto *Heat/Lot*	Certificato *Certificate*	Data *Date*
Parent material	ASME SA516 gr.70	Thk. 15 mm	METINVEST	1TBA53 1TBA530105A	538207	25/10/21

BG/22/050 – JOB. 4267

Other features Specimen from Plate

Test according to specification 4267MRS101 rev.0

BREMBANA & ROLLE S.p.A.
VALBREMBO - BG - ITALY
Q.C.MANAGER M. ESPOSITO
DATE: 09/09/2022

Il presente rapporto di prova riguarda esclusivamente il campione esaminato, non può essere riprodotto neanche parzialmente senza l'autorizzazione del Laboratorio ed è conservato in copia conforme all'originale nell'archivio del Laboratorio. I tempi di conservazione dei rapporti, dei documenti e delle parti dei saggi e delle provette sono riportate nel sito web www.qualitycontrolgroup.com / *This test report only concerns the examined sample, it can not be even partially reproduced without the authorization of the Laboratory and his certified copy is stored in the original in the archive of the Laboratory. The storage times of reports, documents and parts of the sample and the test piece are shown in www.qualitycontrolgroup.com website.*

Tutte le prove riportate nelle pagine seguenti sono state eseguite presso il laboratorio di MEDOLAGO (BG)
All tests reported in the following pages were carried out at the laboratory of MEDOLAGO (BG)

Ente di Collaudo / Surveyor — Ente di Collaudo / Surveyor

Cert. No. 15

QUALITY CONTROL

LAB N° 1384 L

RAPPORTO DI PROVA N. *Test Report No.* 22/1346RP02 DATA *Date* 09/09/2022 CAMPIONE N. *Sample No.* 1346B PAGINA *Page* 2 DI *of* 3

Laboratory of Medolago, Via Roma 79 - 24030 Medolago (BG) t. +39 035 901473 e-mail info@qualitycontrolgroup.com website www.qualitycontrolgroup.com

PROVA DI RESILIENZA SU MATERIALI METALLICI – ASTM A370-21

Charpy impact test on metallic materials – ASTM A370-21

SAGGIO *Test* No.	SENSO *Direction*	POSIZIONE *Position*	TIPO *Type*	TEMP. °C	DIMENS. *Size* mm	VALORI *Single values* ≥ 27 J			MEDIA *Average* ≥ 27 J	ESPANSIONE LATERALE *Lateral Expansion* --- mm			AREA DUTTILE *Shear Area* ≥ 25 %		
						1	2	3		1	2	3	1	2	3
1346B	T	B.M.	KV_8	-46	10x10	179	192	211	194,0	2,34	2,30	2,39	70	80	80

07.01mod RP IT1A

Data inizio prova *Test start date* 09/09/2022 Data fine prova *Test end date* 09/09/2022 Tecnico qualificato *Qualified technician* GIANCARLO FERRARI Apparecchiatura *Equipment* QC 376

Nota / *Note*: i risultati di prova sono conformi ai requisiti previsti da specification 4267MRS101 rev.0/
the test results are conform to the requirements of specification 4267MRS101 rev.0

BREMBANA & SCALVI S.P.A.
VALBREMBO - BG - ITALY
Q.C.MANAGER M.ESPOSITO
DATE: 09/09/2022

Ente di Collaudo / Surveyor

Ente di Collaudo / Surveyor

Cert. No. 15

QUALITY CONTROL

LAB N° 1384 L

RAPPORTO DI PROVA N. *Test Report No.* 22/1346RP02 DATA *Date* 09/09/2022 CAMPIONE N. *Sample No.* 1346B PAGINA *Page* 3 DI *of* 3

Laboratory of Medolago, Via Roma 79 - 24030 Medolago (BG) t. +39 035 901473 e-mail info@qualitycontrolgroup.com website www.qualitycontrolgroup.com

PROVA DI DUREZZA BRINELL SU MATERIALI METALLICI – ASTM E10-18
Brinell hardness test on metallic materials – ASTM E10-18

SAGGIO *Test* N.	POSIZIONE *Position*	TIPO *Type*	U.M. *m.u.*	VALORI *Values* ≤ 200 HBW			MEDIA *Average* ≤ 200 HBW	TEMP. *Temp.* °C
				1	2	3		
1346B	B.M.	HBW 2,5/187,5	HBW	161	161	161	161	+24

07.01mod RP HM1A

Data inizio prova *Test start date* 09/09/2022 Data fine prova *Test end date* 09/09/2022 Tecnico qualificato *Qualified technician* GIANCARLO FERRARI Apparecchiatura *Equipment* QC 371

Nota / *Note*: i risultati di prova sono conformi ai requisiti previsti da specification 4267MRS101 rev.0/
the test results are conform to the requirements of specification 4267MRS101 rev.0

***FINE RAPPORTO** / END REPORT*

BREMBANA & MOIOLI S.P.A. VALBREMBO - BG - ITALY Q.C.MANAGER M.ESPOSITO DATE: 09/09/2022

Ente di Collaudo / Surveyor

Ente di Collaudo / Surveyor

ABO SEALING & COMPONENTS

Cert. No. 101

Material Certificate n.	24-1198	conforming to EN 10204 3.1	Customer
Date	14/11/2024	Entrance Material n° 47/18	BREMBANA&ROLLE SPA
Our ref.	DDT. N. 892 DATED 14/11/2024		
Heat Treatment			P. O. N° 23096-ODA24-003640
\			

Items	Description of the goods	Type of material	Standards
10	THK 0,20 mm	SS316L	
20	USED TO PRODUCED SPIRAL WOUND GASKET		
	POS. 10 N. 12 PZ DIA. 24"300# THK 11-15		
	POS. 20 N. 6 PZ DIA. 1"300# THK 4,9		

CHEMICAL ANALISYS

Items	Heat	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Ti %	Cu %	Al %	N %	V %
AS ABOVE	0449982	0,028	0,32	0,88	0,03	0,001	16,64	10,11	2,02	\	\	\	0,042	\

MECHANICAL PROPERTIES

Items	Rottura tensile st. MPA	Snervamento Yield point 0,2 % MPA	Snervamento Yield point MPA	Allungamento Elongation %	Contrazione Reduc. Area Z%	Durezza Hardness HV	Resilienza Impact test Tmp C°	Resilienza Impact test J
AS ABOVE	637	285	\	61,5	\	165	\	\

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
18 NOV 2024

ABO SRL UNIPERSONALE
QUALITY DEPARTMENT
Diego Bassi

Inspection authority — Quality Assurance (Diego Bassi)

Date 14/11/2024

Notes The material is satisfactory and according to specification required

We certify that the material supplied meets the requirements of the purchase order and the required material specifications.
Chemical and mechanical analisys result have been taken from the certificate of the raw material productor.

Abo srl Unipersonale
Via Vittorio Veneto, 28/32
26010 Pianengo (CR) ITALY
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Tel. +39 (0)373 74 363
info@aboguarnizioni.com
www.aboguarnizioni.com

ABO SEALING & COMPONENTS

Cert. No. 101

Material Certificate n.	24-779	conforming to EN 10204 3.1	Customer
Date	12/07/2024	Entrance Material n° 47/18	BREMBANA&ROLLE SPA
Our ref.	DDT. N. 577 DATED 12/07/2024		
Heat Treatment			
\			P. O. N° 23096-ODA24-000726

Items	Description of the goods	Type of material	Standards
10 ÷ 90	THK 0,20 mm USED TO PRODUCED SPIRAL WOUND GASKET	SS316L	EN10028-7 ASTM A240 / ASME SA240 1.4401 / 1.4404
	POS. 10 N. 6 PZ DIA. 24"300# MK 11	POS. 70 N. 18 PZ DIA. 24"300# \	
	POS. 20 N. 18 PZ DIA. 24"300# MK 11	POS. 80 N. 18 PZ DIA. 24"300# \	
	POS. 30 N. 6 PZ DIA. 24"300# MK 15	POS. 90 N. 18 PZ DIA. 1"300# \	
	POS. 40 N. 18 PZ DIA. 24"300# MK 15		
	POS. 50 N. 6 PZ DIA. 1"300# MK 49		
	POS. 60 N. 18 PZ DIA. 1"300# MK 49		

CHEMICAL ANALISYS

Items	Heat	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Ti %	Cu %	Al %	N %	V %
10 ÷ 90	0449982	0,028 √	0,32 √	0,88 √	0,03 √	0,001 √	16,64 √	10,11 √	2,02 √	\	\	\	0,042 √	\

MECHANICAL PROPERTIES

Items	Rottura tensile st. MPA	Snervamento Yield point 0,2 % MPA	Snervamento Yield point MPA	Allungamento Elongation %	Contrazione Reduc. Area Z%	Durezza Hardness HV	Resilienza Impact test Tmp C°	Resilienza Impact test J
10 ÷ 90	637	285 √	\	61,5 √	\	165 √	\	\

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
25 JUL 2024

ABO S.r.l. UNIPERSONALE QUALITY DEPARTMENT Diego Bassi

Inspection authority — Quality Assurance (Diego Bassi)

Date 12/07/2024 — Notes The material is satisfactory and according to specification required

We certify that the material supplied meets the requirements of the purchase order and the required material specifications.
Chemical and mechanical analisys result have been taken from the certificate of the raw material productor.

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www.aboguarnizioni.com

ABO SEALING & COMPONENTS

Cert. No. 101

Material Certificate n.	24-1199	conforming to EN 10204 3.1		Customer
Date	14/11/2024	Entrance Material n°	95/18	BREMBANA&ROLLE SPA
Our ref.	DDT. N. 892 DATED 14/11/2024			
Heat Treatment				
Solution at 1050°C quenching in air				P. O. N° 23096-ODA24-003640

Items	Description of the goods	Type of material	Standards
10	THK 3,00 mm	316L	EN10028-7
20	USED TO PRODUCED SPIRAL WOUND INNER RING		ASTM A240 / ASME SA240 1.4401 / 1.4404
	POS. 10 N. 12 PZ DIA. 24"300# TAG 11-15		
	POS. 20 N. 6 PZ DIA. 1"300# TAG 49		

CHEMICAL ANALISYS

Items	Heat	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Ti %	Cu %	Co %	N %	V %
AS ABOVE	523031	0,026	0,45	1,30	0,029	0,005	16,51	10,10	2,03	\	0,28	0,248	0,045	\

MECHANICAL PROPERTIES

Items	Rottura tensile st. Mpa	Snervamento Yield point 0,2 % Mpa	Snervamento Yield point Mpa	Allungamento Elongation %	Contrazione Reduc. Area Z%	Durezza Hardness HRB	Resilienza Impact test Tmp C°	Resilienza Impact test J
AS ABOVE	626	305	329	51	\	82	\	\

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
18 NOV 2024

ABO SRL UNIPERSONALE QUALITY DEPARTMENT Diego Bassi

Inspection authority

Quality Assurance (Diego Bassi)

Date 14/11/2024

Notes The material is satisfactory and according to specification required

We certify that the material supplied meets the requirements of the purchase order and the required material specifications.
Chemical and mechanical analisys result have been taken from the certificate of the raw material productor.

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ABO SEALING & COMPONENTS

Cert. No. 102

Material Certificate n.	24-780	conforming to EN 10204 3.1	Customer
Date	12/07/2024	Entrance Material n° 95/18	BREMBANA&ROLLE SPA
Our ref.	DDT. N. 577 DATED 12/07/2024		
Heat Treatment			
Solution at 1050°C quenching in air			P. O. N° 23096-ODA24-000726

Items	Description of the goods	Type of material	Standards
10 ÷ 90	THK 3,00 mm USED TO PRODUCED SPIRAL WOUND INNER RINGS POS. 10 N. 6 PZ DIA. 24"300# POS. 20 N. 18 PZ DIA. 24"300# POS. 30 N. 6 PZ DIA. 24"300# POS. 40 N. 18 PZ DIA. 24"300# POS. 50 N. 6 PZ DIA. 1"300# POS. 60 N. 18 PZ DIA. 1"300#	316L POS. 70 N. 18 PZ DIA. 24"300# POS. 80 N. 18 PZ DIA. 24"300# POS. 90 N. 18 PZ DIA. 1"300#	EN10028-7 ASTM A240 / ASME SA240 1.4401 / 1.4404

CHEMICAL ANALISYS

Items	Heat	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Ti %	Cu %	Co %	N %	V %
10 ÷ 90	523031	0,026 ✓	0,45 ✓	1,30 ✓	0,029 ✓	0,005 ✓	16,51 ✓	10,10 ✓	2,03 ✓	\	0,28	0,248	0,045 ✓	\

MECHANICAL PROPERTIES

Items	Rottura tensile st. Mpa	Snervamento Yield point 0,2 % Mpa	Snervamento Yield point Mpa	Allungamento Elongation %	Contrazione Reduc. Area Z%	Durezza Hardness HRB	Resilienza Impact test Tmp C°	Resilienza Impact test J
10 ÷ 90	626	305 ✓	329	51 ✓	\	82 ✓	\	\

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
25 JUL 2024

ABO S.R.L. UNIPERSONALE QUALITY DEPARTMENT DI BASSI

Inspection authority	Quality Assurance (Diego Bassi)
Date 12/07/2024	Notes The material is satisfactory and according to specification required

We certify that the material supplied meets the requirements of the purchase order and the required material specifications.
Chemical and mechanical analisys result have been taken from the certificate of the raw material productor.

ABO SEALING & COMPONENTS

Cert. No. 103

Material Certificate n.	24-1200	conforming to EN 10204 3.1	
Date	14/11/2024	Entrance Material n°	26/18
Our ref.	DDT. N. 892 DATED 14/11/2024		
Heat Treatment			

Customer
BREMBANA&ROLLE SPA

P. O. N° 23096-ODA24-003640

Items	Description of the goods	Type of material	Standards
10	THK 3,00 mm	CARBON STEEL	DD11 EN10111:2008
20	USED TO PRODUCED SPIRAL WOUND OUTER RING POS. 10 N. 12 PZ DIA. 24"300# THK 11-15 POS. 20 N. 6 PZ DIA. 1"300# THK 49		

CHEMICAL ANALISYS

Items	Heat	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Ti %	Cu %	Al %	N %	V %
AS ABOVE	0057917057	0,06	0,013	0,423	0,021	0,018	\	\	\	\	\	0,046	\	\

MECHANICAL PROPERTIES

Items	Rottura tensile st. MPA	Snervamento Yield point 0,2 % MPA	Snervamento Yield point MPA	Allungamento Elongation %	Contrazione Reduc. Area Z%	Durezza Hardness HRB	Resilienza Impact test Tmp C°	Resilienza Impact test J
AS ABOVE	389	265	\	28,2	\	82	\	\

BREMBANA & ROLLE S.p.A.
QCM : M. GALLI
REVIEWED / ACCEPTED
18 NOV 2024

ABO SRL UNIPERSONALE QUALITY DEPARTMENT Diego Bassi

Inspection authority

Quality Assurance (Diego Bassi)

Date 14/11/2024

Notes The material is satisfactory and according to specification required

We certify that the material supplied meets the requirements of the purchase order and the required material specifications.
Chemical and mechanical analisys result have been taken from the certificate of the raw material productor.

ABO SEALING & COMPONENTS

Cert. No. 103

Material Certificate n.	24-781	conforming to EN 10204 3.1	
Date	12/07/2024	Entrance Material n°	26/18
Our ref.	DDT. N. 577 DATED 12/07/2024		
Heat Treatment			

Customer
BREMBANA&ROLLE SPA

P. O. N° 23096-ODA24-000726

Items	Description of the goods	Type of material	Standards
10 ÷ 90	THK 3,00 mm USED TO PRODUCED SPIRAL WOUND OUTER RING POS. 10 N. 6 PZ DIA. 24"300# POS. 20 N. 18 PZ DIA. 24"300# POS. 30 N. 6 PZ DIA. 24"300# POS. 40 N. 18 PZ DIA. 24"300# POS. 50 N. 6 PZ DIA. 1"300# POS. 60 N. 18 PZ DIA. 1"300#	CARBON STEEL POS. 70 N. 18 PZ DIA. 24"300# POS. 80 N. 18 PZ DIA. 24"300# POS. 90 N. 18 PZ DIA. 1"300#	DD11 EN10111:2008

CHEMICAL ANALISYS

Items	Heat	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Ti %	Cu %	Al %	N %	V %
AS ABOVE	0057917057	0,06	0,013	0,423	0,021	0,018	\	\	\	\	\	0,046	\	\

MECHANICAL PROPERTIES

Items	Rottura tensile st. MPA	Snervamento Yield point 0,2 % MPA	Snervamento Yield point MPA	Allungamento Elongation %	Contrazione Reduc. Area Z%	Durezza Hardness HRB	Resilienza Impact test Tmp C°	Resilienza Impact test J
AS ABOVE	389	265	\	28,2	\	82	\	\

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
25 JUL 2024

ABO SRL UNIPERSONALE QUALITY DEPARTMENT Diego Bassi

Inspection authority

Quality Assurance (Diego Bassi)

Date 12/07/2024

Notes The material is satisfactory and according to specification required

We certify that the material supplied meets the requirements of the purchase order and the required material specifications.
Chemical and mechanical analisys result have been taken from the certificate of the raw material productor.

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info@aboguarnizioni.com
www.aboguarnizioni.com

Cert.
No. 104

TO BREMBANA & ROLLE SPA
ATTENTION
QUALITY CONTROL

MATERIAL CERTIFICATE CONFORMING TO
" UNI EN 10204 .2.2 "

N° 24-1201 DATED 14/11/2024

P.ORDER No.	DOCUMENT	ITEMS
23096-ODA24-003640 Dated 11/11/2024	DDT. N. 892 Dated 14/11/2024	10.20 GRAPHITE FILLER

Si certifica che i pezzi forniti sono stati costruiti in accordo alle prescrizioni del Vs. ordine e dei documenti tecnici di riferimento nello stesso richiamati , utilizzando materiali di prima scelta. Gli stessi sono stati sottoposti ai controlli previsti dai nostri processi di fabbricazione con esito positivo.
We hereby certify that the goods we have produced are according to the specifications required in your above mentioned order, including technical documents.
The material used to produce the gaskets has been verified and tested according to our processes and found satisfactory.

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
18 NOV 2024

Best Regards
A.B.O.s.r.l. unipersonale
ABO SRL UNIPERSONALE
QUALITY DEPARTMENT
Diego Bassi
Diego Bassi
(Quality control service)

ABO
SEALING & COMPONENTS

Cert.
No. 104

TO BREMBANA & ROLLE SPA
ATTENTION
QUALITY CONTROL

MATERIAL CERTIFICATE CONFORMING TO
" UNI EN 10204 .2.2 "

N° 24-782 DATED 12/07/2024

P.ORDER No.	DOCUMENT	ITEMS
23096-ODA24-000726 Dated 19/03/2024	DDT. N. 577 Dated 12/07/2024	10.20.30.50.60.70.80.90 GRAPHITE FILLER

Si certifica che i pezzi forniti sono stati costruiti in accordo alle prescrizioni del Vs. ordine e dei documenti tecnici di riferimento nello stesso richiamati , utilizzando materiali di prima scelta. Gli stessi sono stati sottoposti ai controlli previsti dai nostri processi di fabbricazione con esito positivo.
We hereby certify that the goods we have produced are according to the specifications required in your above mentioned order, including technical documents.
The material used to produce the gaskets has been verified and tested according to our processes and found satisfactory.

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
25 JUL 2024

Best Regards
A.B.O.s.r.l. unipersonale

Diego Bassi
(Quality control service)

MK - 42 - 43 - 44 - 45

SP. 14

NLMK CLABECQ
Rue de Clabecq 101
1460 ITTRE (Belgique) A01

RECEPTION T.G.V. 3.2 selon EN 10204 -AD2000 Merkblatt W1+W10, TRD 100, Vd TUV Wbltt 352/1. Selon SA2 5 ASME II Part.A Ed.10 Add.11a

N° 1111 A02

N° PAGE 4/ 9
BLATT NR
PAGE No A03

PLAQUES-BLECHE-PLATES B01

SIGLE PRODUCTEUR HERSTELLERZEICHEN TRADE MARK A04: NO

(***) EN 10028-2/03- P265GH
EN 10028-3/03- P275NH
ASTM A516/10- Grade 60
ASME SA516 Ed.10 Add.11a- Grade 60

MANNI SIPRE S.P.A. CONTROLLO QUALITA' COPIA CONFORME

N : normalisé ou laminage normalisant - normalized or normalising rolled - normalgeglüht oder normalisierendes Walzen
DL Brut de laminage - Walzgewaltz unbehandelt - As rolled
TM Laminage thermomécanique - thermomechanical rolling - thermomechanisches Walzen
V Revenu - Angelassen - Tempered
NR : laminage normalisant - normalising rolled - normalisierendes Walzen
LC : Laminage contrôlé - Gleichzeitiges Temperaturführung - Controlled rolling B03

Organisme d'inspection Überwachungs-organisation B02: TUV

CLIENT / DESTINATAIRE _ BESTELLER / EMPFÄNGER _ PURCHASER / CONSIGNEE A06:
MANNISIPRE S.P.A.
a l'attention de Chiara Corsini
VIA RIGEI 7 (ZAI)
I-37135 VERONA 148

N° COMM DE COURTIER/CLIENT - MAKLER/KUNDEBESTELL NUMMER - BROKER/PURCHASER'S ORDER No. A05:
AH1L000794 du 14.12.11

VIZI Acciai

N° Commande Usine Werksauftrag Nr. A07: 9031

NUANCE ET SPECIFICATION DE TECHNIQUE B01 STAHLSORTE UND PRÜFBEDINGUNGEN QUALITY AND SPECIFICATION: (***)

STAT LIMITATION LIEFERUMFANG ACCEPTANCE B04: N

TRAITEMENT DE RECEPTION PRÜFBESTÄTIGUNG TREATMENT OF TEST CERTIFICATE B05:

CERTIFICATION DU PRODUIT BEZEICHNUNG DES ERZEUGNISSES - PRODUCT IDENTIFICATION			N° POSTE POSITION ITEM N° B09	Nbre de pièces Stückzahl Number of piece B10	DIMENSIONS _ ABMESSUNGEN _ DIMENSIONS			MASSE THEORIQUE THEORETISCHES GEWICHT THEORETICAL WEIGHT B14	TRACTION _ ZUGVERSUCH _ TENSILE TEST							RESILIENCE - KERBSCHLAGZAHIGKEIT - NOTCH TOUGHNESS							
N° REFERENCE REFERENZ NR REFERENCE N° B07	N° COULEE SCHMELZ NR HEAT N° B08	GRADE GRAUE GRADE B06			EPAISSEUR DICKE THICKNESS B11	LARGEUR BREITE WIDTH B12	LONGUEUR LÄNGE LENGTH B13		Sens (2) C01	Bâtt (3) C02	(4) C04	Re 0.2% C11	Rm C12	A% * (1) C13	A% (2)* (3) C14	C15	TYPE - FORM - TYPE C10	Sens (3) C14	TEMP °C C15	Peau Coeur (4) C16	VALEURS INDIVIDUELLES EINZELWERTE INDIVIDUAL VALUES (Joules) C17			MOYENNE MITTELWERTE AVERAGE C18	T°. & D. de Norm. C09 °C min
	805073 C1		14		15.00	2500	12000																		
	B2		21	2	8.00	2000	12000	3014	1	T		366	476	44.6	33.9		ISO-V	T	-20	P	150	132	140	141	
																	Vnotc	L	-51	P	257	259	260	259	938 52
	B1		24	2	15.00	2000	12000	5652	1	T		320	448	32.5	28.0		ISO-V	T	-20	P	100	90	106	99	
																	Vnotc	L	-51	P	350	342	346	346	931 21
				13				31747									ISO-V	T	-20	P	118	112	122	117	
	805197 A3		2	3	8.00	2500	10000	4710	1	T		358	448	43.9	33.4										
	B3		4	2	14.00	2500	10000	5496	1	T		307	428	31.2	26.5		Vnotc	L	-51	P	267	272	270	270	930 12
																	ISO-V	T	-20	P	90	110	120	107	
	B1		11	3	10.00	2500	12000	7065	1	T		330	443	40.0	31.8		Vnotc	L	-51	P	357	357	357	357	939 40
																	ISO-V	T	-20	P	118	124	129	124	
	G1		19	3	6.00	2000	12000	3390	1	T		357	446	39.9	28.7		Vnotc	L	-51	P	356	356	354	355	930 14
																	ISO-V	T	-20	P	154	150	200	168	
	A1		21	2	8.00	2000	12000	3014	1	T		354	458	44.0	33.5		Vnotc	L	-51	P	90	86	84	87	931 11
																	ISO-V	T	-20	P	44	46	52	47	
				13				23675									Vnotc	L	-51	P	271	277	272	273	936 25
																	ISO-V	T	-20	P	92	98	86	92	

CONTROLE DE SURFACE SELON EN 10163-2, CLASSE B (SOUS-CLASSE 2)

Exemption from the Hot Tensile Tests in accordance with TUV Rheinland's agreement dated 4/12/2007 (unless strictly specified by the customer).

*(1) Lo = 5,65 √S = - (2) Lo = 5C = - (3) Lo = 200 mm

ANALYSE COULEE - SCHMELZANALYSE - HEAT ANALYSIS (*) = ANALYSE PRODUIT - STÜCKANALYSE - PRODUCT ANALYSIS

(5)	N° REFERENCE REFERENZ NR REFERENCE N° B07	N° COULEE SCHMELZ NR HEAT N° B08	Mn % C71	P % C72	S % C73	C % C74	Si % C75	Al % C76	Nb% C77	Cu% C78	Ni% C79	Cr% C80	V% C81	Mo% C82	Ti% C83	B% C84	Ceq C85			N2% C86
C70 O/Y		805073	1.149	0.009	0.005	0.105	0.216	0.037	0.003	0.039	0.020	0.033	0.001	0.008	0.003	0.0002	0.309			0.0049
EF		805197	1.133	0.012	0.005	0.105	0.220	0.040	0.003	0.034	0.014	0.019	0.001	0.001	0.001	0.0003	0.301			0.0040
CC																				

Vorläufige Bescheinigung
Document provisoire
Temporary Document
TÜV Rheinland Belgium

002/203 EXAMINED ACC. TO ADW0 - TRD100(WE570) + CERTIFIED ACC. TO PED 97/23/EC + AD2000-W0(15/10/2001) WITHOUT COUNTER SIGNATURE (21/03/72) NOTIFIED BODY (TUV RHEINLAND) Nr 0035.

Contrôle de marquage d'aspect et de dimensions : Satisfaisants
Bezeichnung, beschaffung und ausmessung : Ohne Beanstandung
Marking, inspection and measurement : Without objection.

P275NEP265GHA/SA516-60 MT LTV
EN 10029/2010 CL.B

ITTRE le 02/02/12
FALZONE Sabrina
Editrice certificat

(2) Prélèvage - Location C05: 1 : Tête - Kopf - Top; 2 : Pied - Fuss - Bottom
(3) Sens - Direction C00: L : Long - Langs - Longitudinal; T : Travers - Quer - Transverse
(4) C : Coeur - Kernprobe - Core sample; P : Peau - Walzblecha - Rolled surface
(5) O/Y : Oxygène pur - Oxygen; CC : Coulée continue - Kontinuierliches giessen Continuous casting; EF : Electric furnace

Nous certifions que les produits énumérés ci-dessus sont conformes aux prescriptions de la commande
Wir bestätigen hiermit dass die obengenannten erzeugnisse den bestellung vorschriften entsprechen
We certify hereby that the above mentioned products are consistent with the order prescriptions Z04

Les résultats des essais particuliers figurent sur les documents complémentaires joints en annexe.
Die ergebnisse der besonderen prüfungen sind in die beigefügten ergänzenden unterlagen angegeben.
The results of the specials tests are indicated on the complementary documents in appendix. C60

Z01

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
3 MAY 2024

Cert. No. 105

1723001756-QC-DB-00017_02 - V25001A

PAGE 493/1016

OSA24-000344 23076 MK 46 NON PRESSURE PARTS

Cert. No. 106

9/4/24 CMI SP.3

outokumpu

Certificate No. / Zeugnis Nr. / N° du certificat: 994663/001
Page / Seite / Page: 1(01)
Date / Datum / Date: 29.02.2024

INSPECTION CERTIFICATE 3.1
DIN EN 10204 3.1

Delivery address, Empfänger, Lieu de livraison:
OUTOKUMPU S.R.L.
VIA FUSTAGNO,21
T7
26012 CASTELLEONE
ITALY

OUTOKUMPU S.R.L.
VIA AGNELLO, 8
20121 MILANO
ITALY

Requirements, Anforderungen, Exigences:
EN 10088-4:2009
AD 2000 W2, W10 & EN 10028-7:2016
ASTM A240/A240M
ASME SA-240/SA-240M II A ED. 2023

Our Order No. / Unser Auftrag Nr. / Notre commande n°: 300704691
Your order, Ihre Bestellung, Votre commande: 803164

Product, Erzeugnisform, Produit: COIL , STAINLESS STEEL

Mark of Manufacturer / Zeichen des Lieferwerkes / Signe de producteur: outokumpu
Process / Erschmelzungsart / Mode de fusion: AOD

Inspector's stamp / Zeichen d. Sachverst. / Poicon de l'expert

Grade, Werkstoff, Nuance: 1.4307 1.4301 TYPE 304L

Tolerances Toleranzen, Tolérances: EN ISO 9445-2

Marking, Kennzeichnung, Marquage: 1.4307 2B

Marks, Versandzeichen, Marques:

Line / Reihe / Ligne	Item / Position / Poste	Charge-test No. / Schmelze-Probe Nr. / Coulée n°	Size, Abmessungen, Dimensions	Quantity / Stückzahl / Nombre	Weight, Gewicht, Poids	Finish / Ausführung / Fini EN/ASTM
1	18	63576 4	3,0 X 1500 MM		22730 KG	2B

CE 10 0045-CPR-0567

Charge no. / Schmelze Nr. / Coulée n°	Chemical composition, Chemische Zusammensetzung, Composition chimiques											
	C %	Si %	Mn %	P %	S %	Cr %	Ni %	N %				
63576	0,020	0,39	1,29	0,036	0,001	18,2	8,1	0,064				

Line / Reihe / Ligne	Mechanical properties, Mechanische Eigenschaften, Caracteristiques mecaniques								Tensile test, Zugversuch, Essai de traction
	Sample ID / Proben ID / Échantillon	Rp0.2 MPa	Rp1.0 MPa	Rm MPa	A5 %	A50 %	%	Hardness Härte,Durate HBW	ISO 6892-1:2019 A224 SAMPLES PERPENDICULAR TO THE ROLLING DIRECTION
1	01	296	332	625	66	61		163	
	02	291	329	623	63	60		160	

APPROVED ACC.TO AD2000-W0 WITH VERIFICATION OF THE UNIFORMITY OVER THE STRIP LENGTH. CERTIFIED ACC.TO PED 2014/68/EU BY TÜV NORD REG. NO. 0045. DOPS ACC. TO CPR AVAILABLE ON THE WEB PAGE BY STEEL NUMBER

Identity test, Verwechslungsprüfung, Controle d'identification: OK
Sizes, Abmessungen, Dimensions: OK
Surface, Oberfläche, Surface: OK
Test of intergran. corros, Prüfung auf interkrist. Korros, Test de corros. intercrist.: EN ISO 3651-2 A: OK

Avg.t CO2e/t 1.08
Model verified
Scope 1,2,3

ASTM A240/A240M
ASME SA-240/SA-240M II A ED. 2023
TYPE 304
EN 10088-2:2014/1.4307, 1.4301
NACE MR0103/ISO 17945 AND
NACE MR0175/ISO 15156-1 / NACE MR0175/ISO 15156-3
HEAT TREATMENT 1060 C
SOLUTION ANNEALED
RAPID COOLING WITH AIR AND WATER
COUNTRY OF MELT TORNIO, FINLAND
MANUFACTURED IN TORNIO, FINLAND

576/24
48.1467
15/03/2024

COPY CONFORMI TO THE ORIGIN Outokumpu S.p.A.
NAME
SIGNATURE

We certify that the above mentioned products comply with the terms of the order contract.
Wir bestätigen, dass die Lieferung den Vereinbarungen der Bestellannahme entspricht.
Nous certifions ques les produits énumérés ci-dessus sont conformes aux prescriptions de la commande.

This test certificate is made by controlled ADP-system and is valid without signature.
Dieses Zeugnis wurde von einem überprüften Datenverarbeitungssystem erstellt und is ohne Unterschrift gültig.
Ce certificat a été établi par un systeme informatique controlé et est valide sans signature.

Outokumpu Stainless Oy

Authorized inspector / Werkssachverständiger / Inspecteur autorisé: JOUNI KUJANSUU

FI-95490 Tornio, Finland
Tel. +358 16 4521,email certificate.tornio@outokumpu.com,
www.outokumpu.com
Domicile: Tornio, Finland. Business Identity Code 0823315-9

BREMBANA & ROLLE S.p.A.
QCM - M.GALLI
REVIEWED & ACCEPTED
3 MAY 2024

BREMBANA&ROLLE
Via delle Industrie, 35 Albignasego PD (Italy)

WELD CONSUMABLE LIST
LISTA CONSUMABILI

REPORT No.
23096-01-SNA÷F
WM
Page 1 of 1

PURCHASER DATA		MANUFACTURER DATA	
Cliente Customer	Rosetti Marino	**Ordine No** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial Number	23096-01-SNA÷F
Sigla Item	V25001 A÷F H2 Storage Vessel	**P.C.Q. No** ITP No	23096-01-QCPA

(1) WELDS 1N - 2N - 3N - 4N - 5N 25/10/2024

Process	Weld	WPS	Dia/nastro (mm)	Batch/Lot/Heat	Trade Name	Certificate No.
GTAW	C1-C2-C3-C4-C5-C6-L1-L2-L3-L4-L5-M1-M2-~~N1-N2-N3-N4-N5~~-K1-K2-LL/1-LL/2-LL/3-LL/4-R1-R2-R3-R4-R5-R6-F1/1- LF1/1-R – F2/1- LF1/2-R – F2/1- TF2/1B – F2/2- TF2/2B – H/1-H/2-NP-F3/1-F3/2 (1)	W01 rev.0 W02 rev.0 W03 rev.0 W04 rev.0 W05 rev.0 W06 rev.0 W08 rev.0	2.4	107229	BOHLER EML5	2024-2014607385-10-107229-014
SMAW	C1-C2-C3-C4-C5-C6-L1-L2-L3-L4-L5-M1-M2-~~N1-N2-N3-N4-N5~~-K1-K2-LL/1-LL/2-LL/3-LL/4-R1-R2-R3-R4-R5-R6-F1/1- LF1/1-R – F2/1- LF1/2-R – F2/1- TF2/1B – F2/2- TF2/2B – H/1-H/2-NP-F3/1-F3/2 (1)	W01 rev.0 W02 rev.0 W03 rev.0 W04 rev.0 W05 rev.0 W06 rev.0 W08 rev.0	4	M1MS225634	TENAX 35S	02163973
			5	M1MS225641	TENAX 35S	02163958
SAW	C1-C2-C3-C4-C5-C6-L1-L2-L3-L4-L5-M1-M2-L/1-LL/2-LL/3-LL/4-R1-R2-R3-R4-R5-R6-H/1-H/2-NP-F3/1-F3/2	W01 rev.0 W02 rev.0 W06 rev.0 W08 rev.0	4	PVX3811564	OK Autorod 12.32	230165
			PNX3512028		OK Flux 10.62	230165 EC27271072 rev.0
FCAW	F4	W07 rev.0	1.2	M1FC224209	FLUXOFIL 14 HD	01874095

BREMBANA&ROLLE S.p.A.	INSPECTION AGENCY	INSPECTION AGENCY
BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED 25 JUL 2024	On Behalf L. D'Alessandro ☐ W ☐ R 0084 17 SEP 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17 SEP 2024

BREMBANA QUALITY CONTROL DEPARTMENT

ESAB Saldatura SpA

Inspection certificate 3.1 – EN 10204

CERTIFICAZIONE
CERTIFICATION

230165

Ns. ordine / Our order
100834823

Vs. Ordine n°/Your order N°
ODA23-002309

Cliente / Customer
BREMBANA & ROLLE S.P.A

VIA VILLINO 1 - VALBREMBO (BG) 24030 - Italy

Codice/Item No.	Descrizione/Description	Lotto / Lot	Quantità / Qty
1232402800	OK Autrod 12.32 4.0mm 30kg	PVX3811564	23,640 Kg
1062800000	OK Flux 10.62 25kg(55lb) BP	PNX3512028	28,000 Kg

Analisi Chimica/ Chemical Analysis Weld Metal

C	Si	Mn	P	S	Cr	Ni	Mo	Cu	N	Co	V	Nb	Al
0,1	0,26	1,5	0,02	0,003	0,07	0,025	0,016	0,04	--	--	0,004	--	--

Trazione/Tensile test –

Metallo d'apporto	ReH	Rp02	Rm	All	Z
	N/mm2	N/mm^2	N/mm^2	%	%
PWHT A	423	396	510	38	--
PWHT B	421	387	495	38	--

Resilienza/Impact test. KV

Metallo d'apporto	Temp	Media/Average J	Energie / Energy	Lat. Expansion	Shear area
	°C	Joule	Joule	mm	%
As Welded	-33	291	287 - 299 - 294	--	--

Note/remarks

Il prodotto è conforme alle norme / This welding consumable conforms to:

CLASSIFICATION

SFA/AWS A5.17: EH12K **EN ISO 14171-A: S3Si**

Hydrogen Diff: 2,87 ml/100g

Cycle A: SPWHT @ 620°C ± 10°C x 4,5 hrs
Cycle B: SPWHT @ 620°C ± 10°C x 4,5hrs x 4 times

Wire Heat Number: 28269

Hardness Test (HV10) Cycle A : 167 - 153 - 158 - 153 - 156

Lab. test report 1933/2023

Ref to Customer Spec.: Brembana&Rolle WCMRS 23031--TMRS Rev. 1

This certification affirms that the contents of this report are correct and accurate and that all tests results and operations performed by Esab Saldatura S.p.A. and its subcontractors are in compliance with the requirements of the material specification and the specific applicable material requirements.

Data 21/11/2023

ESAB SALDATURA S.p.A.
Roberto Pisati
QA Manager

Certificazione – Certification
Certifichiamo che i sopraelencati materiali sono conformi ai requisiti dell'ordine e forniti in accordo col ns. Sistema di Qualità approvato secondo UNI EN ISO 9001 e che i valori riportati sono stati verificati in accordo a quanto stabilito all'atto della vendita.

We hereby certify that the above stated products conform to the sales contract and are supplied in accordance with our Quality System approved to UNI EN ISO 9001 and that the goods, with indicated results have tested according to the instructions in the sales contract.

Ossona, Str. Prov. 34, n.37
20010 Ossona (MI)
Tel.: + 39 02 97968.1
esab.saldatura@esab.se
http://www.esab.it

Sales & Marketing: Fax + 39 02 97968701
Customer Service Desk: Fax + 39 02 97968702
Amministrazione: Fax + 39 02 97968703
Divisione Impianti: Fax + 39 02 97968704
Assistenza Tecnica: Fax + 39 02 97968705

Capitale sociale € 1.000.000,00 i.v.
Codice Fiscale / Partita IVA 00775990153
Sede legale: Via Tranquillo Cremona,12 – 20145 Milano
Reg. Imp. Milano REA 236795
N. Registro AEE IT08020000004273

CERTIFICATO DI COLLAUDO/ INSPECTION CERTIFICATE

Data/Date: 2023-09-12

in accordo a/acc to EN 10204 - 3.1

Numero certificato/Cert no: EC27271072 rev. 0

Nostro ordine/Our order:	0100834823	Vostro ordine/Your order:	ODA23-002309
Nostro riferimento/Our ref:	Stefano di Virgilio	Vostro riferimento/Your ref:	
Codice Cliente/Cust no:	ITB01810	Vostro numero fax/Your fax	
Data ordine Cliente/Your date:	20230816	Vostra e-mail/Your e-mail:	

Indirizzo di fatturazione/Invoice address
BREMBANA & ROLLE S.P.A
VIA VILLINO 1
24030 VALBREMBO
Italy

Destinatario del certificato/Cert receiver

Indirizzo di spedizione/Delivery address
BREMBANA & ROLLE S.P.A
VIA VILLINO 1
24030 VALBREMBO
Italy

PRODOTTO CONSEGNATO/DELIVERED PRODUCT

Marchio/Brand: ESAB
Descrizione/Desc: OK Flux 10.62 25kg(55lb) BP
Codice/Item no: 1062800000
Numero di lotto/Lot no: PNX3512028
Quantità/Quantity: 12000 KGM

ANALISI CHIMICA/CHEMICAL ANALYSIS

Flux	
CaF2	25%
Al2O3+MnO	20%
SiO2+TiO2	15%
CaO+MgO	37%

CLASSIFICAZIONE/CLASSIFICATIONS

EN ISO 14174: S A FB 1 55 AC H5
EN ISO 14174: S A FB 1 55 AC H4 only
BlockPac/moisture-protection

COMMENTI/COMMENTS

Materiale fornito in accordo al Sistema Qualità conforme alla norma EN ISO 9001.
Questo certificato è stampato elettronicamente.
Per ogni chiarimento, rivolgersi a:
ESAB Saldatura S.p.A. | Str. Provinciale 34, n.37 - 20010 Ossona MI, Italy
Product supplied under a QA Programme fulfilling the EN ISO 9001 standard.
This certificate is produced electronically.
Please refer any queries to: (see above)

Validazione/Validation
Piotr Grela Quality Manager

Inspection Certificate 3.1

LINCOLN ELECTRIC
THE WELDING EXPERTS

Product Line	**Electrodes**
Product	**TENAX 35S**
Size(s) mm	**4.00X450XCBOX**
Item No.	**W000380293**
Lot/Batch	**M1MS225634**
Class	**AWS A5.1 E7018-1 H4**
	EN-ISO 2560-A E 42 5 B 3 2 H5

Chemical analysis (%) According to EN10204 3.1

C	Si	Mn	P	S	Cr	Ni	Mo	Nb	Cu	V
0.067	**0.36**	**1.33**	**0.011**	**0.006**	**0.03**	**0.01**	**<0.01**	**<0.01**	**0.03**	**0.02**

Mechanical tests, all weld metal According to EN10204 2.2

Tensile testing

Cond.	Temp. °C	Rp0.2 MPa	Rm MPa	A5 %
AW	**20**	**490**	**541**	**30**

Impact testing

Cond.	Temp. °C	KV J
AW	**-50**	**148**

Remarks

The product identified above has been manufactured, tested and supplied in compliance with a certified ISO 9001 Quality Assurance Programme.

Company
Lincoln Electric Italia srl
Loc. Casalmenini 3
37010 Rivoli Veronese
Italy

Issued By
C.Dascalu
Position: QES Manager

Printed By Lavinia Busato
Function Customer Service Sales Assistant Domesti
Date 27/SEP/2023

Cert. No.
02163973
ZEU_CMN , 1

OERLIKON SAF-FRO METRODE WELDING CONSUMABLES SPECIAL ALLOYS

Inspection Certificate 3.1

LINCOLN ELECTRIC
THE WELDING EXPERTS

Product Line	Electrodes
Product	TENAX 35S
Size(s) mm	5.00X450XCBOX
Item No.	W000380295
Lot/Batch	M1MS225641
Class	AWS A5.1 E7018-1 H4 EN-ISO 2560-A E 42 5 B 3 2 H5

Chemical analysis (%) According to EN10204 3.1

C	Si	Mn	P	S	Cr	Ni	Mo	Nb	Cu	V
0.077	0.39	1.34	0.011	0.005	0.04	0.04	0.01	<0.01	0.06	0.02

Mechanical tests, all weld metal According to EN10204 2.2

Tensile testing

Cond.	Temp. °C	Rp0.2 MPa	Rm MPa	A5 %
AW	20	490	541	30

Impact testing

Cond.	Temp. °C	KV J
AW	-50	148

Remarks

The product identified above has been manufactured, tested and supplied in compliance with a certified ISO 9001 Quality Assurance Programme.

Company
Lincoln Electric Italia srl
Loc. Casalmenini 3
37010 Rivoli Veronese
Italy

Issued By
C.Dascalu
Position: QES Manager

Printed By Lavinia Busato
Function Customer Service Sales Assistant Domesti
Date 27/SEP/2023

Cert. No.
02163958
ZEU_CMN . 1

OERLIKON SAF-FRO METRODE WELDING CONSUMABLES SPECIAL ALLOYS

Inspection Certificate 3.1

LINCOLN ELECTRIC
THE WELDING EXPERTS

Product Line	FCW
Product	FLUXOFIL 14HD 1.2X0016XB300
Size(s) mm	1.2mm
Item No.	W000281099
Lot/Batch	M1FC224209
Class	AWS A5.20: E71T-1M-JH4 / E71T-1C-H4 EN ISO 17632 - A T 46 2 PC 1 H5/ T 46 3 PM 1 H5

Customer Ref	oda22 001861 rev1
Our Reference	817910001
Quantity	448.0 KG
Customer	BREMBANA & ROLLE SPA

VIA DELLE INDUSTRIE, 35
ALBIGNASEGO 35020
Italia

Chemical analysis (%) According to EN10204 3.1

C	Si	Mn	P	S	Cr	Ni	Mo	Nb	Cu	V	Ti	Al	B
0.054	0.48	1.67	0.009	0.007	0.04	0.02	<0.01	0.01	0.06	0.03	0.085	0.019	0.0038

Mechanical tests, all weld metal According to EN10204 2.2

Tensile testing

Cond.	Temp. °C	Rp0.2 MPa	Rm MPa	A5 %
AW	20	530	600	25

Impact testing

Cond.	Temp. °C	KV J
AW	-30	100

Remarks

The product identified above has been manufactured, tested and supplied in compliance with a certified ISO 9001 Quality Assurance Programme.

Company	Issued By	Printed		Cert. No.
Lincoln Electric Italia srl Loc. Casalmenini 3 37010 Rivoli Veronese Italy	C.Dascalu Position: QES Manager	By Function Date	Christian Grigoli Warehouse Operator 19/OCT/2022	01874095 ZEU_CMN_FCW , 1

voestalpine Böhler Welding Italia S.r.l.

Certificato di prova 3.1
Inspection certificate 3.1

secondo / as per : EN 10204
No. : No. : 2024-2014607385-10-107229-014
Rev. 0 Page / Page : 1 / 1

BREMBANA & ROLLE S.p.A
VIA VILLINO 1
24030 VALBREMBO
Italia

Ordine N°	PO no.	000864	del / of	29.03.2024
Ordine N°	Order no.	1014271745		
Bolla di consegna/Pos./Splitt.	Delivery note/pos./split	2014607385/000000/000010	del / of	02.04.2024
Oggetto test	Product	bacchetta/filo GTAW / GTAW rod/wire		
Denominazione commerciale	Trade name	**BÖHLER EML 5**		212838
Classificazione norma	Standard designation	EN ISO 636-A - W 46 5 2Si		34162
		AWS A5.18: ER70S-3		2U04510W 0140
Dimensione	Dimension	2,4 x 1000 mm		
Colata - Lotto	Heat no.	107229		
Quantità fornita	Quantity	300,0 KG		

Composizione chimica in % del prodotto **Chemical composition in % of the product**

C	Si	Mn	P	S	Cr	Mo	Ni	V	Cu	Al				
0,11	0,54	1,09	0,007	0,007	0,04	0,01	0,02	< 0,01	0,01	< 0,01				

proprietà meccaniche **Mechanical properties** **EN 10204 - 2.2**

Prova di trazione Tensile test

T	ReL / Rp 0,2 MPa	Rp 1,0 MPa	Rm MPa	A (Lo = 5d) %	Z %	WBH PWHT	Note Remarks
20°C	≥ 460		530 - 680	≥ 23			

Prova di resilienza Impact test

T	Energia di impatto Impact energy KV / J	Medio Average KV / J	Espansione lat. Lateral expansion mm	Frattura cristalliina Shear fracture %	WBH PWHT	Note Remarks
-50°C	≥ 47					

Questo certificate è stato emesso con sistema automatizzato e non richiede firma
This certificate was issued by DP-equipment and does not require signature.

Centro / Town: Milano
Data / Date: 03.04.2024
Q.A. representative / Authorized representative: Faraone

voestalpine
ONE STEP AHEAD.

BREMBANA&ROLLE
Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)

Particular Material Appraisal

According to Directive 2014/68/UE, Annex I, par 4.2.b

Fabbricante (Manufacturer)

Product Form	PLATES
Specificaton (s)	SA 516 Gr.60, Ed. 2021 Condition: NORMALIZED
Additional requirements	23096-ODA23-003058 23096-ODA23-003052
Allowable Temperature Range	min -29 °C max 80 °C Notes

Property	Annex I, Requirements	Specification Requirement	Incoming Inspection
Ductility (Ref. Annex I, 4.1 (a), 7.5	Elongation > 14% for steel	If not already foreseen as per material specification, material purchased with minimum elongation greater than 14%. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Toughness (Ref. Annex I, 4.1 (a), 7.5	ISO V test > 27 J at 20°C or lowest operating temperature for steel	If not already foreseen as per material specification, material purchased with min 27J average at -46°C. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Chemical Resistance (Ref. Annex I,4.1 (b)	Sufficiently resistant to the fluid, properties required for safety not to be affected during scheduled lifetime of equipment.	Material purchased with HIC resistance properties end user request. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Ageing (Ref. Annex I,4.1 (c)	Not to be significantly affected by ageing.	Materials have been tested after simulated Min and Max PWHTs. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Material Fabrication Procedures (Ref. Annex I, 4.1 (d), & 3.1	Suitable for intended processing procedures.	Material suitable for forming and welding	N.A.
Compatibility with other materials (Ref. Annex I, 4.1(e))	Selected so as to avoid significant undesirable effects when various materials are put together.	No interactions with other materials may occur and are reasonably expected	N.A.

Heat Analysis	Additional requirements to material specification (if any) are set on B&R relevant ORDER	Verify on Material Certificate

Material Certification Requirements (Ref. Annex I, § 4.3	Material Manufacturer must confirm compliance with the material specification. EN 10204 Type 3.1 certification acceptable if Material Manufacturer operates a QA system certified by a recognised Competent Body otherwise certification to Type 3.2 is required.

Notes Material (s) listed in :	ASME Section II - and is (are) considered to be acceptable for pressure equipment purposes within the range of conditions outlined above.

The above material specification (s) have been appraised for compliance with the Essential Safety Requirements of EC Directive, 2014/68/UE.

P M A File Reference Number	23096/PMA/01	Appraiser	
Date	May 27, 2024	Signature	BREMBANA&ROLLE S.p.A. M. GALLI Q.C.M.

EXAMINED
This document has been examined and given the status as shown in the Design Appraisal Document (DAD) number below:
DAD Number: MLN-DAD-PED24-263
Date: 17 July 2024 Initials: AFM
Office: Milan
LRQA Italy S.R.L.
A member of the LRQA Group Limited

For Pressure Equipment in Categories III and IV

Notified Body	No. 0094 – LRQA		
Signature		Date	

BREMBANA&ROLLE

Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)

Particular Material Appraisal

According to Directive 2014/68/UE, Annex I, par 4.2.b

Fabbricante (Manufacturer)

Product Form	FORGINGS	
Specificaton (s)	SA 350 LF2 CL1, Ed.2021	Condition: NORMALIZED
Additional requirements	23096-ODA23-003381 23096-ODA24-000304	
Allowable Temperature Range	min -29 °C	max 80 °C
	Notes	

Property	Annex I, Requirements	Specification Requirement	Incoming Inspection
Ductility (Ref. Annex I, 4.1 (a), 7.5	Elongation > 14% for steel	If not already foreseen as per material specification, material purchased with minimum elongation greater than 14%. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Toughness (Ref. Annex I, 4.1 (a), 7.5	ISO V test > 27 J at 20°C or lowest operating temperature for steel	Material purchased with min 27J average at -46°C. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Chemical Resistance (Ref. Annex I,4.1 (b)	Sufficiently resistant to the fluid, properties required for safety not to be affected during scheduled lifetime of equipment.	Material and corrosion allowance selected on the basis of End user requiremets responsible for process design.	N.A.
Ageing (Ref. Annex I,4.1 (c)	Not to be significantly affected by ageing.	Materials have been tested after simulated Min and Max PWHTs. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Material Fabrication Procedures (Ref. Annex I, 4.1 (d), & 3.1	Suitable for intended processing procedures.	Material suitable for machining and welding.	N.A.
Compatibility with other materials (Ref. Annex I, 4.1(e))	Selected so as to avoid significant undesirable effects when various materials are put together.	No interactions with other materials may occur and are reasonably expected.	N.A.

Heat Analysis	Additional requirements to material specification (if any) are set on B&R relevant ORDER.	Verify on Material Certificate

Material Certification Requirements (Ref. Annex I, § 4.3	Material Manufacturer must confirm compliance with the material specification. EN 10204 Type 3.1 certification acceptable if Material Manufacturer operates a QA system certified by a recognised Competent Body otherwise certification to Type 3.2 is required.

Notes Material (s) listed in :	ASME Section II - and is (are) considered to be acceptable for pressure equipment purposes within the range of conditions outlined above.

The above material specification (s) have been appraised for compliance with the Essential Safety Requirements of EC Directive, 2014/68/UE.

P M A File Reference Number	23096/PMA/02	Appraiser	BREMBANA&ROLLE S.p.A. M. GALLI Q.C. M.
Date	May 27, 2024	Signature	

EXAMINED
This document has been examined and given the status as shown in the Design Appraisal Document (DAD) number below:
DAD Number: MLN-DAD-PED24-263
Date: 17 July 2024 Initials: AFM
Office: Milan
LRQA Italy S.R.L.
A member of the LRQA Group Limited
LRQA001 11.2021

For Pressure Equipment in Categories III and IV

Notified Body	No. 0094 – LRQA		
Signature		Date	

BREMBANA&ROLLE
Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)

Particular Material Appraisal

According to Directive 2014/68/UE, Annex I, par 4.2.b

Fabbricante (Manufacturer)

Product Form	STUDBOLTS	
Specificaton (s)	**SA 193 Gr. B7, Ed.2021**	Condition: **QUENCHED AND TEMPERED**
Additional requirements	**23096-ODA24-000575**	
Allowable Temperature Range	min **-29** °C	max **80** °C
Notes		

Property	Annex I, Requirements	Specification Requirement	Incoming Inspection
Ductility (Ref. Annex I, 4.1 (a), 7.5	Elongation > 14% for steel	If not already foreseen as per material specification, material purchased with minimum elongation greater than 14%. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Toughness (Ref. Annex I, 4.1 (a), 7.5	N.A.	If not already foreseen as per material specification, material purchased with min 40J average at min temperature above or at lower temperature. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Chemical Resistance (Ref. Annex I,4.1 (b)	Sufficiently resistant to the fluid, properties required for safety not to be affected during scheduled lifetime of equipment.	Not in contact with process fluid N.A.	N.A.
Ageing (Ref. Annex I,4.1 (c)	Not to be significantly affected by ageing.	N.A.	N.A.
Material Fabrication Procedures (Ref. Annex I, 4.1 (d), & 3.1	Suitable for intended processing procedures.	N.A.	N.A.
Compatibility with other materials (Ref. Annex I, 4.1(e))	Selected so as to avoid significant undesirable effects when various materials are put together.	No interactions with other materials may occur and are reasonably expected	N.A.

Heat Analysis	Additional requirements to material specification (if any) are set on B&R relevant ORDER.	Verify on Material Certificate

Material Certification Requirements (Ref. Annex I, § 4.3	Material Manufacturer must confirm compliance with the material specification. EN 10204 Type 3.1 certification acceptable if Material Manufacturer operates a QA system certified by a recognised Competent Body otherwise certification to Type 3.2 is required.

Notes Material (s) listed in :	ASME Section II - and is (are) considered to be acceptable for pressure equipment purposes within the range of conditions outlined above.

The above material specification (s) have been appraised for compliance with the Essential Safety Requirements of EC Directive, 2014/68/UE.

P M A File Reference Number	**23096/PMA/03**	Appraiser	BREMBANA&ROLLE S.p.A. M. GALLI Q.C. M.
Date	**May 27, 2024**	Signature	

EXAMINED
This document has been examined and given the status as shown in the Design Appraisal Document (DAD) number below:
DAD Number: MLN-DAD-PED24-263
Date: 17 July 2024 Initials: AFM
Office: Milan
LRQA Italy S.R.L.
LRQA
A member of the LRQA Group Limited

For Pressure Equipment in Categories III and IV

Notified Body	**No. 0094 – LRQA**		
Signature		Date	

LRQA001 11.2021

BREMBANA&ROLLE
Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)

Particular Material Appraisal

According to Directive 2014/68/UE, Annex I, par 4.2.b

Fabbricante (Manufacturer)	
Product Form	NUTS
Specificaton (s)	SA 194 Gr. 2H, Ed.2021 Condition: QUENCHED AND TEMPERED
Additional requirements	23096-ODA24-000575
Allowable Temperature Range	min -29 °C max 80 °C
Notes	

Property	Annex I, Requirements	Specification Requirement	Incoming Inspection
Ductility (Ref. Annex I, 4.1 (a), 7.5	Elongation > 14% for steel	If not already foreseen as per material specification, material purchased with minimum elongation greater than 14%. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Toughness (Ref. Annex I, 4.1 (a), 7.5	N.A.	If not already foreseen as per material specification, material purchased with min 40J average at min temperature above or at lower temperature. See B&R relevant ORDER.	Verify on Material Certificate if the Specific Requirements have been fulfilled
Chemical Resistance (Ref. Annex I,4.1 (b)	Sufficiently resistant to the fluid, properties required for safety not to be affected during scheduled lifetime of equipment.	Not in contact with process fluid N.A.	N.A.
Ageing (Ref. Annex I,4.1 (c)	Not to be significantly affected by ageing.	N.A.	N.A.
Material Fabrication Procedures (Ref. Annex I, 4.1 (d), & 3.1	Suitable for intended processing procedures.	N.A.	N.A.
Compatibility with other materials (Ref. Annex I, 4.1(e))	Selected so as to avoid significant undesirable effects when various materials are put together.	No interactions with other materials may occur and are reasonably expected	N.A.

Heat Analysis	Additional requirements to material specification (if any) are set on B&R relevant ORDER.	Verify on Material Certificate

Material Certification Requirements (Ref. Annex I, § 4.3	Material Manufacturer must confirm compliance with the material specification. EN 10204 Type 3.1 certification acceptable if Material Manufacturer operates a QA system certified by a recognised Competent Body otherwise certification to Type 3.2 is required.

Notes Material (s) listed in :	ASME Section II - and is (are) considered to be acceptable for pressure equipment purposes within the range of conditions outlined above.

The above material specification (s) have been appraised for compliance with the Essential Safety Requirements of EC Directive, 2014/68/UE.

P M A File Reference Number	23096/PMA.04	Appraiser	
Date	May 27, 2024	Signature	BREMBANA&ROLLE S.p.A. M. GALLI Q.C. M.

EXAMINED
This document has been examined and given the status as shown in the Design Appraisal Document (DAD) number below:
DAD Number: MLN-DAD-PED24-263
Date: 17 July 2024
Initials: AFM
Office: Milan
LRQA Italy S.R.L.
A member of the LRQA Group Limited

For Pressure Equipment in Categories III and IV

Notified Body	No. 0094 – LRQA		
Signature		Date	

LRQA001 11.2021

Fabrication site: Albignasego – PD – ITALY

Section 7

Copies of Company approved waivers to Vendor requirements.

NOT APPLICABLE

Fabrication site: Albignasego – PD – ITALY

Section 8

All Non Conformity Reports and Repairs reports with final disposition and resolutions.

NOT APPLICABLE

Fabrication site: Albignasego – PD – ITALY

Section 9

Approved Welding Procedures Specification and Procedure Qualification Record.

BUREAU VERITAS

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO

ISP N°0006

PERMANENT JOINING PROCEDUREAPPROVAL CERTIFICATE
CERTIFICATO DI APPROVAZIONE DELLE GIUNZIONI PERMANENTI

No QP-AP-ITA-24-00162-rev.0

Manufacturer : Brembana&Rolle S.p.A.
Address : Via Villino 1, 24030, Valbrembo (BG) - Italy

Qualification in approval N° No della Qualifica in approvazione	**Reference standard of Qualification in approval** Norma di riferimento Qualifica in approvazione	**Third part recognized or No.Bo.** Terza parte riconosciuta o Organismo Notificato
51/15	ASME IX	Bureau Veritas Italia S.p.A. / Lloyd's Register
63/17	ASME IX	Lloyd's Register
24/17	ASME IX	Lloyd's Register / Bureau Veritas Italia S.p.A.
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

BUREAU VERITAS S.P.A. Notified Body Nr 1370
Bureau Veritas Organismo Notificato n°1370

certifies that the Permanent Joining Procedure Qualification Record, possibly completed by supplementary tests, complies with the Essential Safety Requirements stated by 2014/68/UE Directive - Appendix 1- § 3.1.2.
certifica che la qualifica di assemblaggio permanente,completato da eventuali prove complementari, soddisfa le Esigenze Essenziali di Sicurezza della Direttiva 2014/68/UE Directive - Allegato1 - § 3.1.2.

All Test performed in each qualification are equivalent to harmonized standard published in the Official journal of the European Union. The present document of approval supplementary does not contemplate tests required by Construction Code
Tutti I test effettuati su ciascuna qualifica sono equivalenti a quelle richieste dalla norma armonizzata di riferimento pubblicata nella Gazzetta Ufficiale dell'Unione Europea. Il presente documento di approvazione non contempla prove supplementari richiesti dal codice di fabbricazione

Observations -Osservazioni :

NAME / Nome	**DATE/ Data**	**VISA / Firma**	**STAMP / Timbro**
Carlo Baretta	**18 September 2024**		

BUREAU VERITAS ITALIA Notified Body no. 1370

IT FILE: 24.SF.7713291.138 – P10547/24/CB/CB

Attachment : Approved document & Supplementary test certificate (23096-01-TWB1 Rev.4)

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**WELDING PROCEDURE SPECIFICATION (WPS) AND QUALIFICATION (PQR) RECORDS – H2 STORAGE VESSEL**	Sheet 1 of 136 Date: 24/07/2024 Rev: 04

Base Load Power Hub (BLPH)

WELDING PROCEDURE SPECIFICATION (WPS) AND QUALIFICATION (PQR) RECORDS

Document Number: 1723001756-WEL-PRO-00013

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
Davide Cenacchi	11/09/2024

Document Class: 2

Rev.	Date	Description	Prepared	Reviewed	Approved
04	24/07/2024	Accepted for contruction (AFC)	A.Sandonà	M.Carminati	N.Tosto
03	12/03/2024	Accepted for contruction (AFC)	A.Sandonà	M.Carminati	N.Tosto
02	08/03/2024	Accepted for contruction (AFC)	A.Sandonà	M.Carminati	N.Tosto
01	02/02/2024	Issue for Review (IFR)	A.Sandonà	M.Carminati	N.Tosto
00	21/11/2023	Issue for Review (IFR)	A.Sandonà	M.Carminati	N.Tosto

B&R BREMBANA&ROLLE

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**WELDING PROCEDURE SPECIFICATION (WPS) AND QUALIFICATION (PQR) RECORDS – H2 STORAGE VESSEL**	Sheet 2 of 106 Date: 12/03/2024 Rev: 03

Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
01	Issue for Review (IFR)
02	Accepted for construction (AFC)
03	Accepted for construction (AFC)

HOLDS LIST

No.	Description
1	
2	
3	
4	

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

BREMBANA & ROLLE S.p.A
Registered Office: Via Villino 1, 24030 (BG) Italy
Head Office / Fabrication Site: Via Villino 1 – 24030 Valbrembo (BG) Tel.: +39 035/4510611 Fax +39 035/4510654
Fabrication Site: Albignasego (PD) V.le delle Industrie 35 – 35020 Tel.: +39 049/8624111 Fax +39 049/8626141
Subscribed Capital: € 14.560.000 - Paid-up Capital: € 11.600.000
Website: http://www.brembanarolle.com - VAT No. IT07348970158 - C.F. 00226780161

PURCHASER DATA		MANUFACTURER DATA	
CLIENT: Cliente:	Rosetti Marino	**JOB No.:** Commessa No.:	23096
PLANT: Impianto:	Crosswind Hollande Kust Noord Wind Park Project	**DWG. No.:** Disegno No.:	23096-01-EGA1
P.O.: Ordine:	1723001756 123A90A	**SERIAL No.:** No. di serie:	23096-01÷06-SNA
ITEM: Sigla:	V25001 A/F H2 Storage Vessel	**DOC. N. B&R:** DOC. N. Client: DOC. N. User:	23096-01-TWB1

APPLICABLE CODE:

ASME SECT. IX 2021 Edition
ASME SECT. VIII Div.2 2021 Edition
PED 2014/68/EU

APPLICABLE STANDARDS / SPECIFICATIONS:

Datasheet 123A90-DDL-MAC-DS-50027

WELDING BOOK - Quaderno di saldatura

- Zone reserved for approval stamps -

LRQA 17. SEP. 2024

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector M.B. No. 17119
Milan Office
17. SEP. 2024

REV.	DATE-Data	DESCRIPTION - Descrizione	ISSUED BY Preparato da A. Sandonà	CHECKED BY Controllato da M. Carminati	VERIFIED BY Verificato da N. Tosto
4	24.07.2024	Added WPS W09 and PQR 63/17 for nameplate support	A.S.	M.C.	N.T.
3	12.03.2024	Revised as per customer comments	A.S.	M.C.	N.T.
2	08.03.2024	Revised as per customer comments	A.S.	M.C.	N.T.
1	02.02.2024	Revised as per customer comments	A.S.	M.C.	N.T.
0	20.11.2023	Issued for approval	A.S.	M.C.	N.T.

WELDING PROCEDURES SUMMARY LIST
ELENCO PROCEDURE DI SALDATURA

Purchaser:	Rosetti Marino
Item No.:	V25001 A/F
Serial No.:	23096-01÷06-SNA
B&R Job No.:	23096

Joint Giunto	WPS Spec.	Rev.	PQR PQR	PROCESS/ES Processo/i	Joint description Descrizione giunto	Materials Materiali	Type tipo	thk.mm sp.mm	CVN CVN	PWHT PWHT	Rmks. Note
C1-C6	W08	0	51/15	GTAW SMAW SAW	Head circumferential weld	SA 516 Gr.60 to SA 516 Gr.60	U	44	Yes	Yes	
C2÷C5	W01	0	51/15	GTAW SMAW SAW	Shell circumferential weld	SA 516 Gr.60 to SA 516 Gr.60	X	44	Yes	Yes	
L1÷L5	W01	0	51/15	GTAW SMAW SAW	Shell longitudinal weld	SA 516 Gr.60 to SA 516 Gr.60	X	44	Yes	Yes	
M1-M2	W02	0	51/15	GTAW SMAW SAW	Nozzle to head weld	SA 516 Gr.60 to SA 350 LF2	½ V	40	Yes	Yes	
N1-N3-N5	W03	0	51/15	GTAW SMAW	Nozzle to shell weld	SA 516 Gr.60 to SA 350 LF2	½ V	44	Yes	Yes	
N2-N4	W03	0	51/15	GTAW SMAW	Nozzle to shell weld	SA 516 Gr.60 to SA 350 LF2	½ V	44	Yes	Yes	
K1-K2	W03	0	51/15	GTAW SMAW	Nozzle to shell weld	SA 516 Gr.60 to SA 350 LF2	½ V	44	Yes	Yes	
LL/1÷LL/4	W06	0	51/15	GTAW SMAW SAW	Typical liftiing lug pad weld	SA 516 Gr.60 to SA 516 Gr.60	Fillet	All	N.A.	Yes	
R1÷R6	W06	0	51/15	GTAW SMAW SAW	Typical internal rung weld	SA 516 Gr.60 to SA 516 Gr.60	Fillet	All	N.A.	Yes	
F1/1-L F1/1-R	W05	0	51/15	GTAW SMAW	Typical liftiing lug on M1 flat cover weld	SA 516 Gr.60 to SA 350 LF2	K+Fillet / ½ V+Fillet	All ≤18	No	Yes	
F1/2-L F1/2-R	W05	0	51/15	GTAW SMAW	Typical liftiing lug on M2 flat cover weld	SA 516 Gr.60 to SA 350 LF2	K+Fillet / ½ V+Fillet	All ≤18	No	Yes	
F2/1-T F2/1-B	W04	0	51/15	GTAW SMAW	Typical hinge lug for flat cover on M1 nozzle	SA 516 Gr.60 to SA 350 LF2	K+Fillet / ½ V+Fillet	All >18	Yes	Yes	
F2/2-T F2/2-B	W04	0	51/15	GTAW SMAW	Typical hinge lug for flat cover on M2 nozzle	SA 516 Gr.60 to SA 350 LF2	K+Fillet / ½ V+Fillet	All >18	Yes	Yes	
H/1-H/2	W06	0	51/15	GTAW SMAW SAW	Typical handle on flat cover	SA 516 Gr.60 to SA 350 LF2	Fillet	All	N.A.	Yes	
NP	W06	0	51/15	GTAW SMAW SAW	Name plate support weld	SA 516 Gr.60 to SA 516 Gr.60	Fillet	All	N.A.	Yes	
F3/1-F3/2	W06	0	51/15	GTAW SMAW SAW	Typical fillet weld	SA 516 Gr.60 to SA 516 Gr.60	Fillet	All	N.A.	Yes	
F4	W07	0	24/17	FCAW	Typical no pressure parts fillet weld	SA 516 Gr.60 to SA 516 Gr.60	Fillet	All	N.A.	Yes	
WR	WR	0	51/15	SMAW SAW	Typical for Welding Repair	SA 516 Gr.60 / SA 350 LF2 / W.M. P.No.4	Sketch	N.A.	N.A.	Yes	

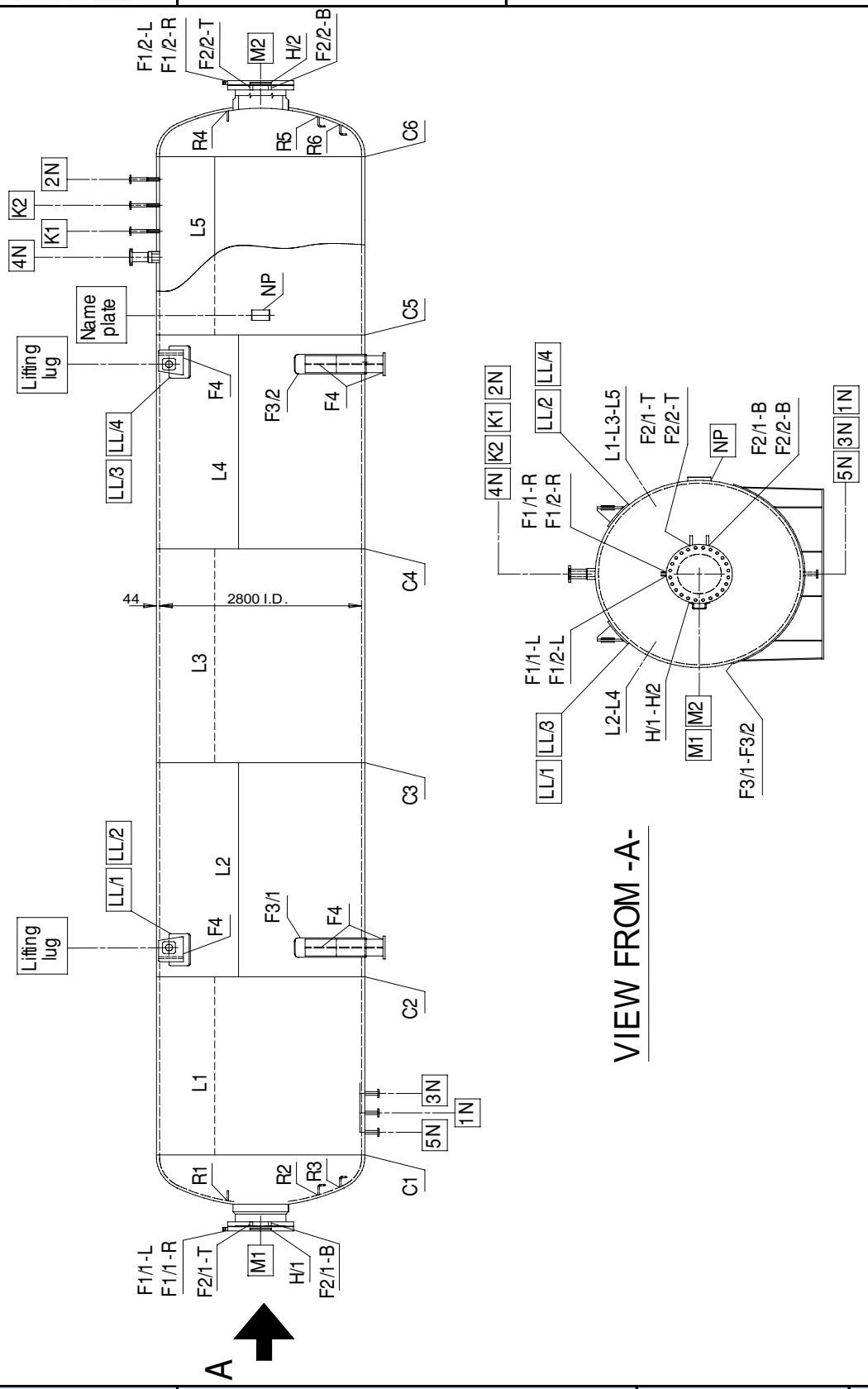
Remarks:

ISSUED BY - Preparato da:	APPROVED BY - Approvato da:	DATE - Data:	REV.- Rev.:
A. SANDONÀ	N. TOSTO	12.03.2024	2
A. SANDONÀ	N. TOSTO	08.03.2024	1
A. SANDONÀ	N. TOSTO	20.11.2023	0

WELDING MAP 1 of 1

Mappa delle Saldature 1 of 1

Purchaser:	Rosetti Marino
Item No.:	V25001 A/F
Serial No.:	23096-01÷06-SNA
B&R Job No.:	23096



ISSUED BY - Preparato da:	APPROVED BY - Approvato da:	DATE - Data:	REV.-Rev.:
A. SANDONÀ	N. TOSTO	12.03.2024	2
A. SANDONÀ	N. TOSTO	08.03.2024	1
A. SANDONÀ	N. TOSTO	20.11.2023	0

REMARKS SHEET

FOGLIO NOTE

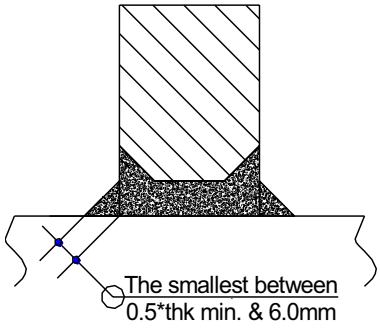
Purchaser:	Rosetti Marino
Item No.:	V25001 A/F
Serial No.:	23096-01÷06-SNA
B&R Job No.:	23096

Fit-up misallignment tolerances:

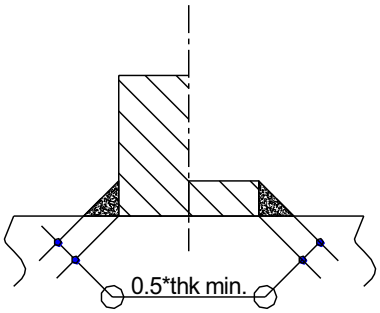
SI Units

Section Thickness, mm	Joint Categories A	Joint Categories B, C, & D
Up to 13, incl.	$\frac{1}{4}t$	$\frac{1}{4}t$
Over 13 to 19, incl.	3 mm	$\frac{1}{4}t$
Over 19 to 38, incl.	3 mm	5 mm
Over 38 to 51, incl.	3 mm	$\frac{1}{8}t$
Over 51	Lesser of $\frac{1}{16}t$ or 10 mm	Lesser of $\frac{1}{8}t$ or 19 mm

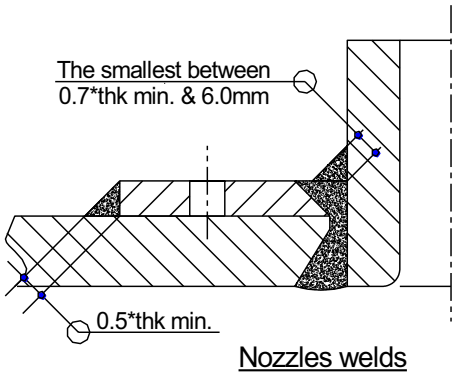
Typical weld throat dimensions (if not otherwise quoted on construction drawings):



Corner joints - full penetration



Fillet welds



Nozzles welds

WELDING PRODUCTION TEST PLATES - Talloni di produzione

Not required / Non richiesti - Exempt from impact test as per ASME VIII Div.2 - Part.3 - Figure 3.8 /3.8M

MINIMUM DESIGN METAL TEMPERATURE - Temperatura minima di progetto

-29 °C

REMARKS - Note

1) Weld bevels and edges shall be free from dirt, oils, paint and other foreign materials for at least 25 mm around.

2) All slag, loose, dirt, scale, weld spattern, oils, paint and other foreign material shall be removed before welds visual inspection.

3) In case of repairs occurs before or after PWHT, repairs activities shall follow what detailed in B&R procedure nominated "121 WR_Procedure for repairing of welds" attached to this document.

ISSUED BY - Preparato da:	APPROVED BY - Approvato da:	DATE - Data:	REV.-Rev.:
A. SANDONÀ	N. TOSTO	02.02.2024	1
A. SANDONÀ	N. TOSTO	20.11.2023	0

Welding Procedure Specification (WPS)

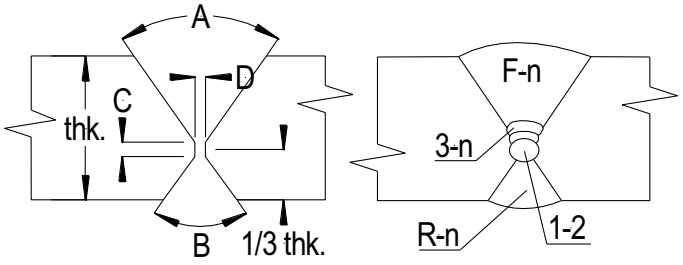
ASME Boiler and Pressure Vessel Code Section IX QW-200.1

Job:	23096	WPS:	W01
Item:	V25001 A/F	Rev.:	0
S.N.:	23096-01÷06-SNA	Date:	20.11.2023

	GTAW	SMAW	SAW	
Welding Process:	GTAW	SMAW	SAW	Supporting PQR: 51/15
Type:	MANUAL	MANUAL	MACHINE	

JOINTS (QW-402)

Design: X | Backing: GTAW No, other Yes | Material: Base + Weld metal



Dimensions:

A:	40° ± 5°
B:	50° ± 5°
C:	1 ÷ 2 mm
D:	3 ÷ 5 mm
E:	-
R:	-
Thk.:	See summary sheet

Retainers: No (QW-402.11)

Tack weld: According to process GTAW or SMAW of present WPS

Weld Bevel Code: ASC36

BASE METAL (QW-403)

Material Spec.; Type or Grade: SA 516 Gr.60

to Material Spec.; Type or Grade: SA 516 Gr.60

P-No.: 1 Gr. No.: 1 to P-No.: 1 Gr. No.: 1

Base Metal Groove T Limits (mm): 16 ÷ 200 Fillet (mm): All

Pipe Ø Range Groove (mm): All Fillet (mm): All

Other: t pass ≤ 13 mm (QW-403.9) T Limits (QW-403.6): Yes

Other: No

FILLER METAL (QW-404)

Process (es):	GTAW	SMAW	SAW	
SFA Specification:	5.18	5.1	5.17	
AWS Classification:	ER70S-3	E7018-1 H4	EH12K	
Filler metal F-No.:	6	4	6	
Weld Metal A-No.:	1	1	1	
Size (mm):	2.4	4 - 5	4	
Product Form:	Solid Wire	N.A.	Solid Wire	
Trade Name:	EML5	Tenax 35S	OK Autrod 12.32	
Supplier:	Bohler	Oerlikon	ESAB	
Flux Trade Name:	N.A.	N.A.	OK Flux 10.62	
Flux Type:	N.A.	N.A.	Neutral/Non Alloying	
Supplier:	N.A.	N.A.	ESAB	
Wire/Flux Class.:	N.A.	N.A.	F7P8-EH12K	
Consumable Ins.:	No	N.A.	N.A.	
Supplemental:	No	N.A.	No	
Recrushed slag:	N.A.	N.A.	No	
Max. weld metal thk.:	8	200	200	
Other:				

POSITION (QW-405)

Process:	GTAW	SMAW	SAW	
Position of Groove:	1G	1G	1G	
Position of Fillet:	N.A.	N.A.	N.A.	
Welding Progression:	N.A.	N.A.	N.A.	
Other:	No			

PREHEAT (QW-406)

	Temperature (°C)	Method	Control	Time (Hours)
Preheat ≥:	50	Gas Burner	Tempilstick	/
Maintaining:	Yes	Gas Burner	Tempilstick	/
Interpass ≤:	250	/	Tempilstick	/
Post-Heat (DHT) ≥:	No	/	/	/

Other: No

Cooling under Insulation: No

POST WELD HEAT TREATMENT (QW-407)

Method:	Gas Furnace	
Control:	Thermocouples	
Temperature Range:	610 ±10°C	°C
Time Range:	3	Hours
Heating/Cooling Rate:	≤60 / ≤60	°C/h
Temperature Limits:	No (QW-407.4)	
Other:	No	

GAS (QW-408)

	Gas(es)	Composition	Flow Rate (l/1')
Process:	GTAW		
Shielding:	Argon	99.997	10 ÷ 12
Process:			
Shielding:	/		
Backing:			
Trailing:			

Other: No

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	GTAW	SMAW	SAW
Current Type:	DC	DC	DC
Pulsing Current:	No	N.A.	N.A.
Polarity:	EN	EP	EP
Tung. El. Type:	EWTh-2	N.A.	N.A.
Tung. El. Ø:	2.4	N.A.	N.A.
Transfer Mode:	N.A.	N.A.	N.A.

Other: No

TECHNIQUE (QW-410)

String/Weave beads:	String
Orifice/Cup size (mm):	10
Initial Cleaning:	Machining
Interpass Cleaning:	Grinding / Brushing
Method of Back Gouge:	N.A.
Oscillation:	No
Single/Multi pass/side:	Single and Multi pass
Single/Multi Electrode:	Single
Electrode Spacing (mm):	N.A.
Electrode Stick out (mm):	25 ÷ 30
Closed/Out of Chamber:	N.A.
Manual or Automatic:	Manual and Machine
Supplemental Device/s:	N.A.
Peening:	No
Other:	QW-410.64: No

TABLE OF PARAMETERS (QW-409; QW-410)

Pass	Process	AWS	Size (mm)	Current Polarity	Ampere range	Volt range	Travel Speed (mm/min.)	ROL ≥ (mm)	Wire Feed Speed (mm/min.)	Min./Max. Heat Input (J/mm)
1-2	GTAW	ER70S-3	2.4	DCEN	110 ÷ 150	10 ÷ 14	060 ÷ 090	/	/	733 ÷ 2100
3-n	SMAW	E7018-1 H4	4	DCEP	150 ÷ 190	24 ÷ 27	180 ÷ 220	/	/	982 ÷ 1710
	SMAW	E7018-1 H4	5	DCEP	180 ÷ 220	24 ÷ 27	190 ÷ 240	/	/	1080 ÷ 1876
F-n/R-n	SAW	EH 12K	4	DCEP	500 ÷ 535	28 ÷ 31	510 ÷ 540	/	/	1556 ÷ 1951

REMARKS:

Issued by:
A. Sandonà
Welding Department

Approved by:
N. Tosto
Welding Department Manager

Welding Procedure Specification (WPS)

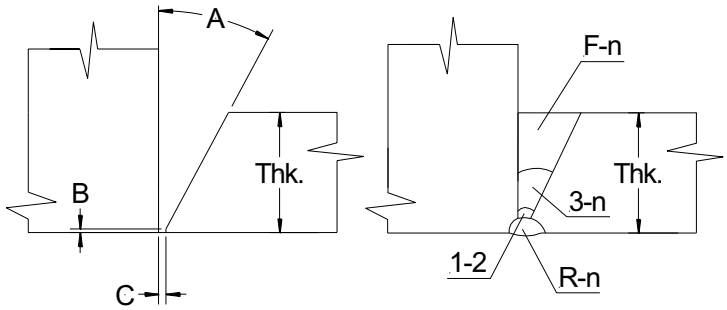
ASME Boiler and Pressure Vessel Code Section IX QW-200.1

Job:	23096	WPS:	W02
Item:	V25001 A/F	Rev.:	0
S.N.:	23096-01÷06-SNA	Date:	20.11.2023

Welding Process:	GTAW	SMAW	SAW	Supporting PQR: 51/15
Type:	MANUAL	MANUAL	MACHINE	

JOINTS (QW-402)

Design: ½ V | Backing: 1st layer No, other Yes | Material: Weld metal



Dimensions:

A:	25° +5/-0°
B:	0 ÷ 1 mm
C:	3 ÷ 5 mm
D:	See remarks sheet
E:	-
F:	-
R:	-
Thk.:	See summary

Retainers: No (QW-402.11)

Tack weld: According to process GTAW or SMAW of present WPS | Weld Bevel Code: ASC29

BASE METAL (QW-403)

Material Spec.; Type or Grade: SA 516 Gr.60

to Material Spec.; Type or Grade: SA 350 LF2

P-No.: 1 Gr. No.: 1 to P-No.: 1 Gr. No.: 2

Base Metal Groove T Limits (mm): 16 ÷ 200 Fillet (mm): All

Pipe Ø Range Groove (mm): All Fillet (mm): All

Other: t pass ≤ 13 mm (QW-403.9) T Limits (QW-403.6): Yes

Other: No

FILLER METAL (QW-404)

Process (es):	GTAW	SMAW	SAW	
SFA Specification:	5.18	5.1	5.17	
AWS Classification:	ER70S-3	E7018-1 H4	EH12K	
Filler metal F-No.:	6	4	6	
Weld Metal A-No.:	1	1	1	
Size (mm):	2.4	4 - 5	4	
Product Form:	Solid Wire	N.A.	Solid Wire	
Trade Name:	EML5	Tenax 35S	OK Autrod 12.32	
Supplier:	Bohler	Oerlikon	ESAB	
Flux Trade Name:	N.A.	N.A.	OK Flux 10.62	
Flux Type:	N.A.	N.A.	Neutral/Non Alloying	
Supplier:	N.A.	N.A.	ESAB	
Wire/Flux Class.:	N.A.	N.A.	F7P8-EH12K	
Consumable Ins.:	No	N.A.	N.A.	
Supplemental:	No	N.A.	No	
Recrushed slag:	N.A.	N.A.	No	
Max. weld metal thk.:	8	200	200	
Other:				

POSITION (QW-405)

Process:	GTAW	SMAW	SAW	
Position of Groove:	1G	1G	1G	
Position of Fillet:	N.A.	N.A.	N.A.	
Welding Progression:	N.A.	N.A.	N.A.	
Other:	No			

PREHEAT (QW-406)

	Temperature (°C)	Method	Control	Time (Hours)
Preheat ≥:	50	Gas Burner	Tempilstick	/
Maintaining:	Yes	Gas Burner	Tempilstick	/
Interpass ≤:	250	/	Tempilstick	/
Post-Heat (DHT) ≥:	No	/	/	/

Other: No

Cooling under Insulation: No

POST WELD HEAT TREATMENT (QW-407)

Method:	Gas Furnace	
Control:	Thermocouples	
Temperature Range:	610 ±10°C	°C
Time Range:	3	Hours
Heating/Cooling Rate:	≤60 / ≤60	°C/h
Temperature Limits:	No (QW-407.4)	
Other:	No	

GAS (QW-408)

	Gas(es)	Composition	Flow Rate (l/1')
Process:	GTAW		
Shielding:	Argon	99.997	10 ÷ 12
Process:			
Shielding:	/		
Backing:			
Trailing:			

Other: No

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	GTAW	SMAW	SAW
Current Type:	DC	DC	DC
Pulsing Current:	No	N.A.	N.A.
Polarity:	EN	EP	EP
Tung. El. Type:	EWTh-2	N.A.	N.A.
Tung. El. Ø:	2.4	N.A.	N.A.
Transfer Mode:	N.A.	N.A.	N.A.

Other: No

TECHNIQUE (QW-410)

String/Weave beads:	String
Orifice/Cup size (mm):	10
Initial Cleaning:	Machining
Interpass Cleaning:	Grinding / Brushing
Method of Back Gouge:	Grinding to sound metal
Oscillation:	No
Single/Multi pass/side:	Single and Multi pass
Single/Multi Electrode:	Single
Electrode Spacing (mm):	N.A.
Electrode Stick out (mm):	25 ÷ 30
Closed/Out of Chamber:	N.A.
Manual or Automatic:	Manual and Machine
Supplemental Device/s:	N.A.
Peening:	No
Other:	QW-410.64: No

TABLE OF PARAMETERS (QW-409; QW-410)

Pass	Process	AWS	Size (mm)	Current Polarity	Ampere range	Volt range	Travel Speed (mm/min.)	ROL ≥ (mm)	Wire Feed Speed (mm/min.)	Min./Max. Heat Input (J/mm)
1-2	GTAW	ER70S-3	2.4	DCEN	110 ÷ 150	10 ÷ 14	060 ÷ 090	/	/	733 ÷ 2100
3-n	SMAW	E7018-1 H4	4	DCEP	150 ÷ 190	24 ÷ 27	180 ÷ 220	/	/	982 ÷ 1710
	SMAW	E7018-1 H4	5	DCEP	180 ÷ 220	24 ÷ 27	190 ÷ 240	/	/	1080 ÷ 1876
F-n/R-n	SAW	EH 12K	4	DCEP	500 ÷ 535	28 ÷ 31	510 ÷ 540	/	/	1556 ÷ 1951

REMARKS:

1) Back gouging shall be performed only if necessary after NDE

Issued by:
A. Sandonà
Welding Department

Approved by:
N. Tosto
Welding Department Manager

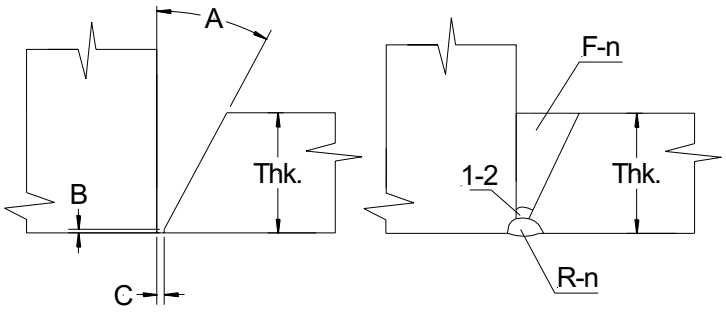
Welding Procedure Specification (WPS)

ASME Boiler and Pressure Vessel Code Section IX QW-200.1

Job:	23096	WPS:	W03
Item:	V25001 A/F	Rev.:	0
S.N.:	23096-01÷06-SNA	Date:	20.11.2023

Welding Process:	GTAW	SMAW			Supporting PQR: 51/15
Type:	MANUAL	MANUAL			

JOINTS (QW-402) Design: ½ V Backing: 1st layer No, other Yes Material: Weld metal



Dimensions:

A:	25° +5/-0°
B:	0 ÷ 1 mm
C:	3 ÷ 5 mm
D:	See remarks sheet
E:	-
F:	-
R:	-
Thk.:	See summary

Retainers: No (QW-402.11)

Tack weld: According to process GTAW or SMAW of present WPS

Weld Bevel Code: ASC29

BASE METAL (QW-403)

Material Spec.; Type or Grade: SA 516 Gr.60

to Material Spec.; Type or Grade: SA 350 LF2

P-No.: 1 Gr. No.: 1 to P-No.: 1 Gr. No.: 2

Base Metal Groove T Limits (mm): 16 ÷ 200 Fillet (mm): All

Pipe Ø Range Groove (mm): All Fillet (mm): All

Other: t pass ≤ 13 mm (QW-403.9) T Limits (QW-403.6): Yes

Other: No

FILLER METAL (QW-404)

Process (es):	GTAW	SMAW		
SFA Specification:	5.18	5.1		
AWS Classification:	ER70S-3	E7018-1 H4		
Filler metal F-No.:	6	4		
Weld Metal A-No.:	1	1		
Size (mm):	2.4	4 - 5		
Product Form:	Solid Wire	N.A.		
Trade Name:	EML5	Tenax 35S		
Supplier:	Bohler	Oerlikon		
Flux Trade Name:	N.A.	N.A.		
Flux Type:	N.A.	N.A.		
Supplier:	N.A.	N.A.		
Wire/Flux Class.:	N.A.	N.A.		
Consumable Ins.:	No	N.A.		
Supplemental:	No	N.A.		
Recrushed slag:	N.A.	N.A.		
Max. weld metal thk.:	8	200		
Other:				

POSITION (QW-405)

Process:	GTAW	SMAW		
Position of Groove:	1G	1G		
Position of Fillet:	N.A.	N.A.		
Welding Progression:	N.A.	N.A.		
Other:	No			

PREHEAT (QW-406)

	Temperature (°C)	Method	Control	Time (Hours)
Preheat ≥:	50	Gas Burner	Tempilstick	/
Maintaining:	Yes	Gas Burner	Tempilstick	/
Interpass ≤:	250	/	Tempilstick	/
Post-Heat (DHT) ≥:	No	/	/	/

Other: No

Cooling under Insulation: No

POST WELD HEAT TREATMENT (QW-407)

Method:	Gas Furnace	
Control:	Thermocouples	
Temperature Range:	610 ±10°C	°C
Time Range:	3	Hours
Heating/Cooling Rate:	≤60 / ≤60	°C/h
Temperature Limits:	No (QW-407.4)	
Other:	No	

GAS (QW-408)

	Gas(es)	Composition	Flow Rate (l/1')
Process:	GTAW		
Shielding:	Argon	99.997	10 ÷ 12
Process:			
Shielding:	/		
Backing:			
Trailing:			

Other: No

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	GTAW	SMAW		
Current Type:	DC	DC		
Pulsing Current:	No	N.A.		
Polarity:	EN	EP		
Tung. El. Type:	EWTh-2	N.A.		
Tung. El. Ø:	2.4	N.A.		
Transfer Mode:	N.A.	N.A.		

Other: No

TECHNIQUE (QW-410)

String/Weave beads:	String
Orifice/Cup size (mm):	10
Initial Cleaning:	Grinding / Brushing
Interpass Cleaning:	Grinding / Brushing
Method of Back Gouge:	Grinding to sound metal
Oscillation:	N.A.
Single/Multi pass/side:	Single and Multi pass
Single/Multi Electrode:	N.A.
Electrode Spacing (mm):	N.A.
Electrode Stick out (mm):	N.A.
Closed/Out of Chamber:	N.A.
Manual or Automatic:	Manual
Supplemental Device/s:	N.A.
Peening:	No
Other:	QW-410.64: No

TABLE OF PARAMETERS (QW-409; QW-410)

Pass	Process	AWS	Size (mm)	Current Polarity	Ampere range	Volt range	Travel Speed (mm/min.)	ROL ≥ (mm)	Wire Feed Speed (mm/min.)	Min./Max. Heat Input (J/mm)
1-2	GTAW	ER70S-3	2.4	DCEN	110 ÷ 150	10 ÷ 14	060 ÷ 090	/	/	733 ÷ 2100
F-n/R-n	SMAW	E7018-1 H4	4	DCEP	150 ÷ 190	24 ÷ 27	180 ÷ 220	/	/	982 ÷ 1710
	SMAW	E7018-1 H4	5	DCEP	180 ÷ 220	24 ÷ 27	190 ÷ 240	/	/	1080 ÷ 1876

REMARKS:

1) Back gouging shall be performed only if necessary after NDE

Issued by:
A. Sandonà
Welding Department

Approved by:
N. Tosto
Welding Department Manager

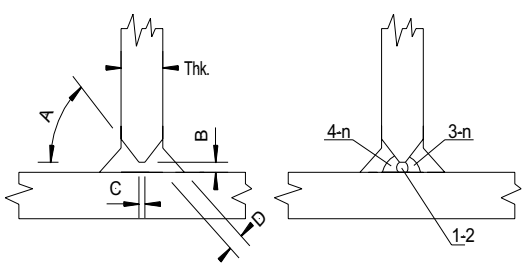
Welding Procedure Specification (WPS)

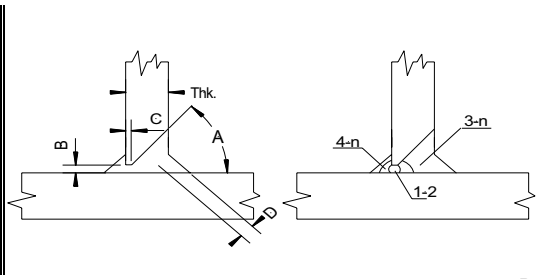
ASME Boiler and Pressure Vessel Code Section IX QW-200.1

Job:	23096	WPS:	W04
Item:	V25001 A/F	Rev.:	0
S.N.:	23096-01÷06-SNA	Date:	20.11.2023

Welding Process:	GTAW	SMAW			Supporting PQR: 51/15
Type:	MANUAL	MANUAL			

JOINTS (QW-402) Design: K+Fillet / ½ V+Fillet Backing: GTAW No, other Yes Material: Weld metal





Dimensions:

A:	50° ± 10°
B:	2 ÷ 4 mm
C:	0 ÷ 1 mm
D:	See remarks sheet
E:	-
F:	-
R:	-
Thk.:	See summary

Retainers: No (QW-402.11)

Tack weld: According to processes GTAW or SMAW of present WPS

Weld Bevel Code: BSC21 - BSC20

BASE METAL (QW-403)

Material Spec.; Type or Grade:	SA 516 Gr.60			
to Material Spec.; Type or Grade:	SA 350 LF2			
P-No.: 1	Gr. No.: 1	to P-No.: 1	Gr. No.: 2	
Base Metal Groove T Limits (mm):	16 ÷ 200	Fillet (mm):	All	
Pipe Ø Range Groove (mm):	All	Fillet (mm):	All	
Other:	t pass ≤ 13 mm (QW-403.9)	T Limits (QW-403.6):	Yes	
Other:	No			

FILLER METAL (QW-404)

Process (es):	GTAW	SMAW		
SFA Specification:	5.18	5.1		
AWS Classification:	ER70S-3	E7018-1 H4		
Filler metal F-No.:	6	4		
Weld Metal A-No.:	1	1		
Size (mm):	2.4	3.2 - 4 - 5		
Product Form:	Solid Wire	N.A.		
Trade Name:	EML5	Tenax 35S		
Supplier:	Bohler	Oerlikon		
Flux Trade Name:	N.A.	N.A.		
Flux Type:	N.A.	N.A.		
Supplier:	N.A.	N.A.		
Wire/Flux Class.:	N.A.	N.A.		
Consumable Ins.:	No	N.A.		
Supplemental:	No	N.A.		
Recrushed slag:	N.A.	N.A.		
Max. weld metal thk.:	8	200		
Other:				

POSITION (QW-405)

Process:	GTAW	SMAW		
Position of Groove:	1G / 2G	1G / 2G		
Position of Fillet:	N.A.	N.A.		
Welding Progression:	N.A.	N.A.		
Other:	No			

PREHEAT (QW-406)

	Temperature (°C)	Method	Control	Time (Hours)
Preheat ≥:	50	Gas Burner	Tempilstick	/
Maintaining:	Yes	Gas Burner	Tempilstick	/
Interpass ≤:	200	/	Tempilstick	/
Post-Heat (DHT) ≥:	No	/	/	/
Other:	No			
Cooling under Insulation:	No			

POST WELD HEAT TREATMENT (QW-407)

Method:	Gas Furnace	
Control:	Thermocouples	
Temperature Range:	610 ±10°C	°C
Time Range:	3	Hours
Heating/Cooling Rate:	≤60 / ≤60	°C/h
Temperature Limits:	No (QW-407.4)	
Other:	No	

GAS (QW-408)

	Gas(es)	Composition	Flow Rate (l/1')
Process:	GTAW		
Shielding:	Argon	99.997	10 ÷ 12
Process:			
Shielding:	/		
Backing:			
Trailing:			
Other:	No		

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	GTAW	SMAW		
Current Type:	DC	DC		
Pulsing Current:	No	N.A.		
Polarity:	EN	EP		
Tung. El. Type:	EWTh-2	N.A.		
Tung. El. Ø:	2.4	N.A.		
Transfer Mode:	N.A.	N.A.		
Other:	No			

TECHNIQUE (QW-410)

String/Weave beads:	String
Orifice/Cup size (mm):	10
Initial Cleaning:	Grinding / Brushing
Interpass Cleaning:	Grinding / Brushing
Method of Back Gouge:	N.A.
Oscillation:	N.A.
Single/Multi pass/side:	Single and Multi pass
Single/Multi Electrode:	N.A.
Electrode Spacing (mm):	N.A.
Electrode Stick out (mm):	N.A.
Closed/Out of Chamber:	N.A.
Manual or Automatic:	Manual
Supplemental Device/s:	N.A.
Peening:	No
Other:	QW-410.64: No

TABLE OF PARAMETERS (QW-409; QW-410)

Pass	Process	AWS	Size (mm)	Current Polarity	Ampere range	Volt range	Travel Speed (mm/min.)	ROL ≥ (mm)	Wire Feed Speed (mm/min.)	Min./Max. Heat Input (J/mm)
1-2	GTAW	ER70S-3	2.4	DCEN	110 ÷ 150	10 ÷ 14	060 ÷ 090	/	/	733 ÷ 2100
3-n/4-n	SMAW	E7018-1 H4	3.2	DCEP	110 ÷ 140	23 ÷ 26	180 ÷ 200	/	/	759 ÷ 1213
	SMAW	E7018-1 H4	4	DCEP	150 ÷ 190	24 ÷ 27	180 ÷ 220	/	/	982 ÷ 1710
	SMAW	E7018-1 H4	5	DCEP	180 ÷ 220	24 ÷ 27	190 ÷ 240	/	/	1080 ÷ 1876

REMARKS:

Issued by:
A. Sandonà
Welding Department

Approved by:
N. Tosto
Welding Department Manager

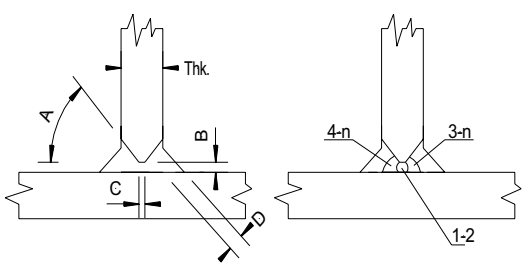
Welding Procedure Specification (WPS)

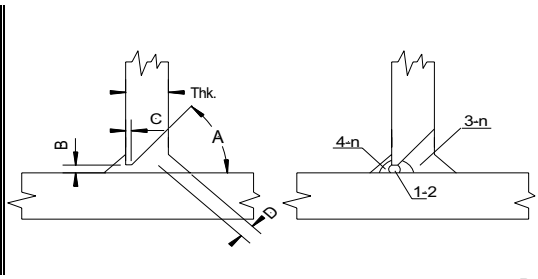
ASME Boiler and Pressure Vessel Code Section IX QW-200.1

Job:	23096	WPS:	W05
Item:	V25001 A/F	Rev.:	0
S.N.:	23096-01÷06-SNA	Date:	20.11.2023

Welding Process:	GTAW	SMAW			Supporting PQR:	51/15
Type:	MANUAL	MANUAL				

JOINTS (QW-402) Design: K+Fillet / ½ V+Fillet Backing: GTAW No, other Yes Material: Weld metal





Dimensions:

A:	50° ± 10°
B:	2 ÷ 4 mm
C:	0 ÷ 1 mm
D:	See remarks sheet
E:	-
F:	-
R:	-
Thk.:	See summary

Retainers: No (QW-402.11)

Tack weld: According to processes GTAW or SMAW of present WPS Weld Bevel Code: BSC21 - BSC20

BASE METAL (QW-403)

Material Spec.; Type or Grade: SA 516 Gr.60

to Material Spec.; Type or Grade: SA 516 Gr.60 - SA 350 LF2

P-No.: 1 Gr. No.: 1 to P-No.: 1 Gr. No.: 1 / 2

Base Metal Groove T Limits (mm): 5 ÷ 200 Fillet (mm): All

Pipe Ø Range Groove (mm): All Fillet (mm): All

Other: t pass ≤ 13 mm (QW-403.9) T Limits (QW-403.6): No

Other: No

FILLER METAL (QW-404)

Process (es):	GTAW	SMAW		
SFA Specification:	5.18	5.1		
AWS Classification:	ER70S-3	E7018-1 H4		
Filler metal F-No.:	6	4		
Weld Metal A-No.:	1	1		
Size (mm):	2.4	3.2 - 4 - 5		
Product Form:	Solid Wire	N.A.		
Trade Name:	EML5	Tenax 35S		
Supplier:	Bohler	Oerlikon		
Flux Trade Name:	N.A.	N.A.		
Flux Type:	N.A.	N.A.		
Supplier:	N.A.	N.A.		
Wire/Flux Class.:	N.A.	N.A.		
Consumable Ins.:	No	N.A.		
Supplemental:	No	N.A.		
Recrushed slag:	N.A.	N.A.		
Max. weld metal thk.:	8	200		
Other:				

POSITION (QW-405)

Process:	GTAW	SMAW		
Position of Groove:	1G / 2G	1G / 2G		
Position of Fillet:	N.A.	N.A.		
Welding Progression:	N.A.	N.A.		
Other:	No			

PREHEAT (QW-406)

	Temperature (°C)	Method	Control	Time (Hours)
Preheat ≥:	50	Gas Burner	Tempilstick	/
Maintaining:	Yes	Gas Burner	Tempilstick	/
Interpass ≤:	200	/	Tempilstick	/
Post-Heat (DHT) ≥:	No	/	/	/

Other: No

Cooling under Insulation: No

POST WELD HEAT TREATMENT (QW-407)

Method:	Gas Furnace	
Control:	Thermocouples	
Temperature Range:	610 ±10°C	°C
Time Range:	3	Hours
Heating/Cooling Rate:	≤60 / ≤60	°C/h
Temperature Limits:	No (QW-407.4)	
Other:	No	

GAS (QW-408)

	Gas(es)	Composition	Flow Rate (l/1')
Process:	GTAW		
Shielding:	Argon	99.997	10 ÷ 12
Process:			
Shielding:	/		
Backing:			
Trailing:			

Other: No

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	GTAW	SMAW		
Current Type:	DC	DC		
Pulsing Current:	No	N.A.		
Polarity:	EN	EP		
Tung. El. Type:	EWTh-2	N.A.		
Tung. El. Ø:	2.4	N.A.		
Transfer Mode:	N.A.	N.A.		

Other: No

TECHNIQUE (QW-410)

String/Weave beads:	String
Orifice/Cup size (mm):	10
Initial Cleaning:	Grinding / Brushing
Interpass Cleaning:	Grinding / Brushing
Method of Back Gouge:	N.A.
Oscillation:	N.A.
Single/Multi pass/side:	Single and Multi pass
Single/Multi Electrode:	N.A.
Electrode Spacing (mm):	N.A.
Electrode Stick out (mm):	N.A.
Closed/Out of Chamber:	N.A.
Manual or Automatic:	Manual
Supplemental Device/s:	N.A.
Peening:	No
Other:	QW-410.64: No

TABLE OF PARAMETERS (QW-409; QW-410)

Pass	Process	AWS	Size (mm)	Current Polarity	Ampere range	Volt range	Travel Speed (mm/min.)	ROL ≥ (mm)	Wire Feed Speed (mm/min.)	Min./Max. Heat Input (J/mm)
1-2	GTAW	ER70S-3	2.4	DCEN	110 ÷ 150	10 ÷ 14	060 ÷ 090	/	/	733 ÷ 2100
3-n/4-n	SMAW	E7018-1 H4	3.2	DCEP	110 ÷ 140	23 ÷ 26	180 ÷ 200	/	/	759 ÷ 1213
	SMAW	E7018-1 H4	4	DCEP	150 ÷ 190	24 ÷ 27	180 ÷ 220	/	/	982 ÷ 1710
	SMAW	E7018-1 H4	5	DCEP	180 ÷ 220	24 ÷ 27	190 ÷ 240	/	/	1080 ÷ 1876

REMARKS:

Issued by:
A. Sandonà
Welding Department

Approved by:
N. Tosto
Welding Department Manager

Welding Procedure Specification (WPS)

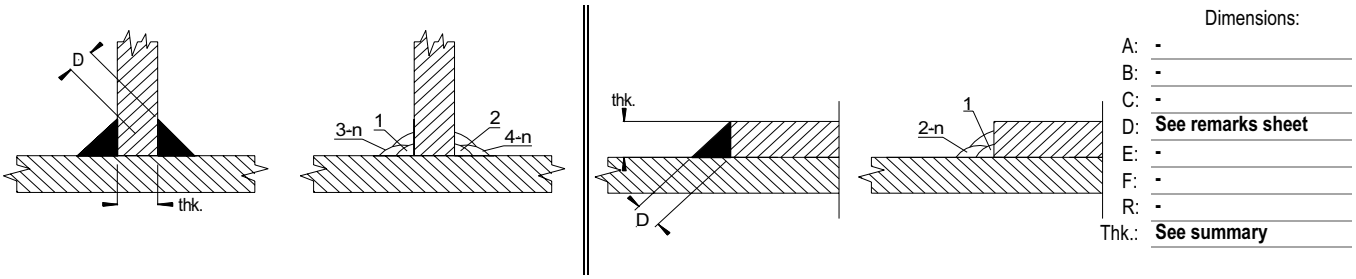
ASME Boiler and Pressure Vessel Code Section IX QW-200.1

Job:	23096	WPS:	W06
Item:	V25001 A/F	Rev.:	0
S.N.:	23096-01÷06-SNA	Date:	20.11.2023

	GTAW	SMAW	SAW	
Welding Process:	GTAW	SMAW	SAW	Supporting PQR: 51/15
Type:	MANUAL	MANUAL	MACHINE	

JOINTS (QW-402)

Design: Fillet | Backing: Yes | Material: Base metal



Dimensions:

A:	-
B:	-
C:	-
D:	See remarks sheet
E:	-
F:	-
R:	-
Thk.:	See summary

Retainers: No (QW-402.11)

Tack weld: According to GTAW or SMAW processes of present WPS

Weld Bevel Code: BSC22 - BCS23

BASE METAL (QW-403)

Material Spec.; Type or Grade: SA 516 Gr.60

to Material Spec.; Type or Grade: SA 516 Gr.60 - SA 350 LF2

P-No.: 1 Gr. No.: 1 to P-No.: 1 Gr. No.: 1 / 2

Base Metal Groove T Limits (mm): N.A. Fillet (mm): All

Pipe Ø Range Groove (mm): All Fillet (mm): All

Other: t pass ≤ 13 mm (QW-403.9) T Limits (QW-403.6): N.A.

Other: No

FILLER METAL (QW-404)

Process (es):	GTAW	SMAW	SAW	
SFA Specification:	5.18	5.1	5.17	
AWS Classification:	ER70S-3	E7018-1 H4	EH12K	
Filler metal F-No.:	6	4	6	
Weld Metal A-No.:	1	1	1	
Size (mm):	2.4	4 - 5	4	
Product Form:	Solid Wire	N.A.	Solid Wire	
Trade Name:	EML5	Tenax 35S	OK Autrod 12.32	
Supplier:	Bohler	Oerlikon	ESAB	
Flux Trade Name:	N.A.	N.A.	OK Flux 10.62	
Flux Type:	N.A.	N.A.	Neutral/Non Alloying	
Supplier:	N.A.	N.A.	ESAB	
Wire/Flux Class.:	N.A.	N.A.	F7P8-EH12K	
Consumable Ins.:	No	N.A.	N.A.	
Supplemental:	No	N.A.	No	
Recrushed slag:	N.A.	N.A.	No	
Max. weld metal thk.:	8	200	200	
Other:				

POSITION (QW-405)

Process:	GTAW	SMAW	SAW	
Position of Groove:	N.A.	N.A.	N.A.	
Position of Fillet:	1F / 2F	1F / 2F	1F / 2F	
Welding Progression:	N.A.	N.A.	N.A.	
Other:	No			

PREHEAT (QW-406)

	Temperature (°C)	Method	Control	Time (Hours)
Preheat ≥:	50	Gas Burner	Tempilstick	/
Maintaining:	Yes	Gas Burner	Tempilstick	/
Interpass ≤:	200	/	Tempilstick	/
Post-Heat (DHT) ≥:	No	/	/	/

Other: No

Cooling under Insulation: No

POST WELD HEAT TREATMENT (QW-407)

Method:	Gas Furnace	
Control:	Thermocouples	
Temperature Range:	610 ±10°C	°C
Time Range:	3	Hours
Heating/Cooling Rate:	≤60 / ≤60	°C/h
Temperature Limits:	No (QW-407.4)	
Other:	No	

GAS (QW-408)

	Gas(es)	Composition	Flow Rate (l/1')
Process:	GTAW		
Shielding:	Argon	99.997	10 ÷ 12
Process:			
Shielding:	/		
Backing:			
Trailing:			

Other: No

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	GTAW	SMAW	SAW
Current Type:	DC	DC	DC
Pulsing Current:	No	N.A.	N.A.
Polarity:	EN	EP	EP
Tung. El. Type:	EWTh-2	N.A.	N.A.
Tung. El. Ø:	2.4	N.A.	N.A.
Transfer Mode:	N.A.	N.A.	N.A.

Other: No

TECHNIQUE (QW-410)

String/Weave beads:	String
Orifice/Cup size (mm):	10
Initial Cleaning:	Machining
Interpass Cleaning:	Grinding / Brushing
Method of Back Gouge:	N.A.
Oscillation:	No
Single/Multi pass/side:	Single and Multi pass
Single/Multi Electrode:	Single
Electrode Spacing (mm):	N.A.
Electrode Stick out (mm):	25 ÷ 30
Closed/Out of Chamber:	N.A.
Manual or Automatic:	Manual and Machine
Supplemental Device/s:	N.A.
Peening:	No
Other:	QW-410.64: No

TABLE OF PARAMETERS (QW-409; QW-410)

Pass	Process	AWS	Size (mm)	Current Polarity	Ampere range	Volt range	Travel Speed (mm/min.)	ROL ≥ (mm)	Wire Feed Speed (mm/min.)	Min./Max. Heat Input (J/mm)
1 / 4-n	GTAW	ER70S-3	2.4	DCEN	110 ÷ 150	10 ÷ 14	060 ÷ 090	/	/	733 ÷ 2100
	SMAW	E7018-1 H4	4	DCEP	150 ÷ 190	24 ÷ 27	180 ÷ 220	/	/	982 ÷ 1710
	SMAW	E7018-1 H4	5	DCEP	180 ÷ 220	24 ÷ 27	190 ÷ 240	/	/	1080 ÷ 1876
	SAW	EH 12K	4	DCEP	500 ÷ 535	28 ÷ 31	510 ÷ 540	/	/	1556 ÷ 1951

REMARKS:

Issued by:
A. Sandonà
Welding Department

Approved by:
N. Tosto
Welding Department Manager

Welding Procedure Specification (WPS)

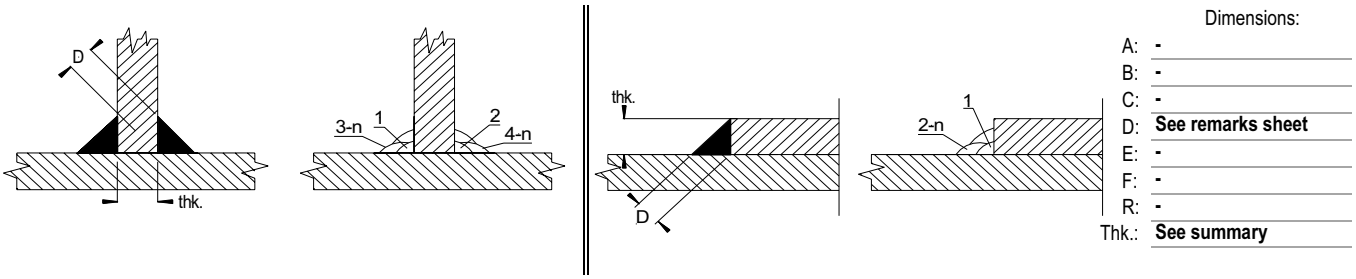
ASME Boiler and Pressure Vessel Code Section IX QW-200.1

Job:	23096	WPS:	W07
Item:	V25001 A/F	Rev.:	0
S.N.:	23096-01÷06-SNA	Date:	20.11.2023

Welding Process: FCAW
Type: SEMI-AUTOMATIC
Supporting PQR: 24/17

JOINTS (QW-402)

Design: Fillet | Backing: Yes | Material: Base metal



Dimensions:
A: -
B: -
C: -
D: See remarks sheet
E: -
F: -
R: -
Thk.: See summary

Retainers: No (QW-402.11)
Tack weld: According to FCAW process of present WPS
Weld Bevel Code: BSC22 - BCS23

BASE METAL (QW-403)

Material Spec.; Type or Grade:	SA 516 Gr.60		
to Material Spec.; Type or Grade:	SA 516 Gr.60		
P-No.: 1	Gr. No.: 1	to P-No.: 1	Gr. No.: 1
Base Metal Groove T Limits (mm):	N.A.	Fillet (mm):	All
Pipe Ø Range Groove (mm):	All	Fillet (mm):	All
Other:	t pass ≤ 13 mm (QW-403.9)	T Limits (QW-403.6):	N.A.
Other:	No		

FILLER METAL (QW-404)

Process (es):	FCAW			
SFA Specification:	5.20			
AWS Classification:	E70T-1			
Filler metal F-No.:	6			
Weld Metal A-No.:	1			
Size (mm):	1.2			
Product Form:	Flux cored wire			
Trade Name:	Fluxofil 14HD			
Supplier:	Oerlikon			
Flux Trade Name:	N.A.			
Flux Type:	N.A.			
Supplier:	N.A.			
Wire/Flux Class.:	N.A.			
Consumable Ins.:	N.A.			
Supplemental:	N.A.			
Recrushed slag:	N.A.			
Max. weld metal thk.:	200			
Other:				

POSITION (QW-405)

Process:	FCAW			
Position of Groove:	N.A.			
Position of Fillet:	1F / 2F			
Welding Progression:	N.A.			
Other:	No			

PREHEAT (QW-406)

	Temperature (°C)	Method	Control	Time (Hours)
Preheat ≥:	50	Gas Burner (note 1)	Tempilstick	/
Maintaining:	No	/	/	/
Interpass ≤:	200	/	Tempilstick	/
Post-Heat (DHT) ≥:	No	/	/	/
Other:	No			
Cooling under Insulation:	No			

POST WELD HEAT TREATMENT (QW-407)

Method:	Gas Furnace	
Control:	Thermocouples	
Temperature Range:	610 ±10°C	°C
Time Range:	3	Hours
Heating/Cooling Rate:	≤60 / ≤60	°C/h
Temperature Limits:	No (QW-407.4)	
Other:	No	

GAS (QW-408)

	Gas(es)	Composition	Flow Rate (l/1')
Process:	FCAW		
Shielding:	Ar + CO2	82 / 18	18 ÷ 20
Process:			
Shielding:	/		
Backing:			
Trailing:			
Other:	No		

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	FCAW			
Current Type:	DC			
Pulsing Current:	N.A.			
Polarity:	EP			
Tung. El. Type:	N.A.			
Tung. El. Ø:	N.A.			
Transfer Mode:	Spray			
Other:	No			

TECHNIQUE (QW-410)

String/Weave beads:	String
Orifice/Cup size (mm):	16
Initial Cleaning:	Grinding / Brushing
Interpass Cleaning:	Grinding / Brushing
Method of Back Gouge:	N.A.
Oscillation:	N.A.
Single/Multi pass/side:	Multi pass
Single/Multi Electrode:	N.A.
Electrode Spacing (mm):	N.A.
Electrode Stick out (mm):	N.A.
Closed/Out of Chamber:	N.A.
Manual or Automatic:	Semi-automatic
Supplemental Device/s:	N.A.
Peening:	No
Other:	QW-410.64: No

TABLE OF PARAMETERS (QW-409; QW-410)

Pass	Process	AWS	Size (mm)	Current Polarity	Ampere range	Volt range	Travel Speed (mm/min.)	ROL ≥ (mm)	Wire Feed Speed (mm/min.)	Min./Max. Heat Input (J/mm)
1 / 4-n	FCAW	E70T-1	1.2	DCEP	180 ÷ 230	23 ÷ 26	190 ÷ 230	/	/	1080 ÷ 1888

REMARKS:

Issued by:
A. Sandonà
Welding Department

Approved by:
N. Tosto
Welding Department Manager

Welding Procedure Specification (WPS)

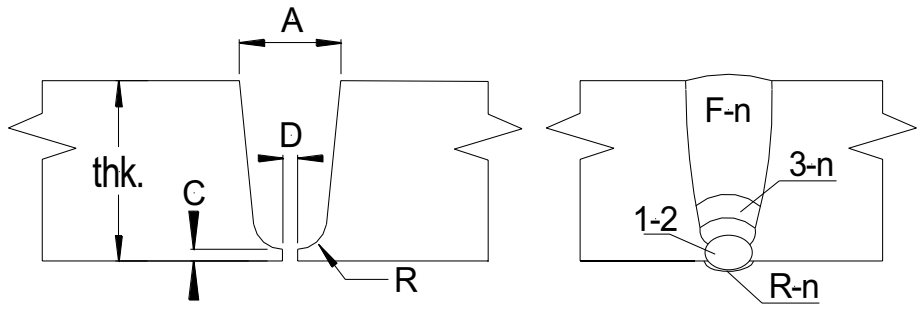
ASME Boiler and Pressure Vessel Code Section IX QW-200.1

Job:	23096	WPS:	W08
Item:	V25001 A/F	Rev.:	0
S.N.:	23096-01÷06-SNA	Date:	08.03.2024

Welding Process:	GTAW	SMAW	SAW	
Type:	MANUAL	MANUAL	MACHINE	

Supporting PQR: 51/15

JOINTS (QW-402) Design: U Backing: GTAW No, other Yes Material: Base + Weld metal



Dimensions:

A:	30 ± 1 mm
B:	
C:	1 ÷ 1,5 mm
D:	3 ÷ 5 mm
E:	-
R:	10 mm
Thk.:	See summary sheet

Retainers: No (QW-402.11)

Tack weld: According to process GTAW or SMAW of present WPS

Weld Bevel Code: ASC34

BASE METAL (QW-403)

Material Spec.; Type or Grade: SA 516 Gr.60

to Material Spec.; Type or Grade: SA 516 Gr.60

P-No.: 1 Gr. No.: 1 to P-No.: 1 Gr. No.: 1

Base Metal Groove T Limits (mm): 16 ÷ 200 Fillet (mm): All

Pipe Ø Range Groove (mm): All Fillet (mm): All

Other: t pass ≤ 13 mm (QW-403.9) T Limits (QW-403.6): Yes

Other: No

FILLER METAL (QW-404)

Process (es):	GTAW	SMAW	SAW	
SFA Specification:	5.18	5.1	5.17	
AWS Classification:	ER70S-3	E7018-1 H4	EH12K	
Filler metal F-No.:	6	4	6	
Weld Metal A-No.:	1	1	1	
Size (mm):	2.4	4 - 5	4	
Product Form:	Solid Wire	N.A.	Solid Wire	
Trade Name:	EML5	Tenax 35S	OK Autrod 12.32	
Supplier:	Bohler	Oerlikon	ESAB	
Flux Trade Name:	N.A.	N.A.	OK Flux 10.62	
Flux Type:	N.A.	N.A.	Neutral/Non Alloying	
Supplier:	N.A.	N.A.	ESAB	
Wire/Flux Class.:	N.A.	N.A.	F7P8-EH12K	
Consumable Ins.:	No	N.A.	N.A.	
Supplemental:	No	N.A.	No	
Recrushed slag:	N.A.	N.A.	No	
Max. weld metal thk.:	8	200	200	
Other:				

POSITION (QW-405)

Process:	GTAW	SMAW	SAW	
Position of Groove:	1G	1G	1G	
Position of Fillet:	N.A.	N.A.	N.A.	
Welding Progression:	N.A.	N.A.	N.A.	
Other:	No			

PREHEAT (QW-406)

	Temperature (°C)	Method	Control	Time (Hours)
Preheat ≥:	50	Gas Burner	Tempilstick	/
Maintaining:	Yes	Gas Burner	Tempilstick	/
Interpass ≤:	250	/	Tempilstick	/
Post-Heat (DHT) ≥:	No	/	/	/

Other: No

Cooling under Insulation: No

POST WELD HEAT TREATMENT (QW-407)

Method:	Gas Furnace	
Control:	Thermocouples	
Temperature Range:	610 ±10°C	°C
Time Range:	3	Hours
Heating/Cooling Rate:	≤60 / ≤60	°C/h
Temperature Limits:	No (QW-407.4)	
Other:	No	

GAS (QW-408)

	Gas(es)	Composition	Flow Rate (l/1')
Process:	GTAW		
Shielding:	Argon	99.997	10 ÷ 12
Process:			
Shielding:	/		
Backing:			
Trailing:			

Other: No

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	GTAW	SMAW	SAW
Current Type:	DC	DC	DC
Pulsing Current:	No	N.A.	N.A.
Polarity:	EN	EP	EP
Tung. El. Type:	EWTh-2	N.A.	N.A.
Tung. El. Ø:	2.4	N.A.	N.A.
Transfer Mode:	N.A.	N.A.	N.A.

Other: No

TECHNIQUE (QW-410)

String/Weave beads:	String
Orifice/Cup size (mm):	10
Initial Cleaning:	Machining
Interpass Cleaning:	Grinding / Brushing
Method of Back Gouge:	N.A.
Oscillation:	No
Single/Multi pass/side:	Single and Multi pass
Single/Multi Electrode:	Single
Electrode Spacing (mm):	N.A.
Electrode Stick out (mm):	25 ÷ 30
Closed/Out of Chamber:	N.A.
Manual or Automatic:	Manual and Machine
Supplemental Device/s:	N.A.
Peening:	No
Other:	QW-410.64: No

TABLE OF PARAMETERS (QW-409; QW-410)

Pass	Process	AWS	Size (mm)	Current Polarity	Ampere range	Volt range	Travel Speed (mm/min.)	ROL ≥ (mm)	Wire Feed Speed (mm/min.)	Min./Max. Heat Input (J/mm)
1-2	GTAW	ER70S-3	2.4	DCEN	110 ÷ 150	10 ÷ 14	060 ÷ 090	/	/	733 ÷ 2100
3-n/R-n	SMAW	E7018-1 H4	4	DCEP	150 ÷ 190	24 ÷ 27	180 ÷ 220	/	/	982 ÷ 1710
	SMAW	E7018-1 H4	5	DCEP	180 ÷ 220	24 ÷ 27	190 ÷ 240	/	/	1080 ÷ 1876
F-n	SAW	EH 12K	4	DCEP	500 ÷ 535	28 ÷ 31	510 ÷ 540	/	/	1556 ÷ 1951

REMARKS:

1) Back gouging and R-n passes shall be performed only if necessary after NDE

Issued by:
A. Sandonà
Welding Department

Approved by:
N. Tosto
Welding Department Manager

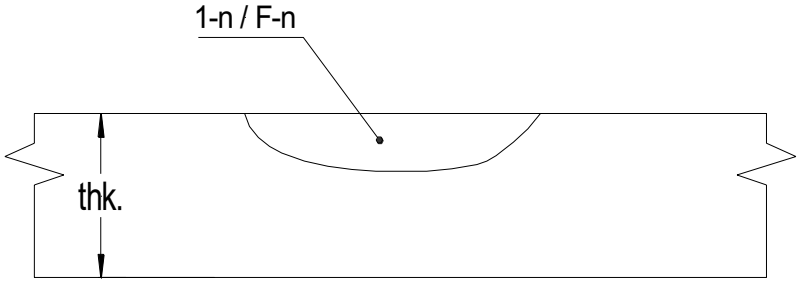
Welding Procedure Specification (WPS)

ASME Boiler and Pressure Vessel Code Section IX QW-200.1

Job:	23096	WPS:	WR
Item:	V25001 A/F	Rev.:	0
S.N.:	23096-01÷06-SNA	Date:	08.03.2024

Welding Process:	SMAW	SAW			Supporting PQR: 51/15
Type:	MANUAL	MACHINE			

JOINTS (QW-402) Design: Sketch Backing: Yes Material: Base + Weld metal



The excavation shall be prepared with smooth profile by grinding taking care to avoid perpendicular wall

Retainers: No (QW-402.11)

Tack weld: N.A. Weld Bevel Code: Sketch

BASE METAL (QW-403)

Material Spec.; Type or Grade: SA 516 Gr.60 - SA 350 LF2 - Weld metal P.No.4

to Material Spec.; Type or Grade: -

P-No.: 1 Gr. No.: 1 to P-No.: - Gr. No.: -

Base Metal Groove T Limits (mm): N.A. Fillet (mm): All

Pipe Ø Range Groove (mm): All Fillet (mm): All

Other: t pass ≤ 13 mm (QW-403.9) T Limits (QW-403.6): N.A.

Other: No

FILLER METAL (QW-404)

Process (es):	SMAW	SAW		
SFA Specification:	5.1	5.17		
AWS Classification:	E7018-1 H4	EH12K		
Filler metal F-No.:	4	6		
Weld Metal A-No.:	1	1		
Size (mm):	4 - 5	4		
Product Form:	N.A.	Solid Wire		
Trade Name:	Tenax 35S	OK Autrod 12.32		
Supplier:	Oerlikon	ESAB		
Flux Trade Name:	N.A.	OK Flux 10.62		
Flux Type:	N.A.	Neutral/Non Alloying		
Supplier:	N.A.	ESAB		
Wire/Flux Class.:	N.A.	F7P8-EH12K		
Consumable Ins.:	N.A.	N.A.		
Supplemental:	N.A.	No		
Recrushed slag:	N.A.	No		
Max. weld metal thk.:	200	200		

Other:

POSITION (QW-405)

Process:	SMAW	SAW		
Position of Groove:	1G	1G		
Position of Fillet:	N.A.	N.A.		
Welding Progression:	N.A.	N.A.		

Other: No

PREHEAT (QW-406)

	Temperature (°C)	Method	Control	Time (Hours)
Preheat ≥:	50	Gas Burner	Tempilstick	/
Maintaining:	Yes	Gas Burner	Tempilstick	/
Interpass ≤:	250	/	Tempilstick	/
Post-Heat (DHT) ≥:	No	/	/	/

Other: No

Cooling under Insulation: No

POST WELD HEAT TREATMENT (QW-407)

Method:	Gas Furnace	
Control:	Thermocouples	
Temperature Range:	610 ±10°C	°C
Time Range:	3	Hours
Heating/Cooling Rate:	≤60 / ≤60	°C/h
Temperature Limits:	No (QW-407.4)	
Other:	No	

GAS (QW-408)

	Gas(es)	Composition	Flow Rate (l/1')
Process:			
Shielding:	/	/	/
Process:			
Shielding:	/		
Backing:			
Trailing:			

Other: No

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	SMAW	SAW		
Current Type:	DC	DC		
Pulsing Current:	N.A.	N.A.		
Polarity:	EP	EP		
Tung. El. Type:	N.A.	N.A.		
Tung. El. Ø:	N.A.	N.A.		
Transfer Mode:	N.A.	N.A.		

Other: No

TECHNIQUE (QW-410)

String/Weave beads:	String
Orifice/Cup size (mm):	N.A.
Initial Cleaning:	Grinding
Interpass Cleaning:	Grinding
Method of Back Gouge:	N.A.
Oscillation:	No
Single/Multi pass/side:	Multi pass
Single/Multi Electrode:	Single
Electrode Spacing (mm):	N.A.
Electrode Stick out (mm):	N.A.
Closed/Out of Chamber:	N.A.
Manual or Automatic:	Manual and Machine
Supplemental Device/s:	N.A.
Peening:	No
Other:	QW-410.64: No

TABLE OF PARAMETERS (QW-409; QW-410)

Pass	Process	AWS	Size (mm)	Current Polarity	Ampere range	Volt range	Travel Speed (mm/min.)	ROL ≥ (mm)	Wire Feed Speed (mm/min.)	Min./Max. Heat Input (J/mm)
1-n/F-n	SMAW	E7018-1 H4	4	DCEP	150 ÷ 190	24 ÷ 27	180 ÷ 220	/	/	982 ÷ 1710
	SMAW	E7018-1 H4	5	DCEP	180 ÷ 220	24 ÷ 27	190 ÷ 240	/	/	1080 ÷ 1876
	SAW	EH 12K	4	DCEP	500 ÷ 535	28 ÷ 31	510 ÷ 540	/	/	1556 ÷ 1951

REMARKS:

1) After completion of excavation, PT or MT examination shall be performed before start of welding activities

Issued by:
A. Sandonà
Welding Department

Approved by:
N. Tosto
Welding Department Manager

BREMBANA&ROLLE

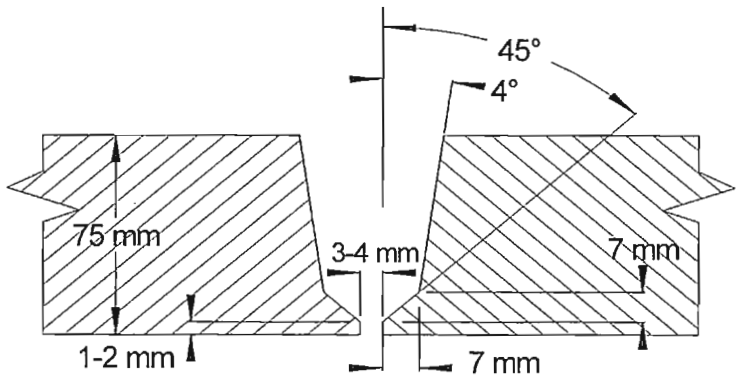
PROCEDURE QUALIFICATION RECORD (PQR)

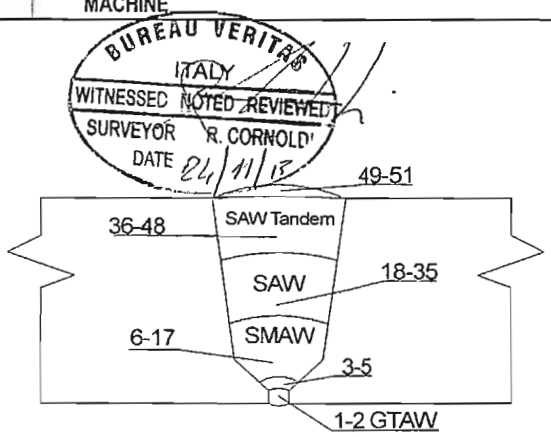
(QW-200.2)

(Section IX of ASME Boiler and Pressure Vessel Code)

Procedure Qualification Record No.:	51/15		Date: 24.11.15	Company:	Brembana & Rolle S.p.A.
Welding Process (es):	1) GTAW	2) SMAW	3) SAW-SAW Tandem	WPS No.:	W51/15
Types (Manual,Automatic,Semi-Auto.):	MANUAL	MANUAL	MACHINE		

JOINT (QW-402)





BASE METAL (QW-403)

Material Spec.; Type or Grade:	SA 516 Gr. 60 ①				
to Material Spec.; Type or Grade:	SA 765 Gr. 2 ②				
P-No.: 1	GR.No: 1	to P-No: 1	GR.No: 2		
Thickness of Test Coupon (mm):	75				
Diameter of Test Coupon (mm):	N.A.				
Other:	① Normalized				
	② Normalized and Tempered				

FILLER METAL (QW-404)

Process (es):	GTAW	SMAW	SAW - SAW Tandem
SFA Specification:	5.18	5.1	5.17
AWS Classification:	ER70S-3	E7018-1 H4	EH12K
Filler metal F-No.:	6	4	6
Weld Metal A-No.:	1	1	/
Size (mm):	3	4 - 5	4
Product Form:	Solid wire	N.A.	Solid wire
Trade Name:	Bohler EML 5	PH 35S	OK Autrod 12.32
Supplier:	Bohler	Oerlikon	Esab
Flux Trade Name:	N.A.	N.A.	OK Flux 10.62
Flux Type:	N.A.	N.A.	Non alloying
Supplier:	N.A.	N.A.	Esab
Wire/Flux Class.:	N.A.	N.A.	F7P8-EH12K
Consumable Ins.:	No	N.A.	No
Supplemental:	N.A.	N.A.	No
Recrushed slag:	N.A.	N.A.	No
Weld Metal Thk.:	4	21	50 (*)
Other:	* 25 mm SAW - 25 mm SAW Tandem		

POSITION (QW-405)

Position of Groove:	1G
Weld Progression:	N.A.
Other:	No

PREHEAT (QW-406)

Preheat Temper. (°C):	99
Interpass Temper. (°C):	253
Other:	No

POSTWELD HEAT TREATMENT (QW-407)

Temperature (°C):	620 ± 10
Time:	Min. 4 hours - Max. 16 hours
Other:	Heating/Cooling rate 60 ÷ 70°C/h
	QW-407.4: N.A.

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow Rate (l/m)
Process:	GTAW		
Shielding:	Argon 99.99	/	10 ÷ 12
Trailing:	No	N.A.	N.A.
Backing:	No	N.A.	N.A.
Other:	No		

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	GTAW	SMAW	SAW
Type of Current:	DC	DC	*
Pulsing Current:	No	N.A.	N.A.
Polarity:	Negative	Positive	Positive/N.A.*
Tungsten Electrode Type:	EWTh2	N.A.	N.A.
Tungsten Electr.Size(mm):	2.4	N.A.	N.A.
Transfer Mode:	N.A.	N.A.	N.A.
Other:	* DC for SAW - DC/AC for SAW Tandem		

TECHNIQUE (QW-410)

String/weave beads:	String - Weave for GTAW
Orifice,cup size(mm):	10
Initial cleaning:	Machining - Brushing
Interpass cleaning:	Grinding - Brushing
Method of back gouge:	No
Oscillation:	No
Multi/Single pass/side:	Multipass
Single/Multi Electrode:	Single - Multiple for SAW tandem
Electrode spacing (mm):	20 mm
Electrode Stick out (mm):	25 ÷ 38
Closed or out of chamber:	N.A.
Manual or automatic:	Manual - Machine
Supplemental device:	N.A.
Other:	No

TABLE OF PARAMETERS (QW-409 ; QW-410)

Pass	Process	Ampere	Volt	Travel Speed (mm/min.)	Heat Input (*) (J/mm)	Filler metal Trade Name	Size (mm)	Flux Trade Name	Heat/Batch No.
1	GTAW	139 ÷ 153	15.5 ÷ 16.5	60 ÷ 88	2330	EML 5	3	N.A.	783420
2	GTAW	164 ÷ 169	15 ÷ 16	71 ÷ 77	2107	EML 5	3	N.A.	
3-5	SMAW	150 ÷ 160	23 ÷ 25.5	165 ÷ 290	1255	PH 35S	4	N.A.	344281002
6-17	SMAW	205 ÷ 212	23.25 ÷ 25.25	150 ÷ 255	1968	PH 35S	5	N.A.	371507302
18-35	SAW	536 ÷ 545	28.5 ÷ 30.5	500 ÷ 540	1984	OK Autrod 12.32	4	OK Flux 10.62	Wire: PV533474204 Flux: PNP19512
36-48	SAW Tandem	529 ÷ 533	28 ÷ 29.5	740	1275		4		
	SAW Tandem	538 ÷ 545	31 ÷ 33	740	1456		4		
49-51	SAW	539 ÷ 543	28.5 ÷ 30	540 ÷ 550	1797		4		

* Above Heat input values are the maximum recorded per layer (see attached welding monitoring)

BREMBANA&ROLLE

PROCEDURE QUALIFICATION RECORD (PQR)

(QW-200.2)

(Section IX of ASME Boiler and Pressure Vessel Code)

Procedure Qualification Record No.: 51/15 Date: 24.11.15 Company: Brembana & Rolle S.p.A.

TENSILE TEST (QW-150)

Specimen No.; Type and Figure No.	Width (mm)	Thickness (mm)	Area (mm2)	Ultimate Total Load (N)	Ultimate Unit Stress (N/mm2)	Type of Failure & Location

For mechanical tests see report: 15/2367RP01

	Diameter (mm)	Gage Length (mm)	Area (mm2)	U.T.L. (N)	U.T.S. (N/mm2)	U.Y.L. (N)	U.Y.S. (N/mm2)	Elongation (%)

GUIDED BEND TEST (QW-160)

Type and Figure No.	Result	Type and Figure No.	Result

For mechanical tests see report: 15/2367RP01

TOUGHNESS TEST (QW-170)

Specimen No. & Notch Location	Specimen Size (mm)	Test Temperature (°C)	Impact Values (Joule)	Lateral Expansion (% shear)	Lateral Expansion (mm)	Drop Weight Break (Yes or No)

For mechanical tests see report: 15/2367RP01

Comments:

FILLET WELD TEST (QW-180)

Result - Satisfactory: Yes ____ No ____ Penetration into Parent Metal: Yes ____ No ____

Macro - Result:

OTHER TESTS

Visual Examination: Satisfactory (PQR 51/15 VT)

R.T. Examination: Satisfactory

P.T. Examination: Satisfactory (PQR 51/15 PT)

M.T. Examination: No

Micro Examination: No

Deposit Analysis:

C	Mn	Si	P	S	Cr	Ni	Mo

Fe	Cu	Nb+Ta

Macro Examination: SATISFACTORY

Hardness Test (Hv10): Base Metal: / Weld Metal: / Haz: See report: 15/2367RP01

Other: No

Welder's Name: Capelli Gilberto - Grasso Stefano - Belligerante Rosario

Stamp No.: S09 - S02 - S04

Test conducted by: Brembana & Rolle S.p.A. Welding Engineer / Quality Control s.r.l. Laboratory / Bureau Veritas Inspector

Laboratory Test No.: 15/2367RP01

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLO' DATE 24/11/15

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of ASME Code Section IX

Prepared by	Checked and Certified by	Date	
S.Mangano 24/11/15	N.Testo 24/11/15	24.11.15	Sheet 2 of 2

BREMBANA&ROLLE

ADDENDA to Procedure Qualification Record

Procedure Qualification Record No.: 51/15 Date: 20.03.17 Company: Brembana & Rolle S.p.A.

TENSILE TEST (QW-150)

Specimen No.; Type and Figure No.	Width (mm)	Thickness (mm)	Area (mm2)	Ultimate Total Load (N)	Ultimate Unit Stress (N/mm2)	Type of Failure & Location

	Diameter (mm)	Gage Length (mm)	Area (mm2)	U.T.L. (N)	U.T.S. (N/mm2)	U.Y.L. (N)	U.Y.S. (N/mm2)	Elongation (%)

GUIDED BEND TEST (QW-160)

Type and Figure No.	Result	Type and Figure No.	Result

TOUGHNESS TEST (QW-170)

Specimen No. & Notch Location	Specimen Size (mm)	Test Temperature (°C)	Impact Values (Joule)	Lateral Expansion (% shear)	Lateral Expansion (mm)	Drop Weight Break (Yes or No)

For mechanical tests see reports: 17/0586RP01 - 17/0586RP02

Comments:

FILLET WELD TEST (QW-180)

Result - Satisfactory: Yes No Penetration into Parent Metal: Yes No

Macro-Result:

OTHER TESTS

Visual Examination: Satisfactory

R.T. Examination: No

P.T. Examination: No

M.T. Examination: No

Micro Examination: No

Deposit Analysis:

C	Mn	Si	P	S	Cr	Ni	Mo

Fe	Cu	Nb+Ta

Macro Examination: No

Hardness Test (Hv10): Base Metal: / Weld Metal: No / Haz:

Other: No

Welder's Name: Jopseph Joy - Pribescu Constantin

Stamp No.: S11 - S20

Test conducted by: Brembana & Rolle S.p.A. Welding Engineer / Quality Control s.r.l. Laboratory / Third Party Inspector

Laboratory Test No.: 15/0586RP01 - 15/0586RP02

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
☐ Witnessed ☐ Monitored ☐ Reviewed
Alessandro Salvatore Monastra
Milan Office
20/03/17

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of ASME Code Section IX

Prepared by	Checked and Certified by	Date	
S.Mangano 21/3/17	M.Esposito	20.03.17	Sheet 1 of 1

BREMBANA&ROLLE

VISUAL EXAMINATION REPORT

REPORT No.

PQR 51/15 VT

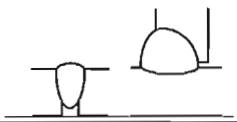
PURCHASER DATA		MANUFACTURER DATA	
PURCHASER		JOB No.	===
PLANT		DWG. No.	===
P.O.		PROCEDURE No.	BCI-007-VT
ITEM		SERIAL No.	===

APPLICABLE CODE:

ASME IX QW-194
ASME VIII Div. 2

APPLICABLE STANDARD/SPECIFICATION:

SP 1173

Nr.	Type of imperfection		Acceptance criteria	Test result conform:
1	Cracks	...	Not permitted	☑
2	Incomplete fusion	...	Not permitted	☑
3	Exposed inclusions	...	Not permitted when occurring at the surface	☑
4	Porosity	...	Not permitted	☑
5	Lack of penetration		Not permitted	☑
				☐
				☐
				☐
				☐
				☐
				☐
				☐
				☐
				☐

BREMBANA & ROLLE S.p.A.

OPERATOR / EVALUATOR LEV. II SNT-TC-1A

BREMBANA&ROLLE S.p.A. P. FACHERIS QUALITY CONTROL DEPT. 09 OTT 2015

☐ F.CEFIS ☑ P.FACHERIS

09 OTT 2015

BREMBANA & ROLLE S.p.A. D.BOTTI QUALITY CONTROL DEPT.

D.BOTTI - Q.C.M.

INSPECTION AGENCY

09 OTT 2015

BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R. CORNOLD
DATE 05/10/15

BREMBANA&ROLLE

DYE PENETRANT TEST REPORT

REPORT No. **PQR 51/15 PT**

PURCHASER DATA		MANUFACTURER DATA	
PURCHASER		JOB No.	
PLANT		DWG. No.	
P.O.		PROCEDURE No.	BCI-002-PT
ITEM		SERIAL No.	

APPLICABLE CODE:	APPLICABLE STANDARD/SPECIFICATION:
ASME IX – QW 195 ASME VIII Div. 2	SP 1173

P.T. examination performed at 100 % on:

- Specimen 51/15

MATERIAL: SA 765 Gr. 2 – SA 516 Gr. 70 **THICKNESS:** 75 mm

P.T. Time:	BEFORE P.W.H.T. ■ HYDROTEST ☐		AFTER P.W.H.T. ☐ HYDROTEST ☐
Surface:	condition : As welded ■	Ground ☐	Machined ☐
	cleaning : Solvent ☐	Brushing ■	Shotblasting ☐
Type:	Water Washable Visible ■	Post Emulsifying None ☐	Solvent Removable None ☐
Penetrant:	Colour Contrast CGM RED W	Emulsifier None	Solvent None Developer Non Acqueous Wet CGM ROTRIVEL U
Application:	PENETRANT : Paint Brush ☐ Spray ■	Penetration time : 10 minutes	
	EMULSIFIER : Dipping ☐	Emulsification time N.A.	
Excess penetrant removal:	Water spray (3.5 barg max) ■	cloths ☐	absorber paper ☐
Drying after excess penetrant removal :	Compressed air (3.5 barg max) ■	cloths ■	
Developer application :	Spraying	Developping time: 10 minutes Interpretation : 30 minutes	
Viewing condition:	Artificial light (1000 Lx min.) ■	Black light (1000 µW/cm² min) ☐	
Post examination cleaning:	Water rinse ■	Cloths ■	
TEST RESULT:	SATISFACTORY, NO REPORTABLE INDICATIONS FOUND		

BREMBANA & ROLLE S.p.A.

OPERATOR / EVALUATOR LEV. II SNT-TC-1A

09 OTT 2015

☒ F.CEFIS ☐ P.FACHERIS

09 OTT 2015

BREMBANA&ROLLE S.p.A. D.BOTTI QUALITY CONTROL DEPT.

D.BOTTI - Q.C.M. -

INSPECTION AGENCY

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R.CORNOLD' DATE 05/10/15

Form PT Rev. 0 Date 23/06/99

QUALITY CONTROL S.r.l.
LABORATORIO DI PROVE E CONTROLLI SU MATERIALI METALLICI E GIUNTI DI SALDATURA
24030 MEDOLAGO (BG) - Via Roma, 79 - Tel. 035/90.14.73 (n. 4 linee r.a.) - Fax 035/90.10.82
www.qualitycontrolsrl.it - e-mail: info@qualitycontrolgroup.com
Iscr. Reg. Imp. BG 12004 - C.C.I.A.A. BG 166333 - Cod. Fisc. e P.IVA 00663350163 - Cap. Soc. €101.490,00

RAPPORTO DI PROVA N. / *Test Report N.* 15/2367RP01 **DATA** / *Date* 24/11/2015 **Foglio** / *Page* 1 **di** / *of* 14

CLIENTE / *Customer* BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) **SAGGIO N.** / *Test No.* 51/15

ORDINE / *Order*	01/04/000484 dated 15/10/2015	**DISTINTA PROVE** / *List of tests*	151/15 dated 19/10/2015	**MATERIALE RICEVUTO IL** / *Material received on*	19/10/2015

OGGETTO / *Object*
Welding Procedure Qualification Record: 51/15
Plate Thk. 75 mm - Preliminary WPS: W51/15 - Job: 4098
Welding Process: GTAW+SMAW manual + SAW-SAW Tandem Machine Pos. 1G
Welder: CAPELLI GILBERTO (Stamp: S09) - BELLIGERANTE ROSARIO (Stamp: S04)
GRASSO STEFANO (Stamp: S02)
Coupon with PWHT MIN (Chart No. 295A/15 dated 22/10/2015)
Coupon with PWHT MAX (Chart No. 299A/15 dated 26/10/2015)

MATERIALE / *Material* ASME SA516 gr.60
ASME SA765 gr.2

COLATA / *Heat* 61003 616857001
9084-14 14-0505

PRODUTTORE / *Supplier* ARCELOR MITTAL **CERT. N.** / *Cert. No.* 2015-104345 **DEL** / *dated* 19/02/2015
FORGE MONCHIERI 14/08449/CM 20/03/2014

NORME DI COLLAUDO / *Test Specification* ASME IX 2013 Ed. + ASME VIII Div.1 2013 Ed. + SP 1173

ENTE DI COLLAUDO / *Surveyors* BUREAU VERITAS + MAN DIESEL & TURBO + CONPACKSYS

Prove / *Tests*	Pagina / *Sheet*	Data Prova / *Date of test*	Metodo di prova / *Test method*	Apparecchiatura / *Equipment*	Note / *Note*
☑ Radiografia / *Radiographic*	2	20-23/10/15	ASME V art.2	See report	*Conform*
☑ Trattamento termico MIN / *Min H.T.*	3	22/10/15	IL 08.00.02	See report	---
☑ Trazione / *Tensile*	4	24/11/15	ASTM A370-14/QW151	QC 355	*Conform*
☑ Pieghe / *Bend*	4	24/11/15	QW 161.1	QC 355	*Conform*
☑ Resilienza / *Impact*	5	24/11/15	UG-84	QC 376	*Conform*
☑ Macrografia / *Macrograph*	6	14/10/15	ASTM E340-00	QC 401	*Conform*
☑ Durezze / *Hardness*	7-8	14/10/15	ASTM E384-11	QC 370	---
☑ Trattamento termico MAX / *MAX H.T.*	9	26/10/15	IL 08.00.02	See report	---
☑ Trazione / *Tensile*	10	24/11/15	ASTM A370-14/QW151	QC 355	*Conform*
☑ Pieghe / *Bend*	10	24/11/15	QW 161.1	QC 355	*Conform*
☑ Resilienze / *Impact*	11	24/11/15	UG-84	QC 376	*Conform*
☑ Macrografia / *Macrograph*	12	14/10/15	ASTM E340-00	QC 401	*Conform*
☑ Durezze / *Hardness*	13-14	14/10/15	ASTM E384-11	QC 370	---

Se non diversamente specificato, per l'accettabilità fanno fede le norme di collaudo e le norme relative al materiale
Unless otherwise specified, for the acceptability are valid test specifications and material standards

SI CERTIFICANO I RISULTATI OTTENUTI. TALI RISULTATI SONO RIFERITI ESCLUSIVAMENTE AI PROVINI TESTATI.
We certify the obtained results. These tests results refer only to examined samples.

ENTE DI COLLAUDO / *Surveyor*
BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 24/11/15
Ing. A.E. Popken I.W.E.
Digitaal ondertekend door Ing. A.E. Popken I.W.E. DN: cn=Ing. A.E. Popken I.W.E., o=welding, ou=Welding Department, emailAddress=popken@upcmail.nl, c=NL Datum: 2016.02.17 17:07:46 +01'00'
BREMBANA & ROLLE S.p.A. WELDING DEPT. - S. MARIANO REVIEWED WITNESSED 24 NOV 2015
QUALITY CONTROL S.r.l. ANGELO PENDEGGIA

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio.

QUALITY CONTROL S.r.l.
LABORATORIO DI PROVE E CONTROLLI SU MATERIALI METALLICI E GIUNTI DI SALDATURA
24030 MEDOLAGO (BG) - Via Roma, 79 - Tel. 035/90.14.73 (n. 4 linee r.a.) - Fax 035/90.10.82
www.qualitycontrolsrl.it - e-mail: info@qualitycontrolgroup.com
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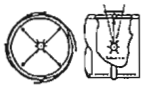
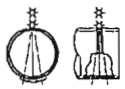
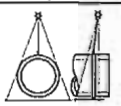
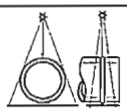
RAPPORTO DI PROVA N. / Test Report N.	15/2367RP01	DATA / Date	24/11/2015	Foglio / Page	2	di / of	14

CLIENTE / Customer	BREMBANA&ROLLE S.p.A. - VALBREMBO (BG)	SAGGIO N. / Test No.	51/15

ESAME RADIOGRAFICO
RADIOGRAPHIC TEST

Norma di riferimento / *Reference standard*	ASME V art.2 - Ed. 2013		
Criterio di accettabilità / *Acceptance criteria*	ASME IX QW 191.1 - Ed.2013	Stadio di lavorazione / *Working step*	AS WELDED

TECNICA DI ESPOSIZIONE / *Exposure technique*

☒	☐	☐	☐	☐	☐
					

PARAMETRI DEL TEST / *Test parameters*

Spess. nominale di parete (mm) / *Nominal single wall thickness*	75	Spessore rinf. di sald. (mm) / *Welding reinforcement thickness*	2	Numero di esposizioni / *Exposure number*	1
Distanza fuoco-oggetto (mm) / *Source to object distance*	840	Distanza oggetto film (mm) / *Object to film distance*	79	Nr. Films per cassetta / *Film for each holder*	1
Costruttore della sorgente / *Source manufacturer*	SEIFERT	Tipo di sorgente / *Source type*	RX	Identificazione / *Source identification*	SA151
Attività (Ci) / *Activity*	---	Energia della radiazione (KV) / *Radiation Energy*	420	Intens. radiazione (mA) / *Radiation intensity*	10
Tempo di esposizione (minuti) / *Exposure time*	5'	Macchia focale (mm) / *Focal spot size*	3	Penombra / *UG*	0,28
Tipo di penetrametro / *Penetrameter type*	1C ASTM	Posizione del penetrametro / *Penetrameter location*	SOURCE	Filo/Foro richiesto / *Required wire/hole*	W11
Produttore film / *Film manufacturer*	KODAK	Tipo di film / *Film type*	T-200	Dimensioni (cm) / *Film size*	15x40

Tecnica di esposizione / *Exposure technique*	☒ Parete sing. / *Single wall*	☐ Parete dop. / *Double wall*		Tecnica di lettura / *Viewing technique*	☒ Parete sing. / *Single wall*	☐ Parete dop. / *Double wall*	
Tipo schermi intensificatori / *Intensifying screen type*	☒ Pb	☐ Cu		Spessore schermi (mm) / *Screen thickness*	Ant.	Post.	
Trattamento del film / *Film treatment*	☒ Automatico / *Automatic*	☐ Manuale / *Manual*					

LEGENDA

C	Conforme / Conforming	R	Non conforme / Not conforming	RRX	Ripetere esposizione / Exposure to be repeated
D*	Densità misurata / Measured density	S*	Filo/Foro rilevato / Wire/Hole detected	G*	Giudizio / Evaluation

VALUTAZIONE / *EVALUATION*

Tallone / *Coupon*	Tratto / *Area*	Discontinuità / *Discontinuity*	D*	S*	G*	Tallone / *Coupon*	Tratto / *Area*	Discontinuità / *Discontinuity*	D*	S*	G*
51/15-1	1 - 2	------	2,8	11	C	51/15-2	1 - 2	------	2,8	11	C
	2 - 3	------	2,8	11	C		2 - 3	------	2,8	11	C
	3 - 4	------	2,8	11	C		3 - 4	------	2,8	11	C

CLASSIFICAZIONE DELLE DISCONTINUITÀ
DISCONTINUITY CLASSIFICATION

101	Cricca longitudinale / *Longitudinal crack*	2014	Porosità allineate / *Linear Porosity*	304	Inclusioni metalliche / *Metallic inclusion*	504	Eccesso di penetrazione / *Excessive penetration*
102	Cricca trasversale / *Transversal crack*	2015 2016	Cavità allungate e tarli / *Elongated cavities and wormholes*	C 401	Mancanza di fusione / *Lack of fusion*	601	Colpo d'arco / *Stray arc*
104	Cricca di cratere / *Crater crack*	202	Cavità di ritiro / Shrinkage cavity	D 402	Mancanza di penetrazione / *Lack of penetration*	602	Spruzzi / *Spatter*
2011 2012	Porosità / *Porosity and gas pores*	2024	Crateri di ritiro / *Crater pipe*	5011 5012	Incisione cont. e interm. / *Undercut continues and intermit.*	SCR	Difetto schermo / *Screen defect*
2013	Gruppi di porosità / *Clustered Porosity*	301 302	Inclusioni di scoria o flusso / *Slag or flux inclusion*	515	Insellamento / *Root concavity*	F	Difetto film / *Film defect*

ENTE DI COLLAUDO / Surveyor
BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 24 NOV 2015

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MANGANO
☒ REVIEWED ☐ WITNESSED
24 NOV 2015

CIMINO EMILIO
Liv. 2 - EN 473 / ISO 9712
II° Liv. SNT-TC-1A
RT - PT - MT - UT - VT

QUALITY CONTROL S.r.l. MEDOLAGO (BG)
ANGELO PANDOLFI

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RAPPORTO DI PROVA N. / Test Report N.	15/2367RP01	DATA / Date	24/11/2015	Foglio / Page	3	di / of	14

CLIENTE / Customer: BREMBANA&ROLLE S.p.A. - VALBREMBO (BG)

SAGGIO N. / *Test No.*: 51/15

TRATTAMENTO TERMICO
HEAT TREATMENT

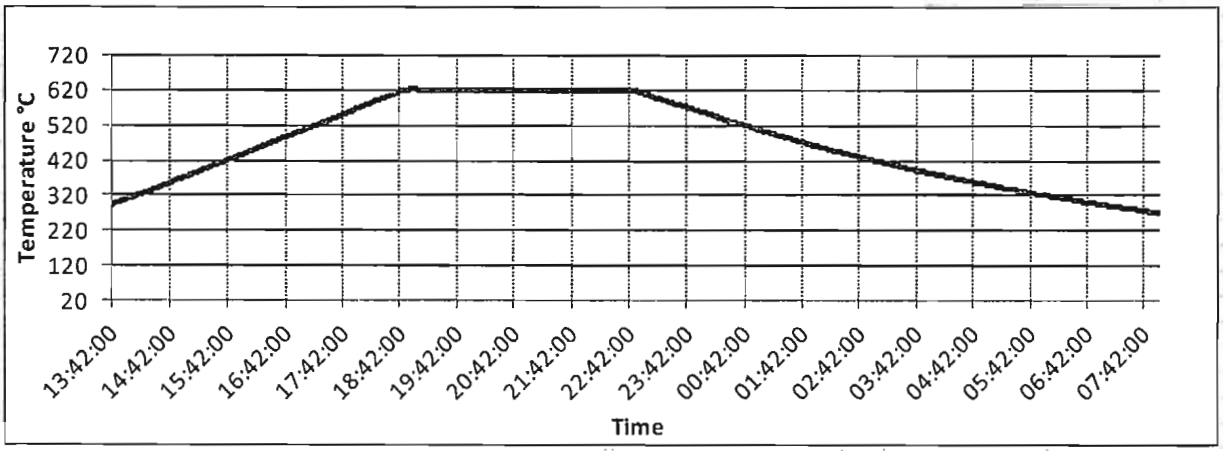
DIAGRAMMA N. / *CHART N.*: 295A/15 — DEL / *DATED*: 22/10/2015

PRESCRIZIONI CLIENTE
CLIENT PARAMETRES

Tipo di Trattamento / *Heat treatment type*	Distensione / *Stress rilieving*
Specifica Tecnica / *Technical Specification*	Richiesta cliente / *Customer required*
Raffreddamento / *Cooling*	Aria calma / *Still air*

Parametri
Parametres

	RICHIESTI / *Required*		RILEVATI / *Recorded*	
Temp. Iniziale / *Start Temp.*	<300	°C	292	°C
Riscaldo / *Heating rate*	50÷80	≤ °C/h	65	°C/h
Temperatura / *Temperature*	620 ±10	°C	620	°C
Permanenza / *Holding time*	4,00	h	4,00	h
Raffreddamento / *Cooling rate*	50÷80	≤ °C/h	63	°C/h
Temp. Finale / *Final Tem.*	<300	°C	270	°C



Forno Elettrico n. / *Electrical Furnace n.*: 223

Il diagramma originale è presso l'archivio della Quality Control S.r.l.
The original chart is in the Quality Control S.r.l. files

N.2 termocoppie tipo K posizionate sul saggio
N.2 type K thermocouples placed on the specimen

Si certifica che il trattamento termico risulta in accordo con la specifica summenzionata
We certify that the heat treatment is according to the named specification

ENTE DI COLLAUDO / Surveyor

BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R. CORNOLDI
DATE 24 NOV 2015

QUALITY CONTROL S.r.l. MEDOLAGO (BG)

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MANGANO
☒ REVIEWED ☐ WITNESSED
24 NOV 2015 ANGELO PEDDEGGIA

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RAPPORTO DI PROVA N. / *Test Report N.* 15/2367RP01 — **DATA** / *Date* 24/11/2015 — **Foglio** / *Page* 4 **di** / *of* 14

CLIENTE / *Customer* BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) — **SAGGIO N.** / *Test No.* 51/15

PROVE DOPO TRATTAMENTO TERMICO MINIMO
TEST AFTER MIN P.W.H.T.

PROVA DI TRAZIONE
TENSILE TEST

SAGGIO *Test* N.		DIMENSIONI *Size* mm	AREA *Section* mm²	SENSO *Direction*	Lo mm	CARICO TOTALE A ROTTURA *Total load at break* ------ N	ROTTURA *Tensile Strength* ≥ 415 N/mm²	ALLUNG. *Elong.* ≥ --- %	STRIZ. *Reduct.* ≥ --- %	TEMP. °C
51/15 Top	1	40,0x19,0	760,0	T	----	376200	495	----	----	+23
51/15 Bottom	2	40,0x19,0	760,0	T	----	380760	501	----	----	+23
51/15 Top	3	40,0x19,0	760,0	T	----	374680	493	----	----	+23
51/15 Bottom	4	39,9x19,0	758,1	T	----	376780	497	----	----	+23

ROTTE FUORI SALDATURA - FRATTURA DUTTILE Lato gr.60
BROKEN OUT OF WELDING - DUCTILE FRACTURE gr.60 SIDE

PROVA DI PIEGA
BEND TEST

SAGGIO *Test* N.		SENSO *Direction*	ANGOLO *Angle*	MANDRINO *Former*	POSIZIONE *Position*	ALLUNG. *Elong.*	RISULTATO *Result*	NOTE *Notes*
51/15	1	T	180	Ø 4T	SIDE	---	SATISFACTORY	Top
51/15	2	T	180	Ø 4T	SIDE	---	SATISFACTORY	Top
51/15	3	T	180	Ø 4T	SIDE	---	SATISFACTORY	Top
51/15	4	T	180	Ø 4T	SIDE	---	SATISFACTORY	Top
51/15	1	T	180	Ø 4T	SIDE	---	SATISFACTORY	Bottom
51/15	2	T	180	Ø 4T	SIDE	---	SATISFACTORY	Bottom
51/15	3	T	180	Ø 4T	SIDE	---	SATISFACTORY	Bottom
51/15	4	T	180	Ø 4T	SIDE	---	SATISFACTORY	Bottom

ENTE DI COLLAUDO / *Surveyor*
BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 24 NOV 2015

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MANGANO
☐ REVIEWED ☑ WITNESSED
24 NOV 2015

QUALITY CONTROL S.r.l.
ANGELO BENDEGGIA

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RAPPORTO DI PROVA N. / Test Report N. 15/2367RP01 **DATA** / Date 24/11/2015 **Foglio** / Page 5 **di** / of 14

CLIENTE / Customer BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) **SAGGIO N.** / Test No. 51/15

PROVE DI RESILIENZA

IMPACT TEST

SAGGIO Test N.	SENSO Direction	POSIZIONE Position	TIPO Type	TEMP. °C	DIMENS. Size Mm	VALORI Values ≥ 18 J			MEDIA Average ≥ 27 J	ESPANSIONE LATERALE Lateral Expantion ≥0,38 mm			AREA DUTTILE Shear Area For info		
						1	2	3		1	2	3	1	2	3
51/15	T	W.M. Top 1,5 mm below surface (SAW Tandem)	KV	-46	10x10	138	125	140	134,3	2,03	2,02	2,32	65	65	65
						4	5	6		4	5	6	4	5	6
51/15	T	W.M. Between ½ ÷ ¼ (SAW)	KV	-46	10x10	142	146	125	137,7	2,11	2,32	2,08	65	65	60
						7	8	9		7	8	9	7	8	9
51/15	T	W.M. ¾ Thk (SMAW)	KV	-46	10x10	109	57	37	67,7	1,88	0,91	0,61	60	40	20
						10	11	12		10	11	12	10	11	12
51/15	T	W.M. Bottom (GTAW)	KV	-46	10x10	56	18	76	50,3	0,92	0,38	1,27	40	20	55
						1	2	3		1	2	3	1	2	3
51/15	T	H.A.Z. gr.60 Top 1,5 mm below surface (SAW Tandem)	KV	-46	10x10	221	296	263	260,0	2,52	2,41	2,50	85	90	90
						4	5	6		4	5	6	4	5	6
51/15	T	H.A.Z. gr.60 Between ½ ÷ ¼ (SAW)	KV	-46	10x10	129	42	18	63,0	2,00	0,75	0,39	60	30	20
						7	8	9		7	8	9	7	8	9
51/15	T	H.A.Z. gr.60 ¾ Thk (SMAW)	KV	-46	10x10	28	28	26	27,3	0,46	0,38	0,40	20	20	20
						10	11	12		10	11	12	10	11	12
51/15	T	H.A.Z. gr.60 Bottom (GTAW)	KV	-46	10x10	28	147	152	109,0	0,38	2,12	2,32	20	65	65
						1	2	3		1	2	3	1	2	3
51/15	T	H.A.Z. gr.2 Top 1,5 mm below surface (SAW Tandem)	KV	-46	10x10	220	172	165	185,7	2,25	2,31	2,24	85	75	70
						4	5	6		4	5	6	4	5	6
51/15	T	H.A.Z. gr.2 Between ½ ÷ ¼ (SAW)	KV	-46	10x10	152	110	142	134,7	2,07	1,72	2,11	70	60	65
						7	8	9		7	8	9	7	8	9
51/15	T	H.A.Z. gr.2 ¾ Thk (SMAW)	KV	-46	10x10	176	152	126	151,3	2,24	2,14	1,90	75	70	60
						10	11	12		10	11	12	10	11	12
51/15	T	H.A.Z. gr.2 Bottom (GTAW)	KV	-46	10x10	28	27	36	30,3	0,51	0,46	0,62	20	20	20

ENTE DI COLLAUDO / Surveyor

BUREAU VERITAS ITALY
WITNESSED ~~NOTED~~ ~~REVIEWED~~
SURVEYOR R. CORNOLDI
DATE 24 NOV 2015

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MARIANO
☐ REVIEWED ☒ WITNESSED
24 NOV 2015

QUALITY CONTROL S.r.l. (BG)
ANGELO PENDEGGIA

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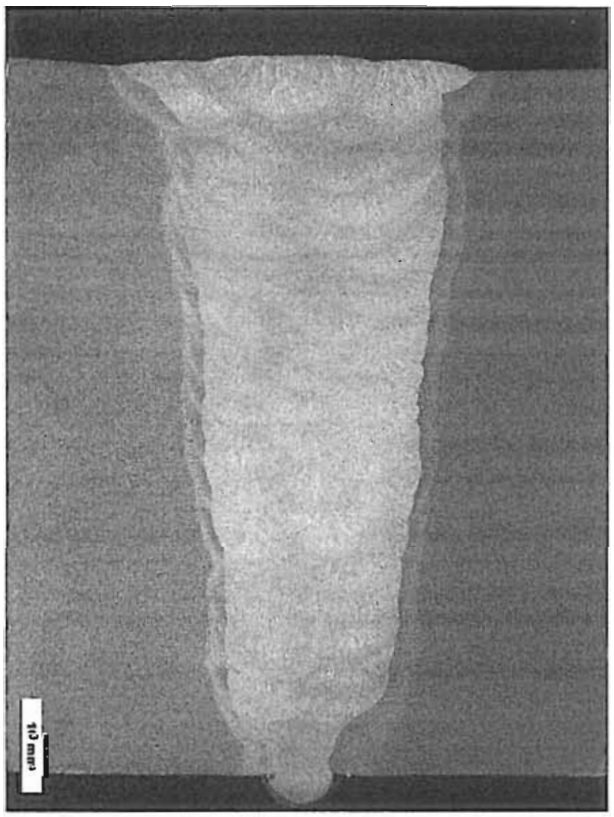
RAPPORTO DI PROVA N. / Test Report N.	15/2367RP01	DATA / Date	24/11/2015	Foglio / Page	6	di / of	14

CLIENTE / Customer	BREMBANA&ROLLE S.p.A. - VALBREMBO (BG)	SAGGIO N. / Test No.	51/15

ESAME MACROGRAFICO
MACROGRAPHIC EXAMINATION



Attacco: Nital 10%
Etching:

RISULTATO
RESULT

L'esame visivo a 10X di ingrandimento non ha evidenziato difetti o anomalie metallurgiche. Assenza di cricche e mancanze di fusione
The visual examination at 10X magnification has shown no defects or abnormal metallurgical features. Absence of cracks and lack of fusion.

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MANGANO
☒ REVIEWED ☐ WITNESSED
24 NOV 2015

ENTE DI COLLAUDO / Surveyor
BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 24 NOV 2015

Metallurgical Laboratory BRAMI ANNIBALE Level II Sector LF Reg. CICPND n. 285

QUALITY CONTROL S.r.l. MEDOLAGO (BG) ANGELO PENDOLO

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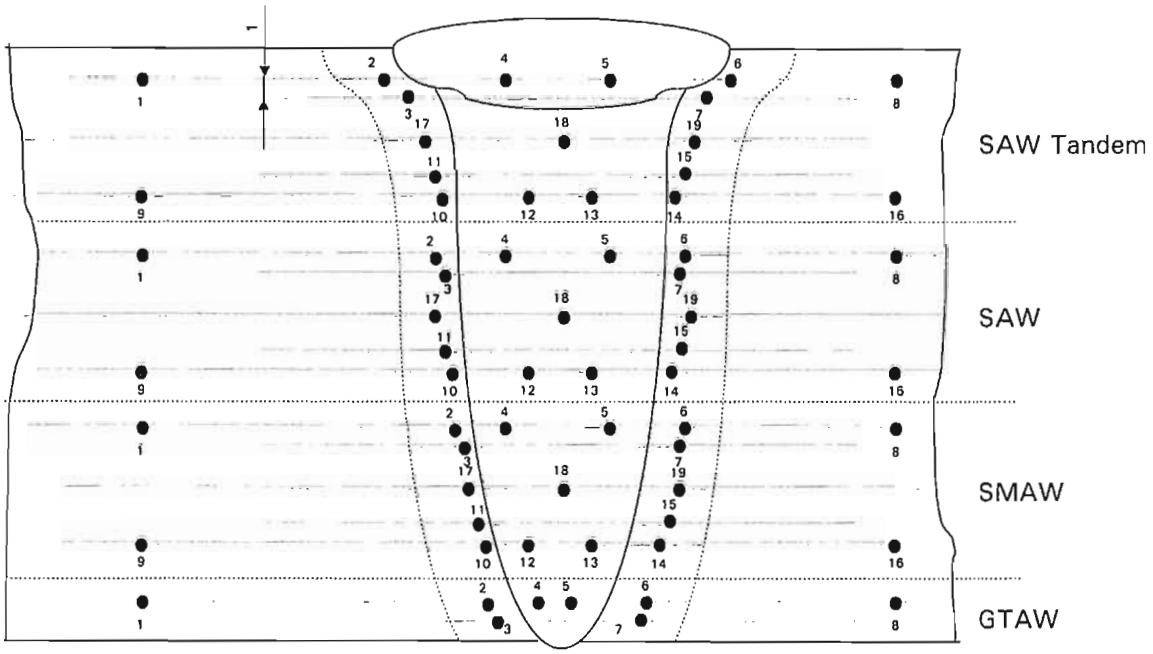
RAPPORTO DI PROVA N. / Test Report N. 15/2367RP01 **DATA** / Date 24/11/2015 **Foglio** / Page 7 **di** / of 14

CLIENTE / Customer BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) **SAGGIO N.** / Test No. 51/15

PROVE DI DUREZZA TIPO HV_{10} (MAX 248) DOPO MIN PWHT

HARDNESS TEST TYPE HV_{10} (MAX 248) AFTER MIN PWHT



RISULTATO Pos. SAW tandem

RESULT

1 =	144	2 =	192	3 =	216	4 =	198	5 =	200
6 =	206	7 =	215	8 =	159	9 =	147	10 =	193
11 =	182	12 =	188	13 =	180	14 =	183	15 =	177
16 =	166	17 =	164	18 =	178	19 =	192		

RISULTATO Pos. SAW

RESULT

1 =	149	2 =	164	3 =	160	4 =	182	5 =	185
6 =	192	7 =	187	8 =	152	9 =	150	10 =	179
11 =	169	12 =	204	13 =	194	14 =	175	15 =	176
16 =	154	17 =	173	18 =	165	19 =	179		

ENTE DI COLLAUDO / Surveyor

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 24 NOV 2015

BREMBANA & ROLLE S.p.A. WELDING DEPT. - S. MANGANO REVIEWED WITNESSED 24 NOV 2015

Metallurgical Laboratory GRAV. ANNIBALE Level II Sector LF Reg. CICPND n. 285

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RAPPORTO DI PROVA N. *Test Report N.*	15/2367RP01	**DATA** *Date*	24/11/2015	**Foglio** *Page*	8	**di** *of*	14

CLIENTE *Customer*	BREMBANA&ROLLE S.p.A. - VALBREMBO (BG)	SAGGIO N. *Test No.*	51/15

RISULTATO Pos. SMAW
RESULT

1 =	133	**2** =	166	**3** =	173	**4** =	199	**5** =	192
6 =	190	**7** =	194	**8** =	153	**9** =	140	**10** =	169
11 =	181	**12** =	186	**13** =	178	**14** =	188	**15** =	186
16 =	151	**17** =	171	**18** =	190	**19** =	187		

RISULTATO Pos. GTAW
RESULT

1 =	151	**2** =	168	**3** =	177	**4** =	170	**5** =	177
6 =	178	**7** =	181	**8** =	161				

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MANGANO
☒ REVIEWED ☐ WITNESSED
24 NOV 2015

ENTE DI COLLAUDO *Surveyor*
BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R CORNOLO'
DATE 24 NOV 2015

Welding Inspection Laboratory
BRAVI ANNIBALE
Level II Sector LF
Reg. CICPND n. 285

QUALITY CONTROL S.r.l.
MEDOLAGO (BG)
ANGELO PEDERSOLI

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio.

QUALITY CONTROL S.r.l.
LABORATORIO DI PROVE E CONTROLLI
SU MATERIALI METALLICI E GIUNTI DI SALDATURA
24030 MEDOLAGO (BG) - Via Roma, 79 - Tel. 035/90.14.73 (n. 4 linee r.a.) - Fax 035/90.10.82
www.qualitycontrolsrl.it - e-mail: info@qualitycontrolgroup.com
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RAPPORTO DI PROVA N. *Test Report N.* 15/2367RP01 **DATA** *Date* 24/11/2015 **Foglio** *Page* 9 **di** *of* 14

CLIENTE *Customer* BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) **SAGGIO N.** *Test No.* 51/15

TRATTAMENTO TERMICO
HEAT TREATMENT

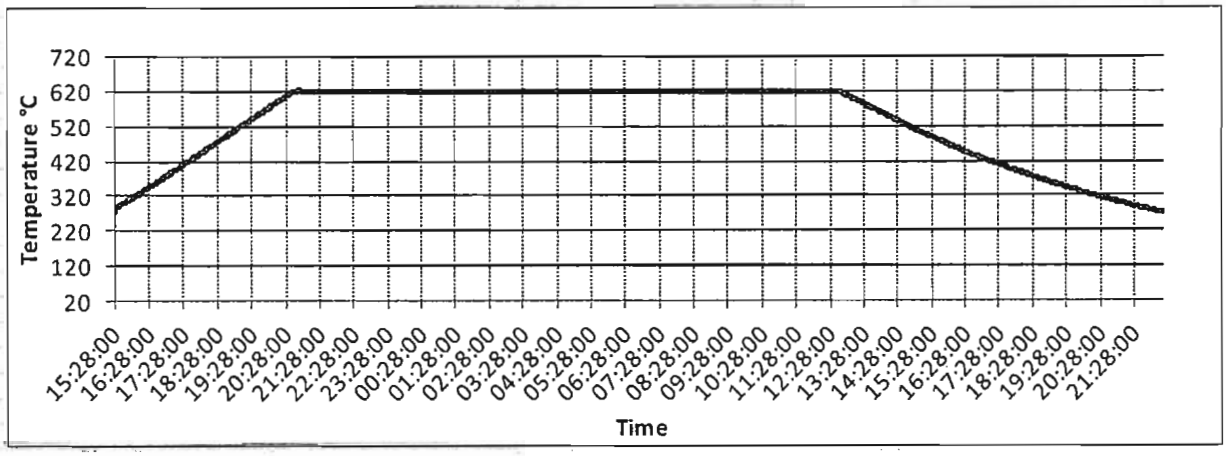
DIAGRAMMA N. *CHART N.* 299A/15 **DEL** *DATED* 26/10/2015

PRESCRIZIONI CLIENTE
CLIENT PARAMETRES

Tipo di Trattamento *Heat treatment type*	Distensione / *Stress rilieving*
Specifica Tecnica *Technical Specification*	Richiesta cliente / *Customer required*
Raffreddamento *Cooling*	Aria calma / *Still air*

Parametri
Parametres

	RICHIESTI *Required*		RILEVATI *Recorded*	
Temp. Iniziale *Start Temp.*	<300	°C	274	°C
Riscaldo *Heating rate*	50 ÷ 80	≤ °C/h	71	°C/h
Temperatura *Temperature*	620 ±10	°C	620	°C
Permanenza *Holding time*	16,00	h	16,00	h
Raffreddamento *Cooling rate*	50 ÷ 80	≤ °C/h	69	°C/h
Temp. Finale *Final Tem.*	<300	°C	270	°C



Forno Elettrico n. *Electrical Furnace n.* 223

Il diagramma originale è presso l'archivio della Quality Control S.r.l.
The original chart is in the Quality Control S.r.l. files

N.2 termocoppie tipo K posizionate sul saggio
N.2 type K thermocouples placed on the specimen

Si certifica che il trattamento termico risulta in accordo con la specifica summenzionata
We certify that the heat treatment is according to the named specification

ENTE DI COLLAUDO *Surveyor*
BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 24 NOV 2015

BREMBANA & ROLLE S.p.A. WELDING DEPT. - S. MANGANO ☒ REVIEWED ☐ WITNESSED 24 NOV 2015

QUALITY CONTROL S.r.l. MEDOLAGO (BG) ANGELO PEDRINI

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio.

QUALITY CONTROL S.r.l.
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RAPPORTO DI PROVA N. / *Test Report N.* 15/2367RP01 — **DATA** / *Date* 24/11/2015 — **Foglio** / *Page* 10 **di** / *of* 14

CLIENTE / *Customer* BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) — **SAGGIO N.** / *Test No.* 51/15

PROVE DOPO TRATTAMENTO TERMICO MASSIMO
TEST AFTER MAX P.W.H.T.

PROVA DI TRAZIONE
TENSILE TEST

SAGGIO *Test* N.		DIMENSIONI *Size* mm	AREA *Section* mm²	SENSO *Direction*	Lo mm	CARICO TOTALE A ROTTURA *Total load at break* ------ N	ROTTURA *Tensile Strength* ≥ 415 N/mm²	ALLUNG. *Elong.* ≥ --- %	STRIZ. *Reduct.* ≥ --- %	TEMP. °C
51/15 Top	1	40,0x19,0	760,0	T	----	357960	471	----	----	+23
51/15 Bottom	2	40,0x19,0	760,0	T	----	356440	469	----	----	+23
51/15 Top	3	39,9x19,0	758,1	T	----	366200	483	----	----	+23
51/15 Bottom	4	40,0x19,0	760,0	T	----	357200	470	----	----	+23
ROTTE FUORI SALDATURA - FRATTURA DUTTILE Lato gr.60 *BROKEN OUT OF WELDING - DUCTILE FRACTURE gr.60 SIDE*										

PROVA DI PIEGA
BEND TEST

SAGGIO *Test* N.		SENSO *Direction*	ANGOLO *Angle*	MANDRINO *Former*	POSIZIONE *Position*	ALLUNG. *Elong.*	RISULTATO *Result*	NOTE *Notes*
51/15	1	T	180	Ø 4T	SIDE	---	SATISFACTORY	Top
51/15	2	T	180	Ø 4T	SIDE	---	SATISFACTORY	Top
51/15	3	T	180	Ø 4T	SIDE	---	SATISFACTORY	Top
51/15	4	T	180	Ø 4T	SIDE	---	SATISFACTORY	Top
51/15	1	T	180	Ø 4T	SIDE	---	SATISFACTORY	Bottom
51/15	2	T	180	Ø 4T	SIDE	---	SATISFACTORY	Bottom
51/15	3	T	180	Ø 4T	SIDE	---	SATISFACTORY	Bottom
51/15	4	T	180	Ø 4T	SIDE	---	SATISFACTORY	Bottom

ENTE DI COLLAUDO / *Surveyor*

BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R. CORNOLDI
DATE 24 NOV 2015

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MANGANO
☐ REVIEWED ☒ WITNESSED
24 NOV 2015

QUALITY CONTROL S.r.l. MEDOLAGO (BG)
ANGELO PEZZOTTA

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QUALITY CONTROL S.r.l.
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RAPPORTO DI PROVA N. / Test Report N. 15/2367RP01 **DATA** / Date 24/11/2015 **Foglio** / Page 11 **di** / of 14

CLIENTE / Customer BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) **SAGGIO N.** / Test No. 51/15

PROVE DI RESILIENZA

IMPACT TEST

SAGGIO Test N.	SENSO Direction	POSIZIONE Position	TIPO Type	TEMP. °C	DIMENS. Size Mm	VALORI Values ≥ 18 J			MEDIA Average ≥27 J	ESPANSIONE LATERALE Lateral Expantion ≥0,38 mm			AREA DUTTILE Shear Area For info		
						1	2	3		1	2	3	1	2	3
51/15	T	W.M. Top 1,5 mm below surface (SAW Tandem)	KV	-46	10x10	113	129	127	123,0	1,95	2,14	2,07	60	65	65
						4	5	6		4	5	6	4	5	6
51/15	T	W.M. Between ½ ÷ ¼ (SAW)	KV	-46	10x10	128	125	120	124,3	2,07	2,11	1,95	65	65	65
						7	8	9		7	8	9	7	8	9
51/15	T	W.M. ¾ Thk (SMAW)	KV	-46	10x10	138	28	132	99,3	2,12	0,50	2,21	65	20	65
						10	11	12		10	11	12	10	11	12
51/15	T	W.M. Bottom (GTAW)	KV	-46	10x10	87	20	27	44,7	1,51	0,38	0,45	55	20	20
						1	2	3		1	2	3	1	2	3
51/15	T	H.A.Z. gr.60 Top 1,5 mm below surface (SAW Tandem)	KV	-46	10x10	31	27	35	31,0	0,51	0,52	0,70	20	20	20
						4	5	6		4	5	6	4	5	6
51/15	T	H.A.Z. gr.60 Between ½ ÷ ¼ (SAW)	KV	-46	10x10	54	149	190	131,0	0,95	2,19	2,43	35	70	80
						7	8	9		7	8	9	7	8	9
51/15	T	H.A.Z. gr.60 ¾ Thk (SMAW)	KV	-46	10x10	38	18	27	31,0	0,66	0,44	0,44	20	20	20
						10	11	12		10	11	12	10	11	12
51/15	T	H.A.Z. gr.60 Bottom (GTAW)	KV	-46	10x5	157	157	168	160,7	2,53	2,39	2,58	70	70	70
						1	2	3		1	2	3	1	2	3
51/15	T	H.A.Z. gr.2 Top 1,5 mm below surface (SAW Tandem)	KV	-46	10x10	28	38	28	31,3	0,64	0,79	0,38	20	20	20
						4	5	6		4	5	6	4	5	6
51/15	T	H.A.Z. gr.2 Between ½ ÷ ¼ (SAW)	KV	-46	10x10	166	171	78	138,3	2,43	2,63	1,32	70	75	50
						7	8	9		7	8	9	7	8	9
51/15	T	H.A.Z. gr.2 ¾ Thk (SMAW)	KV	-46	10x10	166	187	166	173,0	2,55	2,49	2,47	70	75	70
						10	11	12		10	11	12	10	11	12
51/15	T	H.A.Z. gr.2 Bottom (GTAW)	KV	-46	10x5	159	184	169	170,7	2,57	2,75	2,73	70	80	75

ENTE DI COLLAUDO / Surveyor BUREAU VERITAS ITALY WITNESSED ~~NOTED~~ ~~REVIEWED~~ SURVEYOR R. CORNOLDI DATE 24 NOV 2015

BREMBANA & ROLLE S.p.A. WELDING DEPT. - S. MARIANO ☐ REVIEWED ☒ WITNESSED 24 NOV 2015

QUALITY CONTROL S.r.l. MEDOLAGO (BG)

ANGELO PANSEGGIA

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio.

QUALITY CONTROL S.r.l.
LABORATORIO DI PROVE E CONTROLLI
SU MATERIALI METALLICI E GIUNTI DI SALDATURA
24030 MEDOLAGO (BG) - Via Roma, 79 - Tel. 035/90.14.73 (n. 4 linee r.a.) - Fax 035/90.10.82
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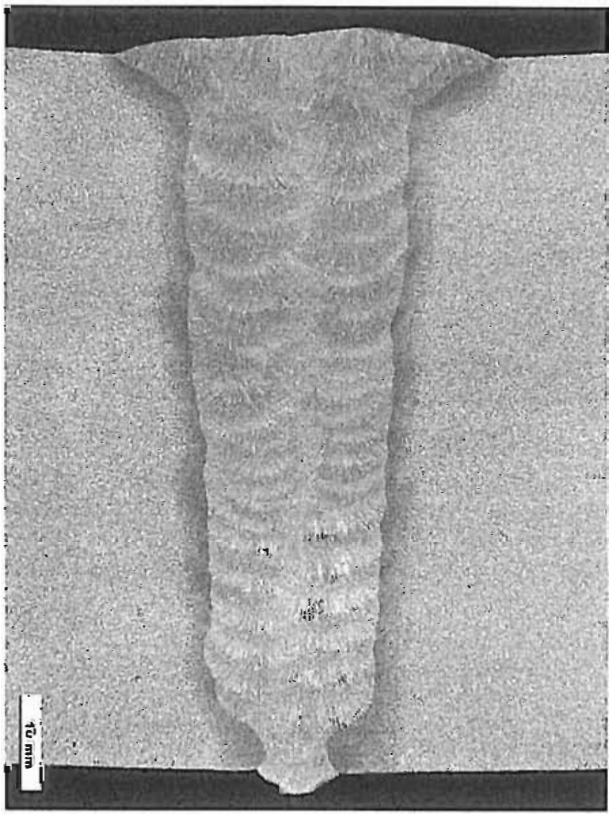
RAPPORTO DI PROVA N. / Test Report N.	15/2367RP01	DATA / Date	24/11/2015	Foglio / Page	12	di / of	14

CLIENTE / Customer	BREMBANA&ROLLE S.p.A. - VALBREMBO (BG)	SAGGIO N. / Test No.	51/15

ESAME MACROGRAFICO
MACROGRAPHIC EXAMINATION



Attacco: Nital 10%
Etching:

RISULTATO
RESULT

L'esame visivo a 10X di ingrandimento non ha evidenziato difetti o anomalie metallurgiche. Assenza di cricche e mancanze di fusione
The visual examination at 10X magnification has shown no defects or abnormal metallurgical features. Absence of cracks and lack of fusion.

ENTE DI COLLAUDO / Surveyor
BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R.CORNOLDI
DATE 24 NOV 2015

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MARIANO
REVIEWED WITNESSED
24 NOV 2015

Metallurgical Laboratory
Level II Sector LF
Reg. CICPND n. 286

QUALITY CONTROL S.r.l.
MEDOLAGO (BG)

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio.

QUALITY CONTROL S.r.l.
LABORATORIO DI PROVE E CONTROLLI
SU MATERIALI METALLICI E GIUNTI DI SALDATURA

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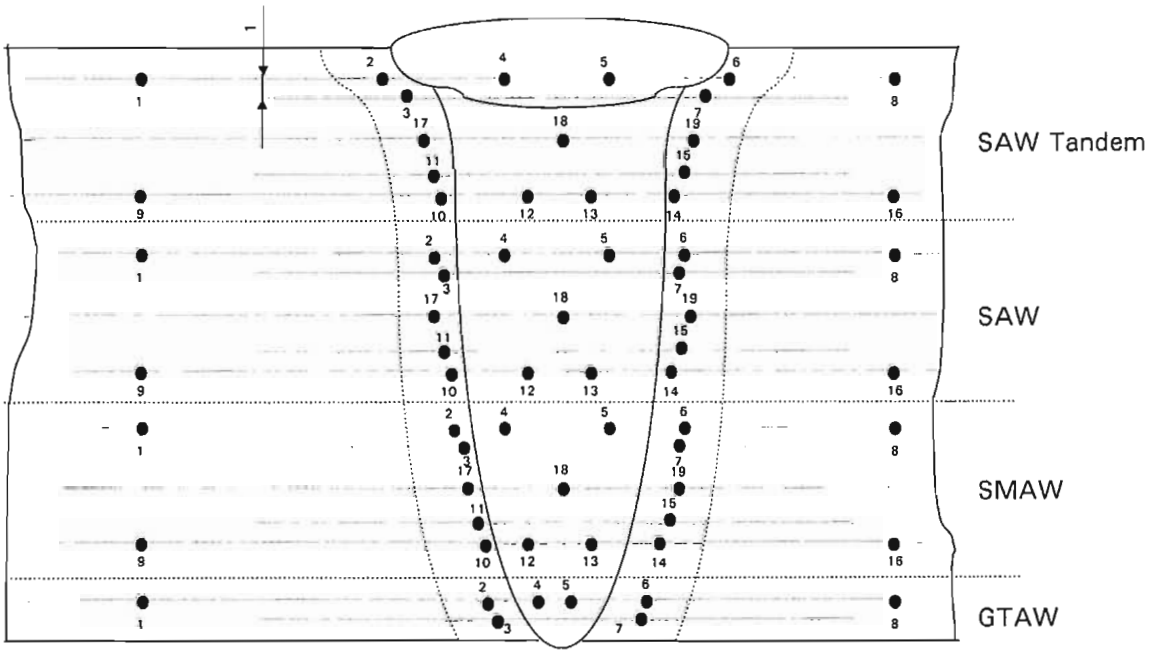
RAPPORTO DI PROVA N. *Test Report N.*	15/2367RP01	**DATA** *Date*	24/11/2015	**Foglio** *Page*	13	**di** *of*	14

CLIENTE *Customer*	BREMBANA&ROLLE S.p.A. - VALBREMBO (BG)	**SAGGIO N.** *Test No.*	51/15

PROVE DI DUREZZA TIPO HV_{10} (MAX 248) DOPO MAX PWHT

HARDNESS TEST TYPE HV_{10} (MAX 248) AFTER MAX PWHT



RISULTATO Pos. SAW tandem

RESULT

1 =	140	**2 =**	176	**3 =**	178	**4 =**	179	**5 =**	185
6 =	198	**7 =**	198	**8 =**	145	**9 =**	142	**10 =**	174
11 =	171	**12 =**	178	**13 =**	179	**14 =**	179	**15 =**	190
16 =	145	**17 =**	162	**18 =**	158	**19 =**	170		

RISULTATO Pos. SAW

RESULT

1 =	143	**2 =**	162	**3 =**	166	**4 =**	170	**5 =**	179
6 =	181	**7 =**	182	**8 =**	144	**9 =**	149	**10 =**	176
11 =	176	**12 =**	168	**13 =**	175	**14 =**	176	**15 =**	185
16 =	145	**17 =**	165	**18 =**	157	**19 =**	174		

ENTE DI COLLAUDO *Surveyor*

BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R. CORNOLDI
DATE 24 NOV 2015

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MARIANO
REVIEWED WITNESSED
24 NOV 2015

Metallurgical Laboratory
Level II Welder ILF
Reg. CICPND n. 2851

QUALITY CONTROL S.r.l. MEDOLAGO (BG)
ANGELO PENDEGGIA

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QUALITY CONTROL S.r.l.
LABORATORIO DI PROVE E CONTROLLI
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RAPPORTO DI PROVA N. / *Test Report N.* 15/2367RP01 — **DATA** / *Date* 24/11/2015 — **Foglio** / *Page* 14 **di** / *of* 14

CLIENTE / *Customer* BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) — **SAGGIO N.** / *Test No.* 51/15

RISULTATO Pos. SMAW
RESULT

1 =	142	2 =	169	3 =	162	4 =	183	5 =	174
6 =	192	7 =	203	8 =	146	9 =	142	10 =	160
11 =	165	12 =	174	13 =	193	14 =	185	15 =	176
16 =	154	17 =	180	18 =	178	19 =	182		

RISULTATO Pos. GTAW
RESULT

1 =	146	2 =	163	3 =	169	4 =	169	5 =	175
6 =	167	7 =	164	8 =	143				

ENTE DI COLLAUDO / *Surveyor*
BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 24 NOV 2015
BREMBANA & ROLLE S.p.A. WELDING DEPT. - S. MANGANO REVIEWED WITNESSED 24 NOV 2015
Metallurgical Laboratory BRAVI ANNIBALE Level II Sector UT Reg. CICPND n. 295
QUALITY CONTROL S.r.l. MEDOLAGO (BG) ANGELO PENDESSE

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio.

QUALITY CONTROL S.r.l.
LABORATORIO DI PROVE E CONTROLLI SU MATERIALI METALLICI E GIUNTI DI SALDATURA
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RAPPORTO DI PROVA N. / *Test Report N.* 17/0586RP01 **DATA** / *Date* 13/03/2017 **Foglio** / *Page* 1 **di** / *of* 2

CLIENTE / *Customer* BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) **SAGGIO N.** / *Test No.* 586.A

ORDINE *Order*	01/04/000185 dated 10/03/2017	**DISTINTA PROVE** *List of tests*	053/17	**MATERIALE RICEVUTO IL** *Material received on*	10/03/2017

OGGETTO / *Object*
Welding Procedure Qualification Record: **51/15**
Plate Thk. 75 mm - Preliminary WPS: W51/15 - Job: 4129
Welding Process: GTAW+SMAW manual + SAW-SAW Tandem Machine Pos. 1G
Welders: JOSEPH JOY (Stamp: S11) - PRIBESCU CONSTANTIN (Stamp: S20)
Coupon 586.A with PWHT MIN (performed by client)

MATERIALE / *Material*
ASME SA516 gr.60
ASME SA765 gr.2

COLATA / *Heat*
61003 616857001
14E101854

PRODUTTORE / *Supplier* ARCELOR MITTAL / OFFICINE BINDA E GALPERTI **CERT. N.** / *Cert. No.* 2015-104345 / 17594 **DEL** / *dated* 19/02/2015 / 17/09/2015

NORME DI COLLAUDO / *Test Specification* ASME IX 2015 Ed. + ASME VIII Div.2 2015 Ed.

ENTE DI COLLAUDO / *Surveyors* Lloyds' Register

Prove / *Tests*	Pagina / *Sheet*	Data Prova / *Date of test*	Metodo di prova / *Test method*	Apparecchiatura / *Equipment*	Note / *Note*
☑ Resilienze / *Impact*	2	13/03/17	UG-84	QC 376	***Conform***
☐					
☐					
☐					
☐					
☐					
☐					
☐					
☐					
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☐					
☐					

Se non diversamente specificato, per l'accettabilità fanno fede le norme di collaudo e le norme relative al materiale
Unless otherwise specified, for the acceptability are valid test specifications and material standards

SI CERTIFICANO I RISULTATI OTTENUTI. TALI RISULTATI SONO RIFERITI ESCLUSIVAMENTE AI PROVINI TESTATI.
We certify the obtained results. These tests results refer only to examined samples.

ENTE DI COLLAUDO / *Surveyor*

Lloyd's Register Verification Limited
A member of the Lloyd's Register Group
Lloyd's Register
☒ Witnessed ☐ Monitored ☐ Reviewed
Alessandro Salvatore Monastra
13 March 2017
Milan Office

QUALITY CONTROL S.r.l.
Dott. Ing. ALESSANDRO DONADONI

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio.

QUALITY CONTROL S.r.l.
LABORATORIO DI PROVE E CONTROLLI SU MATERIALI METALLICI E GIUNTI DI SALDATURA
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RAPPORTO DI PROVA N. / Test Report N. 17/0586RP01 **DATA** / Date 13/03/2017 **Foglio** / Page 2 **di** / of 2

CLIENTE / Customer BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) SAGGIO N. / Test No. 586.A

PROVE DI RESILIENZA
IMPACT TEST

SAGGIO Test N.	SENSO Direction	POSIZIONE Position	TIPO Type	TEMP. °C	DIMENS. Size Mm	VALORI Values ≥ 27 J			MEDIA Average ≥ 27 J	ESPANSIONE LATERALE Lateral Expantion ≥0,38 mm			AREA DUTTILE Shear Area For info		
						1	2	3		1	2	3	1	2	3
586.A	T	W.M. Bottom (GTAW)	KV	-46	10x10	134	128	146	136,0	2,15	1,80	2,20	60	60	70
586.A	T	H.A.Z. gr.60 Between ½ ÷ ¼ (SAW)	KV	-46	10x10	279	303	291	291,0	2,45	2,50	2,48	90	90	85
586.A	T	H.A.Z. gr.60 Between ½ ÷ ¾ (SMAW)	KV	-46	10x10	182	263	217	220,7	2,09	2,45	2,25	75	90	80
586.A	T	H.A.Z. gr.60 Bottom (GTAW)	KV	-46	10x10	174	108	70	117,3	2,20	1,75	1,11	75	60	50
586.A	T	H.A.Z. gr.2 Between ½ ÷ ¼ (SAW)	KV	-46	10x10	96	158	91	115,0	1,50	2,17	1,48	55	70	55
586.A	T	H.A.Z. gr.2 Between ½ ÷ ¾ (SMAW)	KV	-46	10x10	231	314	250	265,0	2,35	2,41	2,27	85	90	85
586.A	T	H.A.Z. gr.2 Bottom (GTAW)	KV	-46	10x10	146	179	164	163,0	2,11	2,24	2,19	65	75	70

ENTE DI COLLAUDO / Surveyor

Lloyd's Register Verification Limited
A member of the Lloyd's Register Group
Lloyd's Register
[X] Witnessed [-] Monitored [-] Reviewed
Alessandro Salvatore Monastra
13 March 2017
Milan Office
LRV003.1 2013-12

QUALITY CONTROL S.r.l.
Dott. Ing. ALESSANDRO DONADONI

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio.

QUALITY CONTROL S.r.l.
LABORATORIO DI PROVE E CONTROLLI SU MATERIALI METALLICI E GIUNTI DI SALDATURA
24030 MEDOLAGO (BG) - Via Roma, 79 - Tel. 035/90.14.73 (n. 4 linee r.a.) - Fax 035/90.10.82
www.qualitycontrolsrl.it - e-mail: info@qualitycontrolgroup.com
Iscr. Reg. Imp. BG 12004 - C.C.I.A.A. BG 166333 - Cod. Fisc. e P.IVA 00663350163 - Cap. Soc. €101.490,00

RAPPORTO DI PROVA N. *Test Report N.* 17/0586RP02 **DATA** *Date* 20/03/2017 **Foglio** *Page* 1 **di** *of* 3

CLIENTE *Customer* BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) **SAGGIO N.** *Test No.* 586.B

ORDINE *Order*	01/04/000185 dated 10/03/2017	**DISTINTA PROVE** *List of tests*	053/17	**MATERIALE RICEVUTO IL** *Material received on*	10/03/2017

OGGETTO *Object*
Integrative test to Welding Procedure Qualification Record: **51/15**
Plate Thk. 75 mm - Preliminary WPS: W51/15 - Job: 4129
Welding Process: GTAW + SMAW manual + SAW-SAW Tandem Machine Pos. 1G
Welders: JOSEPH JOY (Stamp: S11) - PRIBESCU CONSTANTIN (Stamp: S20)
Coupon 586.B with PWHT MAX (Chart No.072A/17 dated 13 ÷ 15/03/2017)

MATERIALE *Material* ASME SA516 gr.60 / ASME SA765 gr.2

COLATA *Heat* 61003 616857001 / 14E101854

PRODUTTORE *Supplier* ARCELOR MITTAL / OFFICINE BINDA E GALPERTI **CERT. N.** *Cert. No.* 2015-104345 / 17594 **DEL** *dated* 19/02/2015 / 17/09/2015

NORME DI COLLAUDO *Test Specification* ASME IX 2015 Ed. + ASME VIII Div.2 2015 Ed.

ENTE DI COLLAUDO *Surveyors* CLIENT INSPECTOR

Prove *Tests*	Pagina *Sheet*	Data Prova *Date of test*	Metodo di prova *Test method*	Apparecchiatura *Equipment*	Note *Note*
☑ Trattamento temico MAX / *MAX H.T.*	2	13 ÷ 15/03/17	IL 08.00.02	See report	---------
☑ Resilienze / *Impact*	3	20/03/17	UG-84	QC 376	*Conform*
☐					
☐					
☐					
☐					
☐					
☐					
☐					
☐					
☐					
☐					
☐					

Se non diversamente specificato, per l'accettabilità fanno fede le norme di collaudo e le norme relative al materiale
Unless otherwise specified, for the acceptability are valid test specifications and material standards

SI CERTIFICANO I RISULTATI OTTENUTI. TALI RISULTATI SONO RIFERITI ESCLUSIVAMENTE AI PROVINI TESTATI.
We certify the obtained results. These tests results refer only to examined samples.

ENTE DI COLLAUDO *Surveyor*
BREMBANA & ROLLE S.p.A. WELDING DEPT. S. MARCIANO
☐ REVIEWED ☒ WITNESSED
21/3/17.

ACES GLOBAL QUALITY SERVICES
☐ REVIEWED ☐ NOTED
☑ WITNESSED ☐ SPOT WITNESSED
NAME: FRANCOVIG E
DATE: 21 MAR. 2017
SIGNATURE:

QUALITY CONTROL S.r.l.
Dott. Ing. ALESSANDRO DONADONI

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio

QUALITY CONTROL S.r.l.
LABORATORIO DI PROVE E CONTROLLI SU MATERIALI METALLICI E GIUNTI DI SALDATURA
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RAPPORTO DI PROVA N. *Test Report N.*	17/0586RP02	DATA *Date*	20/03/2017	Foglio *Page*	2	di *of*	3

CLIENTE *Customer* BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) SAGGIO N. *Test No.* 586.B

TRATTAMENTO TERMICO
HEAT TREATMENT

DIAGRAMMA N. *CHART N.* 072A/17 DEL *DATED* 13 ÷ 15/03/2017

PRESCRIZIONI CLIENTE
CLIENT PARAMETRES

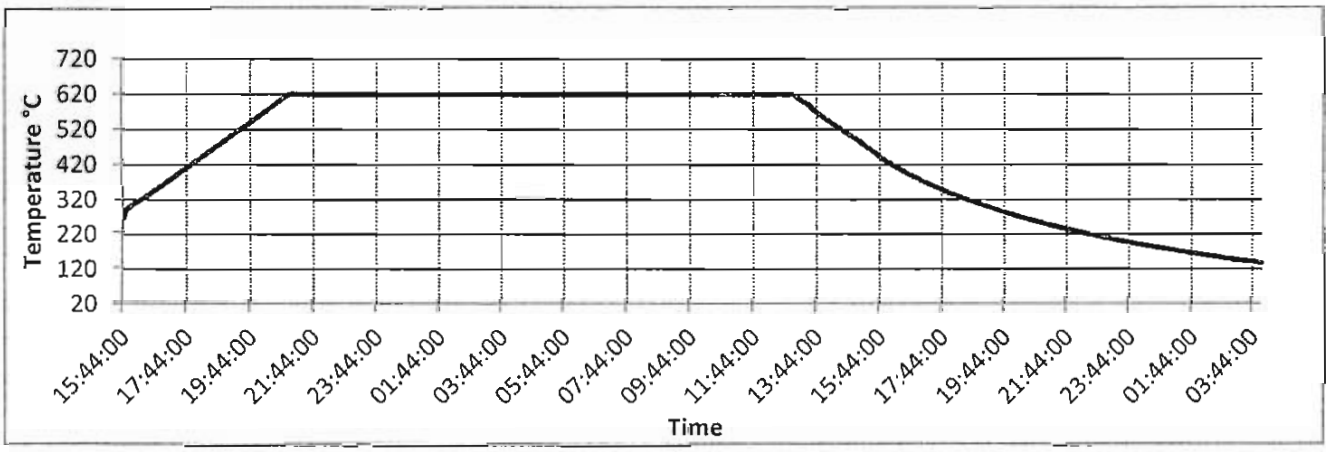
Tipo di Trattamento *Heat treatment type*: Distensione / *Stress rilieving*

Specifica Tecnica *Technical Specification*: Richiesta cliente / *Customer required*

Raffreddamento *Cooling*: Aria calma / *Still air*

Parametri
Parametres

	RICHIESTI *Required*		RILEVATI *Recorded*	
Temp. Iniziale *Start Temp.*	<300	°C	265	°C
Riscaldo *Heating rate*	50 ÷ 80	≤°C/h	65	°C/h
Temperatura *Temperature*	620±10	°C	620	°C
Permanenza *Holding time*	16,00	h	16,00	h
Raffreddamento *Cooling rate*	50 ÷ 80	≤°C/h	66	°C/h
Temp. Finale *Final Tem.*	<300	°C	131	°C



Forno Elettrico n. *Electrical Furnace n.* 221

Il diagramma originale è presso l'archivio della Quality Control S.r.l.
The original chart is in the Quality Control S.r.l. files

N.2 termocoppie tipo K posizionate sul saggio
N.2 type K thermocouples placed on the specimen

Si certifica che il trattamento termico risulta in accordo con la specifica summenzionata
We certify that the heat treatment is according to the named specification

ENTE DI COLLAUDO *Surveyor*
BREMBANA & ROLLE S.p.A.
WELDING DEPT. S. MARIANO
☐ REVIEWED ☒ WITNESSED
20/3/2017.

ACES GLOBAL QUALITY SERVICES
☑ REVIEWED ☐ NOTED
☐ WITNESSED ☐ SPOT WITNESSED
NAME: FRANCOVIC F.
DATE:
SIGNATURE: 20 MAR. 2017

QUALITY CONTROL S.r.l.
Dott. Ing. ALESSANDRO DONADONI

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio

QUALITY CONTROL S.r.l.
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RAPPORTO DI PROVA N. / *Test Report N.* 17/0586RP02 **DATA** / *Date* 20/03/2017 **Foglio** / *Page* 3 **di** / *of* 3

CLIENTE / *Customer* BREMBANA&ROLLE S.p.A. - VALBREMBO (BG) SAGGIO N. / *Test No.* 586.B

PROVE DOPO TRATTAMENTO TERMICO MASSIMO
TEST AFTER MAX P.W.H.T.

PROVE DI RESILIENZA
IMPACT TEST

SAGGIO *Test* N.	SENSO *Direction*	POSIZIONE *Position*	TIPO *Type*	TEMP. °C	DIMENS. *Size* Mm	VALORI *Values* ≥ 27 J			MEDIA *Average* ≥ 27 J	ESPANSIONE LATERALE *Lateral Expantion* ≥0,38 mm			AREA DUTTILE *Shear Area* For info		
						1	2	3		1	2	3	1	2	3
586.B	T	W.M. Bottom (GTAW)	KV	-46	10x10	159	148	168	158,3	2,31	2,21	2,40	70	70	75
586.B	T	H.A.Z. gr.60 Between ½ ÷ ¾ (SMAW)	KV	-46	10x10	151	200	178	176,3	2,36	2,60	2,40	70	80	75
586.B	T	H.A.Z. gr.2 Between ½ ÷ ¾ (SMAW)	KV	-46	10x10	235	119	312	222,0	2,44	1,61	2,47	85	65	90

ENTE DI COLLAUDO / *Surveyor*
BREMBANA & ROLLE S.p.A. WELDING DEPT. S. MANGANO
☐ REVIEWED ☒ WITNESSED
20/3/2017

ACES GLOBAL QUALITY SERVICES
☐ REVIEWED ☐ NOTED
☑ WITNESSED ☐ SPOT WITNESSED
NAME: FRANCOVIG F.
DATE: 20 MAR. 2017
SIGNATURE:

QUALITY CONTROL S.r.l.
Dott. Ing. ALESSANDRO DONADONI

Il presente certificato non può essere riprodotto, salvo autorizzazione scritta del laboratorio

forge monchieri

AMAI FORGINGS MEMBER

COMPANY CERTIFIED BY ASME
AS A MATERIAL ORGANIZATION
- CERTIFICATE NUMBER QSC-610 -

ISO 9001, ISO 14001, OHSAS 18001 BUREAU VERITAS Certification

14\08449 rev. 00

Cividate Camuno, li (Date) 21-MAG-2014 foglio (Page) 1 di (of) 12

CERTIFICATO DI COLLAUDO \ CERTIFICATE MATERIAL TEST REPORT

CERTIFICAT DE RÉCEPTION \ ABNAHMEPR ÜFZEUGNIS

N. 14\08449\CM

Page 1 of 1

CLIENTE / *Customer Client / Kunde*: **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung*: **000725 JOB M288**

DATA / *Date / Datum*: **20.03.2014**

COMMESSA / *Job. Nr. Réf. / Auftrag*: **14\120**

MATERIALE / *Material Nuance/ Werkstoff*: **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation*: **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

CODICE / *Code Kundenidentifikation*

Id Fm	POS Item	QTA Q.ty / Qte	DESCRIZIONE / Subject Object / Betreff	DISEGNO / Drawing Plan / Zeichnung	MATRICOLA / Serial Nr. Repère / Kenn-Nr.	PROVA / Test Essai / Test Nr.	COLATA / Heat Coulée / Schmelze
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14

LISTA DEI CERTIFICATI / List of enclosed certificates

Pages	List of enclosed certificates	Report No.	
1	Certificato di Collaudo \ Certificate Material Test Report \ Certificat de Réception \ Abnahmepr üfzeugnis	14\08449\CM	1
2	Analisi Chimica \ Chemical Analysis \ Analyse Chimique \ Chem. Zusammensetzung	14\08449\CA	1
3	Trattamento Termico \ Heat Treatment \ Traitement Thermique \ Wärmebehandlung	14\08449\HTQ	1
4	Prova Meccanica di Trazione \ Mechanical Tensile Test \ Essai de Traction \ Zugfestigkeitsversuch	14\08449\TE	1
5	Prova Meccanica di Resilienza \ Mechanical Impact Test \ Essai de Résilience \ Kerbschlagbiegeversuch	14\08449\IM	1
6	Trattamento Termico Simulato Max\ Simulated Heat Treatment Max \ Traitement Thermique Simulé Max.\ Max. Simulierte Wärmebehandlung	14\08449\PWX	1
7	Trazione MAX SPWHT\ Tensile Test MAX SPWHT \ Essai de Traction MAX SPWHT \ Zugfestigkeitsversuch MAX SPWHT	14\08449\TEX	1
8	Resilienza MAX SPWHT \ Impact Test MAX SPWHT \ Essai de Résilience MAX SPWHT \ Kerbschlagbiegeversuch MAX SPWHT	14\08449\IMX	1
9	Durezza \ Hardness \ Essai de Dureté \ Härteprüfung	14\08449\HPF	1
10	Esame Magnetico \ Magnetic Test \ Côntrole Magnétoscopique \ Magnetpulverprüfung	14\08449\MT	1
11	Esame Ultrasonoro \ Ultrasonic Test \ Côntrole Ultrasons \ Ultrachallprüfung	14\08449\USF	1
12	Esame Dimensionale \ Dimensional and Visual check \ Contrôle Visuel et Dimensionnel \ Visuelle Prüfung und Maßkontr.	14\08449\DI	1

I controlli eseguiti sono conformi all'ordine e specifiche del materiale
The tests have been in conformance with the order and material specifications

BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R. CORNOLDI
DATE 3/06/15

BREMBANA & ROLLE S.p.A.
QCM - L. BENSONI
REVIEWED / ACCEPTED
13 GIU 2014

Operatore *Operator*	Enti collaudatori *Inspection Authorities*	saipem spa QC INSPECTOR Sergio Ricci Review Witness date 21.05.'14 Snamprogetti Centre of Excellence	Responsabile controllo qualità *Quality Control Manager*
			FORGE MONCHIERI S.p.A. - Morandini Dario - Quality Control Manager

forge monchieri

MEMBER FORGINGS

COMPANY CERTIFIED BY ASME
AS A MATERIAL ORGANIZATION
- CERTIFICATE NUMBER QSC-610 -

ISO 9001, ISO 14001, OHSAS 18001 BUREAU VERITAS Certification

14\08449 rev. 00

Cividate Camuno, li 21-MAG-2014 foglio 2 di 12
Date *Page* *of*

ANALISI CHIMICA \ CHEMICAL ANALYSIS
ANALYSE CHIMIQUE \ CHEM. ZUSAMMENSETZUNG

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\CA** *of* *Page* 1 *of* 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung* **000725 JOB M288** DATA *Date / Datum* **20.03.2014**

COMMESSA / *Job. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance/ Werkstoff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

CODICE / *Code Kundenidentifikation*

Id *Fm*	POS *Item*	QTA *Q.ty / Qte*	DESCRIZIONE / *Subject Objet / Betreff*	DISEGNO / *Drawing Plan / Zeichnung*	MATRICOLA / *Serial Nr. Repère / Kenn-Nr.*	PROVA / *Test Essai / Test Nr.*	COLATA / *Heat* Coulée / Schmelze
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14

COLATA	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	V	Al	Ceq
Heat	%	%	%	%	%	%	%	%	%	%	%	%
Min		,6	,15									
Max	,22	1,35	,35	,02	,02	,4	,5	,1	,2	,05	,05	,43
Ladle analysis					*Steelmaker : OLIFER-ACP S.P.A.*							
9084-14	,16	1,17	,22	,007	,0007	,11	,14	,05	,15	,002	,023	,4067
Product analysis					*Performed by Forge Monchieri Spa*							
14-0505	,162	1,168	,221	,008	,0007	,107	,138	,049	,151	,003	,025	,4077

Acciaio elaborato al forno elettrico degassato sottovuoto calmato a grano fine .
Steel made by electric furnace process, vacuum degassed fully killed , fine grain practice .

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. SORNOLDI DATE 5/6/14

BREMBANA & ROLLE S.p.A.
QCM - L. BENSONI
REVIEWED / ACCEPTED
13 GIU 2014

[X] CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*

[ ] *NON CONFORME ALLA SPECIFICA / Not According to specif. Non Conf. Svt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*	Enti collaudatori *Inspection Authorities*		Responsabile controllo qualità *Quality Control Manager*
		saipem spa QC INSPECTOR Sergio Ricci ☒ review ☐ witness date 21.05.14 Snamprogetti Centre of Excellence	FORGE MONCHIERI S.p.A. - Morandini Dario - Quality Control Manager

OLIFER-ACP SPA
Soc. per Az. Unipersonale soggetta ad attività di direz. e coord. esercitata da "OLIFIN SPA" con sede in Odolo — BS- Via Marconi,4 cod.fisc e iscr. reg. impr. Bs: 00286190178
LOC. Motte Alte, 14 - 24050 CIVIDATE AL PIANO (BG)
Tel. +39 0363 97193-4 - Fax +39 0363 976665
P.I. 02477420168 C.F. e REG. IMPR. BG 00496820176
Capitale sociale i.v. Euro 10.000.000,00

CERTIFICATO DI COLLAUDO / MILL TEST CERTIFICATE

ACPL00269/2014 Data / Date **26/02/2014**

EN 10204 3.1

Azienda con sistema di gestione certificato da IGQ secondo ISO 9001 e da TUV secondo ISO 14001

ISO 9001 Quality Management System Certified by IGQ,ISO 14001 Environmental System Certified by TUV

Cliente / Customer **FORGE MONCHIERI S.P.A.** **VIA INDUSTRIALE, 3** **25040 CIVIDATE CAMUNO BS**		Nostra conferma N° / Our confirmation no. **138/2014 del 28-01-2014** Colata N. / Heat no. **9084-14**	Ordine cliente n./Customer **2014/A2/00020 pos.1-2-3-4 del 27/01/14** Stato fornitura materiale / State of supplies material
Norma Specifica / Standard	Acciaio / Steel grade	Scheda / Sheet **CL430DF**	Dimensioni (mm) / Size (mm)

Acciaio prodotto con fusione in E.A.F. ed affinazione in L.F. - Trattamento sottovuoto - Materiale esente da radioattività e da saldature - Lo stato di fornitura del materiale è prodotto siderurgico primario

Steel is fully killed - produced by E.A.F. - Refined in L.F. - Vacuum Degassed - the employed material is free from ionizing radiation beyond the natural intrinsic radiation - No welding operation has been performed - Supply status is raw material -

Analisi chimica / Chemical composition %

C	Si	Mn	P	S	Ni	Cu	Cr	Mo	Al	Sn	H2	V	Ti	B	Nb	As	Ca
0,16	**0,22**	**1,17**	**0,007**	**0,0007**	**0,14**	**0,15**	**0,11**	**0,05**	**0,023**	**0,011**	**0,00012**	**0,002**	**0,002**	**0,0004**	**0,001**	**0,007**	**0,001**
Sb	Co	N	O2														
0,0031	**0,008**	**0,0062**	**0,0018**														

CuEq	Ceq	Cef	Jfact	xfact	Pcm
0,26	**0,41**	**0,090**	**250**	**14**	**0,25**

DUREZZA HARDNESS (HB)	INCLUSIONI NON METALLICHE NON METALLIC INCLUSION CHECK	GRANO AUSTENITICO GRAIN SIZE	TRATTAMENTO TERMICO HEAT TREATMENT		
			Raffreddamento in c. Controlled cooling	Ricotto Annealing	Spedito caldo Hot delivery
			–	–	–

ALTRE PROVE / OTHER TEST

BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R CORNOLO
DATE 9/12/15

Si dichiara che il materiale corrisponde alle specifiche concordate alla conferma dell'ordine/ We confirm that the productions correspond to the agreement made during order confirmation.

saipem spa
QC INSPECTOR
Sergio Ricci
review witness
date 29.04.14
Impianti Centre of Excellence

COPY CONFORM TO ORIGINAL

Forge monchieri
Dario Brandini
Quality Control Manager

SREMBANA & BOLIS S.p.A.
QCM - LORENSONI
REVIEWED / ACCEPTED
13 GIU 2014

Controllo Qualità / Quality control		Preparato controllo qualità/Prepared quality control	Verificato responsabile controllo qualità/ Verified quality control
Controllo superficiale Surface quality	Antimescolamento Grade check		
X	X	Alberto Sengermano	Alessandro D'Amico

1723001756-QC-DB-00017_02 - V25001A

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COMPANY CERTIFIED BY ASME
AS A MATERIAL ORGANIZATION
- CERTIFICATE NUMBER QSC-610 -

ISO 9001, ISO 14001, OHSAS 18001 BUREAU VERITAS Certification

14\08449 rev. 00

Cividate Camuno, li 21-MAG-2014 foglio 3 di 12
Date *Page* *of*

TRATTAMENTO TERMICO \ HEAT TREATMENT
TRAITEMENT THERMIQUE \ WÄRMEBEHANDLUNG

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\HTQ** *of* *Page* 1 *of* 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung* **000725 JOB M288** DATA *Date / Datum* **20.03.201**

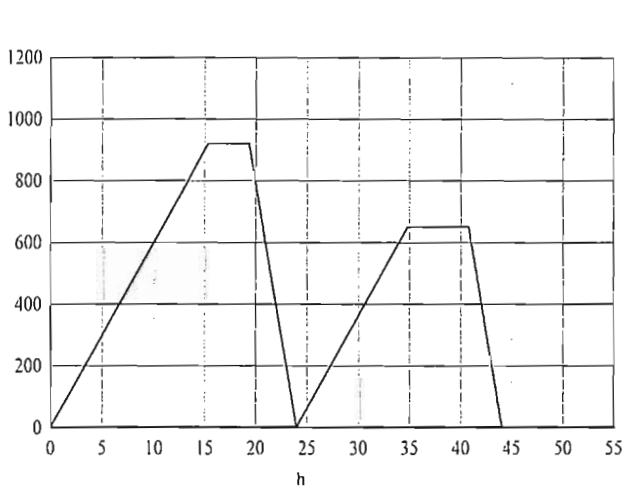
COMMESSA / *Joh. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance/ Werkstoff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

CODICE / *Code Kundenidentifikation*

Id *Fm*	POS *Item*	QTA *Q.ty / Qte*	DESCRIZIONE / *Subject Object / Betreff*	DISEGNO / *Drawing Plan / Zeichnung*	MATRICOLA / *Serial Nr. Repère / Kenn-Nr.*	PROVA / *Test Essai / Test Nr.*	COLATA / *Hea Coulée / Schmelz*
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14



Trattamento Termico *Heat treatment*	Gradiente Salita *Heating rate*		Temperatura di Permanenza *Holding temperature*		Permanenza *Holding time*	Raffreddamneto *Cooling*	
Normalizzazione - Normalization	60,0 °C/h	108,0 °F/h	920 °C	1688 °F	4,0 h	Aria	Air
Rinvenimento - Tempering	60,0 °C/h	108,0 °F/h	650 °C	1202 °F	6,0 h	Aria	Air

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 6/6/14

BREMBANA & ROLLE S.p.A QCM - L. BENSONI - REVIEWED / ACCEPTED 13 GIU 2014

[X] CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*

[ ] *NON CONFORME ALLA SPECIFICA / Not According to specif. Non Conf. Svt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*	Enti collaudatori *Inspection Authorities*		Responsabile controllo qualità *Quality Control Manager*
		saipem spa QC INSPECTOR Sergio Ricci [X] review [ ] witness date 21.05.14	FORGE MONCHIERI S.p.A. - Morandini Dario - Quality Control Manager
		Snamprogetti Centre of Excellence	

forge monchieri

COMPANY CERTIFIED BY ASME
AS A MATERIAL ORGANIZATION
- CERTIFICATE NUMBER QSC-610 -

ISO 9001, ISO 14001, OHSAS 18001 BUREAU VERITAS Certification

14\08449 rev. 00

Cividate Camuno, li 21-MAG-2014 foglio 4 di 12
Date Page of

PROVA MECCANICA DI TRAZIONE \ MECHANICAL TENSILE
ESSAI DE TRACTION \ ZUGFESTIGKEITSVERSUCH

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\TE** of Page 1 of 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung* **000725 JOB M288** DATA / *Date / Datum* **20.03.2014**

COMMESSA / *Job. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance/ Werkstoff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

CODICE / *Code Kundenidentifikation*

Id *Fm*	POS *Item*	QTA *Q.ty / Qte*	DESCRIZIONE / *Subject Object / Betreff*	DISEGNO / *Drawing Plan / Zeichnung*	MATRICOLA / *Serial Nr. Repère / Kenn-Nr.*	PROVA / *Test Essai / Test Nr.*	COLATA / *Hea Coulée / Schmelze*
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14

TRAZIONE - *Tensile*

Ø 12,5 mm.				Sec. 122,66 mm²			Lo 50,00 mm		
Tensile tests machines: Macchina di Trazione		ZWICK matricola 181845-08							
Prova *Test*	**Direzione** *Direction*	**Temp.**		**Rp (0,02%)**	**Rp (0,2%)**	**Rp (1%)**	**R**	**A**	**Z**
		°C	°F	MPa	MPa	MPa	MPa	%	%
		20	*68,00*		*>=250*		*485÷655*	*>=22*	*>=30*
14-0505	*Tangential ¼TxT*	*20*	*68,00*		*352,0*		*524,0*	*35,3*	*76,0*

Le prove meccaniche sono state eseguite in condizioni di fornitura
The mechanical tests have been performed in delivered condition

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 5/6/14

BREMBANA & ROLLE S.p.A. QCM - L. BENSONI REVIEWED / ACCEPTED 13 GIU 2014

X CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*

NON CONFORME ALLA SPECIFICA / *Not According to specif. Non Conf. Svt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*	Enti collaudatori *Inspection Authorities*	Responsabile controllo qualità *Quality Control Manager*
	saipem spa QC INSPECTOR Sergio Ricci ☐ review ☒ witness date 21.05.14 Snamprogetti Centre of Excellence	FORGE MONCHIERI S.p.A. - Morandini Dario - Quality Control Manager

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AS A MATERIAL ORGANIZATION
- CERTIFICATE NUMBER QSC-610 -

ISO 9001, ISO 14001, OHSAS 18001 BUREAU VERITAS Certification

14\08449 rev. 00

Cividate Camuno, li 21-MAG-2014 foglio 5 di 12
Date *Page* *of*

PROVA MECCANICA DI RESILIENZA \ MECHANICAL IMPACT
ESSAI DE RÉSILIENCE \ KERBSCHLAGBIEGEVERSUCH

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\IM** *of* *Page* 1 *of* 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung* **000725 JOB M288** DATA *Date / Datum* **20.03.2014**

COMMESSA / *Job. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance/ Werkstoff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

ASME VIII Div.2 Para AM-201.4(b)

CODICE / *Code Kundenidentifikation*

Id *Fm*	POS *Item*	QTA *Q.ty / Qte*	DESCRIZIONE / *Subject Object / Betreff*	DISEGNO / *Drawing Plan / Zeichnung*	MATRICOLA / *Serial Nr. Repère / Kenn-Nr.*	PROVA / *Test Essai / Test Nr.*	COLATA / *Hea* Coulée / Schmelze
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14

RESILIENZA - *Impact*

Sezione Provino *Impact specimen Section* 10x10 mm L.55 mm

Impact tests machines: Macchina per Resilienza ZWICK ROELL mod. RKP450 matricola 189240/09

Prova *Test*	Direzione *Direction*	KV °C	KV °F	Esp Laterale *Lat Espansion*	Fratt.Duttile *Sheare Fracture*
		-45,00	-49,00		
		KV J		mm	%
		Average	>=20		
		Single	>=16		
			Average		
14-0505	Tangential ¼TxT	287,0	294,0	305,0	295,3

Le resilienze sono state eseguite in condizioni di fornitura
The impact tests have been performed in delivered condition

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 5/1c/15

BREMBANA & ROLLE S.p.A. QCM - L. BENSONI REVIEWED / ACCEPTED 13 GIU 2014

[X] CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*
[ ] *NON CONFORME ALLA SPECIFICA / Not According to specif. Non Conf. Svt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*	Enti collaudatori *Inspection Authorities*	saipem spa QC INSPECTOR Sergio Ricci ☐ review ☒ witness date 21.05.14 Snamprogetti Centre of Excellence	Responsabile controllo qualità *Quality Control Manager* FORGE MONCHIERI S.p.A. - Marandini Dario - Quality Control Manager

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COMPANY CERTIFIED BY ASME
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- CERTIFICATE NUMBER QSC-610 -

ISO 9001, ISO 14001, OHSAS 18001 BUREAU VERITAS Certification

14\08449 rev. 00

Cividate Camuno, li 21-MAG-2014 foglio 6 di 12
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TRATTAMENTO TERMICO SIMULATO MAX\ SIMULATED HEAT
TRAITEMENT THERMIQUE SIMULÉ MAX.\ MAX. SIMULIERTE

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\PWX** *of* *Page* 1 *of* 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande / Bestellung* **000725 JOB M288** DATA *Date / Datum* **20.03.201**

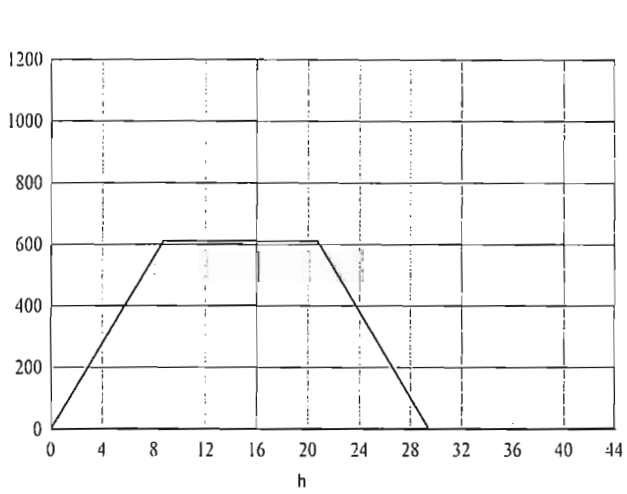
COMMESSA / *Job. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance / Werkstoff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

CODICE / *Code Kundenidentifikation*

Id *Fm*	POS *Item*	QTA *Q.ty / Qte*	DESCRIZIONE / *Subject Object / Betreff*	DISEGNO / *Drawing Plan / Zeichnung*	MATRICOLA / *Serial Nr. Repère / Kenn-Nr.*	PROVA / *Test Essai / Test Nr.*	COLATA / *Hea Coulée / Schmelz*
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14



Trattamento Termico *Heat treatment*	Gradiente Salita *Heating rate*		Temperatura di Permanenza *Holding temperature*		Permanenza *Holding time*	Gradiente Discesa *Cooling rate*		Raffreddamneto *Cooling*	
SPWHT	70,0 °C/h	126,0 °F/h	610 °C	1130 °F	12,00 h	70,0 °C/h	126,0 °F/h	Forno	Furnace

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R CORNOLDI DATE 9/10/14

BREMBANA & ROLLE S.p.A. QCM - L. BENSONI REVIEWED / ACCEPTED 13 GIU 2014

[X] CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*

[ ] *NON CONFORME ALLA SPECIFICA / Not According to specif. Non Conf. Svt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*	Enti collaudatori *Inspection Authorities*		Responsabile controllo qualità *Quality Control Manager*
		saipem spa QC INSPECTOR Sergio Ricci ☒ review ☐ witness date 21.05.14 Snamprogetti Centre of Excellence	FORGE MONCHIERI S.p.A. - Marandini Dario - Quality Control Manager

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COMPANY CERTIFIED BY ASME
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- CERTIFICATE NUMBER QSC-610 -

ISO 9001, ISO 14001, OHSAS 18001 BUREAU VERITAS Certification

14\08449 rev. 00

Cividate Camuno, li 21-MAG-2014 foglio 7 di 12
Date Page of

TRAZIONE MAX SPWHT\ TENSILE TEST MAX SPWHT
ESSAI DE TRACTION MAX SPWHT \ ZUGFESTIGKEITSVERSUCH MAX SPWHT

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\TEX** of Page 1 of 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung* **000725 JOB M288** DATA / *Date / Datum* **20.03.201**

COMMESSA / *Job. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance / Werkstoff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

CODICE / *Code Kundenidentifikation*

Id Fm	POS Item	QTA Q.ty / Qte	DESCRIZIONE / Subject Object / Betreff	DISEGNO / Drawing Plan / Zeichnung	MATRICOLA / Serial Nr. Repère / Kenn-Nr.	PROVA / Test Essai / Test Nr.	COLATA / Hea Coulée / Schmelzı
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14

TRAZIONE - *Tensile*

Ø 12,5 mm. Sec. 122,66 mm² Lo 50,00 mm

Tensile tests machines: Macchina di Trazione ZWICK matricola 181845-08

Prova *Test*	Direzione *Direction*	Temp. °C	Temp. °F	Rp (0,02%) MPa	Rp (0,2%) MPa	Rp (1%) MPa	R MPa	A %	Z %
		20	*68,00*		*>=250*		*485÷655*	*>=22*	*>=30*
14-0505	*Tangential ¼TxT*	*20*	*68,00*		*318,0*		*501,0*	*36,4*	*73,8*

Le prove meccaniche sono state eseguite dopo SPWHT
The mechanical test have been performed after SPWHT

BUREAU VERITAS ITALY WITNESSED - NOTED - REVIEWED SURVEYOR R. CORNOLDI DATE 9/10/14

BREMBANA & ROLLE S.p.A. QCM - E. BENSONI REVIEWED / ACCEPTED 13 GIU 2014

[X] CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*

[ ] *NON CONFORME ALLA SPECIFICA / Not According to specif. Non Conf. Svt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*	Enti collaudatori *Inspection Authorities*	saipem spa QC INSPECTOR Sergio Ricci ☐ review ☒ witness date 21.05.14 Snamprogetti Centre of Excellence	Responsabile controllo qualità *Quality Control Manager* FORGE MONCHIERI S.p.A. - Morandini Dario - Quality Control Manager

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COMPANY CERTIFIED BY ASME
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- CERTIFICATE NUMBER QSC-610 -

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14\08449 rev. 00

Cividate Camuno, li 21-MAG-2014 foglio 8 di 12
Date *Page* *of*

RESILIENZA MAX SPWHT \ IMPACT TEST MAX SPWHT

ESSAI DE RÉSILIENCE MAX SPWHT \ KERBSCHLAGBIEGEVERSUCH MAX SPWHT

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\IMX** *of* *Page* 1 of 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung* **000725 JOB M288** DATA / *Date / Datum* **20.03.2014**

COMMESSA / *Job. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance/ Werkstaff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

ASME VIII Div.2 Para AM-201.4(b)

CODICE / *Code Kundenidentifikation*

Id *Fm*	POS *Item*	QTA *Q.ty / Qte*	DESCRIZIONE / *Subject Object / Betreff*	DISEGNO / *Drawing Plan / Zeichnung*	MATRICOLA / *Serial Nr. Repére / Kenn-Nr.*	PROVA / *Test Essai / Test Nr.*	COLATA / *Hea* Coulée / Schmelze
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14

RESILIENZA - *Impact*

Sezione Provino *Impact specimen Section* 10x10 mm L.55 mm

Impact tests machines: Macchina per Resilienza ZWICK ROELL mod. RKP450 matricola 189240/09

Prova *Test*	Direzione *Direction*	KV °C	KV °F	Esp Laterale *Lat Espansion*	Fratt.Duttile *Sheare Fracture*
		-45,00	-49,00		
		J		mm	%
		Average	>=20		
		Single	>=16		

		Average									
14-0505	Tangential ¼TxT	225,0	194,0	211,0	210,0						

Le resilienze sono state eseguite dopo SPWHT
The impact tests have been performed after SPWHT

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 3/10/15

BREMBANA & ROLLE S.p.A. QCM - L. BENSONI REVIEWED / ACCEPTED 13 GIU 2014

[X] CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*

[ ] *NON CONFORME ALLA SPECIFICA / Not According to specif. Non Conf. Svt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*	Enti collaudatori *Inspection Authorities*		Responsabile controllo qualità *Quality Control Manager*
		saipem spa QC INSPECTOR Sergio Ricci ☐ review ☒ witness date 21.05.'14 Snamprogetti Centre of Excellence	FORGE MONCHIERI S.p.A. - Morandini Dario - Quality Control Manager

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- CERTIFICATE NUMBER QSC-610 -

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Cividate Camuno, li 21-MAG-2014 foglio 9 di 12
Date *Page* *of*

DUREZZA \ HARDNESS
ESSAI DE DURETÉ \ HÄRTEPRÜFUNG

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\HPF** *of* *Page* 1 *of* 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung* **000725 JOB M288** DATA *Date / Datum* **20.03.201**

COMMESSA / *Job. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance/ Werkstoff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

CODICE / *Code Kundenidentifikation*

Id *Fm*	POS *Item*	QTA *Q.ty / Qte*	DESCRIZIONE / *Subject Object / Betreff*	DISEGNO / *Drawing Plan / Zeichnung*	MATRICOLA / *Serial Nr. Repère / Kenn-Nr.*	PROVA / *Test Essai / Test Nr.*	COLATA / *Hea* Coulée / Schmelz
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14

APPARATO *Apparatus*	Durezza *Hardness*	**HB**
SPINA	Richiesto *Required*	**<200**

Identificazione *Identification*	Risultati Results	
	From	To
Item 6A	162	164

La prova di durezza è stata eseguita sui forgiati in condizione di fornitura
The hardness test has been performed on the forgings in delivered condition

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE 5/06/15

BREMBANA & ROLLE S.p.A. QCM - L. BENSONI REVIEWED / ACCEPTED 13 GIU 2014

X CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*

☐ *NON CONFORME ALLA SPECIFICA / Not According to specif. Non Conf. Svt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*	Enti collaudatori *Inspection Authorities*	saipem spa QC INSPECTOR Sergio Ricci ☐ review ☒ witness date 20.05.14 Snamprogetti Centre of Excellence	Responsabile controllo qualità *Quality Control Manager* FORGE MONCHIERI S.p.A. - Morandini Dario - Quality Control Manager

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COMPANY CERTIFIED BY ASME AS A MATERIAL ORGANIZATION - CERTIFICATE NUMBER QSC-610 -

ISO 9001, ISO 14001, OHSAS 18001 BUREAU VERITAS Certification

14\08449 rev. 00

Cividate Camuno, li 21-MAG-2014 foglio 10 di 12
Date *Page* *of*

ESAME MAGNETICO \ MAGNETIC TEST
CÔNTROLE MAGNÉTOSCOPIQUE \ MAGNETPULVERPRÜFUNG

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\MT** *of* *Page* 1 *of* 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung* **000725 JOB M288** DATA / *Date / Datum* **20.03.201**

COMMESSA / *Job. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance/ Werkstoff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

ASTM A-275

CODICE / *Code Kundenidentifikation*

Id *Fm*	POS *Item*	QTA *Q.ty / Qte*	DESCRIZIONE / *Subject Object / Betreff*	DISEGNO / *Drawing Plan / Zeichnung*	MATRICOLA / *Serial Nr. Repère / Kenn-Nr.*	PROVA / *Test Essai / Test Nr.*	COLATA / *Heat Coulée / Schmelz*
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14

Condizioni Superficiali - *Surface condition*

X Machined to drawing

Pulitura - *Cleaning*

X Trielina - Tricloroetylene - Con Straccio - Cloth

Magnetizzazione - *Magntization*

	Apparato - *Apparatus*	Distanza *Distance*	Corrente *Current*	Intesità *Intensity*	Magnetico *Magnetic*	Note *Note*
X	YOKE ES AC/DC	180 mm	AC	40 Gauss		

Metodo di Ispezione - *Inpection Method*

X	Controllo col. Nero Black color Contrast	Tipo *Type*	LK-35 CGM	Lampada a Luce Bianca White light lamp	
		Tipo *Type*			

L'esame è stato eseguito sul 100% della superficie. Nessuna indicazione rilevata.
The magnetoscopic examination has been carried out on 100% of surfaces . No indication has been detected

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R CORNOLDI DATE 31/10/14

BREMBANA & ROLLE S.p.A. QCM - L. BENSONI REVIEWED/ACCEPTED 13 GIU 2014

X CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*

NON CONFORME ALLA SPECIFICA / *Not According to specif. Non Conf. Svt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*

QUALITY CONTROL Salari Francesco II° LEVEL UT-MT-PT SNT-TC-1A-EN 473

Enti collaudatori *Inspection Authorities*

saipem spa QC INSPECTOR Sergio Ricci review witness date 21.05.14 Snamprogetti Centre of Excellence

Responsabile controllo qualità *Quality Control Manager*

FORGE MONCHIERI S.p.A. - Morandini Dario - Quality Control Manager

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COMPANY CERTIFIED BY ASME
AS A MATERIAL ORGANIZATION
- CERTIFICATE NUMBER QSC-610 -

ISO 9001, ISO 14001, OHSAS 18001 BUREAU VERITAS Certification

14\08449 rev. 00

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ESAME ULTRASONORO \ ULTRASONIC TEST
CONTROLE ULTRASONS \ ULTRACHALLPRÜFUNG

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\USF** (of) (Page) 1 of 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung* **000725 JOB M288** DATA / *Date / Datum* **20.03.2014**

COMMESSA / *Job. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance/ Werkstoff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

ASME SA-388 - ASME VIII Div.2 Para AM-203.2

CODICE / *Code Kundenidentifikation*

Id *Fm*	POS *Item*	QTA *Q.ty / Qte*	DESCRIZIONE / *Subject Objeet / Betreff*	DISEGNO / *Drawing Plan / Zeichnung*	MATRICOLA / *Serial Nr. Repère / Kenn-Nr.*	PROVA / *Test Essai / Test Nr.*	COLATA / *Hea* Coulée / Schmelze
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14

Condizioni Superficiali - *Surface Condition*

[X] Finito-Finish Machined

Accoppiante - *Couplage*

[X] Metilcellulosa - Methycellulose

Apparecchio - *Apparatus* USN 60 SW Mat.01V906

Calibrazione - *Calibration*

[X] ECO di Riferimento - Reference ECO

[X] Blocco V1 - Block V1

[X] Blocco V2 - Block V2

Maticola *Identification*	Tipo Sonda *Type*	Dimensioni *Dimension mm*	Frequenza *Frequency Mhz*	Angolo *Angle °*	Amplificaz. *Amplificat. dB*	Potenza *Damping*	Rilevato *Rilevato*	Note *Note*
57745-50210	B2S EN	Ø 24	2,00	0,00				

L'esame è stato eseguito sul 100% del volume. Nessuna indicazione rilevata.
The ultrasonic examination has been carried out on 100% of volume . No indication has been detected

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R CORNOLDI DATE 9/10/14

BREMBANA & ROLLE S.p.A. QCM - L. BENSONI REVIEWED / ACCEPTED 13 GIU 2014

[X] CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*

[ ] *NON CONFORME ALLA SPECIFICA / Not According to specif. Non Conf. Svt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*	Enti collaudatori *Inspection Authorities*		Responsabile controllo qualità *Quality Control Manager*
QUALITY CONTROL Salari Francesco II LEVEL UT-MT-LP SNT-TC-1A-EN 473		saipem spa QC INSPECTOR Sergio Mori ☐ review ☒ witness date 21.05.14 Snamprogetti Centre of Excellence	FORGE MONCHIERI S.p.A. - Morandini Dario - Quality Control Manager

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M&M FORGINGS MEMBER

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- CERTIFICATE NUMBER QSC-610 -

ISO 9001, ISO 14001, OHSAS 18001 BUREAU VERITAS Certification

14\08449 rev. 00

Cividate Camuno, li 21-MAG-2014 foglio 12 di 12
Date *Page* *of*

ESAME DIMENSIONALE \ DIMENSIONAL AND VISUAL CHECK
CONTRÔLE VISUEL ET DIMENSIONNEL \ VISUELLE PRÜFUNG UND MAßKONTR.

Inspection report according to EN10204 Ed.2004 3.2 N. **14\08449\DI** *of* *Page* 1 *of* 1

CLIENTE / *Customer Client / Kunde* **BREMBANA & ROLLE S.p.A**

ORDINE / *Order Commande /Bestellung* **000725 JOB M288** DATA / *Date / Datum* **20.03.2014**

COMMESSA / *Job. Nr. Réf. / Auftrag* **14\120**

MATERIALE / *Material Nuance/ Werkstoff* **SA765 M Gr.II**

SPECIFICHE / *Specif. Spécif. / Spezifikation* **ASME II Part A Ed.2004 Add. 2006 - ASME VIII Div.1 Ed.2004 Add. 2004 - 0288MRS202 Rev.2**

CODICE / *Code Kundenidentifikation*

Id *Fm*	POS *Item*	QTA *Q.ty / Qte*	DESCRIZIONE / *Subject Object / Betreff*	DISEGNO / *Drawing Plan / Zeichnung*	MATRICOLA / *Serial Nr. Repère / Kenn-Nr.*	PROVA / *Test Essai / Test Nr.*	COLATA / *Hea Coulée / Schmelze*
6A	11	1	TEST COUPON	150 x 125 x 700 mm		14-0505	9084-14

Dimensional and Visual Inspection

Il controllo visivo dimensionale eseguito sui pezzi in oggetto ha dato esito favorevole.
The visual and dimensionalcheck has been satisfactory carried out on the above mentioned pieces

Marcatura - *Marking*

Order / Order	000725 JOB M288
Materiale / Material	SA765 M Gr.II
Colata / Heat	9084-14
Prova / Test	14-0505
ID Fm	14\120\6A

Marcatura del "Fornitore" / *Forge master stamp*

Marchio dell'ispettore esterno / *Inspector stamp*

Forge Monchieri S.p.A. dichiara che il materiale è conforme con l' ordine e le specifiche applicabili .
Forge Monchieri S.p.A. declare that the material is conformity with P. order and applicable specification .

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R.CORNOLDI DATE 3/10/15

BREMBANA & ROLLE S.p.A. QCM - LABENSONI REVIEWED / ACCEPTED 13 GIU 2014

[X] CONFORME ALLA SPECIFICA / *According to specif Conforme à Spécif / Gemäß spezifikation*
[ ] *NON CONFORME ALLA SPECIFICA / Not According to specif. Non Conf. Swt Spécif. / Nicht Gemäß spezifikation*

Operatore *Operator*	Enti collaudatori *Inspection Authorities*	saipem spa QC INSPECTOR Sergio Ricci ☐ review ☒ witness date 21.05.14 Snamprogetti Centre of Excellence	Responsabile controllo qualità *Quality Control Manager* FORGE MONCHIERI S.p.A. - Morandini Dario - Quality Control Manager

CERTIFICAT DE RECEPTION 3.2 / EN 10204:2004
Inspection Certificate 3.2 / EN 10204:2004
Prüfbescheinigung 3.2 / EN 10204:2004

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ArcelorMittal

Client - Purchaser - Besteller	BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag	002974 Job4085/
Projet - Project - Projekt	STAR Aegean Refinery (ARP)

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + MAQ REV 12 du 02/05/2012
ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + QAM REV 12 of 02/05/2012

Produit - Product - Erzeugnis	Plate(s)
Commande / Poste - Internal order - Werksbestellung	1062273 / 000010
Bordereau de livraison - Delivery note - Lieferungsdokument	80271507 80271504

#010 - PRODUITS LIVRES - DELIVERED PRODUCTS - GELIEFERTEN GEGENSTÄNDE

Nuance - Grade - Werkstoff	SA 516 Grade 60 + S5 (HIC)			Selon norme - According to - Entsprechend	ASME IIA ED. 2013 SA 516/M
Epaisseur - Thickness - Dicke	94.00 mm	Largeur - Width - Breite	2,260 mm	Longueur - Length - Länge	5,600 mm

Spécification - Specification - Spezifikation

DOC 4085MRS102 REV.2
FROM 29/01/2015
ASME II A 2010 Ed.- ADD.2011
NO REPAIR BY WELDING

Material fulfills all requirements of
ASME VIII Div. 2 part 3 2010 Ed. 2011 Add.

BREMBANA & ROLLE S.p.A.
QCM - L. BENSONI
TRUE COPY OF THE ORIGINAL
ACCEPTED FOR JOB 4085

Etat thermique de livraison - Heat treatment state of delivery - Wärmebehandlung Lieferzustand: IDENTICAL WITH
Normalisation (920 °C - 1 min/mm) - Normalization - Normalisierung: ASME SA 516 Gr.60

Procédé d'élaboration - Melting process - Erschmelzungsart: 2010 ED. 2011pADD.
Electric-arc furnace - Vacuum degassed - Fully killed - Fine grain practice

Nbre Nbr Stz	N° produit Product Erzeugnis	N° de coulée Ladle nr. Schmelze nr.	N° de lot de contrôle Inspection lot nr. Prüflos nr.	Nbre Nbr Stz	N° produit Product Erzeugnis	N° de coulée Ladle nr. Schmelze nr.	N° de lot de contrôle Inspection lot nr. Prüflos nr.
01	616857001	61003	616857.1001 / 616857.4001	01	616858001	61003	616857.4001 / 616858.1001
01	616860001	61003	616857.4001 / 616860.1001	01	620378001	62763	620378.1001 / 620378.4001

Total - Total - Gesamtzahl 004

BUREAU VERITAS S.p.A.
ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R. CORNOLDI
DATE 9/10/15

BREMBANA & ROLLE S.p.A.
QCM - L. BENSONI
REVIEWED / ACCEPTED
06 MAR 2015

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BUREAU VERITAS
INSPECTORS AT ANTWERP
paris 1828
INDUSTRY & FACILITIES
INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

CERTIFICAT DE RECEPTION 3.2 / EN 10204:2004
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ArcelorMittal

Client - Purchaser - Besteller: BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag: 002974 Job4085/
Projet - Project - Projekt: STAR Aegean Refinery (ARP)

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + MAQ REV 12 du 02/05/2012
ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + QAM REV 12 of 02/05/2012

Produit - Product - Erzeugnis: Plate(s)
Commande / Poste - Internal order - Werksbestellung: 1062273 / 000010
Bordereau de livraison - Delivery note - Lieferungsdokument: 80271507 80271504

#020 - ANALYSE CHIMIQUE DE COULEE - LADLE CHEMICAL COMPOSITION - SCHMELZE CHEMISCHE ZUSAMMENSETZUNG

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
	%	%	%	%	%	%	%	%	%
Min.		0.850			0.150				
61003	0.175	1.199	0.0044	0.0004	0.377	0.040	0.046	0.071	0.010
62763	0.183	1.193	0.0032	0.0006	0.380	0.042	0.044	0.037	0.009
Max.	0.200	1.200	0.0100	0.0020	0.400	0.400	0.400	0.300	0.120
	Al	Nb	V	Ti	(01)	(02)	B	(03)	(04)
	%	%	%	%			%		
Min.	0.020								
61003	0.029	0.013	0.002	0.001	0.168	0.081	0.0001	0.397	0.015
62763	0.021	0.010	0.002	0.002	0.132	0.046	0.0001	0.397	0.012
Max.	100.000	0.020	0.030	0.030	1.000	0.320	0.0010	0.450	0.020
	(05)								
Min.									
61003	0.016								
62763	0.013								
Max.	0.150								

(01) F(104) = Cu+Ni+Cr+Mo
(02) F(143) = Cr+Mo
(03) Ceq = C+(Mn/6)+((Cu+Ni)/15)+((Cr+Mo+V)/5)
(04) F(106) = Nb+V
(05) F(107) = Nb+Ti+V

#030 - ANALYSES PRODUITS - PRODUCTS ANALYSIS - STÜCKANALYSEN

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
	%	%	%	%	%	%	%	%	%
Min.		0.850			0.150				
616857.4001	0.179	1.162	0.0053	0.0002	0.380	0.043	0.055	0.079	0.013
620378.4001	0.177	1.170	0.0038	0.0004	0.385	0.039	0.038	0.032	0.008
Max.	0.200	1.200	0.0100	0.0020	0.400	0.400	0.400	0.300	0.120
	Al	Nb	V	Ti	(01)	(02)	B	(03)	(04)
	%	%	%	%			%		
Min.	0.020								
616857.4001	0.027	0.012	0.002	0.004	0.190	0.092	0.0003	0.398	0.014
620378.4001	0.023	0.009	0.002	0.004	0.117	0.040	0.0004	0.386	0.010
Max.	100.000	0.020	0.030	0.030	1.000	0.320	0.0010	0.450	0.020
	(05)								
Min.									
616857.4001	0.018								
620378.4001	0.015								
Max.	0.150								

(01) F(104) = Cu+Ni+Cr+Mo
(02) F(143) = Cr+Mo
(03) Ceq = C+(Mn/6)+((Cu+Ni)/15)+((Cr+Mo+V)/5)
(04) F(106) = Nb+V
(05) F(107) = Nb+Ti+V

BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R CORNOLO
DATE

BREMBANA & ROLLE S.p.A.
QCM - C. BENSONI
REVIEWED / ACCEPTED
10 MAR 2015

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BUREAU VERITAS INSPECTORS AT ANTWERP paris 1828 INDUSTRY & FACILITIES
INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

CERTIFICAT DE RECEPTION 3.2 / EN 10204:2004
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ArcelorMittal

Client - Purchaser - Besteller: BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag: 002974 Job4085/
Projet - Project - Projekt: STAR Aegean Refinery (ARP)

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + MAQ REV 12 du 02/05/2012
ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + QAM REV 12 of 02/05/2012

Produit - Product - Erzeugnis: Plate(s)
Commande / Poste - Internal order - Werksbestellung: 1062273 / 000010
Bordereau de livraison - Delivery note - Lieferungsdokument: 80271507 80271504

#072 ESSAIS MECANIQUES - MECHANICAL TESTS - MECHANISCHE PRÜFUNGEN

DURETE SUR COUPON - HARDNESS ON SAMPLE - HÄRTE AUF COUPON

Brinell HB Brinell HB - Brinell HB								HB10 Ind	HB10 Ind	HB10 Ind	HB10 Aver								
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	Brinell	Brinell	Brinell	Brinell								
							Min	123	123	123	123								
							Max	200	200	200	200								
616857.1001	000	T3/4	PSS	20	°C			153	155	155	154								
616858.1001	000	T3/4	PSS	20	°C			153	155	153	154								
616860.1001	000	T3/4	PSS	20	°C			154	153	155	154								
620378.1001	000	T3/4	PSS	20	°C			158	156	158	157								

DURETE SUR COUPON - HARDNESS ON SAMPLE - HÄRTE AUF COUPON

DURETE NACE MR0103 HRC < 22 NACE MR0103 - NACE MR0103																			
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac													
616857.1001	000	T3/4	PSS	20	°C														
616858.1001	000	T3/4	PSS	20	°C														
616860.1001	000	T3/4	PSS	20	°C														
620378.1001	000	T3/4	PSS	20	°C														

Test result HRC < 22
Test result HRC < 22
Test result HRC < 22
Test result HRC < 22

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R CORNOLDI DATE

BREMBANA & ROLLE S.p.A. QCM - L. BENSONI REVIEWED / ACCEPTED 06 MAR 2015

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BUREAU VERITAS INSPECTORS AT ANTWERP paris 1828 INDUSTRY & FACILITIES
INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

CERTIFICAT DE RECEPTION 3.2 / EN 10204:2004
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ArcelorMittal

Client - Purchaser - Besteller: BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag: 002974 Job4085/
Projet - Project - Projekt: STAR Aegean Refinery (ARP)

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + MAQ REV 12 du 02/05/2012
ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + QAM REV 12 of 02/05/2012

Produit - Product - Erzeugnis: Plate(s)
Commande / Poste - Internal order - Werksbestellung: 1062273 / 000010
Bordereau de livraison - Delivery note - Lieferungsdokument: 80271507 80271504

DURETE SUR COUPON - HARDNESS ON SAMPLE - HÄRTE AUF COUPON

			Brinell HB Brinell HB - Brinell HB					HB10 Ind	HB10 Ind	HB10 Ind	HB10 Aver								
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	Brinell	Brinell	Brinell	Brinell								
							Min	123	123	123	123								
							Max	200	200	200	200								
616857.1001	001	T3/4	PSS	20	°C			152	156	155	154								
616858.1001	001	T3/4	PSS	20	°C			153	153	155	154								
616860.1001	001	T3/4	PSS	20	°C			151	153	153	152								
620378.1001	001	T3/4	PSS	20	°C			155	157	157	156								

DURETE SUR COUPON - HARDNESS ON SAMPLE - HÄRTE AUF COUPON

			Brinell HB Brinell HB - Brinell HB					HB10 Ind	HB10 Ind	HB10 Ind	HB10 Aver								
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	Brinell	Brinell	Brinell	Brinell								
							Min	123	123	123	123								
							Max	200	200	200	200								
616857.1001	002	T3/4	PSS	20	°C			147	149	149	148								
616858.1001	002	T3/4	PSS	20	°C			145	148	147	147								
616860.1001	002	T3/4	PSS	20	°C			148	147	147	147								
620378.1001	002	T3/4	PSS	20	°C			152	153	151	152								

TRACTION A L' AMBIANTE - ROOM TEMPERATURE TENSILE TEST - ZUGVERSUCH BEI RT

			Traction cylindrique Round tensile test - Zugversuch					Rp 0,2%	Rm	A Lo=50									
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	MPa	MPa	%									
							Min	220	415	25									
							Max		550										
616857.1001	000	T3/4	1/4ST	20	°C			341	498	60									
616858.1001	000	T3/4	1/4ST	20	°C			337	497	53									
616860.1001	000	T3/4	1/4ST	20	°C			348	497	62									
620378.1001	000	T3/4	1/4ST	20	°C			349	517	62									

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R CORNOLDI DATE

BREMBANA & ROLLE S.p.A. QCM / L. BENSONI REVIEWED / ACCEPTED 06 MAR 2015

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
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BUREAU VERITAS INSPECTORS AT ANTWERP paris 1828 INDUSTRY & FACILITIES

INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

CERTIFICAT DE RECEPTION 3.2 / EN 10204:2004 Inspection Certificate 3.2 / EN 10204:2004 Prüfbescheinigung 3.2 / EN 10204:2004	Numéro de document Rev 00 Document number Bescheinigungnummer 2015-104345 AVS 1514500	Page 005 Sheet / Seite 014	ArcelorMittal
Client - Purchaser - Besteller	BREMBANA & ROLLE SPA		
Référence client - Purchase order - Kaufauftrag	002974 Job4085/		
Projet - Project - Projekt	STAR Aegean Refinery (ARP)		
Industeel Belgium Site : Rue de Châtelet 266 6030 Marchienne-au-Pont	ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + MAQ REV 12 du 02/05/2012 ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + QAM REV 12 of 02/05/2012		
Produit - Product - Erzeugnis		Plate(s)	
Commande / Poste - Internal order - Werksbestellung		1062273 / 000010	
Bordereau de livraison - Delivery note - Lieferungsdokument		80271507 80271504	

TRACTION A L' AMBIANTE - ROOM TEMPERATURE TENSILE TEST - ZUGVERSUCH BEI RT

Traction cylindrique Round tensile test - Zugversuch								Rp 0,2%	Rm	A Lo=50
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	MPa	MPa	%
							Min	220	415	25
							Max		550	
616857.1001	001	T3/4	1/4ST	20	°C			335	494	62
616858.1001	001	T3/4	1/4ST	20	°C			330	488	54
616860.1001	001	T3/4	1/4ST	20	°C			337	489	61
620378.1001	001	T3/4	1/4ST	20	°C			343	503	59

TRACTION A L' AMBIANTE - ROOM TEMPERATURE TENSILE TEST - ZUGVERSUCH BEI RT

Traction cylindrique Round tensile test - Zugversuch								Rp 0,2%	Rm	A Lo=50
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	MPa	MPa	%
							Min	220	415	25
							Max		550	
616857.1001	002	T3/4	1/4ST	20	°C			324	478	56
616858.1001	002	T3/4	1/4ST	20	°C			322	471	52
616860.1001	002	T3/4	1/4ST	20	°C			327	473	57
620378.1001	002	T3/4	1/4ST	20	°C			332	488	56

RESILIENCE - TOUGHNESS - KERBSCHLAGZÄHIGKEIT

KCV ASTM 10X10mm KCV ASTM 10X10mm - KCV ASTM 10X10mm								Energ Ind	Energ Ind	Energ Ind	Energ Ave
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	J	J	J	J
							Min	24	24	24	34
							Max				
616857.1001	000	T3/4	1/4ST	-4	°C			131	157	154	147
616858.1001	000	T3/4	1/4ST	-4	°C			135	175	162	157
616860.1001	000	T3/4	1/4ST	-4	°C			139	130	151	140
620378.1001	000	T3/4	1/4ST	-4	°C			161	132	166	153

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R CORNOLDI DATE

BREMBANA & ROLLE S.p.A. QCM - L. BENISONI REVIEWED / ACCEPTED 06 MAR 2015

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BUREAU VERITAS INSPECTORS AT ANTWERP paris 1828 INDUSTRY & FACILITIES

INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

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ArcelorMittal

Client - Purchaser - Besteller: BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag: 002974 Job4085/
Projet - Project - Projekt: STAR Aegean Refinery (ARP)

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + MAQ REV 12 du 02/05/2012
ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + QAM REV 12 of 02/05/2012

Produit - Product - Erzeugnis: Plate(s)
Commande / Poste - Internal order - Werksbestellung: 1062273 / 000010
Bordereau de livraison - Delivery note - Lieferungsdokument: 80271507 80271504

RESILIENCE - TOUGHNESS - KERBSCHLAGZÄHIGKEIT

KCV ASTM 10X10mm KCV ASTM 10X10mm - KCV ASTM 10X10mm								Energ Ind	Energ Ind	Energ Ind	Energ Ave								
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	J	J	J	J								
							Min	24	24	24	34								
							Max												
616857.1001	001	T3/4	1/4ST	-4	°C			129	151	145	142								
616858.1001	001	T3/4	1/4ST	-4	°C			132	154	141	142								
616860.1001	001	T3/4	1/4ST	-4	°C			130	134	151	138								
620378.1001	001	T3/4	1/4ST	-4	°C			134	124	139	132								

RESILIENCE - TOUGHNESS - KERBSCHLAGZÄHIGKEIT

KCV ASTM 10X10mm KCV ASTM 10X10mm - KCV ASTM 10X10mm								Energ Ind	Energ Ind	Energ Ind	Energ Ave								
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	J	J	J	J								
							Min	24	24	24	34								
							Max												
616857.1001	002	T3/4	1/4ST	-4	°C			114	130	140	128								
616858.1001	002	T3/4	1/4ST	-4	°C			124	126	142	131								
616860.1001	002	T3/4	1/4ST	-4	°C			138	120	126	128								
620378.1001	002	T3/4	1/4ST	-4	°C			130	132	108	123								

Loc	3/4	Trois-Quart - 3/4 Width - 3/4 Breite
Loc	T	Tête - Top - Kopf
Epr. Epaisseur	1/4	Quart épaisseur - 1/4 Thickness - 1/4 Dicke
Epr. Epaisseur	P	Peau - Rolled Surface - Walzfläche
Epr. Face	S	Supérieure - Upper face - obere
Epr. Sens	S	Standard - Standard - Standard
Epr. Sens	T	Travers - Transverse - Quer
Etat	000	Etat thermique de livraison - Heat treatment state of delivery - Wärmebehandlung Lieferustand
Etat	001	PWHT - PWHT (From 425 °C at 70 °C/h to 630 °C (-10/+10) (min: 4 h) - Down to 425 °C at 70 °C/h - 1 Cycle) - PWHT
Etat	002	PWHT - PWHT (From 425 °C at 70 °C/h to 630 °C (-10/+10) (min: 16 h) - Down to 425 °C at 70 °C/h - 1 Cycle) - PWHT
Epr.Ep./Face/Sens	1/4ST	Quart épaisseur - 1/4 Thickness - 1/4 Dicke / Supérieure - Upper face - obere / Travers - Transverse - Quer
Epr.Ep./Face/Sens	PSS	Peau - Rolled Surface - Walzfläche / Supérieure - Upper face - obere / Standard - Standard - Standard

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R CORNOLDI DATE

BREMBANA & ROLLE S.p.A.
QCM - L. BENSONI
REVIEWED ACCEPTED
06 MAR 2015

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
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BUREAU VERITAS INSPECTORS AT ANTWERP paris 1828 INDUSTRY & FACILITIES
INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

CERTIFICAT DE RECEPTION 3.2 / EN 10204:2004 Inspection Certificate 3.2 / EN 10204:2004 Prüfbescheinigung 3.2 / EN 10204:2004	Numéro de document Rev 00 Document number Bescheinigungnummer 2015-104345 AVS 1514500	Page 007 Sheet / Seite 014	ArcelorMittal
Client - Purchaser - Besteller	BREMBANA & ROLLE SPA		
Référence client - Purchase order - Kaufauftrag	002974 Job4085/		
Projet - Project - Projekt	STAR Aegean Refinery (ARP)		
Industeel Belgium Site : Rue de Châtelet 266 6030 Marchienne-au-Pont	ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + MAQ REV 12 du 02/05/2012 ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + QAM REV 12 of 02/05/2012		
Produit - Product - Erzeugnis	Plate(s)		
Commande / Poste - Internal order - Werksbestellung	1062273 / 000010		
Bordereau de livraison - Delivery note - Lieferungsdokument	80271507 80271504		

#082 ESSAIS TECHNOLOGIQUES - TECHNOLOGICAL TESTS - TECHNOLOGISCHE PRÜFUNGEN

BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR R. CORNOLDI DATE

BREMBANA & ROLLE S.p.A. QCM - L. BENSONI REVIEWED/ACCEPTED 06 MAR 2015

Nous certifions que les produits ci-dessus sont conformes aux prescriptions de la commande.
We hereby certify that the above mentioned products are complying with the order requirements.
Wir bestätigen hiermit, dass die obengenannten Erzeugnisse den Bestellungvorschriften entsprechen.

BUREAU VERITAS INSPECTORS AT ANTWERP paris 1828 INDUSTRY & FACILITIES

INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

CERTIFICAT DE RECEPTION 3.2 / EN 10204:2004
Inspection Certificate 3.2 / EN 10204:2004
Prüfbescheinigung 3.2 / EN 10204:2004

Numéro de document Rev 00
Document number
Bescheinigungnummer
2015-104345
AVS 1514500

Page 008 / 014
Sheet
Seite

ArcelorMittal

Client - Purchaser - Besteller: BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag: 002974 Job4085/
Projet - Project - Projekt: STAR Aegean Refinery (ARP)

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + MAQ REV 12 du 02/05/2012
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Produit - Product - Erzeugnis: Plate(s)
Commande / Poste - Internal order - Werksbestellung: 1062273 / 000010
Bordereau de livraison - Delivery note - Lieferungsdokument: 80271507 80271504

HIC - HIC - HIC

HIC NACE TM02-84 HIC NACE TM02-84 - HIC NACE TM02-84								T° solution	Initial H2S	Final H2S	Initial T°	Final T°	Initial pH	Final pH	pH solution	Nbr cracks	Longest crack		
N° lot QM	Etat	Loc	Epr.	T°	Uni	Mac	Uni	°C	ppm	ppm	°C	°C				Nombre	mm		
							Min	22	2.000	2.000	22	22	2.700		2.600				
							Max	28			28	28	3.300	4.000	2.800				
616857.4001	001	T3/4	SSL	20	°C			23	2,451.000	2,678.000	23	25	2.980	3.810	2.670	0	0		
620378.4001	001	T3/4	SSL	20	°C			23	2,451.000	2,678.000	23	25	2.980	3.810	2.670	0	0		

Standard: NACE TM0284 ed.2011
Specimen surface preparation: 320-grit polishing
Degreasing: Acetone + Check according to ASTM F21
Solution: A
Test result: Compliant with Standards

Size of Specimen - Dimensions de l'échantillon - Probengrösse					
Length - Longueur - Länge	Unit - Unité - Einheit	Width - Largeur - Breite	Unit - Unité - Einheit	Thickness - Epaisseur - Dicke	Unit - Unité - Einheit
100.00	mm	20.00	mm	30.00	mm
Total area - Surface de l'échantillon - Probenoberfläche			112.00	cm2	

Start of Test - Début de test - Testenbeginn	12/02/2015 12:30
End of Test - fin de test - Testenende	16/02/2015 12:30
Test duration in h Durée du test - Testendauer	96.00

N°	Location - Localisation - Lage	Picture - Image - Bild	Magnification - Grossissement - Vergrößerung
01	Top Surface	AN_0001062273_000010_616857001_001(1)	1X
02	Bottom Surface	AN_0001062273_000010_616857001_001(1)	1X
03	Microstructure	AN_0001062273_000010_616857001_001(2)	100X

Blisters whose dimensions are < 1,0 mm are not taken into account

	1st specimen					2nd specimen					3rd specimen					4th specimen					5th specimen				
Number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diameter in mm	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5

	1st specimen				2nd specimen				3rd specimen			
	S1.1	S1.2	S1.3	S1 Aver.	S2.1	S2.2	S2.3	S2 Aver.	S3.1	S3.2	S3.3	S3 Aver.
CLR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CTR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CSR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	4th specimen				5th specimen				Aver.	Max requirements		
	S4.1	S4.2	S4.3	Aver	S5.1	S5.2	S5.3	Aver		Per sect	Per spec	Aver.
CLR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		7.000	5.000
CTR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		2.000	1.500
CSR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.700	0.500

Standard: NACE TM0284 ed.2011
Specimen surface preparation: 320-grit polishing
Degreasing: Acetone + Check according to ASTM F21
Solution: A
Test result: Compliant with Standards

ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R. CORNOLDI
DATE

BREMBANA & ROLLE S.p.A.
QCM - L. BENSONI
REVIEWED/ACCEPTED
06 MAR 2015

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BUREAU VERITAS INSPECTORS AT ANTWERP paris 1828 INDUSTRY & FACILITIES
INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

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Inspection Certificate 3.2 / EN 10204:2004
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2015-104345
AVS 1514500

Page 009
Sheet /
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ArcelorMittal

Client - Purchaser - Besteller: BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag: 002974 Job4085/
Projet - Project - Projekt: STAR Aegean Refinery (ARP)

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + MAQ REV 12 du 02/05/2012
ISO 9001 (Cert.95587-2011, Valid 02/06/2017) + QAM REV 12 of 02/05/2012

Produit - Product - Erzeugnis: Plate(s)
Commande / Poste - Internal order - Werksbestellung: 1062273 / 000010
Bordereau de livraison - Delivery note - Lieferungsdokument: 80271507 80271504

Size of Specimen - Dimensions de l'échantillon - Probengrösse

Length - Longueur - Länge	Unit - Unité - Einheit	Width - Largeur - Breite	Unit - Unité - Einheit	Thickness - Epaisseur - Dicke	Unit - Unité - Einheit
100.00	mm	20.00	mm	30.00	mm
Total area - Surface de l'échantillon - Probenoberfläche			112.00	cm2	

Start of Test - Début de test - Testenbeginn	12/02/2015 12:30
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N°	Location - Localisation - Lage	Picture - Image - Bild	Magnification - Grossissement - Vergrößerung
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Blisters whose dimensions are < 1,0 mm are not taken into account

	1st specimen					2nd specimen					3rd specimen					4th specimen					5th specimen				
Number	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diameter in mm	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5

	1st specimen				2nd specimen				3rd specimen			
	S1.1	S1.2	S1.3	S1 Aver.	S2.1	S2.2	S2.3	S2 Aver.	S3.1	S3.2	S3.3	S3 Aver.
CLR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CTR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CSR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	4th specimen				5th specimen				Aver.	Max requirements		
	S4.1	S4.2	S4.3	Aver	S5.1	S5.2	S5.3	Aver		Per sect	Per spec	Aver.
CLR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		7.000	5.000
CTR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		2.000	1.500
CSR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.700	0.500

Loc	3/4	Trois-Quart - 3/4 Width - 3/4 Breite
Loc	T	Tête - Top - Kopf
Epr. Epaisseur	S	Standard - Standard - Standard
Epr. Face	S	Supérieure - Upper face - obere
Epr. Sens	L	Long - Longitudinal - Längs
Etat	001	PWHT - PWHT (From 425 °C at 70 °C/h to 630 °C (-10/+10) (min: 4 h) - Down to 425 °C at 70 °C/h - 1 Cycle) - PWHT
Epr.Ep./Face/Sens	SSL	Standard - Standard - Standard / Supérieure - Upper face - obere / Long - Longitudinal - Längs

BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR DR CORNOLDI
DATE

BREMBANA & ROLLE S.p.A.
QCM - L. BENSONI
REVIEWED ACCEPTED
06 MAR 2015

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BUREAU VERITAS
INSPECTORS AT ANTWERP
paris 1828
INDUSTRY & FACILITIES
INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

CERTIFICAT DE RECEPTION 3.2 / EN 10204:2004 Inspection Certificate 3.2 / EN 10204:2004 Prüfbescheinigung 3.2 / EN 10204:2004	Numéro de document Rev 00 Document number Bescheinigungnummer 2015-104345 AVS 1514500	Page 010 Sheet / Seite 014	ArcelorMittal

Client - Purchaser - Besteller	BREMBANA & ROLLE SPA
Référence client - Purchase order - Kaufauftrag	002974 Job4085/
Projet - Project - Projekt	STAR Aegean Refinery (ARP)

Industeel Belgium
Site : Rue de Châtelet 266 6030 Marchienne-au-Pont

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Produit - Product - Erzeugnis	Plate(s)
Commande / Poste - Internal order - Werksbestellung	1062273 / 000010
Bordereau de livraison - Delivery note - Lieferungsdokument	80271507 80271504

#141 - CONTROLE US - ULTRASONIC EXAMINATION - ULTRACHALLPRÜFUNGSBESCHEINIGUNG

Norme applicable 1 - Applicable standard 1 -	ASTM A 578 C+S1 100% + overlaping 10%
Procédure applicable 1 - Applicable procedure 1 -	Procedure 1564
Résultat du contrôle - Examination result - Prüfergebnis	
Conforme aux spécifications précitées - Conforming to above specifications - Entspricht der vorgenannten vorschriften	

BUREAU VERITAS
ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R. CORNOLDI
DATE

BREMBANA & ROLLE S.p.A.
QCM L. BENSONI
REVIEWED / ACCEPTED
06 MAG 2015

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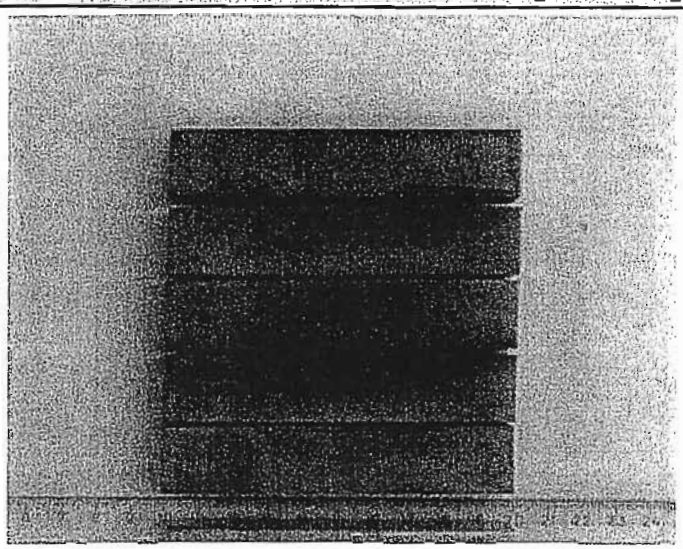
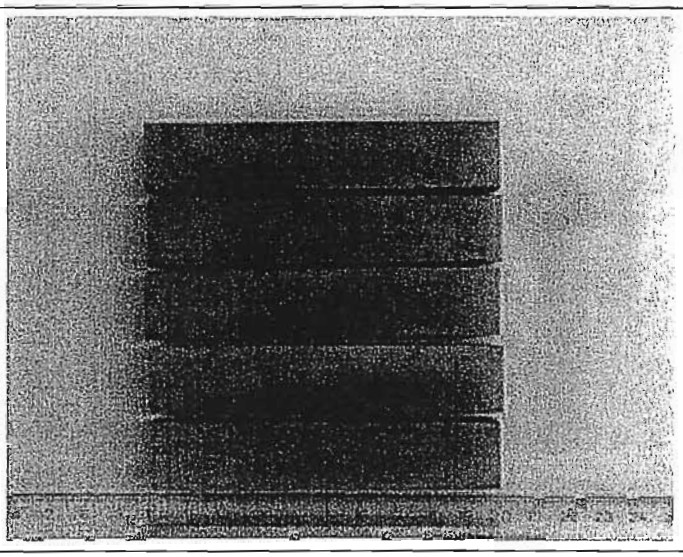
Client - Purchaser - Besteller	BREMBANA & ROLLE SPA		
Référence client - Purchase order - Kaufauftrag	002974 Job4085/		
Projet - Project - Projekt	STAR Aegean Refinery (ARP)		

ANNEXES - APPENDIX - ANLAGEN 616857001 AN_0001062273_000010_616857001_001





BUREAU VERITAS ITALY WITNESSED NOTED REVIEWED SURVEYOR DATE P. CORNOLDI

BREMBANA & ROLLE S.p.A. QCM - L. BENSONI REVIEWED & ACCEPTED 06 MAR 2015

BUREAU VERITAS INSPECTORS AT ANTWERP paris 1828 INDUSTRY & FACILITIES

INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

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Client - Purchaser - Besteller	BREMBANA & ROLLE SPA		
Référence client - Purchase order - Kaufauftrag	002974 Job4085/		
Projet - Project - Projekt	STAR Aegean Refinery (ARP)		

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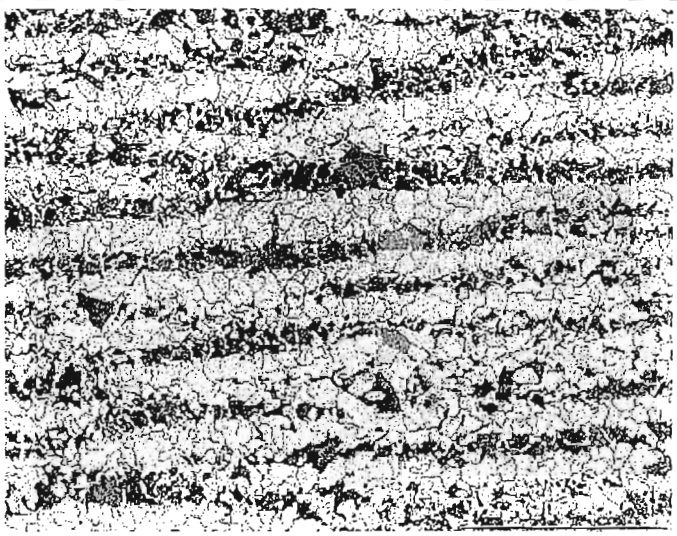

BUREAU VERITAS ITALY
WITNESSED NOTED REVIEWED
SURVEYOR R CORNOLD
DATE

BREMBANA & ROLLE S.p.A.
QCM - L. BENSONI
REVIEWED / ACCEPTED
06 MAR 2015

BUREAU VERITAS INSPECTORS AT ANTWERP paris 1828 INDUSTRY & FACILITIES
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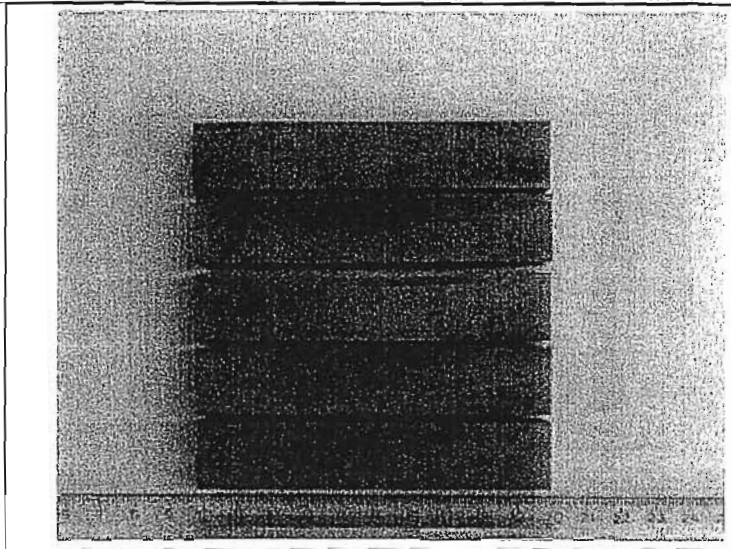
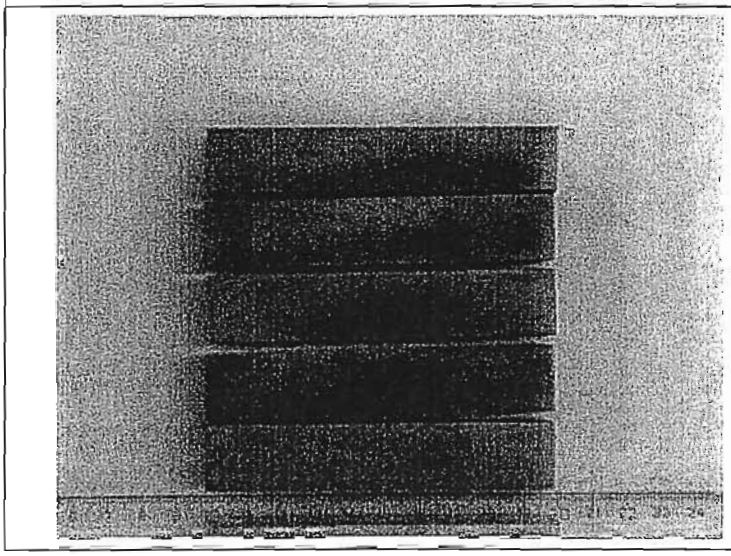
Projet - Project - Projekt	STAR Aegean Refinery (ARP)		

ANNEXES - APPENDIX - ANLAGEN 620378001 AN_0001062273_000010_620378001_001





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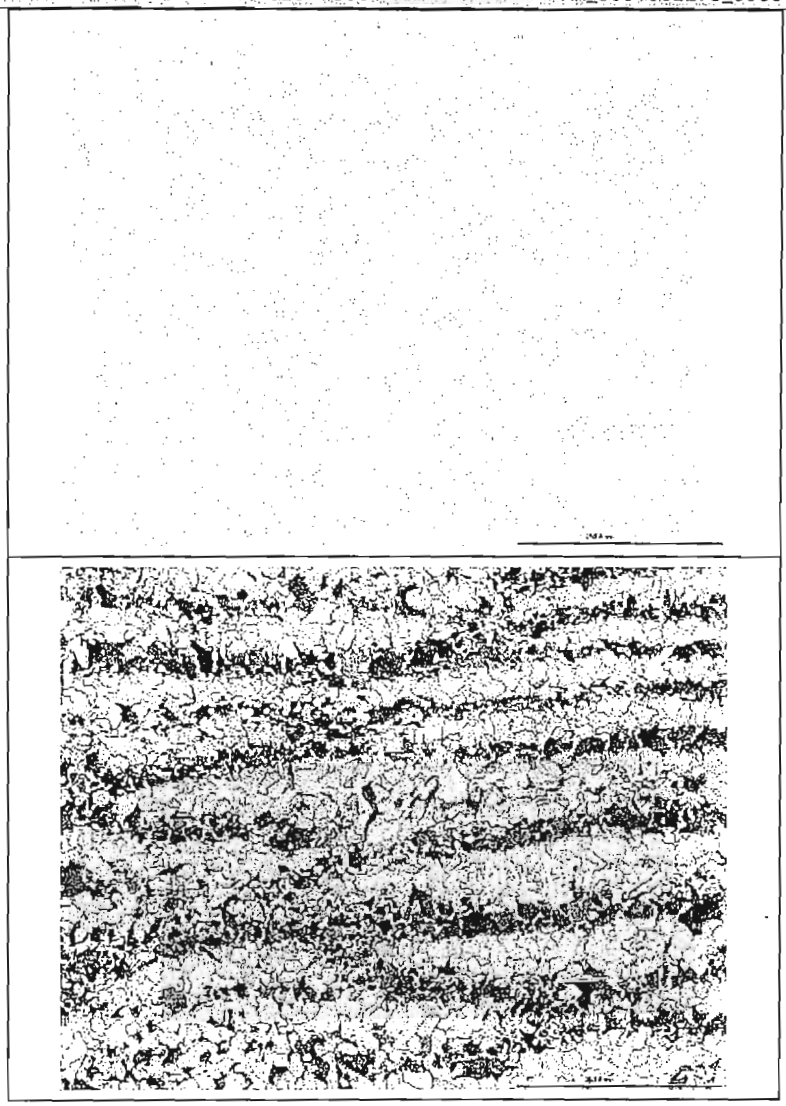

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DATE

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QCM - A. BENSONI
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INSPECTOR'S STAMP

TONI D'ANGELO
19/02/2015
Gestionnaire Commande
Mill inspector
Werksbeauftragte

voestalpine Böhler Welding

voestalpine Böhler Welding Italia S.p.A.

Via Palizzi, 90
I – 20157 MILANO MI
Tel. +39 02 39017.1
Fax +39 02 39017244

www.voestalpine.com/welding

Certificato di prova 3.1
Inspection certificate 3.1

secondo / as per : EN 10204
No. : No. : 2012-2014163563-900001-014
Rev. 0 Page / Page : 1 / 1

BREMBANA & ROLLE S.P.A.
VIA VILLINO 1
24030 VALBREMBO
Italia

Ordine N°	PO no.	000739	del / of	30.05.2012
Ordine N°	Order no.	1014147959		
Bolla di consegna/Pos./Splitt.	Delivery note/pos./splitt	2014163563/000010/900001	del / of	01.06.2012

Oggetto test	Product	bacchetta/filo GTAW / GTAW rod/wire
Denominazione commerciale	Trade name	**BOEHLER EML 5**
Classificazione norma	Standard designation	EN ISO 636-A: W 46 5 W2Si AWS A5.18: ER70S-3

212838
10251
2U045I0W
0140

Dimensione	Dimension	3,0 x 1000 mm
Colata - Lotto	Heat no.	783420
Quantità fornita	Quantity	50,0 KG

Composizione chimica in % del prodotto **Chemical composition in % of the product**

C	Si	Mn	P	S	Cr	Mo	Ni	V	Cu	Al				
0,11	0,54	1,14	0,012	0,006	0,04	< 0,01	0,01	< 0,01	0,01	< 0,01				

proprietà meccaniche **Mechanical properties** **EN 10204 - 2.2**

Prova di trazione Tensile test

T	ReL / Rp 0,2 MPa	Rp 1,0 MPa	Rm MPa	A (Lo = 5d) %	Z %	WBH PWHT	Note Remarks
20°C	≥ 460		530 - 680	≥ 23			

Prova di resilienza Impact test

T	Energia di impatto Impact energy KV / J	Medio Average KV / J	Espansione lat. Lateral expansion mm	Frattura cristalliina Shear fracture %	WBH PWHT	Note Remarks
-50°C	≥ 47					
20°C	≥ 130					

Questo certificate è stato emesso con sistema automalizzato e non richiede firma
This certificate was issued by DP-equipment and does not require signature.

Centro / Town: Milano
Data / Date: 04.06.2012

Q.A. representative / Authorized representative
Zuin

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MARIANO
SUPERVISED WITNESSED
04/06/2012

voestalpine
ONE STEP AHEAD.

AIR LIQUIDE WELDING FRANCE
13 Rue d'Epluches, Saint-Ouen l'Aumône
95315 Cergy Pontoise Cedex - France

Phone: +33134213333
Fax: +33134213130

OERLIKON

Certificato di Prodotto / Product Certificate

Certificato N°:	Ordine N°:	Bolla N°:	Cliente:
Certificate n°:	Order n°:	Delivery Note n°:	Customer:
ALW04142194-34	2953	47030	BREMBANA & ROLLE SPA VIA VILLINO, 1
Data:	**Quantità:**	**UM:**	
Date:	Quantity:	Unit:	24030 VALBREMBO ITALY
22/12/2014	2800	N.	

Designazione: 0010502016
Trade name: ELECTRODE ETC PH 35S 4.00X0450XCBOX

Lotto N°: / Batch n°: 344281002

Classificazione: AWS A5.1: E7018-1 H4
Classification: EN ISO 2560-A: E 42 5 B 3 2 H5

Si confermano le proprietà sotto riportate per i consumabili di saldatura da noi forniti

We confirm following properties for the welding filler metals delivered by us

Analisi chimica del deposito: / Weld metal chemical analysis (%):

In accordo a / According to EN 10204-3.1

C	Mn	Si	Cr	Ni	Mo	S	P	Cu	Nb
0.069	1.326	0.474	0.028	0.082	0.003	0.0052	0.0152	0.06	0.0072

V
0.018

Proprietà meccaniche del deposito / Weld metal mechanical properties:

In accordo a / According to EN 10204-2.2

Trattamento Termico Heat treatment	Test temp. °C	Snervamento Yield Strength ReH [N/mm²]	Trazione Tensile Strength Rm [N/mm²]	Allungamento Elongation A [%]	Durezza Hardness HB	Resilienza - Impact strength (Charpy-V)		
						Temp: °C	Joule	Media Average
Come Saldato as Welded	20	490	541	29.5		-50		148

Note:

Remarks:

Questo certificato è stato stampato da computer e non necessita di firma

This certificate is printed by computer and needs no signature

Quality Departement - Due Carrare Plant

Munarin Riccardo

Emesso da - issued by: Fiaccadori Stefano

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MANGANO
☒ REVIEWED ☐ WITNESSED
13 GEN 2015

AIR LIQUIDE
WELDING

AIR LIQUIDE WELDING FRANCE
13, rue d'Epluches
Saint-Ouen L 'Aumône
95315 Cergy Pontoise Cedex
FRANCE
Phone: +33 1 342 13 333
Fax : +33 1 342 13 130
Internet : www.airliquidewelding.com

OERLIKON

Certificato / Product Certificate

Cliente: / Customer:	Certificato N. / Certificate n°:	Ordine N. / Order n°:	Documento di Trasporto / Delivery note:
BREMBANA & ROLLE SPA Italia	2110310380057801	00871	12543
	Data : / Date:	**Quantità / Quantity:**	**UM / UM:**
	09/04/15	10.065,00	N Numero

Designazione / Trade name: ETC PH 35S 5.00X450

Lotto N.: / Batch n°: 371507302

Classificazione: / Classification: EN ISO 2560-A - E 42 5 B 32 H5
AWS A5.1: E 7018-1 H4

Si certificano le caratteristiche di seguito riportate per i materiali d'apporto da noi forniti.
We confirm following properties for the welding filler metals delivered by us.

Analisi Chimica / Chemical analysis (%):

Certificato Tipo: EN 10 204-3.1 WELD METAL

C	Mn	Si	S	P	Cr	Ni	V	Cu	Nb
0.067	1.340	0.456	0.004	0.011	0.029	0.026	0.018	0.036	0.006

Mo									
0.005									

Proprietà Meccaniche: / Mechanical properties:

Certificato Tipo: EN 10 204-2.2 WELD METAL

Prova di Trazione in accordo a EN ISO 6892-1 Trazione					Resilienza in accordo a EN ISO 148-1 Resilienza		
Temperatura di Prova Test Temp. °C	Limite Elastico Yield strength $R_{p0,2}$ N/mm²	Resistenza a Rottura Tensile strength N/mm²	Allungamento Elongation %	Z %	Temperatura di Prova Test Temp. °C	Resilienza Impact strength Joule (Charpy-V)	Trattamento Termico Heat treatment
+20	490	541	30		-50	150	As Welded

09.04.2015

La Vostra Persona di riferimento : / Your Contact Person :
Quality Corporate Department
Airliquide Welding France
Tél. : 33/1 34 21 33 33
Fax : 33/1 34 21 31 30
ETC -Oerlikon
Tél. : 39/045 82 91 511
Fax : 39/045 82 91 500

Marian Domnescu
QA Manager – Buzau Plant

This document has been issued by computer and needs no signature

Questo documento è emesso informaticamente e non necessita di firma
This document has been issued by computer and needs no signature.

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MANGANO
REVIEWED WITNESSED

15 APR 2015

AIR LIQUIDE WELDING

CERTIFICATO DI COLLAUDO/ INSPECTION CERTIFICATE

in accordo a/acc to EN 10204 - 3.1

Data/Date: 2015-08-20

Numero certificato/Cert no: EC23998477 rev. 0

Nostro ordine/Our order:	1135666	Vostro ordine/Your order:	N° 001764
Nostro riferimento/Our ref:	Web user - Movex CMP020 ITB	Vostro riferimento/Your ref:	
Codice Cliente/Cust no:	ITB01810	Vostro numero fax/Your fax	
Data ordine Cliente/Your date:	20150731	Vostra e-mail/Your e-mail:	

Indirizzo di fatturazione/Invoice address
ESAB SALDATURA SpA
.
VIA ROSA LUXEMBURG 49
20085 LOCATE DI TRIULZI (MI)
20085 ITALY
Italy

Destinatario del certificato/Cert receiver

Indirizzo di spedizione/Delivery address
BREMBANA & ROLLE S.P.A
.
VIA VILLINO 1
24030 VALBREMBO BG
Italy

PRODOTTO CONSEGNATO/DELIVERED PRODUCT

Marchio/Brand:	ESAB
Descrizione/Desc:	OK Autrod 12.32 4.0mm 30kg
Codice/Item no:	**1232402800**
Numero di lotto/Lot no:	**PV533474204**
Quantità/Quantity:	2490 KG

CLASSIFICAZIONE/CLASSIFICATIONS

SFA/AWS A5.17	EH12K
EN ISO 14171-A	S3Si

ANALISI CHIMICA/ CHEMICAL ANALYSIS

Wire/strip

Altro/Auxiliary:

C	0.13%
Si	0.31%
Mn	1.79%
P	0.015%
S	0.009%
Cr	0.03%
Ni	0.02%
Mo <	0.01%
Cu	0.04%

BREMBANA&ROLLE S.p.A.
WELDING DEPT. - M. ESPOSITO
☒ REVIEWED ☐ WITNESSED
01 SET 2015

COMMENTI/COMMENTS

Materiale fornito in accordo al Sistema Qualità conforme alla norma EN ISO 9001.
Questo certificato è stampato elettronicamente ed è valido senza firma.
Per ogni chiarimento, rivolgersi a:

ESAB Saldatura Spa, Via Rosa Luxemburg 49, I-20085 Locate Triulzi (MI), +39 02 97968.1

Product supplied under a QA Programme fulfilling the EN ISO 9001 standard.
This certificate is produced electronically and is valid without signature.
Please refer any queries to: (see above)

Validazione/Validation

Josef Moravek Quality Manager

CERTIFICATO DI COLLAUDO/ INSPECTION CERTIFICATE

in accordo a/acc to EN 10204 - 3.1

Data/Date: 2015-05-22

Numero certificato/Cert no: EC23891836 rev. 0

Nostro ordine/Our order:	1083070	Vostro ordine/Your order:	N° 001123
Nostro riferimento/Our ref:	Web user - Movex CMP020 ITB	Vostro riferimento/Your ref:	
Codice Cliente/Cust no:	ITB01810	Vostro numero fax/Your fax	
Data ordine Cliente/Your date:	20150513	Vostra e-mail/Your e-mail:	

Indirizzo di fatturazione/Invoice address
ESAB SALDATURA SpA
.
VIA ROSA LUXEMBURG 49
20085 LOCATE DI TRIULZI (MI)
20085 ITALY
Italy

Destinatario del certificato/Cert receiver

Indirizzo di spedizione/Delivery address
BREMBANA & ROLLE S.P.A
.
VIA VILLINO 1
24030 VALBREMBO BG
Italy

PRODOTTO CONSEGNATO/DELIVERED PRODUCT

Marchio/Brand:	ESAB
Descrizione/Desc:	OK Flux 10.62 25kg(55lb) BP
Codice/Item no:	**1062800000**
Numero di lotto/Lot no:	**PNP19512**
Quantità/Quantity:	3000 KG

ANALISI CHIMICA/ CHEMICAL ANALYSIS

Flux

Altro/Auxiliary:

CaF2	24%
SiO2+TiO2	14%
CaO+MgO	36%
Al2O3+MnO	20%

CLASSIFICAZIONE/CLASSIFICATIONS

EN ISO 14174	S A FB 1 55 AC H5
EN ISO 14174	S A FB 1 55 AC H4 only BlockPac/moisture-protection

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - S. MANGANO
☒ REVIEWED ☐ WITNESSED
29 MAG 2015

COMMENTI/COMMENTS

Materiale fornito in accordo al Sistema Qualità conforme alla norma EN ISO 9001.
Questo certificato è stampato elettronicamente ed è valido senza firma.
Per ogni chiarimento, rivolgersi a:

ESAB Saldatura Spa, Via Rosa Luxemburg 49, I-20085 Locate Triulzi (MI), +39 02 97968.1

Product supplied under a QA Programme fulfilling the EN ISO 9001 standard.
This certificate is produced electronically and is valid without signature.
Please refer any queries to: (see above)

Validazione/Validation

Dariusz Kijowski Quality Assurance Manager

BREMBANA&ROLLE

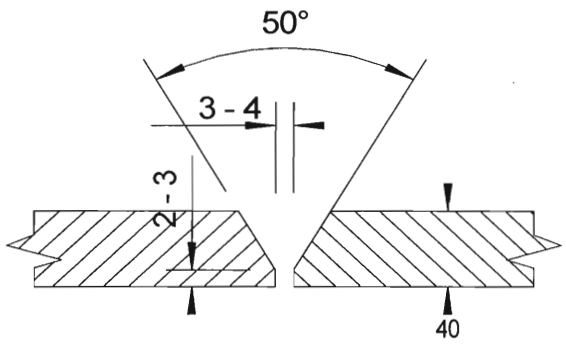
PROCEDURE QUALIFICATION RECORD (PQR)

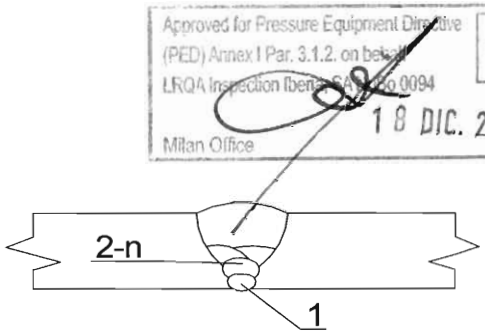
QW-200.2

ASME Boiler and Pressure Vessel Code Section IX

PQR No.:	24/17					Company:	Brembana&Rolle S.p.A.
Welding Process:	1) GMAW	2) FCAW	3)	4)		WPS No.:	W24/17
Type:	SEMI-AUTOMATIC	SEMI-AUTOMATIC				Date:	19.02.2018

JOINTS (QW-402)





Approved for Pressure Equipment Directive (PED) Annex I Par. 3.1.2. on behalf of LRQA Inspection Iberia S.A. No 0094
LRQA
Milan Office
18 DIC. 2021

Tack weld: By clumps

Retainers: No (QW-402.11)

BASE METAL (QW-403)

Material Spec.; Type or Grade:	SA 516 Gr.70 (*)		
to Material Spec.; Type or Grade:	SA 765 Gr.2 (**)		
P-No.: 1	Gr. No.: 2	to P-No.: 1	Gr. No.: 2
Thickness of Test Coupon (mm):	40		
Diameter of Test Coupon (mm):	/		
Other:	t pass ≤ 13 mm (QW-403.9)		
	*Normalized; **Quenched + Tempered		

POST WELD HEAT TREATMENT (QW-407)

Temperature Range:	610 ± 10	°C
Time Range:	min 2h; max 16h	Hours
Heating Rate:	56 ÷ 80	°C/h
Cooling Rate:	56 ÷ 80	°C/h
Other:	QW-407.4: N.A.	

GAS (QW-408)

	Gas(es)	Composition	Flow Rate (l/1')
Process:	GMAW		
Shielding:	Ar + CO2	82 / 18	18 ÷ 20
Process:	FCAW		
Shielding:	Ar + CO2	82 / 18	18 ÷ 20
Backing:			
Trailing:			
Other:			

FILLER METAL (QW-404)

Process (es):	GMAW	FCAW		
SFA Specification:	5.18	5.20		
AWS Classification:	ER70S-6	E71T-1		
Filler metal F-No.:	6	6		
Weld Metal A-No.:	*	1		
Size (mm):	1.2	1.2		
Product Form:	Solid wire	Flux cored wire		
Trade Name:	Carbofil 1	Fluxofil 14HD		
Supplier:	Oerlikon	Oerlikon		
Flux Trade Name:	N.A.	N.A.		
Flux Type:	N.A.	N.A.		
Supplier:	N.A.	N.A.		
Wire/Flux Class.:	N.A.	N.A.		
Consumable Ins.:	N.A.	N.A.		
Supplemental:	N.A.	N.A.		
Recrushed slag:	N.A.	N.A.		
Weld metal thk. (mm):	3	37		
Other:	* see AWS reference			

ELECTRICAL CHARACTERISTICS (QW-409)

Process:	GMAW	FCAW		
Current Type:	DC	DC		
Pulsing Current:	No	N.A.		
Polarity:	EP	EP		
Tung. El. Type:	N.A.	N.A.		
Tung. El. Ø:	N.A.	N.A.		
Transfer Mode:	Short	Spray		
Other:	No			

POSITION (QW-405)

Process:	GMAW	FCAW		
Position of Groove:	3G	3G		
Position of Fillet:	N.A.	N.A.		
Welding Progression:	Downhill	Uphill		
Other:	No			

TECHNIQUE (QW-410)

String/Weave beads:	String and Weave
Orifice/Cup size (mm):	16
Initial Cleaning:	Machining
Interpass Cleaning:	Grinding / Brushing
Method of Back Gouge:	/
Oscillation:	No
Single/Multi pass/side:	Single and Multi pass
Single/Multi Electrode:	N.A.
Electrode Spacing (mm):	N.A.
Electrode Stick out (mm):	N.A.
Closed/Out of Chamber:	N.A.
Manual or Automatic:	Semi-automatic
Supplemental Device/s:	N.A.
Peening:	No
Other:	QW-410.64: No

PREHEAT (QW-406)

	Temperature (°C)	Method	Control	Time (Hours)
Preheat ≥:	100	Gas Burner	Tempilstick	/
Maintaining:	Yes	Gas Burner	Tempilstick	/
Interpass ≤:	250	/	Tempilstick	/
Post-Heat (DHT) ≥:	No	/	/	/

Other: No

Cooling under Insulation: No

TABLE OF PARAMETERS (QW-409; QW-410)

Pass	Process	AWS	Size (mm)	Current Polarity	Ampere range	Volt range	Travel Speed (mm/min.)	ROL (mm)	Tungsten Electrode Ø (mm)	Min./Max. Heat Input (J/mm)
1	GMAW	ER70S-6	1.2	DCEP	165 ÷ 185	17 ÷ 20	120 ÷ 140	/	/	1202 ÷ 1850
2 - n	FCAW	E71T-1	1.2	DCEP	180 ÷ 220	23 ÷ 26	180 ÷ 230	/	/	1080 ÷ 1907

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Witnessed Monitored Reviewed
Alessandro Salvatore Monastra
Milan Office
31 GEN. 2018

BREMBANA&ROLLE

PROCEDURE QUALIFICATION RECORD (PQR)

QW-200.2

Section IX of ASME Boiler and Pressure Vessel Code

Procedure Qualification Record No.: 24/17 Date: 19.02.2018 Company: Brembana&Rolle S.p.A.

TENSILE TEST (QW-150)

Specimen No.; Type and Figure No.	Width (mm)	Thickness (mm)	Area (mm2)	Ultimate Total Load (N)	Ultimate Unit Stress (N/mm2)	Type of Failure & Location
0426-5 - QW-462.1(a)	19.06	40.52	772.31	390800	506	Broken out of weld - Ductile fracture
0426-6 - QW-462.1(a)	19.04	40.18	765.03	384900	503	Broken out of weld - Ductile fracture

	Diameter (mm)	Gage Length (mm)	Area (mm2)	U.T.L. (N)	U.T.S. (N/mm2)	U.Y.L. (N)	U.Y.S. (N/mm2)	Elongation (%)

GUIDED BEND TEST (QW-160)

Type and Figure No.	Result	Type and Figure No.	Result
0425-5 - QW-462.2	Satisfactory		
0425-6 - QW-462.2	Satisfactory		
0425-7 - QW-462.2	Satisfactory		
0425-8 - QW-462.2	Satisfactory		

TOUGHNESS TEST (QW-170)

Specimen No. & Notch Location	Specimen Size (mm)	Test Temperature (°C)	Impact Values (Joule)	Lateral Expansion (% shear)	Lateral Expansion (mm)	Drop Weight Break (Yes or No)
WM Top	10x10x55	-46	72.2 - 72.6 - 72.9	-	-	
WM ¾ Thk.	10x10x55	-46	37.4 - 40.2 - 65.7	-	-	
WM Bottom	10x10x55	-46	39.7 - 45 - 51.7	-	-	
HAZ Between ½ ÷ ¼ BOTTOM SA 765 side	10x10x55	-46	109 - 124.2 - 150.1	-	-	
HAZ Between ½ ÷ ¼ TOP SA 765 side	10x10x55	-46	32.9 - 39.2 - 37.5	-	-	
HAZ Bottom SA 765 side	10x10x55	-46	53.6 - 105.5 - 110.8	-	-	
HAZ Between ½ ÷ ¼ BOTTOM SA 516 side	10x10x55	-46	30.9 - 33.2 - 43.6	-	-	
HAZ Between ½ ÷ ¼ TOP SA 516 side	10x10x55	-46	133.4 - 170.1 - 196.3	-	-	
HAZ Bottom SA 516 side	10x10x55	-46	49.5 - 58.1 - 66.3	-	-	

Comments:

FILLET WELD TEST (QW-180)

Result - Satisfactory: Yes ____ No ____ Penetration into Parent Metal: Yes ____ No ____

Macro - Result:

OTHER TESTS

Visual Examination: Satisfactory (PQR 24/17 VT)

R.T. Examination: Satisfactory

P.T. Examination: Satisfactory (PQR 24/17 PT)

M.T. Examination: No

Micro Examination: No

Deposit Analysis:

C	Mn	Si	P	S	Cr	Ni	Mo

Fe	Cu	Nb+Ta

Macro Examination: Satisfactory

Hardness Test (Hv10):
- Base Metal: 147 - 153 (SA 765) / 133 - 142 (SA 516)
- Weld Metal: 162 - 246
- Haz: 145 - 232 (SA 765) / 133 - 245 (SA 516)

Other: No

Welder's Name: Kachi Abderrahim

Stamp No.: S32

Test conducted by: Brembana & Rolle S.p.A. Welding Engineer

Sigma Tre Lab

Third party Inspector

Laboratory Test No.: 2018/01/0400

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Lloyd's Register
☒ Witnessed ☐ Monitored ☐ Reviewed
Alessandro Salvatore Monastra
Milan Office 31 GEN. 2018

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of ASME Code Section IX

Prepared by	Checked and Certified by	Date	
S.Mangano	N.Tosto	19.02.2018	Sheet 2 of 2

BREMBANA&ROLLE

PROCEDURE QUALIFICATION RECORD (PQR) Integrative test

QW-200.2

Section IX of ASME Boiler and Pressure Vessel Code

Procedure Qualification Record No.: **24/17** Date: **03/07/2023** Company: **Brembana&Rolle S.p.A.**

TENSILE TEST (QW-150)

Specimen No.; Type and Figure No.	Width (mm)	Thickness (mm)	Area (mm2)	Ultimate Total Load (N)	Ultimate Unit Stress (N/mm2)	Type of Failure & Location

Diameter (mm)	Gage Length (mm)	Area (mm2)	U.T.L. (N)	U.T.S. (N/mm2)	U.Y.L. (N)	U.Y.S. (N/mm2)	Elongation (%)

GUIDED BEND TEST (QW-160)

Type and Figure No.	Result	Type and Figure No.	Result

TOUGHNESS TEST (QW-170)

Specimen No. & Notch Location	Specimen Size (mm)	Test Temperature (°C)	Impact Values (Joule)	Lateral Expansion (% shear)	Lateral Expansion (mm)	Drop Weight Break (Yes or No)

Comments:

FILLET WELD TEST (QW-180)

Result - Satisfactory: **Yes** **No** **Penetration into Parent Metal:** **Yes** **No**

Macro - Result:

OTHER TESTS

Visual Examination: /

R.T. Examination: /

P.T. Examination: /

M.T. Examination: /

Micro Examination: /

Deposit Analysis:

C	Mn	Si	P	S	Cr	Ni	Mo

Fe	Cu	Nb+Ta

Macro Examination: /

Hardness Test (Hv10):
- Base Metal: **171 - 178 (SA 765) / 170 - 178 (SA 516)**
- Weld Metal: **190 - 195**
- Haz: **180 - 191 (SA 765) / 170 - 194 (SA 516)**

Other: **No**

Welder's Name: **Jospeh joy**

Stamp No.: **S11**

Test conducted by: **Brembana & Rolle S.p.A. Welding Engineer**

Quality Control

Third party Inspector

Laboratory Test No.: **23/1016RP05**

BUREAU VERITAS ITALIA WELDING 14

IT FILE:

DATE:

WITNESSED ☐ REVIEW ☑

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of ASME Code Section IX

Prepared by	Checked and Certified by	Date	
M.Carminati	**N.Tosto**	**03/07/2023**	Sheet 3 of 3

BREMBANA&ROLLE

PROCEDURE QUALIFICATION RECORD (PQR) Integrative test

QW-200.2

Section IX of ASME Boiler and Pressure Vessel Code

Procedure Qualification Record No.: 24/17 Date: 12/09/2023 Company: Brembana&Rolle S.p.A.

TENSILE TEST (QW-150)

Specimen No.; Type and Figure No.	Width (mm)	Thickness (mm)	Area (mm2)	Ultimate Total Load (N)	Ultimate Unit Stress (N/mm2)	Type of Failure & Location

	Diameter (mm)	Gage Length (mm)	Area (mm2)	U.T.L. (N)	U.T.S. (N/mm2)	U.Y.L. (N)	U.Y.S. (N/mm2)	Elongation (%)
2121-B-005 (Max PWHT)	12.56	50	123.9	/	569	/	474	73

GUIDED BEND TEST (QW-160)

Type and Figure No.	Result	Type and Figure No.	Result

TOUGHNESS TEST (QW-170)

Specimen No. & Notch Location	Specimen Size (mm)	Test Temperature (°C)	Impact Values (Joule)	Lateral Expansion (% shear)	Lateral Expansion (mm)	Drop Weight Break (Yes or No)
2121-C-001 HAZ ½ T	10x10x55	-46	151 - 157 - 187	/	/	/
2121-D-001 WM ½ T	10x10x55	-46	70 - 77- 77	/	/	/

Comments:

FILLET WELD TEST (QW-180)

Result - Satisfactory: Yes No Penetration into Parent Metal: Yes No

Macro - Result:

OTHER TESTS

Visual Examination: /

R.T. Examination: /

P.T. Examination: /

M.T. Examination: /

Micro Examination: /

Deposit Analysis:

C	Mn	Si	P	S	Cr	Ni	Mo

Fe	Cu	Nb+Ta

Macro Examination: /

Hardness Test (Hv10): Base Metal: /; Weld Metal: /; Haz: /

Other: No

Welder's Name: Bonzi Michele

Stamp No.: S15

Test conducted by: Brembana & Rolle S.p.A. Welding Engineer

Quality Control

Third party Inspector

Laboratory Test No.: 2023080280

BUREAU VERITAS ITALIA WELDING 14

IT FILE:

DATE:

WITNESSED REVIEW

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of ASME Code Section IX

Prepared by	Checked and certified by	Date	
M.Carminati		12/09/2023	Sheet 3 of 3

BREMBANA&ROLLE

VISUAL EXAMINATION REPORT

REPORT No.
PQR 24/17VT

PURCHASER DATA		MANUFACTURER DATA	
PURCHASER		JOB No.	===
PLANT		DWG. No.	===
P.O.		PROCEDURE No.	BCI-007-VT
ITEM		SERIAL No.	===

APPLICABLE CODE:
ASME IX - ASME VIII Div. 1 UW-31

APPLICABLE STANDARD/SPECIFICATION:

Nr.	Type of imperfection		Acceptance criteria	Test result conform:
1	Cracks	...	Not permitted	☑
2	Crater cracks	...	Not permitted	☑
3	Exposed inclusions	...	Not permitted when occurring at the surface	☑
4	Porosity/Surface pores	...	Not permitted	☑
5	Incomplete/Lack of fusion	...	Not permitted	☑
				☐
				☐
				☐
				☐
				☐
				☐
				☐
				☐
				☐

BREMBANA & ROLLE S.p.A.

OPERATOR / EVALUATOR LEV. II SNT-TC-1A
BREMBANA&ROLLE S.p.A.
P.FACHERIS
QUALITY CONTROL DEPT.
11 GEN 2018

☐ F.CEFIS ☒ P.FACHERIS

BREMBANA & ROLLE S.p.A.
M. ESPOSITO
Q. C. MANAGER
11 GEN 2018

M.ESPOSITO - Q.C.M.

INSPECTION AGENCY

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
☑ Witnessed ☐ Monitored ☐ Reviewed
Alessandro Salvatore Monastra
Milan Office

BREMBANA&ROLLE

DYE PENETRANT TEST REPORT

REPORT No. PQR 24/17 PT

PURCHASER DATA	MANUFACTURER DATA
PURCHASER	JOB No.
PLANT	DWG. No.
P.O.	PROCEDURE No. BCI-002-PT
ITEM	SERIAL No.

APPLICABLE CODE:	APPLICABLE STANDARD/SPECIFICATION:
ASME IX – QW 195	

P.T. examination performed at 100 % on:

- Specimen 24/17

MATERIAL: SA 765 Gr.2 - SA 516 Gr. 70 **THICKNESS:** 40 mm

P.T. Time:	BEFORE: P.W.H.T. ■ HYDROTEST ☐	AFTER: P.W.H.T. ☐ TUBE EXPANSION ☐
Surface:	condition : As welded ■ Ground ☐ Machined ☐	
	cleaning : Solvent ☐ Brushing ■ Shotblasting ☐	
Type:	Water Washable Visible ■ Post Emulsifying None ☐ Solvent Removable None ☐	
Penetrant:	Colour Contrast CGM RED W Emulsifier None Solvent None Developer Non Acqueous Wet CGM ROTRIVEL U	
Application:	PENETRANT : Paint Brush ☐ Spray ■ Penetration time : 10 minutes	
	EMULSIFIER : Dipping ☐ Emulsification time N.A.	
Excess penetrant removal:	Water spray (3.5 bar max) ■ cloths ☐ absorber paper ☐	
Drying after excess penetrant removal :	Compressed air (3.5 bar max) ■ cloths ■	
Developer application :	Spraying	Developping time: 10 minutes Interpretation : 30 minutes
Viewing condition:	Artificial light (1000 Lx min.) ■ Black light (1000 µW/cm² min) ☐	
Post examination cleaning:	Water rinse ■ Cloths ■	
TEST RESULT:	SATISFACTORY, NO REPORTABLE INDICATIONS FOUND	

BREMBANA & ROLLE S.p.A.

OPERATOR / EVALUATOR LEV. II SNT-TC-1A

11 GEN 2018

☒ F.CEFIS ☐ P.FACHERIS

BREMBANA & ROLLE S.p.A.
M. ESPOSITO
Q. C. MANAGER
11 GEN 2018
M.ESPOSITO - Q.C.M.

INSPECTION AGENCY

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Lloyd's Register
☑ Witnessed ☐ Monitored ☐ Reviewed
Alessandro Salvatore Monastra
Milan Office

Form PT Rev. 0 Date 23/06/'99

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
LAB N° 1464

Sigma Tre Lab

LABORATORIO ACCREDITATO UNI CEI EN ISO/IEC 17025

Rapporto di prova / Test Report **2018/01/0400**

Garbagnate M.ero 2018 January 31

Campionamento eseguito a cura del Cliente
Sampling performed by Customer

I Campioni sottoposti a prova sono conservati per 4 mesi
Tested samples are kept for 4months

Ordine Interno / Internal Order: 2018/0078

Materiale Ricevuto il / Material Received on: 2018 January 25

Prove Eseguite il / Test Performed on: 2018 January 31

Ditta/Messrs *Request by*

BREMBANA & ROLLE S.p.A.

Via Villino, 1

24030 Valbrembo (BG)

Campione sottoposto a prova / Tested Specimen	**Materiale dichiarato** / Declared Material	**Specifiche applicate** / Applied Specifications
Procedure qualification record No.24/17	**Base Metal:**	
Preliminary WPS: W24/17	**SA 516 Gr.70**	
Process: GMAW-FCAW Semi-Automatic	**SA 765 Gr.2**	**ASME IX - Ed. 2015 QW-153 QW-163**
Pos. : 3G		
WPS: W23/17		
Welder: Kachi Abderrahim Stamp: S32		
	Colata / Heat	**ASME VIII Div. 1 UW 51**
Thk.40 mm (SA 765 Gr.2)		
Thk.45 mm (SA 516 Gr.70)	**1SN427**	
Supplier:	**(SA 516 Gr.70)**	
Metinvest Cert. 305269 dtd 22/10/2013	**16791**	
Forgiatura Vienna Cert. 16012803 dtd 28/10/2016	**(SA 765 Gr.2)**	
Test Plan 008/18		

Prove eseguite / Performed Tests	**Metodo di prova** / Test method	Accreditation Yes	Accreditation No	**Apparecchiature utilizzate** / Used Equipments
➢ **Esame Radiografico** / Radiographic Examination	**ASME V art.2**		X	**vedere pagina successiva** / see following page
➢ **Trattamento Termico** / Heat Treatment	-		X	**Furnace** Cod.FO-SALD1
➢ **Prova di Piega**	**ASME IX-QW-161-15**	X		**Testing Machine** Cod.TRAZ-200
Side Bend Test	**ASTM A370-17**	X		**Termometer** Cod.TERM005 **Caliper** Cod.CAL675
➢ **Prova di Resilienza**	**ASME IX -QW171-15**	X		**Testing Machine** Cod.CH-750
Impact Test	**ASTM E23-16b**	X		**Termometer** Cod.TERM007 **Caliper** Cod.CAL675
➢ **Esame Macrografico** / Macrographic Examination	**ASTM E340-15**	X		**Macro camera** Cod.MACRO-1
➢ **Prova di Durezza** / Hardness Test	**ASTM E92-16** **NACE MR0175, ISO 15156-2**	X		**Testing Machine** Cod.DU-KB

Responsabile Tecnico Laboratorio / Laboratory Manager
Ing. C. Pratola
SIGMATRE LAB srl

mb

BREMBANA & ROLLE S.p.A.
WELDING DEPT.
☐ REVIEWED ☐ WITNESSED

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
☒ Witnessed ☐ Monitored ☐ Reviewed
Alessandro Salvatore Monastra
Milan Office 31 GEN 2018

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The present report covers exclusively the samples tested and it cannot be reproduced partially without written approval by the test laboratory PM01-R00

SigmaTre-LAB Srl - Via Fornace 31 - 23846 Garbagnate Monastero (Lecco) Tel. +39 031 87 94 25 - Fax +39 031 87 94 22 Mail sigmalab@sigmalab.it P.IVA 03615120130

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
LAB N° 1464

Sigma Tre Lab

LABORATORIO ACCREDITATO UNI CEI EN ISO/IEC 17025

Rapporto di prova Test Report **2018/01/0400**

Garbagnate M.ero 2018 January 31

Ditta/Messrs *Request by*

BREMBANA & ROLLE S.p.A.

CONTROLLI NON DISTRUTTIVI - NOT DESTRUCTIVE TESTS
Esame Radiografico – Radiographic Examination

Posizione Position	Sensibilità Sensitivity	Valutazione Evaluation	Indicazioni Indications
008-17			
1-2	W8	C	Sd
2-3	W8	C	Sd
3-4	W8	C	Sd

Legenda: Legend:		
2011	poro	Gas pore
2016	Tarlo	warm hole
2014	Pori allineati	Linear porosity
301	inclusione scoria	Slag inclusion
202	Cavità di ritiro	Shrinkage cavity
401	Mancanza di fusione	lack of fusion
502	Sovrametallo eccessivo	Excess weld metal
402	mancanza di penetrazione	incomplete penetration
4013	Mancanza di fusione al vertice	Lack of root fusion
515	insellamento	Root concavity
504	eccessi di penetrazione	excess penetration
100	cricca	crack
2015	Cavità allungata	Elongated cavity
5011	incisione marginale	undercut
304	inclusione metallica	Metallic inclusion
503	Convessità eccessiva	Excessive convexity
Sd	senza indicazioni	withoutdefects

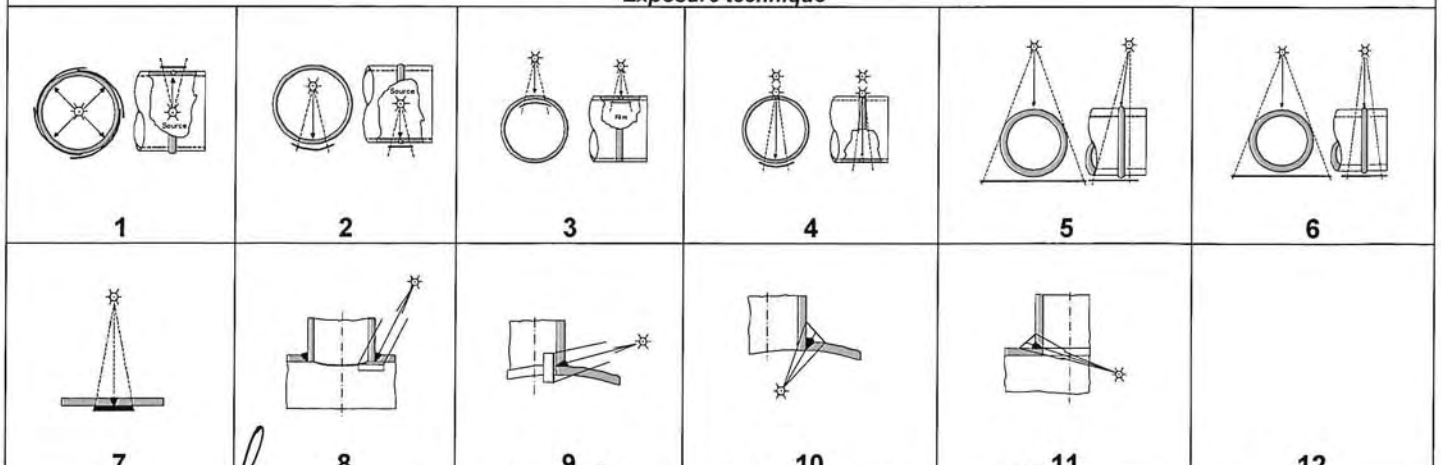
TECNICHE DI ESPOSIZIONE
Exposure technique

No. 7

Apparecchiatura utilizzata	Used equipment
Apparecchio Equipment	SEIFERT
Modello Type	ERESCO 65MF3
Macchia focale Focus	3 mm
Tipo Pellicola Film Type	Agfa gevaert 15X40 D7
Penetrametro IQI Penetrameter IQI	1B ASTM
Schermi Screens	0.05 / 0.10 Pb
Distanza F/F mm Distance F/F mm	700 mm
Densità Density	**2.6÷2.9**
Intensità/mA Intensity/mA	3
Max Voltaggio kV Max Voltage kV	290
Durata Esposizione Exposition Time	2' 36"
Sp. materiale Thk.material	40÷45 mm

Note: C = Conform, NC = Not Conform W=Filo IQI
designazione delle imperfezioni /imperfection designation UNI EN ISO 6520-1
Acceptability as per ASME VII Div.1 UW-51

TECNICHE DI ESPOSIZIONE
Exposure technique



Responsabile Tecnico Laboratorio
Laboratory Manager
Ing. G. Fratola
SIGMATRE LAB srl

SCHEDA DI RILIEVO S.p.A.
WELDING REPORT
REVIEWED / WITNESSED

SCIARRONE DOMENICO
Liv.2 - EN 473 / ISO 9712
II° Liv. SNT-TC-1A
RT - UT - PT - MT - VT

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Witnessed Monitored Reviewed
Alessandro Salvatore Monastra
Milan Office

mb

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ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
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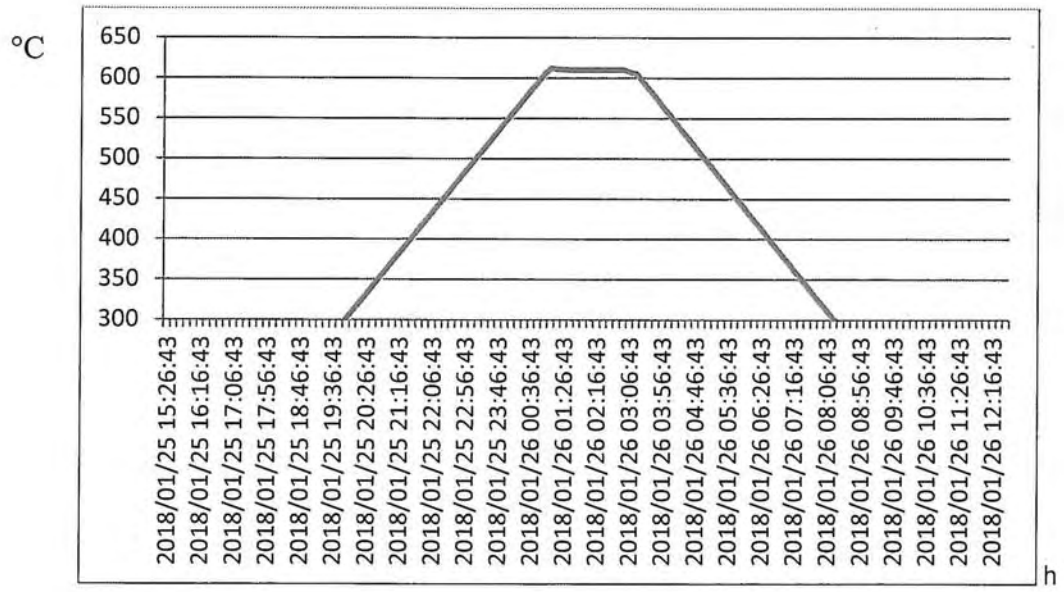
Sigma Tre Lab
LABORATORIO ACCREDITATO UNI CEI EN ISO/IEC 17025

Rapporto di prova 2018/01/0400
Test Report

Garbagnate M.ero 2018 January 31

Ditta/Messrs *Request by*
BREMBANA & ROLLE S.p.A.

PWHT at 610°C +/-10°C for 2 h - Heating and Cooling Rate 56÷80°C/h



Responsabile Tecnico Laboratorio
Laboratory Manager
Ing. G. Prato
SIGMATRE LAB srl
mb

BREMBANA & ROLLE S.p.A.
WELDING DEPT.
REVIEWED / WITNESSED

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Witnessed Monitored Reviewed
Alessandro Salvatore Monastra
Milan Office

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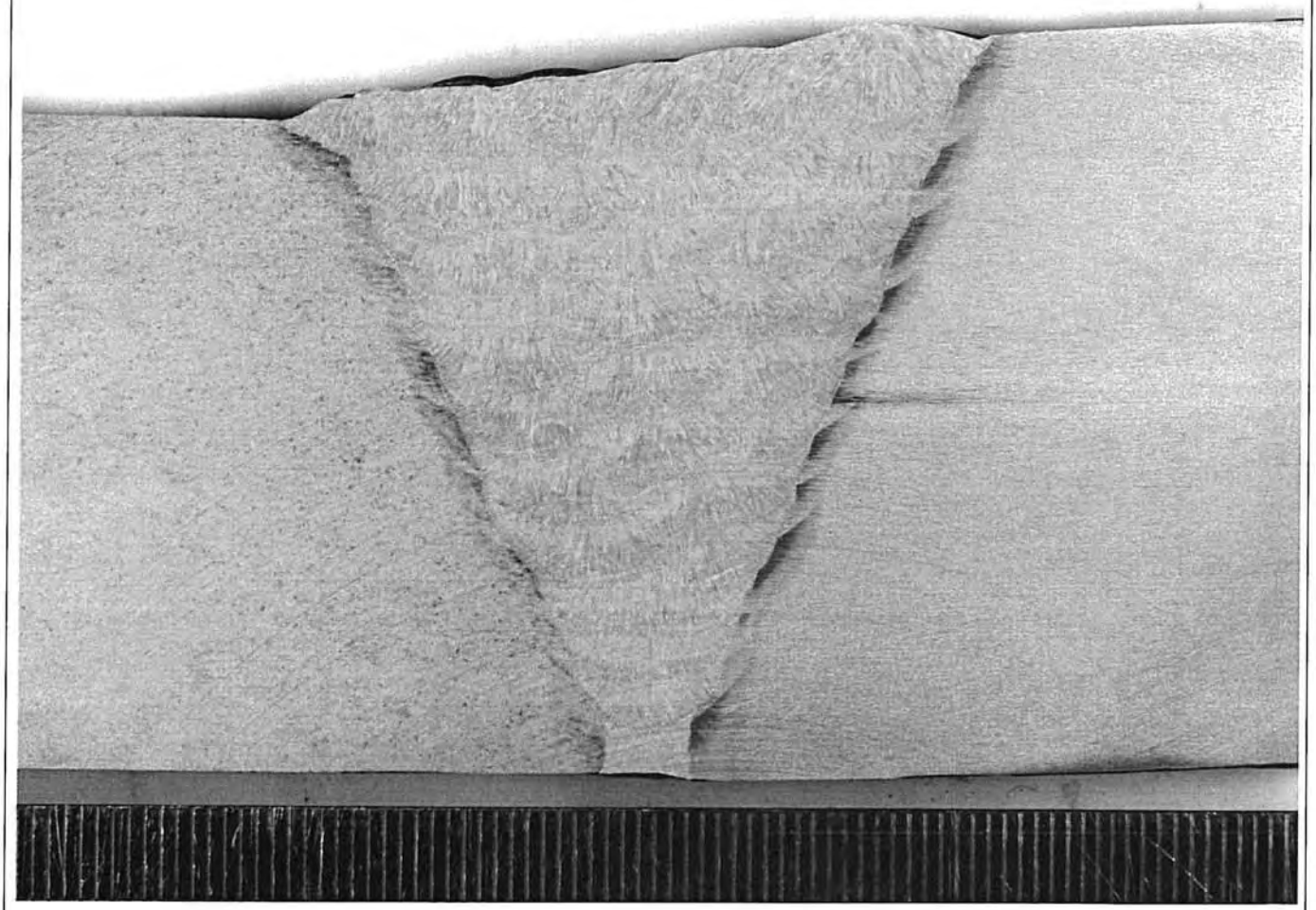
Rapporto di prova 2018/01/0400
Test Report

Garbagnate M.ero 2018 January 31

Ditta/Messrs *Request by*

BREMBANA & ROLLE S.p.A.

ESAME MACROGRAFICO *MACROGRAPHIC EXAMINATION*	***Campione sottoposto a prova*** *Tested specimen* 425



Ingrandimento Magnification	≈ 2.2 x	**Attacco** Etching	Nital	**Figura N.** Picture Nr.	1

Assenza di Difetti -- Absence of defects

Responsabile Tecnico Laboratorio
Laboratory Manager
Ing. G. Pratola
SIGMATRE LAB srl

mb

BREMBANA & ROLLE S.p.A.
WELDING ENGINEER
EXAMINED & WITNESSED

Lloyd's Register Verification Limited
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Witnessed – Monitored – Reviewed
Alessandro Salvatore Monastra
Milan Office

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SA-516 Gr.70

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO

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Sigma Tre Lab

LABORATORIO ACCREDITATO UNI CEI EN ISO/IEC 17025

Rapporto di prova Test Report **2018/01/0400**

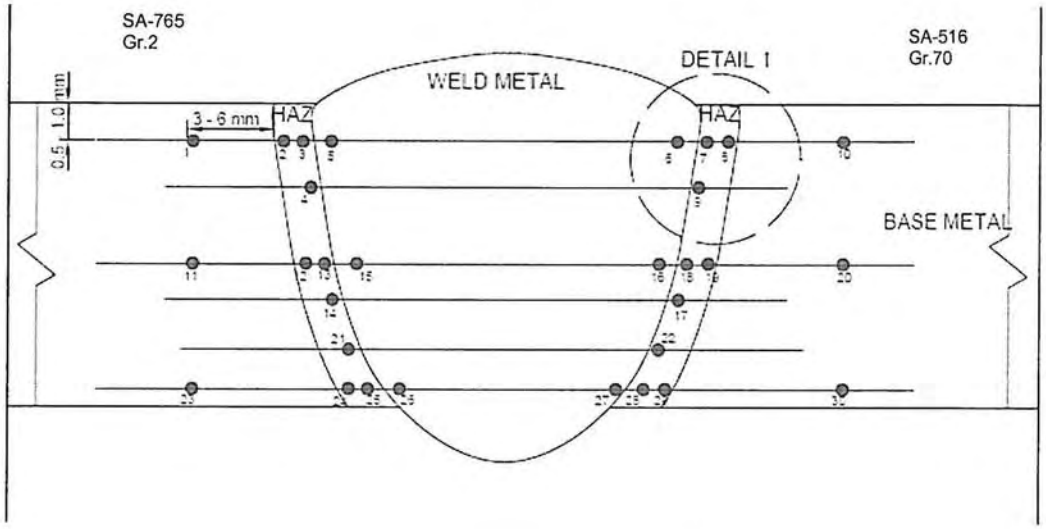
Garbagnate M.ero 2018 January 31

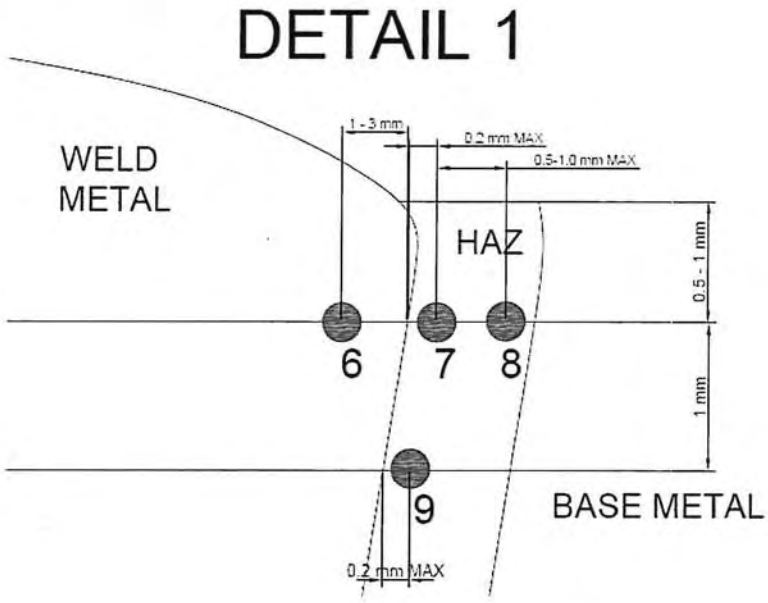
Ditta/Messrs **BREMBANA & ROLLE S.p.A.**

Request by

PROVA DI DUREZZA HV10
HARDNESS TEST HV10

Campione sottoposto a prova *Tested specimen* 425





Responsabile Tecnico Laboratorio
Laboratory Manager
Ing. G. Pratola
SIGMATRE LAB srl

mb

BREMBANA & ROLLE S.p.A. WELDING PROCEDURE QUALIFICATION WITNESSED

Lloyd's Register Verification Limited
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Alessandro Salvatore Monastra
Milan Office

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ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
LAB N° 1464

Sigma Tre Lab

LABORATORIO ACCREDITATO UNI CEI EN ISO/IEC 17025

Rapporto di prova 2018/01/0400
Test Report

Garbagnate M.ero 2018 January 31

Ditta/Messrs *Request by*

BREMBANA & ROLLE S.p.A.

HARDNESS TEST HV10 according to NACE MR0175 / ISO 15156-2/ AB-036386-001

Position	Top Line		Middle line		Bottom Line	
	Pos.	HV 10	Pos.	HV 10	Pos.	HV 10
Base Metal	1	**150**	11	**147**	23	**153**
Heat Affected Zone	2	**161**	12	**149**	21	**145**
	3	**210**	13	**166**	24	**160**
	4	**232**	14	**209**	25	**176**
Weld Metal	5	**241**	15	**207**	26	**168**
	6	**246**	16	**221**	27	**162**
Heat Affected Zone	7	**245**	17	**242**	22	**133**
	8	**223**	18	**192**	28	**187**
	9	**161**	19	**154**	29	**165**
Base Metal	10	**133**	20	**142**	30	**140**

Note: Hardness Test maximum value: **max. 248 HV** (maximum value requested by Customer).
Condition: As Welded

Responsabile Tecnico Laboratorio
Laboratory Manager
Ing. G. Piatola
SIGMATRE LAB srl
mb

BREMBANA & ROLLE S.p.A.

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Witnessed Monitored Reviewed
Alessandro Salvatore Monastra
Milan Office

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Rapporto di prova Test Report **2018/01/0400**

Garbagnate M.ero 2018 January 31

Ditta/Messrs *Request by*

BREMBANA & ROLLE S.p.A.

Prova di Piega - Side Bend Test**

Identificazione Campione Sample identification	Posizione prova Test Position	Distanza tra i rulli Distance between rollers mm	Dimensioni Dimensions mm W x Thk	Mandrino / Angolo Mandrel/angle mm/°	Risultati Prova Test results < 1.6 mm
0425-5	Side/Tr	70.0	10.0 x 40.0	40/180	No indication
0425-6	Side/Tr	70.0	10.0 x 40.0	40/180	No indication
0425-7	Side/Tr	70.0	10.0 x 40.0	40/180	No indication
0425-8	Side/Tr	70.0	10.0 x 40.0	40/180	No indication

Prova di Resilienza - Impact Test**

Identificazione campione Sample identification	Posizione prova Test position	Dimensioni Dimensions mm	Intaglio Notch type	Temp. Temp. °C	Risultati prova Test results Joule			Media Average ≥27J*	Lateral expansion mm			Shear Fracture %		
0425-11	WM TOP	10x10x55	KV	-46	72.2	72.6	72.9	72.6	-	-	-	-	-	-
0425-12	WM ¾ Thk.	10x10x55	KV	-46	37.4	40.2	65.7	47.7	-	-	-	-	-	-
0425-13	WM BOTTOM	10x10x55	KV	-46	39.7	45.0	51.7	45.5	-	-	-	-	-	-
0425-14	HAZ ½ ÷¼ BOTTOM (SA-516 Gr.70)	10x10x55	KV	-46	30.9	33.2	43.6	35.9	-	-	-	-	-	-
0425-15	HAZ TOP ½ ÷¼ (SA-516 Gr.70)	10x10x55	KV	-46	133.4	170.1	196.3	166.6	-	-	-	-	-	-
0425-16	HAZ BOTTOM (SA-516 Gr.70)	10x10x55	KV	-46	49.5	58.1	66.3	57.9	-	-	-	-	-	-
0425-17	HAZ ½ ÷¼ BOTTOM (SA-765 Gr.2)	10x10x55	KV	-46	109.0	124.2	150.1	127.8	-	-	-	-	-	-
0425-18	HAZ TOP ½ ÷¼ (SA-765 Gr.2)	10x10x55	KV	-46	32.9	39.2	37.5	36.5	-	-	-	-	-	-
0425-19	HAZ BOTTOM (SA-765 Gr.2)	10x10x55	KV	-46	53.6	105.5	110.8	90.0	-	-	-	-	-	-

L	*Longitudinale*	*Longitudinal*
Tr	*Trasversale*	*Transversal*
Tang	*Tangenziale*	*Tangential*
W	*Larghezza*	*Width*
Thk	*Spessore*	*Thickness*
amb	*Temp.ambiente*	*RoomTemper.*

Note : *Minimum value requested by Customer
** Test Performed after PWTH at 610°C +/-10°C for 2 h - Heating and Cooling Rate 56÷80°C/h

Responsabile Tecnico Laboratorio
Laboratory Manager
Ing. G. Pratola
SIGMATRE LAB srl
mb

BREMBANA & ROLLE S.p.A.
WELDING SHOP
WITNESSED

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Witnessed Monitored Reviewed
Alessandro Salvatore Monastra
Milan Office

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Sigma Tre Lab

LABORATORIO ACCREDITATO UNI CEI EN ISO/IEC 17025

Rapporto di prova Test Report **2018/01/0401**

Garbagnate M.ero 2018 January 31

Ditta/Messrs *Request by*

BREMBANA & ROLLE S.p.A.

Via Villino, 1

24030 Valbrembo (BG)

Campionamento eseguito a cura del Cliente
Sampling performed by Customer

I Campioni sottoposti a prova sono conservati per 4 mesi
Tested samples are kept for 4months

Ordine Interno / Internal Order: 2018/0078

Materiale Ricevuto il / Material Received on: 2018 January 25

Prove Eseguite il / Test Performed on: 2018 January 31

Campione sottoposto a prova Tested Specimen	**Materiale dichiarato** Declared Material	**Specifiche applicate** Applied Specifications
Procedure qualification record No.24/17	Base Metal:	
Preliminary WPS: W24/17	SA 516 Gr.70	
Process: GMAW-FCAW Semi-Automatic	SA 765 Gr.2	ASME IX - Ed. 2015, QW-153, QW-163
Pos. : 3G		
WPS: W23/17		
Welder: Kachi Abderrahim Stamp: S32	Colata / Heat	ASME VIII Div. 1 UW 51
Thk.40 mm (SA 765 Gr.2)		
Thk.45 mm (SA 516 Gr.70)	1SO902	
Supplier:	(SA 516 Gr.70)	
Metinvest Cert. 305269 dtd 22/10/2013	16791	
Forgiatura Vienna Cert. 16012803 dtd 28/10/2016	(SA 765 Gr.2)	
Test Plan 008/18		

Prove eseguite Performed Tests	**Metodo di prova** Test method	Accreditation Yes	Accreditation No	**Apparecchiature utilizzate** Used Equipments
➢ **Esame Radiografico** Radiographic Examination	**ASME V art.2**		X	**vedere pagina successiva** see following page
➢ **Trattamento Termico** Heat Treatment	-		X	**Furnace** Cod.FO-SALD1
➢ **Prova di Trazione** Tensile Test	**ASME IX -QW 150-15**	X		**Testing Machine**
	ASTM A370-17	X		Cod.TRAZ600
				Caliper Cod.CAL675
				Termometer Cod.TERM007

Responsabile Tecnico Laboratorio
Laboratory Manager
Ing. G. Piabla
SIGMATRE LAB srl

mb

BREMBANA & ROLLE S.p.A.
WELDING OPERATOR
EVERY WELD WITNESSED

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Witnessed Monitored Reviewed
Alessandro Salvatore Mobastra
Milan Office
31 DEN 2018

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ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
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Sigma Tre Lab
LABORATORIO ACCREDITATO UNI CEI EN ISO/IEC 17025

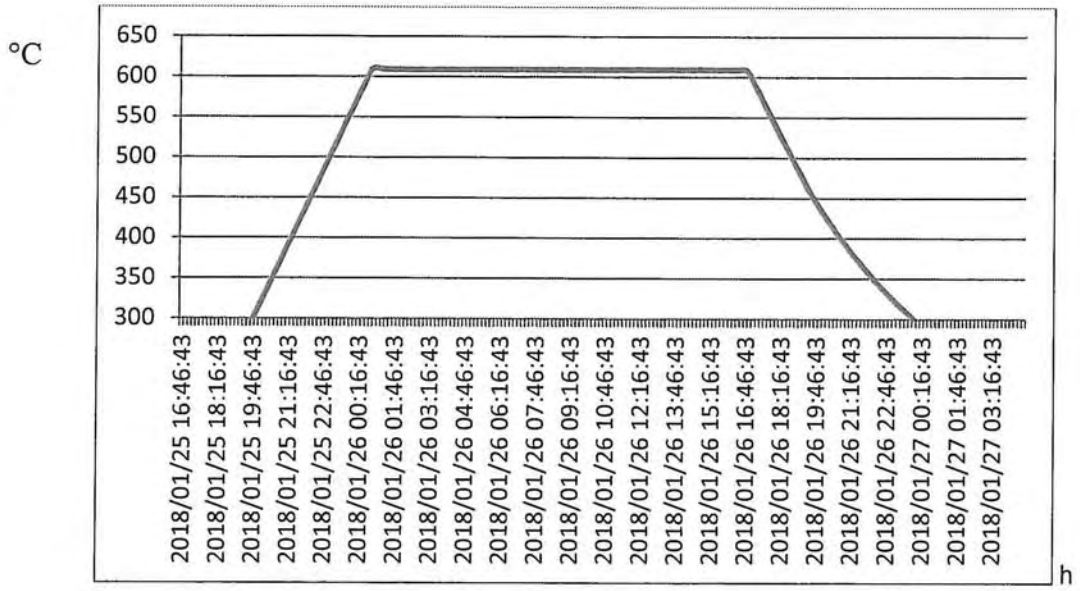
Rapporto di prova / Test Report **2018/01/0401**

Garbagnate M.ero 2018 January 31

Ditta/Messrs *Request by*

BREMBANA & ROLLE S.p.A.

PWHT at 610°C +/-10°C for 16 h - Heating and Cooling Rate 56÷80°C/h



Responsabile Tecnico Laboratorio
Laboratory Manager
Ing. G. Prabla
SIGMATRE LAB srl
mb

BREMBANA & ROLLE S.p.A.
WELDING DEPT.
REVIEWED WITNESSED

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Witnessed Monitored Reviewed
Alessandro Salvatore Monastra
Milan Office

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Rapporto di prova 2018/01/0401
Test Report

Garbagnate M.ero 2018 January 31

Ditta/Messrs *Request by*

BREMBANA & ROLLE S.p.A.

Prova di Trazione - Tension Test*

Identificazione campione Sample identification	Posizione prova Test position	Dimensioni Dimensions Ø o WxThk mm	Sezione Area So mm²	Tratto utile Gage length Lo mm	Temp. Temp. °C	Carico Totale di rottura Total Charge of failure kN	Carico Rottura Tensile strength Rm MPa ≥485	Posizione di rottura Failure position	Tipo di frattura Fracture type
0426-5	Tr	19.06 x 40.52	772.31	-	amb	390.8	506	Base Material (SA-516 Gr.70)	Ductile
0426-6	Tr	19.04 x 40.18	765.03	--	amb	384.9	503	Base Material (SA-516 Gr.70)	Ductile

L	*Longitudinale*	*Longitudinal*
Tr	*Trasversale*	*Transversal*
Tang	*Tangenziale*	*Tangential*
W	*Larghezza*	*Width*
Thk	*Spessore*	*Thickness*
amb	*Temp.ambiente*	*RoomTemper.*

Note : Test performed after PWHT a at 610°C +/-10°C for 16 h - Heating and Cooling Rate 56÷80°C/h

Responsabile Tecnico Laboratorio
Laboratory Manager
Ing. G. Pratola
SIGMATRE LAB srl
mb

BREMBANA & ROLLE S.p.A.
WITNESSED

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Witnessed Monitored Reviewed
Alessandro Salvatore Monastra
Milan Office

Il presente rapporto riguarda esclusivamente i campioni testati e non può essere riprodotto parzialmente senza l'approvazione scritta del laboratorio di prova.
The present report covers exclusively the samples tested and it cannot be reproduced partially without written approval by the test laboratory

SigmaTre-LAB Srl - Via Fornace 31 - 23846 Garbagnate Monastero (Lecco) Tel. +39 031 87 94 25 - Fax +39 031 87 94 22 Mail sigmalab@sigmalab.it P.IVA 03615120130

QUALITY CONTROL

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
LAB N° 1384 L

RAPPORTO DI PROVA N. *Test Report No.*	23/1016RP05	DATA *Date*	23/06/2023	CAMPIONE N. *Sample No.*	1016EN	PAGINA *Page*	1	DI *of*	2

Laboratory of Medolago, Via Roma 79 - 24030 Medolago (BG) t. +39 035 901473 e-mail info@qualitycontrolgroup.com website www.qualitycontrolgroup.com

ORDINE / *Order* Letter
Data ordine / Order date 07/06/2023

RIFERIMENTO / *Reference* BG/23/071
Data riferimento / Reference date

DATA DI RICEZIONE *Reception date* 07/06/2023

CLIENTE / Customer

BREMBANA & ROLLE S.p.A.
via Villino 1
24030 Valbrembo (BG)

DATA DI ACCETTAZIONE *Acceptance date* 07/06/2023

OGGETTO *Subject* **Tallone di saldatura per test integrativi**
Coupon weld Test for integrative test

ELENCO DELLE PROVE / List of tests	**Metodo /** *Method*	**Saggio /** *Test*	**Pagina /** *Sheet*
Prova di durezza Vickers su giunti saldati / *Destructive tests on welds – Vickers hardness test*	UNI EN ISO 9015-1:2011	1016EN	2

L'accreditamento è legato esclusivamente alle prove incluse nell'elenco allegato al certificato n° 1384L disponibile sul sito web www.accredia.it. Le prove non accreditate da Accredia sono caratterizzate dall'asterisco (*) / *The accreditation is related solely to the tests included in the list annexed to the certificate n° 1384L available on the website www.accredia.it. The tests not accredited by Accredia are characterized by asterisk (*)*

Alessandro Donadoni
Vice Direttore Tecnico / Technical Deputy Manager

La firma digitale o la firma autografa sul rapporto certifica la sua validità. L'originalità del rapporto è garantita dalla tracciabilità nel sistema PEC utilizzata per la sua consegna al cliente /
The digital or hand-written signature on report certifies its validity. The originality of the relationship is guaranteed by the traceability of the PEC system used for delivery to customer.
La regola decisionale utilizzata dal laboratorio quando fornisce dichiarazioni di conformità a norme o specifiche è riportata nel sito web www.qualitycontrolgroup.com /
The decision rule used by the laboratory when providing declarations of compliance with standards or specifications is shown in www.qualitycontrolgroup.com website.
Il campionamento è effettuato dal cliente e non è oggetto di accreditamento; i risultati delle prove si riferiscono al campione così come ricevuto /
Sampling is carried out by the customer and is not subject to accreditation; test results refer to the sample as received.
Il laboratorio è responsabile di ogni informazione riportata nel presente rapporto di prova ad eccezione delle informazioni fornite dal cliente rispetto alle quali declina ogni responsabilità /
The laboratory is responsible for any information reported in this report except for the information provided by the customer with the respect to which it disclaims any responsibility

CARATTERISTICHE DEL CAMPIONE DICHIARATE DAL CLIENTE / *features of sample declared by customer*

	Descrizione *Description*	Dimensioni *Dimension*	Fornitore *Supplier*	Colata/Lotto *Heat/Lot*	Certificato *Certificate*	Date *Date*
Materiale base 1 *Parent material1*	ASME SA516 gr.70	Plate Thk. 40 mm	---	---	---	---
Materiale base 2 *Parent material 2*	ASME SA765 gr.2	Plate Thk. 40 mm	---	---	---	---
Metallo d'apporto *Filler Metal*	---	---	---	---	---	---
Tipo di giunto *Joint type*	BW	Processo di saldatura *Welding process*	GMAW-FCAW		Posizione di saldatura *Welding position*	---
pWPS n.	W24/17	Saldatore *Welder*	---		Stamp	S11
Altre caratteristiche *Other features*	Procedure Qualification Record P.Q.R. - integrative hardness test Job. 22177 Coupon test 1016EN after min PWHT performed by B. & R.					
	Test according to:	**Customer specification**				

Il presente rapporto di prova riguarda esclusivamente il campione esaminato, non può essere riprodotto neanche parzialmente senza l'autorizzazione del Laboratorio ed è conservato in copia conforme all'originale nell'archivio del Laboratorio I tempi di conservazione dei rapporti, dei documenti e delle parti dei saggi e delle provette sono riportate nel sito web www.qualitycontrolgroup.com / *This test report only concerns the examined sample, it can not be even partially reproduced without the authorization of the Laboratory and his certified copy is stored in the original in the archive of the Laboratory. The storage times of reports, documents and parts of the sample and the test piece are shown in www.qualitycontrolgroup.com website*

Tutte le prove riportate nelle pagine seguenti sono state eseguite presso il laboratorio di MEDOLAGO (BG)
All tests reported in the following pages were carried out at the laboratory of MEDOLAGO (BG)

Ente di Collaudo / Surveyor

BUREAU VERITAS ITALIA WELDING 14
IT FILE:
DATE:
WITNESSED ☐ REVIEW ☑

Ente di Collaudo / Surveyor

QUALITY CONTROL

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO LAB N° 1384 L

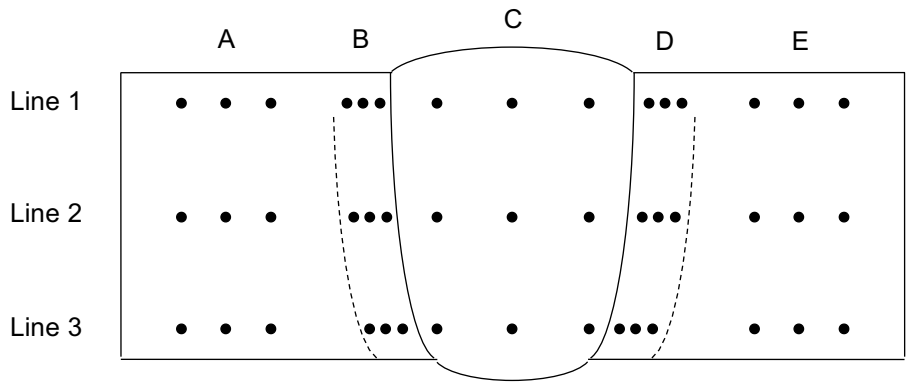
RAPPORTO DI PROVA N. *Test Report No.*	23/1016RP05	DATA *Date*	23/06/2023	CAMPIONE N. *Sample No.*	1016EN	PAGINA *Page*	2	DI *of*	2

Laboratory of Medolago, Via Roma 79 - 24030 Medolago (BG) t. +39 035 901473 e-mail info@qualitycontrolgroup.com website www.qualitycontrolgroup.com

PROVA DI DUREZZA VICKERS SU GIUNTI SALDATI – UNI EN ISO 9015-1: 2011

Weld joints Vickers hardness testing – UNI EN ISO 9015-1: 2011

SAGGIO *Test*	**1016EN**
TIPO DI DUREZZA *Hardness type*	HV10
VALORE RICHIESTO *Required value*	MAX 200 HV



Lo schema delle impronte di durezza la distanza tra le impronte è in accordo alla ISO 9015-1
The hardness indentation sketch and indentation distance are according to ISO 9015-1

RISULTATO

RESULT

Pos.	A (M.B.) *A (B.M.)*	B (Z.T.A.) *B (H.A.Z.)*	C (Z.F.) *C (W.M.)*	D (Z.T.A.) *D (H.A.Z.)*	E (M.B.) *E (B.M.)*
LINEA 1 ***LINE 1***	170-172-176	170-179-194	192-193-195	191-190-186	178-176-172
LINEA 2 ***LINE 2***	170-178-174	177-180-185	193-195-195	187-182-180	173-174-171
LINEA 3 ***LINE 3***	174-173-172	179-178-184	194-194-190	190-189-186	173-173-171

Norme di accettabilità: Customer specification
***Acceptability standards**: Customer specification*

Dichiarazione di conformità
la superficie esaminata risulta conforme ai requisiti previsti dalle norme di accettabilità summenzionate
Statement of conformity
The examined surface comply with the requirements of the acceptability standards mentioned above

Data inizio prova *Test start date*	23/06/2023	Data fine prova *Test end date*	23/06/2023	Tecnico qualificato *Qualified techinician*	MARIO PUCCI	Apparecchiatura *Equipment*	QC 371

07.01mod RP HM2I

***FINE RAPPORTO** / END REPORT*

BUREAU VERITAS ITALIA WELDING 14
IT FILE:
DATE
WITNESSED ☐ REVIEW ☑

Ente di Collaudo / Surveyor

Ente di Collaudo / Surveyor

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
LAB N° 1464 L

Sigma Tre Lab
Laboratorio Controllo Qualità

Rapporto di Prova
Test Report

2023080280

Garbagnate M.ro 08 September 2023

Ditta / Messers

BREMBANA & ROLLE SPA

Indirizzo/Address
VIA VILLINO 1
VALBREMBO
24030
BG

Campionamento eseguito a cura del Cliente Sampling performed by Customer	
I Campioni sottoposti a prova sono conservati per 4 mesi Tested samples are kept for 4 months	
Prove Eseguite Presso Laboratorio SIGMATRELAB, salvo diversa indicazione Tests Performed on SIGMATRELAB Laboratory, if not othervised specified	
Ordine Interno: Internal Order:	202302121
Id Interno: Internal Id:	202302121-B,C, D
Materiale Ricevuto il: Material Received on:	9 August 2023
Prove Terminate il: Test Ended on:	08 September 2023
Condizioni di Prova: Test Condition:	Campione Testato Dopo MAX PWHT Sample Tested After MAX PWHT

Informazioni fornite dal cliente, per le quali il laboratorio non si assume responsabilità - Information provided by the customer, for which the laboratory assumes no responsibility

Campione Sottoposto a Prova
Tested Sample

Weld test coupon – Integrative test
PQR no. 24/17 – Job no. 23031
Welding process: GMAW+FCAW
Welder: Michele Bonzi – Stamp S15

Tracciabilità *Traceability*	BG/23/113 - JOB 23031 - TT MAX	[O] Ordine / Order	BG/23/113	
		[C] *Consegna / Delivery*	1250 del 04/08/2023	
Specifiche Applicate / Standard Materiale *Applied Specifications / Material Standard*	Materiale Dichiarato *Declared Material*	Colata *Heat*	Dettagli *Details*	Spec. #
ASME BPVC.II.A-2021 (PART A2)	SA 516/SA-516M - GRADE 70	-	Side A - Thk 40 mm	1
ASME BPVC.II.A-2021 (PART A2)	SA-765/SA-765M - SA765 Grade II	-	Side B - Thk 40 mm	2
ASME BPVC.IX-2021	-	-	-	3

Prove Eseguite *Performed Tests*	Metodo di Prova *Test Method*	Accreditamento *Accreditation* Si / Yes	 No / No
Prove di trazione a temperatura ambiente *Tensile testing at room temperature*	*ASTM E8/E8M -22*	*X*	
Prove di resilienza *Impact test*	*ASME IX QW 170:2021*	*X*	

Vice Responsabile Tecnico Laboratorio
Vice Laboratory Manager
ING. VIVIANA CREPALDI

BREMBANA & ROLLE S.p.A.
WELDING DEPT. CARMINATI
REVIEWED / WITNESSED

BUREAU VERITAS ITALIA WELDING
T. FILE
DATE
WITNESSED
REVIEWED

14

Questo rapporto riguarda esclusivamente i campioni sottoposti a prova, così come ricevuti, pertanto non può essere riprodotto parzialmente senza l'autorizzazione scritta del laboratorio.
The present report concerns exclusively the samples tested, as received, and it cannot be reproduced partially without written approval by the test laboratory.

Nel caso in cui venga resa una dichiarazione di conformità la regola decisionale adottata da SIGMATRELAB per valutare il risultato di prova tiene conto del relativo margine di incertezza di misura, nel caso questa sia stata considerata un fattore di copertura (k) a un livello di fiducia del 95%.
If expressed a declaration of conformity, the decision rule taken by SIGMATRELAB is to issue the result without considering the uncertainty contribution; if expressed the coverage factor considered is k = 2 and a level of confidence of 95%.

SigmaTre-LAB Srl – Via Fornace 31 – 23846 Garbagnate Monastero (Lecco) Tel. +39 031 87 94 25 Fax +39 031 87 94 22 Mail:info@sigmatrelab.it – P.IVA 03615170130

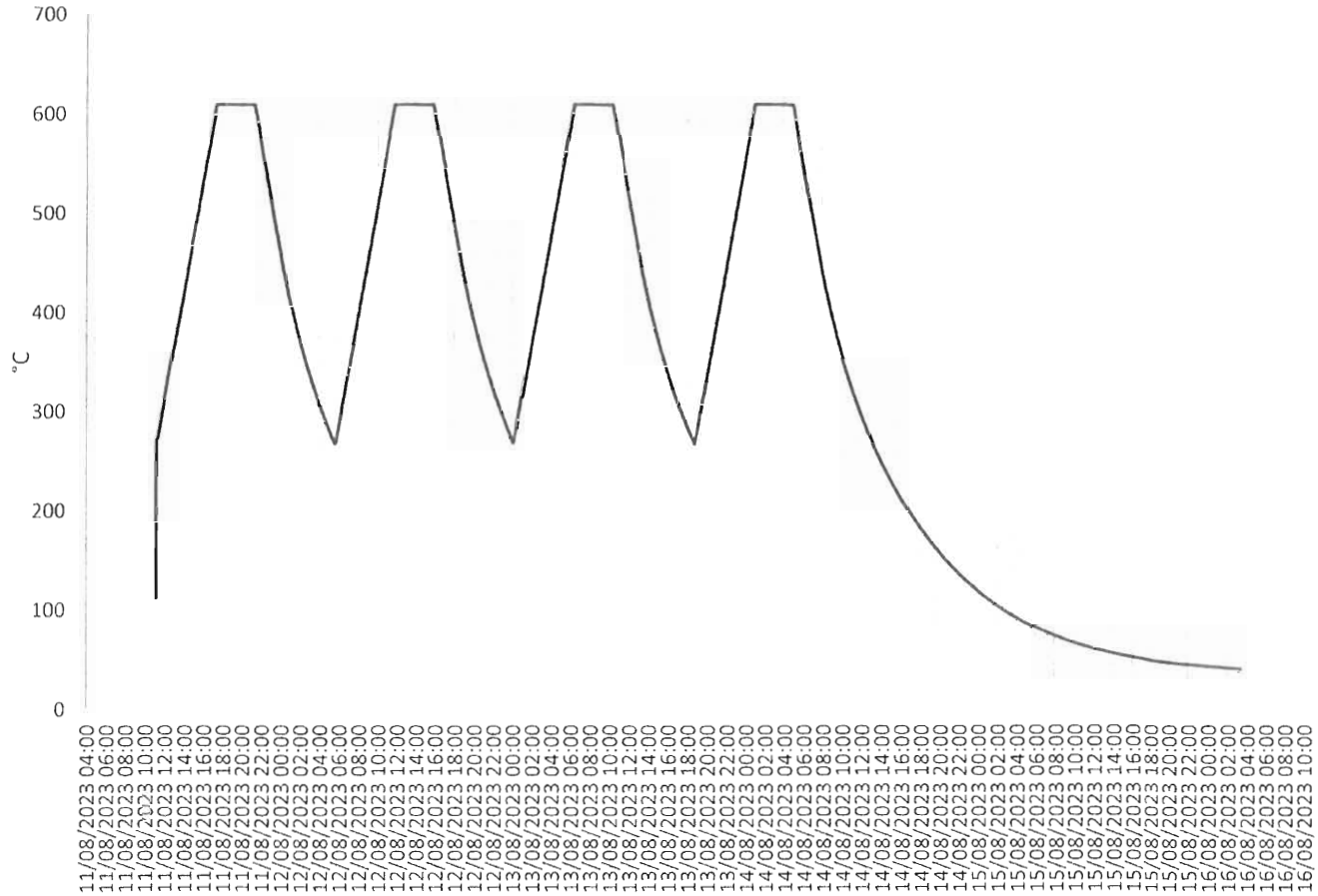
ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
LAB N° 1464 L
Sigma Tre Lab
Laboratorio Controllo Qualità

Rapporto di Prova
Test Report
Garbagnate M.ro

2023080280
08 September 2023

Ditta / Messers
BREMBANA & ROLLE SPA

MAX PWHT: 610 +/-10°C for 4 hours for 4 cycles – Heating and cooling rate: 50÷60°C/h



Vice Responsabile Tecnico Laboratorio
Vice Laboratory Manager
ING. VIVIANA CHERALDI

BREMBANA & ROLLE S.p.A.
WELDING DEPT. M. CARMINATI
REVIEWED WITNESSED

BUREAU VERITAS ITALIA WELDING 14
IT FILE:
DATE:
WITNESSED
REVIEW

Il presente rapporto riguarda esclusivamente i campioni testati così come ricevuti e non può essere riprodotto parzialmente senza l'approvazione scritta del laboratorio di prova.
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Nel caso in cui, in aggiunta a una dichiarazione di conformità la regola decisionale adottata da SIGMATRE LAB è di prendere il risultato senza tenere conto del contributo dell'incertezza di misura, nel caso questo sia rilevante deve considerare un fattore di copertura k = 2 pari al livello di fiducia del 95%.
In case in which, in addition to a statement of conformity the decision rule used by SIGMATRE LAB is to issue the results without considering the uncertainty contribution, if it is relevant the coverage factor considered is k = 2 and level of confidence of 95%.

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ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
LAB N° 1464 L

Sigma Tre Lab
Laboratorio Controllo Qualità

Rapporto di Prova
Test Report
Garbagnate M.ro

2023080280
08 September 2023

Ditta / Messers
BREMBANA & ROLLE SPA

Prove di trazione a temperatura ambiente - Tensile testing at room temperature
ASTM E8/E8M -22

Provino *Specimen*	Ori *Pos*	Dimensioni *Dimensions*	Sezione *Area*	Tratto Utile *Gauge Length*	Temp. *Temp.*	Snervamento *Yield Strength*	Carico Rottura *Tensile Strength*	Allungamento *Elongation*	Strizione *Reduction*
-	-	mm	mm^2	mm	°C	MPa	MPa	%	%
-	-	T x W - Ø	S_0	G	T	$YS_{0.2}$	S_u	E	Z
Requirements from Specification # [O]						FOR INFO	FOR INFO	FOR INFO	FOR INFO
2121-B-005	LONG 1/2T	Ø 12.56	123.9	50	+22	474	569	35.0	73

Note:

Legenda e Dettagli – Legend and Details

Macchina di Prova *Testing Machine*		Orientamento *Test Position*		LONG	Longitudinale *Longitudinal*	TRAS	Trasversale *Transversal*	TANG	Tangenziale *Tangential*
X	TRAZ-250	Orientamento – Zona Rottura *Test Position – Fracture Location*		BM	Metallo Base *Base Metal*	WM	Saldatura *Weld Metal*	HAZ	Zona Termicamente alterata *Heat Affected Zone*
-	-								
Sampling Sketch (solo se richiesto - only if required)		Orientamento *Test Position*		THK	Spessore *Thickness*	-	-	-	-
-		Dimensioni *Dimensions*		B	Spessore *Thickness*	W	Larghezza *Width*	Ø	Diametro *Diameter*

Prove di resilienza - Impact test
ASME IX QW 170:2021

Provino *Specimen*	Ori *Pos*	Dimensioni *Dimensions*	Intaglio *Notch*	Temp. *Temp.*	Energia Assorbita *Absorbed Energy*				Espansione Laterale *Lateral Expansion*			Aspetto Frattura *Shear Fracture*		
-	-	mm	-	°C	J				mm			%		
-	-	B x W x L	KV	T	Valore Singolo *Single Value*			Media *Average*	Valore Singolo *Single Value*			Valore Singolo *Single Value*		
Requirements from Specification # [O]					≥ 27			≥ 27	-			-		
2121-C-001	TRAS HAZ 1/2T	10 X 10 X 55	KV	-46	151	157	187	165	-	-	-	-	-	-
2121-D-001	TRAS WM 1/2T	10 X 10 X 55	KV	-46	70	77	77	75	-	-	-	-	-	-

Note:

Legenda e Dettagli – Legend and Details

Macchina di Prova - Testing Machine *CH-750 (KV8)*		Orientamento (Ori) *Test Position (Pos)*		LONG	Longitudinale *Longitudinal*	TRAS	Trasversale *Transversal*	TANG	Tangenziale *Tangential*
CH-750: Nominal Energy 750J, Stricker Radius 8 mm		Orientamento (Ori) *Test Position (Pos)*		BM	Metallo Base *Base Metal*	WM	Saldatura *Weld Metal*	HAZ	Zona Termicamente alterata *Heat Affected Zone*
CH-450: Nominal Energy 450J, KV_2		Orientamento (Ori) *Test Position (Pos)*		THK	Spessore *Thickness*	-	-	-	-
I valori superiori all'80% dell'energia nominale si devono considerare approssimativi. *Absorbed energy values above 80% of the nominal energy are approximate.*		Dimensioni *Dimensions*		B	Spessore *Thickness*	W	Larghezza *Width*	L	Lunghezza *Length*

Fine del Rapporto di Prova – End of Test Report

Vice Responsabile Tecnico Laboratorio
Vice Laboratory Manager
ING. VIVIANA CREPALDI

BREMBANA & ROLLE S.p.A.
WELDING DEPT. - CARMINATI
REVIEWED WITNESSED

BUREAU VERITAS ITALIA WELDING 14
IT FILE:
DATE:
WITNESSED
REVIEW

Il presente rapporto di prova è stato emesso in conformità alle condizioni generali di fornitura dei servizi del laboratorio. I campioni testati sono stati ricevuti così come identificati nel presente rapporto di prova. Il presente rapporto di prova è valido solo per i campioni testati, così come ricevuti, e non può essere riprodotto parzialmente senza l'approvazione scritta del laboratorio di prova.
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Nel caso in cui sia espressa una dichiarazione di conformità tale regola decisionale adottata, ad eccezione di quanto già previsto, è stata presa in considerazione l'incertezza di misura, nel caso in cui sia espressa, come considerato un fattore di copertura k=2, con livello di fiducia del 95%.
If expressed a declaration of conformity the decisional rule taken by SIGMATRELAB is to take the result without considering the uncertainty contribution, if it is expressed the coverage factor considered is k=2 and a level of confidence of 95%.

SigmaTre-LAB Srl – Via Fornace 31 – 23846 Garbagnate Monastero (Lecco) Tel. +39 031 87 94 25 Fax +39 031 87 94 22 Mail: info@sigmatrelab.it – P.IVA 03615120130

A01

CERTIFICATO DI CONTROLLO 3.1 / INSPECTION CERTIFICATE 3.1 - EN 10204:2004

A04/A05

METINVEST®

Metinvest Trametal spa

A01 Società per azioni con socio unico - soggetta a direzione e coordinamento di Metinvest B.V.
STABILIMENTO: 33058 S. GIORGIO DI NOGARO (UD) VIA E. FERMI, 44
TEL. 0431/629989 (RIC. AUT.) - FAX 0431/629985 (RIC. AUT.)
SEDE LEGALE: 16121 GENOVA - VIA XII OTTOBRE, 3 - 6° PIANO
Capitale sociale € 300.120.000,00 I.V. - R.E.A. Genova n. 437720
C.F., P. Iva e Iscr. Reg. Imp. Genova n. 05956630965

(A) PROCESSO DI ELABORAZIONE / STEELMAKING PROCESS: E = ELECTRIC ; BO = BASIC OXYGEN
(B) STATO DI FORNITURA / DELIVERY CONDITION: AR = GREZZO DI LAMINAZIONE / AS ROLLED ;
N° = LAMINAZIONE A TEMPERATURA CONTROLLATA / NORMALIZING ROLLING ;
N = NORMALIZZATO / NORMALIZED at 910°C, 1,5 min/mm ; ARIA CALMA / STILL AIR;
R = RICOTTO / ANNEALED;
N+R = NORMALIZZATO + RINVENUTO / NORMALIZED + ANNEALED
(C) TRATTAMENTO TERMICO DEL CAMPIONE / HEAT TREATMENT OF SAMPLE:
N = 910°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
R = 650°C, 1,5 min/mm ; ARIA CALMA / STILL AIR
(D) Ceq_1 = C + Mn/6 ; Ceq_2 = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 ;
Pcm = C + Si/30 + (Mn + Cu + Cr)/20 + Ni/50 + Mo/15 + V/10 + B*5
(1) POSIZIONE / LOCATION: 1 = TESTA / TOP ; 2 = PIEDE / BOTTOM
(2) POSIZIONE / LOCATION: C = CUORE / 1/2 THICKNESS ; P = PELLE / SURFACE ; D = 1/4 SPESSORE / THICKNESS
(3) DIREZIONE / DIRECTION: L = LONGITUDINALE / LONGITUDINAL ; T = TRASVERSALE / TRANSVERSE
(4) FORMA DEL PROVINO / SHAPE OF TEST PIECE: P = PRISMATICO / PRISMATIC ; C = CILINDRICO / CYLINDRICAL
(5) ESITO PROVA DI PIEGA / RESULT: OK = COMPLYING ; NO = NOT COMPLYING

A03 N° Certificato / Certificate no.	Z02 Data / Date
305269	22/10/2013
A08 N° Ordine Trametal / Works order	A07 N° Ordine cliente / Customer's order
31305663	4042/00232
DDT	del / date
BOL 31320616	21/10/2013
Pratica / File no.	
del / date	

A06 Cliente / Customer

BREMBANA & ROLLE SPA

VIA VILLINO, 1
24030 VALBREMBO
BG ITALIA

B01/B02/B03

Prodotto / Product	Lamiere / Hot rolled plates
Qualità / Steel grade	SA516GR70MT/LTV
Normativa / Specification	ASME

B06 Marcatura di prodotto / Marking of the product

LAMIERA/ORDINE/N° INFORNAMENTO/DIMENSIONI/QUALITÀ/MARCHIO DEL PRODUTTORE
PLATE/ORDER/INTERNAL N°/DIMENSIONS/STEEL GRADE/MANUFACTURER'S MARK

B07 ITEM	B07 LAMIERA PLATE	B07 N° INFORN. INTERNAL NUMBER	B09/B11 DIMENSIONI [mm] DIMENSIONS	B12 PESO TEORICO [t] THEORICAL WEIGHT	B07 LOTTO BATCH NO.	C70 PROCESSO ELAB. (A) STEELMAKING PROCESS	B04 STATO FORNITURA LAMIERA (B) DELIVERY CONDITION	C00 CAMPIONE SAMPLE	B05 TRATT. CAMPIONE (C) HEAT TREATMENT	C00 CAMPIONE PWHT SAMPLE	B05 PWHT BEGINNING TEMPERATURE TEMPERATURA INIZIO °C	HEATING RATE VELOCITA' RISCALDO C/h	TEMPERATURE TREATMENT TEMPERATURA TRATTAMENTO °C	HOLDING TIME PERMANENZA Min	COOLING RATE VELOCITA' RAFFREDDAMENTO °C/h	END TEMPERATURE TEMPERATURA FINE °C	N° CICLI / CYCLES	C00 CAMPIONE Q+T SAMPLE	B05 Q+T TEMPERATURE TEMPERATURA (Q) °C	HOLDING TIME PERMANENZA (Q) Min	COOLING RAFFREDDAMENTO	TEMPERATURE TEMPERATURA (T) °C	HOLDING TIME PERMANENZA (T) Min	COOLING RAFFREDDAMENTO
1	1SO9020403A	1039223	45.00X2500X4000	3,53	379314	BO	N	GM374																
2	1NP3020905A	1039347	72.00X1500X4000	3,39	379358	BO	N	GM396																

C71/C92 COMPOSIZIONE CHIMICA DI COLATA / HEAT CHEMICAL ANALYSIS

B07	C71	C72	C73	C74	C75	C76	C77	C78	C79	C80	C81	C82	C83	C84	C85	C86	C87	C88	C89	C90	C91
COLATA HEAT	C	Mn	Si	P	S	Cu	Ni	Cr	Mo	Al	V	Nb	Ti	Sn	Ca	N	B	H	Ceq1	Ceq2	Pcm
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	% (D)	% (D)	% (D)
Ordine Min 1	0,00	0,00	0,00	0,000	0,000	0,000	0,000	0,000	0,00	0,000	0,000	0,000	0,000	0,000		0,0000	0,0000	0,0000	0,00	0,00	0,00
Ordine Max 1	0,21	0,00	0,00	0,000	0,000	0,000	0,000	0,000	0,00	0,000	0,000	0,050	0,000	0,000		0,0000	0,0000	0,0000	0,00	0,44	0,00
Ordine Min 2	0,00	0,00	0,00	0,000	0,000	0,000	0,000	0,000	0,00	0,000	0,000	0,000	0,000	0,000		0,0000	0,0000	0,0000	0,00	0,00	0,00
Ordine Max 2	0,21	0,00	0,00	0,000	0,000	0,000	0,000	0,000	0,00	0,000	0,000	0,050	0,000	0,000		0,0000	0,0000	0,0000	0,00	0,44	0,00
SA51670LTV Min 12.60 - 50.00		0,85	0,15																		
SA51670LTV Max 12.60 - 50.00	0,28	1,20	0,40	0,035	0,035																
SA51670LTV Min 50.10 - 100.00		0,85	0,15																		
SA51670LTV Max 50.10 - 100.00	0,30	1,20	0,40	0,035	0,035																
1NP302	0,16	1,44	0,24	0,012	0,003	0,030	0,020	0,030	0,00	0,037	0,000	0,023	0,000	0,000	0,0000	0,0060	0,0000	0,0004	0,40	0,41	0,24
1SO902	0,21	1,03	0,28	0,013	0,002	0,020	0,020	0,030	0,00	0,036	0,000	0,000	0,000	0,000	0,0000	0,0060	0,0000	0,0003	0,38	0,39	0,27

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Alessandro Salvatore Monastra
Milan Office 12/11/13

BREMBANA & ROLLE S.p.A.
QCM - L. BENSONI
REVIEWED / ACCEPTED
22 OTT. 2013

			PROVA DI TRAZIONE TENSILE TEST									PROVA DI RESILIENZA IMPACT TEST - CHARPY V-NOTCH TEST						PROVA DI PIEGA BEND TEST				PROVA DI DUREZZA HARDNESS TEST				PROVA DI STRIZIONE Z% TEST	
C00		C01	C01	C02	C03	C11	C12		C13	C14	C10	C41	C02	C03	C01	C42	C43	C02	C51	C52	C50	C01	C30	C31	C32	C53	C54
CAMPIONE SAMPLE	SPESSORE LAMIERA PLATE THICKNESS	POSIZIONE LOCATION (1)	POSIZIONE LOCATION (2)	DIREZIONE ORIENTATION (3)	TEMPERATURA TEST TEMPERATURE [°C]	ReH [Mpa] YIELD STRENGTH	Rm [Mpa] TENSILE STRENGTH	ReH/Rm	A2" ELONGATION	Rp 0,2 [Mpa] PROOF STRENGTH	FORMA PROVINO (4) SHAPE OF TEST PIECE	LARGHEZZA [mm] WIDTH	DIREZIONE ORIENTATION (3)	TEMPERATURA [°C] TEST TEMPERATURE	POSIZIONE LOCATION (2)	SINGOLI VALORI [J] INDIVIDUAL VALUES	MEDIA [J] MEAN VALUE	DIREZIONE ORIENTATION (3)	MANDRINO MANDREL [mm]	ANGOLO ANGLE [°]	ESITO RESULT (5)	POSIZIONE LOCATION (2)	METODO TEST METHOD	SINGOLI VALORI INDIVIDUAL VALUES	MEDIA MEAN VALUE	Z% INDIVIDUAL VALUES	Z% VALORE MEDIO Z% MEAN VALUE
ORDINE Min 1														-20		27	0										
ORDINE Min 2														-20		27	0										
SA51670LTV Min 20.10 - 120.00					20		485		17,0																		
SA51670LTV Max 20.10 - 120.00					20		620		0,0																		
SA51670LTV Min 25.10 - 50.00													L	-40		20	0										
SA51670LTV Min 50.10 - 75.00													L	-35		20	0										
GM374	45,00	2	P	T	20		511		37,3	355	C	10,00	L	-20	P	160 168 112	147						HB	166 167 168	167		
GM396	72,00	2	P	T	20		520		35,7	368	C	10,00	L	-20	P	245 248 229	241						HB	170 168 171	170		

C10
ASME SA-370 FIG. 3 AND FIG. 10 (FIG. 11 a 10x10mm) - SAMPLE TAKEN AFTER PLATE HEAT TREATMENT

D02-D50 CONTROLLO ULTRASONORO / ULTRASONIC EXAMINATION

D02	D03	D04	D05	D06	D07
APPARECCHIATURA EQUIPMENT	N° SERIE SERIAL NO	CONDIZIONI SUPERFICIALI SURFACE CONDITIONS	ACCOPPIANTE COUPLANT	MODALITÀ OPERATIVE PROCEDURE	TARATURA CALIBRATION
GILARDONI RDG450	RDG450-450-140156TC	GREZZO DI LAMINAZIONE AS ROLLED	ACQUA WATER	IN ACCORDO ALLA SPECIFICA ACCORDING TO SPECIFICATION	IN ACCORDO ALLA SPECIFICA ACCORDING TO SPECIFICATION

B07 LAMIERA PLATE	D08 SONDE PROBE	D09 DIAMETRO DIAMETER MM	D10 FREQUENZA FREQUENCE MHZ	D11 ANGOLO Angle °	D12 NORMA DI RIFERIMENTO STANDARD SPECIFICATION	D13 CLASSE DI ACCETTABILITÀ ACCEPTANCE SPECIFICATIONS	D14 ESITO RESULT	D15 INDICAZIONI INDICATIONS	D16 RETICOLO RETICLE	D17 BORDI EDGES
1SO9020403A		mm 25	2,25 MHz	0	ASME-SA578/B + S1		OK	NO INDICATIONS FOUND	100%	
1NP3020905A		mm 25	2,25 MHz	0	ASME-SA578/B + S1		OK	NO INDICATIONS FOUND	100%	

D18 NOTE REMARKS	D19 ENTE ISPETTIVO INSPECTOR	D20 FIRMA SIGNATURE
		METINVEST TRAMETAL S.p.a. F. Andrian III Liv. EN 473

Z01

ITEM		TOLLERANZA DI SPESSORE TOLERANCE ON THICKNESS	TOLLERANZE DI LARGHEZZA TOLERANCE ON WIDTH	TOLLERANZE DI LUNGHEZZA TOLERANCE ON LENGTH	CONDIZIONI SUPERFICIALI SURFACE FINISH	PLANARITÀ FLATNESS
1		ASME SA20/SA20M - 0.30/0.80	-0+100 MM	-0+200 MM	ASME SA20/SA20M	ASME SA20/SA20M
2		ASME SA20/SA20M - 0.30/0.80	-0+100 MM	-0+200 MM	ASME SA20/SA20M	ASME SA20/SA20M

CERTIFICHIAMO che le lamiere elencate sono conformi alla prescrizione dell'ordine, che i controlli della marcatura, dell'aspetto superficiale e dimensionale hanno dato esito positivo.
WE CERTIFY that the above mentioned plates are consistent with the order prescriptions: marking, inspection and measurement without objection.

Z06

VACUUM DEGASSED

Z07	Z03 ENTE COLLAUDO / INSPECTION BODY	Z02
PRODUCED FROM CONTINOUS CAST SLAB AND HAVE A MINIMUN REDUCTION RATIO OF 3 TO 1. ACCORDING TO ASME II PART A ED. 2010+ADDENDA 2011. FULLY KILLED, FINE GRAIN STEEL. Value of Mn maximun in derogation permitted up to 1.50% Plates acc. to PED 97/23/EC	TIMBRO DELL'ISPETTORE STAMP OF THE INSPECTION REPRESENTATIVE	METINVEST TRAMETAL S.p.a. F. Andrian Lab. Test Resp.le

BREMBANA & MOLLE S.p.A.
QCM - L. BENSONI
REVIEWED / ACCEPTED
22 OTT. 2013

LABORATORIO CONTROLLO QUALITA'

ISPESL	Istituto Superiore Prevenzione e Sicurezza del Lavoro		
FS	Ferrovie dello Stato	BV	Bureau Veritas
LR	Lloyd's Register of Shipping	DNV	Det Norske Veritas
RINA	Registro Italiano Navale	MMI	Marina Militare Italiana
IIS	Istituto Italiano della Saldatura	TUV	Technischen Uberwachungs Vereine

Sigma Tre

TEST - RESEARCH - EXPEDITING

Rapporto di prova / Test Report: **2013/7996/A/PM**

Garbagnate M.ero: 2013 December 18

Ordine Interno / Internal Order: 2013/3120

Materiale Ricevuto il / Material Received on: 2013 December 06

Prove Eseguite il / Test Performed on: 2013 December 18

Ditta/Messrs — *Request by*

BREMBANA & ROLLE S.p.A.

Via Villino, 1

24030 VALBREMBO BG

Campione sottoposto a prova / Tested Specimen

Plate 4042-23
Test 1SO9020403A
Dimensions : Thk 45 mm

Materiale dichiarato / Material declared

ASME SA 516 Gr. 70

Specifiche di Prova / Test Specifications

ASME II Part A-2010 Ed. 2011 Add
ASME VIII Div.1-2010 Ed. 2011 Add
ASME SA 516

Job 4042 - test sheet 223/13

Colata / Heat: 1SO902 1SO9020403A

Quando non specificato considerare valida l'ultima versione della norma citata
When not specified the last version of the mentioned standard is to be considered valid

Prova di Trazione - Tension Test

Identificazione campione Sample identification	Posizione prova Test position	Dimensioni Dimensions Ø o WxThk mm	Sezione Area So mm^2	Tratto utile Gage length Lo mm	Temperatura Temperature °C	Snervamento Yield strength Rp 0,2% MPa ≥260	Carico Rottura Tensile strength Rm MPa 485÷620	Allungamento Elongation A % ≥21	Strizione Reduction Z %
4042-23-MIN	Tr	12.49	122.52	50	amb	299	495	35.1	70.6

Prova di Resilienza - Impact Test

Identificazione campione Sample identification	Posizione prova Test position	Dimensioni Dimensions mm	Intaglio Notch type	Temp. Temp. °C	Risultati prova Test results Joule			Media Average ≥27
4042-23-MIN	Tr	10x10x55	KV	-20	108.1	146.6	155.9	136.9

Prova di Durezza - Hardness Test

Identificazione campione Sample identification	Tipo durezza Hardness type	Risultati prova Test results max 200
4042-23-MIN	HBW 10/3000	131-134-134

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Milan Office

L	Longitudinale	Longitudinal
Tr	Trasversale	Transversal
W	Larghezza	Width
Thk	Spessore	Thickness

Note : Test performed after Heat Treatment MIN : 610±10 °C x 2.5 hours - Heating and cooling 80°C/h

CONFORM

Tecnico-Engineer G.Vigano'

cc SIGMATRE srl

WITNESSED
REVIEWED
DATE 21/11/14
SIGNATURE

BREMBANA & ROLLE S.p.A.
QCM - L. BENSONI
REVIEWED / ACCEPTED
13 DEC. 2014

PM14-2012-05

Il presente rapporto riguarda esclusivamente i campioni testati e non può essere riprodotto parzialmente senza l' approvazione scritta del laboratorio di prova.
The present report covers exclusively the samples tested and it cannot be reproduced partially without written approval by the test laboratory

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Mail sigmatre@sigmatre.it
P.IVA 01516910138 - C.F. 05544130153
CCIAA Como 195838 - Trib. Como 17954

- Prove Meccaniche e Tecnologiche
- Analisi Chimiche e Prove Corrosione
- Esami Metallografici
- Controlli Non Distruttivi
- Corsi di Qualifica Personale e Saldatori

- Mechanical and Technological Tests
- Chemical Analysis and Corrosion tests
- Metallographic Examination
- Non Destructive Tests
- Training for Personnel and Welders Qualification

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Trib. Milano n.169930-5000-30
Camera Commercio Milano 938573
N. posizione mecc. MI 055315
Cap. Soc. € 2.000.000,00 i.v.

Certificate N. **16012803** Sheet 1 of 5 Rev 00

Order N. 1610 rev 001 JOB 4131
Pos N. 006
Condition machined
Heat treatment Quenched and tempered

Customer
BREMBANA&ROLLE Srl
VIA VILLINO, 1 - (BG) - 24030 VALBRERMBO (BG) Italia

Material Description: N. 3 FORGING TEST COUPONS DIM. 700 x 150 x 159 mm - MK EXT 2 - ITEM 1-146-D

Test n.	Heat n.	Material Grade	Drawing n.
767	16791	SA 765 Gr.2	M.F.= 150*159*700

Mechanical Tests

Tensile test Ø mm 12.5 - Gage Length mm 50 Area mm² 122.6 -
Impact test Section mm 10x10 - Length mm 55 -

Specification Reference

Applicable Specification	Tensile Test: Direction Long. Transv. Tang.	Temp. °C	Yield Strength Rp 0,2 Mpa Min	Yield Strength Rp 0,2 Mpa Max	Modulus Elasticity E Mpa	Tensile Strength Rm Mpa Min.	Tensile Strength Rm Mpa Max	Elongation A% Min.	Reduct. of area Z% Min.	Impact Test: Temp. °C	Impact energy KV J Min	Impact energy KV J Average	Lateral Expansion mils Min.	Shear Area % Min.	Hardness Test HB 10/3000 Test piece Min.	Hardness Test HB 10/3000 Test piece Max	Note Test location
ASME SA765 GR II, 2015 Edition - B&R spec. 4131MRS201 rev. 0	Long.	20	250			485	655	22	30	-45	16	20				200	
	Long.									-36	20						

Test Results

Tests n.														
767	Long 1/4TxT	20	329		523	31,8	65,3	-45	99-90-85	31,5-31,5-27,6	45-45-40	152÷153		
767B	Long 1/4TxT							-36	110-126-100	35,4-39,4-35,4	45-45-45	150÷152		
767A	Long 1/4TxT	20	308		505	33,2	66,1							

Lloyd's Register Verification Limited
Umberto Breda
Authorised Inspector - NDT No. 13615 ABN
☐ Witnessed ☑ Reviewed
Date: 5/APRIL/16
REVIEWED ALL PAGES

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Alessandro Salvatore Monastra
Milan Office

Notes: Inspection performed according to B&R doc. 4131MRS201 rev. 0 - ASME II Part A & D, ASME VIII Div. 2, 2015 Edition

Test n. 767 carried out in quenched and tempered condition - Test n. 767B carried out after min. PWHT at 620°C (required 620°C ± 10°C) fo 4h heating and cooling rates 50°C/h (required 40÷55°C/h) above 430°C
Test n. 767A carried out after max PWHT at 620°C (required 620°C ±10°C) for 12h heating and cooling rates 50°C/h (required 40÷55°C/h) above 430°C

We certify that all requirements of the material specification and all special requirements of Part 3 para 3.2.6.1 and 3.3.1 of ASME VIII Div. 2, 2015 Edition, which are to be fulfilled have been complied with

LR Ref.: MLN1691403

Compiler Casé Antonella ☒ Conforming ☐ Non-Conforming

Quality Control	*Date*	*Inspection Certificate*	*Inspection Authority*
Giudici Marco	28.10.2016	According to EN 10204 3.2	Lloyd's Register EMEA A member of the Lloyd's Register group ☑ Witnessed ☐ Monitored ☐ Reviewed Giuseppe Floriello Milan Office

1 NOV 2016

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N. posizione mecc. MI 055315
Cap. Soc. € 2.000.000,00 i.v.

Certificate N. **16012803** Sheet 2 of 5 Rev 00

Order N.: 1610 rev 001 JOB 4131
Pos N. 006
Condition machined
Heat treatment Quenched and tempered
Material Description : N. 3 FORGING TEST COUPONS DIM. 700 x 150 x 159 mm - MK EXT 2 - ITEM 1-146-D

Customer
BREMBANA&ROLLE Srl
VIA VILLINO, 1 - (BG) - 24030 VALBRERMBO (BG)
Italia

Test n.	Heat n.	Material Grade	Drawing n.
767	16791	SA 765 Gr.2	M.F.= 150*159*700

Chemical analysis

Specified Chemical Composition

Applicable Specification: ASME SA 765/SA 765M Book 2015 + BREMBANA & ROLLE 4131MRS201 Rev. 0

	C%	Mn%	Si %	P%	S%	Cr%	Ni%	Mo%	Al%	Cu%	Sn%	V%	Ti%	Nppm	Nb%	B%	As%	Sb%	JF	XF	Co%	Ca%	CE%	Hppm
Min		0,600	0,150																					
Max	0,220	1,350	0,350	0,020	0,020	0,400	0,500	0,100	0,050	0,350		0,050												
Heat n.	**Ladle Analysis**																							
NUNKI STEEL 16791	0,181	1,175	0,234	0,0105	0,0006	0,19	0,13	0,04	0,028	0,15	0,008	0,006	0,003	101	0,002	0,0004	0,005	0,003	260,66	15,70		0,0002	0,443	1
	Melting process : E.A.F. + L.F. + V.D.																							
CHECK ANALYSIS 16791	0,194	1,19	0,25	0,01	0,001	0,203	0,144	0,062	0,033	0,17	0,01	0,005	0,002		0,002	0,0002	0,0056	0,0035	288,00	16,31		0,0001	0,467	
	Melting process:																							
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Notes:

Compiler Casé Antonella

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Quality Control	*Date*	*Inspection Certificate*	*Inspection Authority*
Giudici Marco	28.10.2016	According to EN 10204 3.2	

BREMBANA & ROLLE S.P.A. ALZANO LOMBARDO (BG) - ITALY Q.C. INSPECTION P.S.CARICA ATG 4 NOV. 2016

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Certificate N. **16012803** Sheet 3 of 5 Rev 00

Order N. 1610 rev 001 JOB 4131
Pos N. 006
Condition machined
Heat treatment Quenched and tempered

Customer
BREMBANA&ROLLE Srl
VIA VILLINO, 1 - (BG) - 24030
VALBRERMBO (BG)
Italia

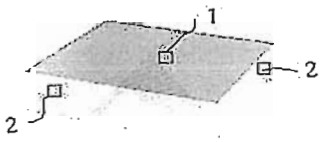
Material Description: N. 3 FORGING TEST COUPONS DIM. 700 x 150 x 159 mm - MK EXT 2 - ITEM 1-146-D

Test n.	Heat n.	Material Grade	Drawing n.
767	16791	SA 765 Gr.2	M.F.= 150*159*700

Ultrasonic Examination

Specification : B&R doc. 4131MRS201 rev. 0 ASME SA388 - ASME VIII div. 2, 2015 Edition, part 3 acceptance criteria according to para 3.3.4		Search Unit			Calibration Data				
		Used Probe	Frequency MHz	Dimension (mm)	Angle	Pos	Type and serial number	Calibration Sett (db)	Inspection Sett (db)
Surface Status:	machined	SEB4 EN	2	Ø 24	0°	1-2	Krautkramer SN 60714		
Coupling :	Cellulose								
Apparatus Type :	Krautkramer USN 58L mtr 433								
Apparatus Type :									
Calibration Method :	according to specification								
Reference Block :	Thickness of piece								
Test Results :	No indication found to declare								
100% ultrasonic examination performed according to specification with satisfactory result									

SKETCH



Notes: cable used type RG58 Lemo1-Lemo2

Compiler Casé Antonella

Conforming ☒ Non-Conforming ☐

Quality Control	***Date***	***Inspection Certificate***	***Inspection Authority***
Radice Simone NDT Level II SNT-TC - 1A and UNI EN ISO 9712	28.10.2016	According to EN 10204 3.2 BREMBANA & ROLLE S.p.A. ALZANO LOMBARDO (BG) ITALY Q.C. INSPECTOR 17 NOV. 2016	Lloyd's Register EMEA A member of the Lloyd's Register group Witnessed ☐ Monitored ☐ Reviewed Giuseppe Floriello Milan Office

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CERT ISO 9001 ISO/TS 16949
APPROVED DIRECTIVE 97/23 EC

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N. posizione mecc. MI 055315
Cap. Soc. € 2.000.000,00 i.v.

Certificate N. 16012803 Sheet 4 of 5 Rev 00

Order N. 1610 rev 001 JOB 4131
Pos N. 006
Condition machined
Heat treatment Quenched and tempered

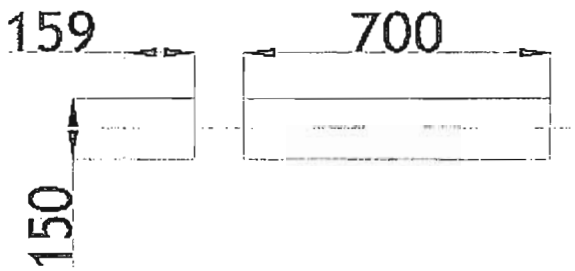
Customer
BREMBANA&ROLLE Srl
VIA VILLINO, 1 - (BG) - 24030 VALBRERMBO (BG) Italia

Material Description: N. 3 FORGING TEST COUPONS DIM. 700 x 150 x 159 mm - MK EXT 2 - ITEM 1-146-D

Test n.	Heat n.	Material Grade	Drawing n.
767	16791	SA 765 Gr.2	M.F.= 150*159*700

Dimensional Report

- T 767 -2 - H 16791 - SA765M-II-036 QT - MK EXT 2 - JOB 4131 - PO 001610/1 ITEM 006 - LR STAMP
- T 767 -3 - H 16791 - SA765M-II-036 QT - MK EXT 2 - JOB 4131 - PO 001610/1 ITEM 006 - LR STAMP
- T 767 -4 - H 16791 - SA765M-II-036 QT - MK EXT 2 - JOB 4131 - PO 001610/1 ITEM 006 - LR STAMP



Test n.	Point																								
						Ra µm																			
required mm	150	159	700			<6,3																			
	+2/-0	+2/-0	+10/+30																						
T 767 -2	151	160	730			1,96																			
T 767 -3	150,7	161	714			2																			
T 767 -4	151,5	160,6	730			2,05																			

Notes:

Compiler Casé Antonella

Conforming ☒ Non-Conforming ☐

Quality Control	*Date*	*Inspection Certificate*	*Inspection Authority*
Radice Simone	28.10.2016	According to EN 10204 3.2	Lloyd's Register EMEA A member of the Lloyd's Register group ☑ Witnessed ☐ Monitored ☐ Reviewed Giuseppe Floriello Milan Office

SOCIETÀ GIVA ROLLE S.P.A. ALSAGNASCO (PD) ITALY Q.C. INSPECTOR P. SACCAROLA DATE 11 NOV. 2016

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CERT AD 2000 WO/1PD 160
APPROVED DIRECTIVE 97/23 CE

Trib. Milano n.169930-5000-30
Camera Commercio Milano 938573
N. posizione mecc. MI 055315
Cap. Soc. € 2.000.000,00 i.v.

Certificate N. **16012803** Sheet 5 of 5 Rev 00

Order N. 1610 rev 001 JOB 4131
Pos N. 006
Condition machined
Heat treatment Quenched and tempered

Customer
BREMBANA&ROLLE Srl
VIA VILLINO, 1 - (BG) - 24030 VALBRERMBO (BG) Italia

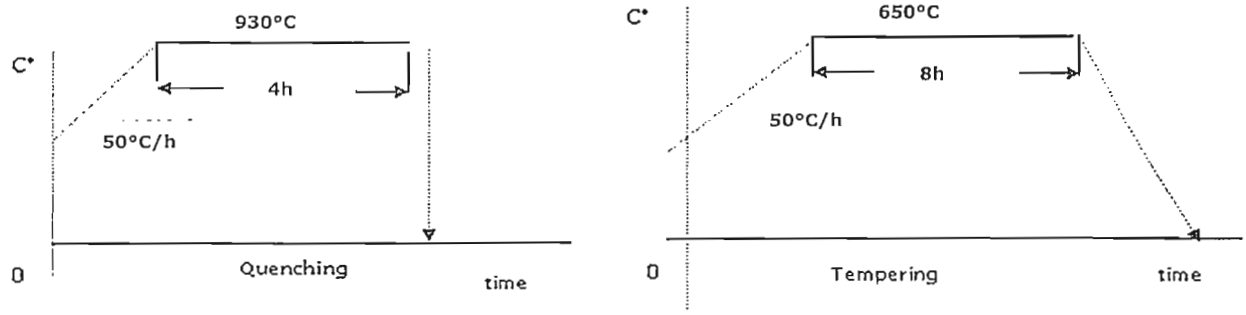
Material Description: N. 3 FORGING TEST COUPONS DIM. 700 x 150 x 159 mm - MK EXT 2 - ITEM 1-146-D

Test n.	Heat n.	Material Grade	Drawing n.
767	16791	SA 765 Gr.2	M.F.= 150*159*700

Heat Treatment

Furnace n. 8 — Specification : B&R doc. 431MRS201 rev. 0
Temperature Monitoring Method: Furnace set Termocouple

	REQUIRED	REQUIRED		
Heat Treatment Type	Quenching	Tempering		
Entry Furnace Temperature	20°C	20°C		
Heating Rate	<100°C/h	<80°C/h		
Holding Temperature	930°C	min. 650°C		
Holding Time	1min/mm thk	1h/inch thk		
Cooling Rate				
Exit Furnace				
Type cooling	water cooling	air cooling		
Heat Treatment Diagramm				



Notes:

Compiler Casé Antonella — Conforming ☒ Non-Conforming ☐

Quality Control	*Date*	*Inspection Certificate*	*Inspection Authority*
Giudici Marco	30.09.2016	According to EN 10204 3.2	Lloyd's Register EMEA A member of the Lloyd's Register group ☐ Witnessed ☐ Monitored ☑ Reviewed Giuseppe Floriello Milan Office

BREMBANA & ROLLE S.P.A. ITALY PD — Q.C. INSPECTOR — DATE 11 NOV. 2016

Air Liquide Welding France S.A.
25 Boulevard de la Paix
CS 30003 Cergy
95895 CERGY SAINT CHRISTOPHE
France
Telefono: +33 134213333
Fax: +33 134213130
Internet: www.airliquidewelding.com

Product Certificate

Cliente:	Certificato N°:	Ordine N°:	Bolla N°:
BREMBANA & ROLLE SPA VIA VILLINO, 1 24030 VALBREMBO (BG) Italy	30094503	002377	2227054
	Reference Number:	Quantità:	UM:
	W000282617	960.00	KG
Designazione:	CARBOFIL 1 1.2X0016XB300XP		Lotto N°: 3917104
Classificazione:	AWS- A 5.18: ER 70S-6 EN ISO 14341-A: G42 4 M21 3Si1 / G42 3 C1 3Si1 M21, C1		

Si confermano le proprietà sotto riportate per i consumabili di saldatura da noi forniti

Analisi chimica del deposito:
In accordo a EN 10 204-3.1 PRODUCT

C	Mn	Si	S	P	Cr	Ni	Mo	Al	Cu
0,073	1,420	0,816	0,014	0,008	0,026	0,012	0,002	0,001	0,078
V	Ti+Zr								
0,001	0,030								

Proprietà meccaniche del deposito:
In accordo a EN 10 204-2.2 WELD METAL

Tensile Test according to EN ISO 6892-1					Impact Strength Test according to EN ISO 148--1		
Test Temp. °C	Snervamento ReH N/mm²	Trazione Tensile N/mm²	Allungamento %	Z %	Test Temp. °C	Resilienza Joule(Charpy-V)	Trattamento Termico
20	506	595	30		-20 -40	117 72	AS WELDED

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
Witnessed Monitored Reviewed
Alessandro Salvatore Monastra
Milan Office

BREMBANA & ROLLE S.p.A.

08 JAN 2018

Mattia Fusi
QA Manager - Storo
Data: 04/12/2017

AIR LIQUIDE WELDING FRANCE
25 Boulevard de la Paix
CS 30003 CERGY SAINT CHRISTOPHE
95895 CERGY PONTOISE CEDEX
FRANCE
Phone: +33 1 342 13 333
Fax : +33 1 342 13 130
Internet : www.airliquidewelding.com

Product Certificate

Customer:	Certificate No.:	Order No.:	Delivery Note:
BREMBANA & ROLLE SPA	2110310380023371	000631	9676
	Date:	**Quantity** Quantity:	**UM**
	13/03/17	160,00	KG Kilograms

Trade Name: FLUXOFIL 14HD 1.2X0016XB300

Batch No.: 421706033

Classification: EN ISO 17632-A:T463PM1H5
AWS A5.20:E71T1-MJH4

Gas: Mix: Ar/CO2

We confirm following properties for the welding filler metals delivered by us.

Chemical Analysis:

Certificate Type EN 10 204-3.1 WELD METAL

C	Mn	Si	P	S	Al	Cr	Ni	Mo	V
0.048	1.564	0.433	0.010	0.006	0.015	0.034	0.012	0.002	0.020

Cu	Nb	B	Ti						
0.076	0.010	0.0029	0.062						

Mechanical Properties:

Certificate Type EN 10 204-2.2 WELD METAL

Tensile Test according to EN ISO 6892-1					Impact Strength Test according to EN ISO 148-1		
Test Temp. °C	Yield Strength Rp0,2 N/mm²	Tensile Strength N/mm²	Elongation %	Z %	Test Temp. °C	Impact Strength Joule (Charpy-V)	heat Treatment
+20	530	600	25		-30	100	As Welded

06.04.2017

Your Contact Person :
Quality Corporate Department
Airliquide Welding France
Tél. : 33/1 34 21 33 33
Fax : 33/1 34 21 31 30
ETC -Oerlikon
Tél. : 39/045 82 91 511
Fax : 39/045 82 91 500

Bogdan Serban
QA Manager – Buzau Plant

This document has been issued by computer and needs no signature.

BREMBANA & ROLLE S.p.A.
WELDING DEPT - A. BANA
☒ REVIEWED ☐ WITNESSED
07 APR 2017

Lloyd's Register Verification Limited
A member of the Lloyd's Register group
☐ Witnessed ☐ Monitored ☑ Reviewed
Aiessandro Salvatore Monastra
Milan Office 7/03/18

AIR LIQUIDE WELDING

B&R GROUP PROCEDURE

PROCEDURE SPECIFICATION FOR REPAIRING OF WELD

PR.N° 121 WR

REV.0

REFERENCE DOCUMENTS:

ASME BPV CODE Sections I, VIII div. 1, VIII div. 2 Ed.2021

ASME Power Piping B31.1 Ed.2020

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Gianluca Cestari
Authorized Inspector N.B. No. 16408
Milan Office 28/06/2022

A.I.

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Alessandro Monastra
Authorized Inspector N.B. No. 13420
Milan Office 21 GIU. 2022

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Flavio Zanon
Authorized Inspector N.B. No. 13421
Milan Office 27-06-2022

A.I.

LRQA Verification Limited
☐ Witnessed ☑ Reviewed 2nd
Luca Rivaroli
Authorized Inspector N.B. No. 13097
Milan Office 27/04/22
Accepted

REVIEW FOR COMPLIANCE WITH REFERENCE CODE / DOCUMENT REVISION

Date	Code Edition	TP

Rev.	Date	Description	Issued by	Reviewed by	Approved by TP
0	27-01-2022	Issued for approval	M. Hamminga	S.L Rigobon	N. Tosto

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 121 WR

REV.0

	INDEX		INDICE
1.	SCOPE	1.	SCOPO
2.	MATERIAL	2.	MATERIALE
3.	EXAMINATION	3.	ESAME
4.	EVALUATION OF DEFECT	4.	VALUTAZIONE DEL DIFETTO
5.	REPAIRING	5.	RIPARAZIONE
6.	INSPECTION AND TESTING OF REPAIRS	6.	ISPEZIONE E COLLAUDO DOPO RIPARAZIONE

ABBREVIATIONS:
A.I. Authorized Inspector
P.W.H.T. Post-Weld Heat Treatment
N.D.E. Non-Destructive Examination

B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 121 WR

REV.0

1. Scope	1. Scopo
This specification outlines the system used to repair defective welds (weld metal and heat affected zone). Defective welds may be repaired, provided acceptance by the A.I. is first obtained for the method and extent of repairs. The requirements of this procedure do not apply when the welded repairs are minor restoration of the weld surface.	Questa specifica delinea il sistema utilizzato per riparare le saldature difettose (metallo di saldatura e zona termicamente alterata). Le saldature difettose possono essere riparate, previa accettazione da parte dell'A.I. per il metodo e l'entità delle riparazioni. I requisiti di questa procedura non si applicano quando le riparazioni saldate sono un ripristino minore della superficie di saldatura.

2. Material	2. Materiale
The type of material shall be as specified on relevant drawings and specification.	Il tipo di materiale deve essere quello specificato nei disegni e nelle specifiche pertinenti.

3. Examination	3. Esame
3.1 The defect may be detected by means of visual examination, Liquid penetrant test, magnetic test, or ultrasonic test, hydrostatic/pneumatic test, as specified by applicable Code requirements..	3.1 Il difetto può essere rilevato mediante esame visiva, test con liquido penetrante, test magnetoscopico, o indagine ultrasonora, test idrostatico/pneumatico, come specificato dai requisiti del Codice applicabile.
3.2 Additional tests and investigations methods may be used, in order to detect the full extension of the defective area	3.2 Ulteriori metodi di prova e di indagine possono essere utilizzati al fine di accertare la piena estensione dell'area difettosa.

4. Evaluation of defect	4. Valutazione del difetto
4.1 The defect shall be evaluated as specified by applicable Code standards and User specifications.	4.1 Il difetto dovrà essere valutato come specificato dalle norme del Codice applicabili e dalle specifiche dell'Utilizzatore.

5. Repairing	5. Riparazione
All unacceptable defects shall be treated as follows: 5.1 The defective welds shall be removed by grinding, machining, or arcair process. The groove shall be re-welded by qualified welders, using matching consumables and according to a qualified welding procedure specification (to be submitted to the A.I. and User for their acceptance prior to start with any repairing activity). Before re-welding, the repairing area shall be re-examined by the N.D.E. required by the Code and User specifications, to verify the full removal of all defect.	Tutti i difetti inaccettabili devono essere trattati come segue: 5.1 L'area difettosa deve essere rimossa mediante molatura, lavorazione a macchina o di scriccatura con arcair. Se necessario, un deposito di saldatura deve essere applicato da saldatori qualificati, utilizzando materiali di consumo corrispondenti e secondo una specifica della procedura di saldatura qualificata (da presentare all'AI e all'Utilizzatore per la loro accettazione prima di iniziare qualsiasi attività di riparazione). Prima della saldatura, l'area di riparazione deve essere riesaminata con N.D.E. richiesto dal Codice e dalle Specifiche dell'Utilizzatore, per verificare la completa rimozione di ogni difetto.

5.2 Repairing of welds may be made after the final P.W.H.T. and before the final hydrostatic test, without additional P.W.H.T. only if permitted by Code / User specifications. Such repair shall be recorded on Data Report	5.2 La riparazione mediante saldatura può essere effettuata dopo il P.W.H.T. e prima della prova idrostatica finale, senza P.W.H.T. solo se consentito dal codice e dalle specifiche dell'utilizzatore. Tale riparazione dovrà essere registrata su Data Report.
5.3 Defective welds that cannot be satisfactorily repaired shall be rejected.	5.3 Le saldature difettose che non possono essere riparate in modo soddisfacente devono essere respinte.

6. Inspection and testing after repair	**6. Ispezione e collaudo dopo riparazione**
Repaired areas shall be re-inspected in accordance with applicable Code, and User specification. The report of these repairs shall be made available to the **A.I.** and User for their acceptance.	Le aree riparate devono essere nuovamente ispezionate in conformità con il Codice applicabile e le specifiche dell'utilizzatore. Il rapporto di tali riparazioni deve essere messo a disposizione dell'A.I. e dell'utilizzatore per loro accettazione.

BREMBANA&ROLLE
Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)

ULTRASONIC TEST EXAMINATION

REPORT No.
PQR 63/17 UT
Sheet 1 of 1

PURCHASER DATA		MANUFACTURER DATA	
PURCHASER	/	JOB No.	/
PLANT	/	DWG. No.	/
P.O.	/	PROCEDURE No.	004-UTA-23
ITEM	PQR 63/17	SERIAL No.	/

APPLICABLE CODE:
ASME VIII/1 - App.12 Ed. 2023
ASME IX – QW 191.2 Ed. 2023

APPLICABLE STANDARD/SPECIFICATION:
ASME V - Art.4 Ed. 2023

Object: INTEGRATIVE TEST COUPON FOR PQR 63-17

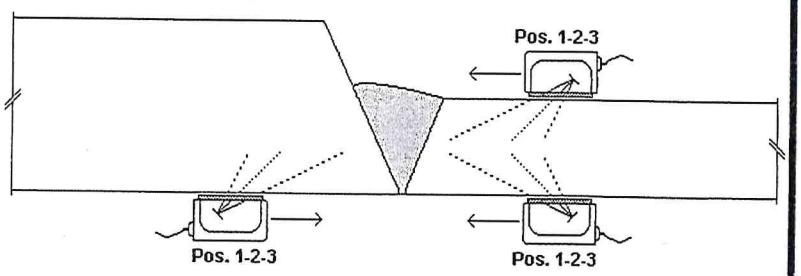
Material	SA 516 Gr.70 – SA 240 tp304L	**Surface Condition**	As welded	**Material Condition**	After PWHT
Equipment Used	**Type** Krautkramer USN 60	**Serial No.**	14C01JLJ	**Date of Calibration**	See calibration report
Couplant	Tylose Paste / Gel	**Reference block**	☐ V1 ■ V2	**Calibration Block**	UTDIS-01 Thk. 10 mm

Primary reference reflector				Control technique	
☐ Flat bottom hole (FBH)	mm	■ Side drilled hole (SDH)	3 mm	■ Contact	■ Impulse echo
☐ Back-wall echo (BW)		☐ Notch type	% wall thk.	☐ Tandem	☐ Immersion

Probes

Manufacturer	IMG	IMG	IMG		
Brand name	LFI 25-45-2 fp30	LFI 25-60-2 fp20	LFI 25-70-2 fp10		
Serial number	6173	5340	6176		
Wave type	LONGITUDINAL	LONGITUDINAL	LONGITUDINAL		
Beam angle	45°	60°	70°		
Frequency	2 Mhz	2 Mhz	2 Mhz		
Size	8X14mm	8X14mm	8X14mm		
Ref. Level gain / Damping / Reject	Db 44-50	Db 46-52	Db 48-54		
Search unit cable type & Length	Coaxial – 1,3 Mt.	Coaxial – 1,3 Mt.	Coaxial – 1,3 Mt.		
Probe position	1	2	3		

Sensitivity level	Reflector at 80% SDH
Scanning level	100% + 6dB
Evaluation level	> 20% of DAC
Recording level	≥ 50% of DAC



Test Result

■ Acceptable ■ Not found reportable indications ☐ Reportable indication: see sheet ☐ Not acceptable

BREMBANA & ROLLE S.p.A.

OPERATOR / EVALUATOR
BREMBANA&ROLLE
NICOLA TROLIO
DATE: 30/07/2024
Q.C.I.

BREMBANA & ROLLE S.P.A.
ALBINASEGO - PD - ITALY
Q.C. MANAGER M. GALLI
DATE: 30/07/24
M. GALLI – Q.C.M.

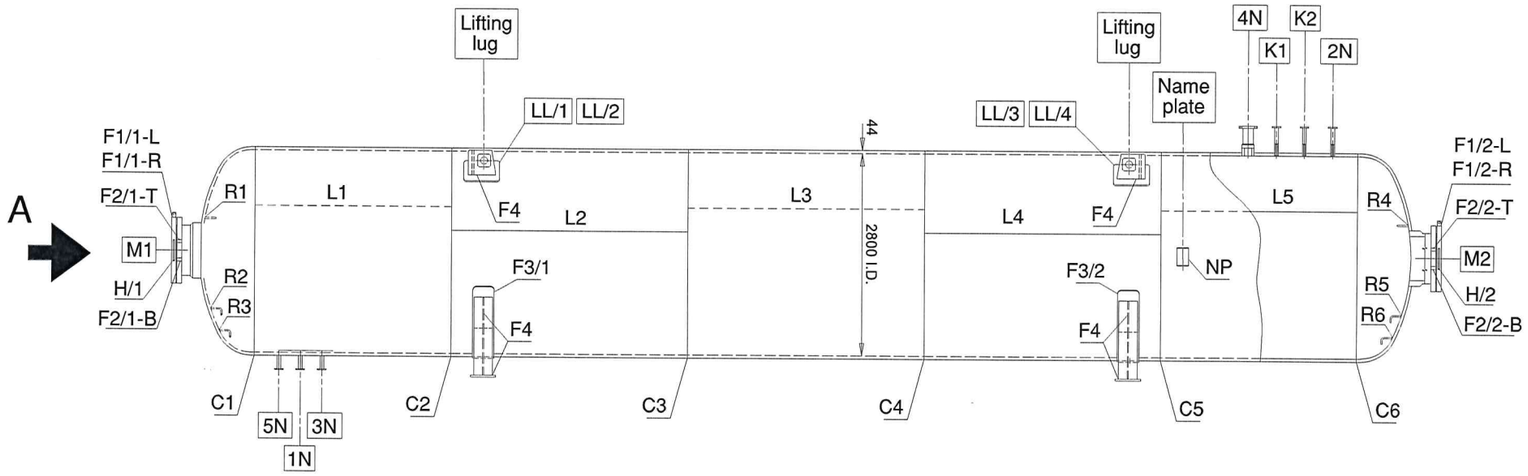
INSPECTION AGENCY

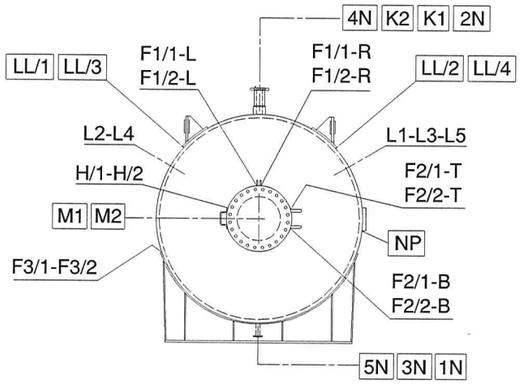
BUREAU VERITAS ITALIA WELDING 66
IT FILE: 245F.7713291.138
DATE: 30 LUG. 2024
WITNESSED ☐ REVIEW ☒

Fabrication site: Albignasego – PD – ITALY

Section 10

Welding map

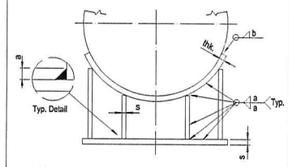




VIEW FROM -A-

ROSETTI MARINO	
1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED
NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.	
Sign	Date
D.Cenacchi	17/06/2024

SUPPORT SADDLES DETAIL



Ref. to Note 2	"a"= LEG (mm)
s(mm) =< 6	3
6 < s(mm) <= 12	5
12 < s(mm) <= 20	6
s(mm) > 20	8

	"b"= LEG (mm)
thk.(mm)	b=thk./2

NOTES :

1) THIS STANDARD IS APPLICABLE FOR SUPPORT SUBJECT TO COMPRESSIVE LOAD.
2) "s" IS THE THICKER PLATE TO BE JOINTED.

REFERENCE :

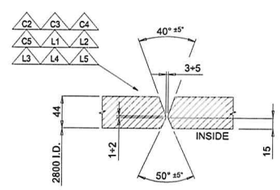
1) AWS D1.1/D1.1M : 2015 - Table 5.7
2) Uhde PS-UN V416-01 Part 2 : 2003-02 - ITEM U 8.7

Internal standard for fillet weld

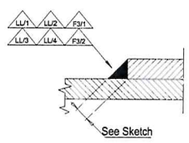
NOTE

1) FOR EQUIPMENT ASSEMBLY, AND BILL OF MATERIAL WITH GENERAL NOTES SEE DRAWINGS: DWG. 23096-01-EGA1 & DWG. 23096-01-EBM1 .

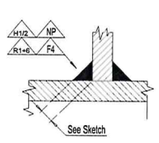
LRQA Verification Limited
Witnessed Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 17. SEP. 2024



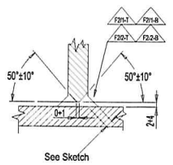
LONGIT. & CIRCUMF. WELDING DETAIL



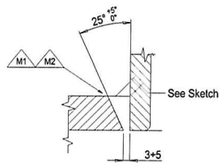
FILLET WELD



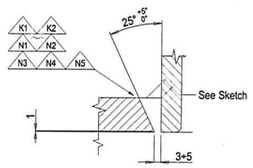
FILLET WELD



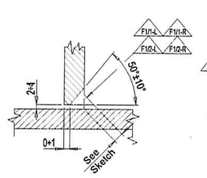
FULL PENETRATION WELDING DETAIL



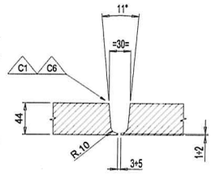
MANHOLE WELDING DETAIL



NOZZLE - SHELL WELDING DETAIL

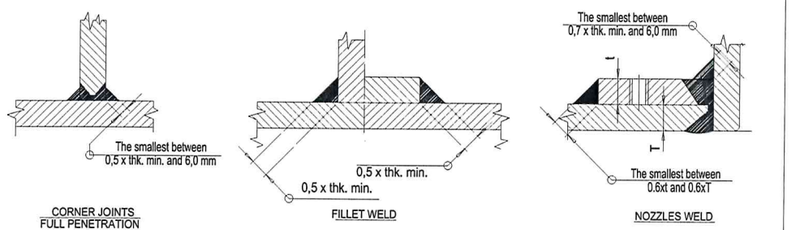


FULL PENETRATION WELDING DETAIL



HEAD CIRCUMF. WELDING DETAIL

SKETCH



Typical weld throat dimensions (if not otherwise quoted on construction drawing)
ASME VIII DIV.2

Date : 30-06-2021
REV.0

FIT-UP MISALIGNMENT TOLERANCES Table 6.4 (ASME VIII Div.2-2021) 3		
Section Thickness, mm	Joint Category A	B,C and D
13 (1/2 in.) =< t	t/4	t/4
13 (1/2 in.) < t =< 19 (3/4 in.)	3 mm (1/8 in.)	t/4
19 (3/4 in.) < t =< 38 (1 1/2 in.)	3 mm (1/8 in.)	5 mm (3/16 in.)
38 (1 1/2 in.) < t =< 50 (2 in.)	3 mm (1/8 in.)	t/8
t > 50 (2 in.)	min [t/16, 10mm (3/8 in.)]	min [t/8, 19mm (3/4 in.)]
GENERAL NOTE : t is the nominal thickness of the thinner section at the weld joint.		

0094
17. SEP. 2024

BREMBANA&ROLLE — VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.
PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK
PURCHASE ORDER No.: 1723001756 123A90A
LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.
B&R CAD FILE No: 23096-01-EBM1.dwg
MFR'S S.N. 23096-01-SNA/F
B&R DRAWING No. 23096-01-EWM1

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
3	14/06/2024	AFD	MAT	DPA	ACCEPTED FOR CONSTRUCTION (AFC)
2	13/03/2024	AFD	MAT	DPA	ACCEPTED FOR CONSTRUCTION (AFC)
1	07/03/2024	AFD	MAT	DPA	ACCEPTED FOR CONSTRUCTION (AFC)
0	05/12/2023	AFD	MAT	DPA	ISSUE FOR REVIEW (IFR)

CROSSWIND — ROSETTI MARINO

WELDING DETAIL DRAWING
HYDROGEN STORAGE VESSEL ITEM : V-25001A/F

CONTRACT NO. CW-1-WP4-2023-05 / H2 STORAGE — SCALE 1:35

DRAWN	CHECKED	APPROVED	DATE
A.FRANCO	M.TONIOLO	D.PASSERINI	14/06/24

A1 — DRAWING NO. 1723001756-WEL-DD-00014 — SHEET 1 — REV. 3

File Name : 1723001756-WEL-DD-00014.DWG

Fabrication site: Albignasego – PD – ITALY

Section 11

List of Welders and Qualified Operators

BUREAU VERITAS

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO

PRS N°0076

Area : ITALY
Region :

Certificato No. : **QS-AP-ITA-24-00260-rev.0**
Certificate No. :

Rif. Interno : 24.SF.7713291.138
Internal No. : P10546/24/CB/cb

PERMANENT JOINING PERSONNEL QUALIFICATION APPROVAL CERTIFICATE

CERTIFICATO DI APPROVAZIONE DELLE QUALIFICHE DI PERSONALE ADDETTO ALLE GIUNZIONI PERMANENTI

Manufacturer: Brembana&Rolle S.p.A.
Address: Via Villino 1, 24030, Valbrembo (BG) - Italy
IT File: 24.SF.7713291.138

Certificate n° *N° Certificato*	Name and surname *Nome e cognome*	Stamp *Punzone*	*Reference standard Norma di riferimento	Third part recognized or No.Bo. Terza parte riconosciuta o Organismo Notificato	Starting date of qualification Data inizio validità della qualifica	Date of approval of certification Date di approvazione della certificazione	**Expiration date of certification *Data di scadenza della certificazione*
S03 12/19	SUNEESAN PARIKKATHRA	S03	ASME IX	Lloyd's Register	07/02/2019	18/09/2024	17/09/2026
S03 01/19	SUNEESAN PARIKKATHRA	S03	ASME IX	Lloyd's Register	22/01/2019	18/09/2024	17/09/2026
S06 04/23	CRISTIAN GIUSTINIONI	S06	ASME IX	Bureau Veritas	02/03/2023	18/09/2024	17/09/2026
S06 01/23	CRISTIAN GIUSTINIONI	S06	ASME IX	Bureau Veritas	01/03/2023	18/09/2024	17/09/2026
S20 12/19	CONSTANTIN PRIBESCU	S20	ASME IX	Lloyd's Register	07/02/2019	18/09/2024	17/09/2026
S20 01/19	CONSTANTIN PRIBESCU	S20	ASME IX	Lloyd's Register	21/01/2019	18/09/2024	17/09/2026
S28 12/19	DIEGO MICELI	S28	ASME IX	Lloyd's Register	21/08/2019	18/09/2024	17/09/2026
S28 01/19	DIEGO MICELI	S28	ASME IX	Lloyd's Register	23/08/2019	18/09/2024	17/09/2026
S52 01/24	DAVIDE CATOZZO	S52	ASME IX	Bureau Veritas	22/03/2024	18/09/2024	17/09/2026
WPQ 5/H	ANDREA BALLOTTA	S55	ASME IX	SGS Italia	18/08/2011	18/09/2024	17/09/2026
WPQ 5/E	ANDREA BALLOTTA	S55	ASME IX	SGS Italia	18/08/2011	18/09/2024	17/09/2026
S58 02/19	LUCIANO BETTIN	S58	ASME IX	Lloyd's Register	26/06/2019	18/09/2024	17/09/2026
S58 01/19	LUCIANO BETTIN	S58	ASME IX	Lloyd's Register	26/06/2019	18/09/2024	17/09/2026
S60 04/23	PIERPAOLO TIMPONE	S60	ASME IX	Bureau Veritas	30/08/2023	18/09/2024	17/09/2026
S60 05/23	PIERPAOLO TIMPONE	S60	ASME IX	Bureau Veritas	30/08/2023	18/09/2024	17/09/2026
S60 01/24	PIERPAOLO TIMPONE	S60	ASME IX	Bureau Veritas	29/03/2024	18/09/2024	17/09/2026
S61 04/19	MOUNAIM BENAISSOUN	S61	ASME IX	Lloyd's Register	30/08/2019	18/09/2024	17/09/2026
S61 04/20	MOUNAIM BENAISSOUN	S61	ASME IX	Lloyd's Register	15/04/2020	18/09/2024	17/09/2026
S61 01/20	MOUNAIM BENAISSOUN	S61	ASME IX	Lloyd's Register	21/02/2020	18/09/2024	17/09/2026
S70 01/22	MICHAEL MANFO	S70	ASME IX	LRQA	19/09/2022	18/09/2024	17/09/2026
S71 01/23	FEDERICO TASINATO	S71	ASME IX	Bureau Veritas	18/08/2023	18/09/2024	17/09/2026
S71 02/23	FEDERICO TASINATO	S71	ASME IX	Bureau Veritas	18/08/2023	18/09/2024	17/09/2026
S72 01/19	CORRADO PERONI	S72	ASME IX	Lloyd's Register	16/07/2019	18/09/2024	17/09/2026

BUREAU VERITAS

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO
PRS N°0076

Area : ITALY
Region :
Certificato No. : **QS-AP-ITA-24-00260-rev.0**
Certificate No. :
Rif. Interno : 24.SF.7713291.138
Internal No. : P10546/24/CB/cb

PERMANENT JOINING PERSONNEL QUALIFICATION APPROVAL CERTIFICATE

CERTIFICATO DI APPROVAZIONE DELLE QUALIFICHE DI PERSONALE ADDETTO ALLE GIUNZIONI PERMANENTI

Manufacturer: Brembana&Rolle S.p.A.
Address: Via Villino 1, 24030, Valbrembo (BG) - Italy
IT File: 24.SF.7713291.138

Certificate n° *N° Certificato*	**Name and surname** *Nome e cognome*	**Stamp** *Punzone*	***Reference standard** Norma di riferimento	**Third part recognized or No.Bo.** Terza parte riconosciuta o Organismo Notificato	**Starting date of qualification** Data inizio validità della qualifica	**Date of approval of certification** Date di approvazione della certificazione	****Expiration date of certification** *Data di scadenza della certificazione*
S73 01/23	MIRKO GIBBIN	S73	ASME IX	BUREAU VERITAS	12/07/2023	18/09/2024	17/09/2026
S73 02/20	MIRKO GIBBIN	S73	ASME IX	Lloyd's Register	08/01/2020	18/09/2024	17/09/2026
S74 01/19	OMAR ZANELLATO	S74	ASME IX	Lloyd's Register	29/06/2019	18/09/2024	17/09/2026
WPQ 24/N	OMAR ZANELLATO	S74	ASME IX	SGS Italia	28/12/2009	18/09/2024	17/09/2026
S76 02/23	ANDREA DEVICIENTI	S76	ASME IX	Bureau Veritas	11/07/2023	18/09/2024	17/09/2026
WPQ 27/H	NICOLI LEKAJ	S77	ASME IX	SGS Italia	28/12/2010	18/09/2024	17/09/2026
WPQ 27/I	NICOLI LEKAJ	S77	ASME IX	SGS Italia	28/12/2010	18/09/2024	17/09/2026
S79 02/19	SIMONE PADOVANI	S79	ASME IX	Lloyd's Register	22/08/2019	18/09/2024	17/09/2026
S79 01/24	SIMONE PADOVANI	S79	ASME IX	BUREAU VERITAS	22/03/2024	18/09/2024	17/09/2026
S83 01/19	MORENO SCRAULECH	S83	ASME IX	Lloyd's Register	16/07/2019	18/09/2024	17/09/2026
S84 01/22	FABIO LUCATO	S84	ASME IX	LRQA	01/04/2022	18/09/2024	17/09/2026
S88 01/22	VALENTIN CIOBANU	S88	ASME IX	BUREAU VERITAS	15/11/2022	18/09/2024	17/09/2026
S90 01/19	TIZIANO MELATO	S90	ASME IX	Lloyd's Register	30/08/2019	18/09/2024	17/09/2026
S91 02/18	ANDREA DONA'	S91	ASME IX	Lloyd's Register	14/12/2018	18/09/2024	17/09/2026
S91 01/18	ANDREA DONA'	S91	ASME IX	Lloyd's Register	14/02/2023	18/09/2024	17/09/2026
S92 04/19	JEAN BONGOU	S92	ASME IX	Lloyd's Register	28/08/2019	18/09/2024	17/09/2026
S92 01/24	JEAN BONGOU	S92	ASME IX	BUREAU VERITAS	29/03/2024	18/09/2024	17/09/2026
S100 01/22	DENNIS MIOTTO	S100	ASME IX	BUREAU VERITAS	20/10/2022	18/09/2024	17/09/2026
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

*** Checking the job continuity by the employer if required by the applicable standard**
Verificare la continuità lavorativa da parte del Datore di lavoro qualora fosse richiesta dalla norma

**** The expiration of the approval is linked to the expiry date of the qualification certificate previously acquired and in any case cannot exceed the time of validity in accordance with the harmonized standard of reference from the date of approval**
La durata del certificato di approvazione è correlato alla scadenza della qualifica saldatore cui fa riferimento ed in ogni caso non può superare il periodo di validità previsto dalla norma armonizzata di riferimento

Observations: Osservazioni:
This PERMANENT JOINING PERSONNEL QUALIFICATION APPROVAL CERTIFICATE QS-AP-ITA-24-00260-rev.0 (Internal No.: 24.SF.7713291.138 – P10546/24/CB/cb) is valid for: Brembana&Rolle Job: 23096 – Item: V-25001 A÷F - S.N.: 23096-01-SNA÷F.

BUREAU VERITAS S.P.A. Notified Body Nr 1370
Bureau Veritas Organismo Notificato n°1370

certifies that the operator for permanent joining qualification, subject to the date of validity and/or prolongation imposed by the referenced Standard and possibly completed by additional tests, complies with the Essential Safety Requirements stated by 2014/68/UE Directive Annex I- § 3.1.2.
certifica che il personale di assemblaggi permanenti, su riserva della data di validità e/o prolungamento imposto dalla norma di riferimento ed eventuali prove complementari, soddisfa le Esigenze Essenziali di Sicurezza della Direttiva 2014/68/UE
Allegato I - § 3.1.2.

All Test performed in each qualification are equivalent to harmonized standard published in the Official journal of the Europ ean Union. The present document of approval supplementary does not contemplate tests required by Construction Code
Tutti I test effettuati su ciascuna qualifica sono equivalenti a quelle richieste dalla norma armonizzata di riferimento pubblicata nella Gazzetta Ufficiale dell'Unione Europea . Il presente documento di approvazione non contempla prove supplementari richiesti dal codice di fabbricazione

Certificate issued by / Certificato emesso da	DATE/ Data	VISA / Firma	STAMP / Timbro
Carlo Baretta	18 September 2024		BUREAU VERITAS ITALIA Notified Body no. 1370

1723001756-QC-DB-00017_02 - V25001A

PAGE 624/1016

WELDERS/ WELD OPERATORS SUMMARY LIST ELENCO SALDATORI/OPERATORI DI SALD. V-25001A	Purchaser:	Rosetti Marino
	Item No.:	V25001 A
	Serial No.:	23096-01-SNA
	B&R Job No.:	23096

Joint Giunto	WPS Spec.	Rev.	PQR PQR	PROCESS/ES Processo/i	Materials	Type tipo	thk.mm sp.mm	Welders and Weld operators
C1	W08	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	U	44	S73 - S92
C6	W08	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	U	44	S72 - S88 - S100
C2	W01	0	51/15	GTAW SMAW	SA 516 Gr.60 to SA 516 Gr.60	X	44	S55 - S88 - S77
C3	W01	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	X	44	S73 - S91 - S90
C4	W01	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	X	44	S73 - S92 - S55 - S88
C5	W01	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	X	44	S70 - S83 - S88 - S90
L1	W01	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	X	44	S28
L2	W01	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	X	44	S58 - S72 - S77
L3	W01	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	X	44	S91 -S88
L4	W01	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	X	44	S91 - S88
L5	W01	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	X	44	S28
M1	W02	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 350 LF2	½ V	40	S83 - S90
M2	W02	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 350 LF2	½ V	40	S83 - S90
N1-N3-N5	W03	0	51/15	GTAW SMAW	SA 516 Gr.60 to SA 350 LF2	½ V	44	S91 - S71
N2-N4	W03	0	51/15	GTAW SMAW	SA 516 Gr.60 to SA 350 LF2	½ V	44	S91 - S71
K1-K2	W03	0	51/15	GTAW SMAW	SA 516 Gr.60 to SA 350 LF2	½ V	44	S91 - S71
LL/1÷LL/4	W06	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	Fillet	All	S91 - S71
R1÷R6	W06	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 516 Gr.60	Fillet	All	S71 - S79
F1/1-LF1/1-R	W05	0	51/15	GTAW SMAW	SA 516 Gr.60 to SA 350 LF2	K-Fillet/2¼ V-Fillet	All ≤18	S61 - S92
F1/2-LF1/2-R	W05	0	51/15	GTAW SMAW	SA 516 Gr.60 to SA 350 LF2	K-Fillet/2¼ V-Fillet	All ≤18	S61 - S92
F2/1-TF2/1-B	W04	0	51/15	GTAW SMAW	SA 516 Gr.60 to SA 350 LF2	K-Fillet/2¼ V-Fillet	All >18	S71 - S83
F2/2-TF2/2-B	W04	0	51/15	GTAW SMAW	SA 516 Gr.60 to SA 350 LF2	K-Fillet/2¼ V-Fillet	All >18	S71 - S83
H/1-H/2	W06	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 350 LF2	Fillet	All	S61
NP	W09	0	63/17	GTAW	SA 516 Gr.60 to SA 240 tp 316	Fillet	All	S61
F3/1-F3/2	W06	0	51/15	GTAW SMAW SAW	SA 516 Gr.60 to SA 350 LF2	Fillet	All	S71 - S83 - S79
F4	W07	0	24/17	FCAW	SA 516 Gr.60 to SA 516 Gr.60	Fillet	All	S52 - S60 - S79 - S92

Remarks:

BREMBANA & ROLLE S.P.A.
Q.C. INSPECTION
M. RAMPAZZO
DATE 22 JUL 2024

LRQA Group Limited
Witnessed Monitored Reviewed
Name: Flavio Zanon
Date: 20 September 2024
Ref. No.: AI 13421 - NoBo 0094
Office: Milan
Signature
LRQA004 11.2021

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTIMARINO
Document Title:	**WELDING OPERATORS LIST and WELDER QUALIFICATIONS RECORDS (WPQ)** **H2 STORAGE VESSEL**	Sheet 1 of 76 Date: 30/05/2024 Rev: 02

Base Load Power Hub (BLPH)

WELDING OPERATORS LIST and WELDER QUALIFICATIONS RECORD (WPQ) H2 STORAGE VESSEL

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from ...ndatory compliance with contractual documents and ...fications. Comments made do not imply acceptance ...y cost or delivery impact.

Sign	Date
DAVIDE CENACCHI	30/05/2024

...ument Number: 1723001756-WEL-LIS-00015

Document Class: 2

Rev.	Date	Description	Prepared	Reviewed	Approved
02	30/05/2024	Accepted for Construction (AFC)	A. Sandonà	M.Carminati	N.Tosto
01	09/05/2024	Accepted for Construction (AFC)	A. Sandonà	M.Carminati	N.Tosto
00	06/03/2024	Issue for Review (IFR)	A. Sandonà	M.Carminati	N.Tosto

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BREMBANA&ROLLE

RECORD OF WELDER PERFORMANCE QUALIFICATION TESTS (WPQ)
(QW-301 Section IX ASME B.P.V Code)

W.P.Q. No. **S52 01/24**

Welder' s name: **CATOZZO DAVIDE** Identification No.: **S52**

TEST DESCRIPTION

Identific. of WPS followed: **CS GMAW FCAW** ■ Test coupon ☐ Production weld
Specificat. of base metal(s): **SA-516 Gr. 70** Thickness(mm): **34**

TESTING CONDITIONS AND QUALIFICATION LIMITS

WELDING VARIABLES (QW-350)	ACTUAL VALUES		RANGE QUALIFIED	
Welding process(es):	GMAW	FCAW	GMAW	FCAW
Type (ie:manual,semi-auto) used:	SEMI-AUTO	SEMI-AUTO	SEMI-AUTO	SEMI-AUTO
Backing (metal, weld metal,double welded, etc.):	WITHOUT	WITH	WITH OR WITHOUT / WITH	
■ Plate ☐ Pipe (enter diameter if pipe or tube):	NO		73 mm AND OVER	
Base metal P or S-No. to P or S-No.:	P-No. 1 to P-No. 1		P-No.1÷P-No.11,P34,P41÷P49 (see note 1)	
Filler metal or electrode specification(s) (SFA):	5.18	5.20		
Filler metal or electrode classification(s):	ER70S-6	E71T-1/1M		
Filler metal F-No.:	6		6	
With or without filler metal (GTAW or PAW):	N.A.		N.A.	
Consumables inserts (GTAW or PAW):	N.A.		N.A.	
Filler type (solid/metal or flux cored/powder) (GTAW or PAW):	N.A.		N.A.	
Weld deposit "t" for each welding process:				
Process 1: GMAW 3 layers min. ☐ Yes ■ No	GMAW: 3 mm		GMAW: 3.3 mm	
Process 2: FCAW 3 layers min. ■ Yes ☐ No	FCAW: 31 mm		FCAW: MAX TO BE WELDED	
Weld deposit "t" for S.Circ.Arc.(GMAW-FCAW):	3 mm	N.A.	3.3 mm	N.A.
Welding position (1G,2G,6G,3F etc.):	3G	3G	Groove: F, V	Groove: F, V
			Fillet: F, H, V	Fillet: F, H, V
Vertical progression (uphill or downhill):	DOWNHILL	UPHILL	DOWHHILL	N.A.
Type of fuel gas (OFW):	N.A.		N.A.	
Inert gas backing (GTAW or PAW or GMAW-FCAW):	WITHOUT		WITH OR WITHOUT	
Transfer mode (spray/globular or pulse to short)(GMAW-FCAW):	SHORT ARC	SPRAY ARC	SHORT / SPRAY,GLOBULAR,PULSE	
GTAW current type/polarity (AC, DCEP, DCEN):	N.A.		N.A.	
Other:	NO		NO	

RESULTS

Visual Examination of Completed Weld (QW-302.4): **SATISFACTORY**

■ Bend test; ☐ Trans.root and face QW-462.3(a); ☐ Long.root and face QW-462.3(b); ■ Side bend QW-462.2;
☐ Pipe bend spec.,corrosion-resist.overlay QW-462.5(c); ☐ Plate bend spec.,corrosion-resist.overlay QW-462.5(d);
☐ Macro test for fusion QW-462.5(b); ☐ Macro test for fusion QW-462.5(e).

Type	Result	Type	Result
SIDE BEND	SATISFACTORY		
SIDE BEND	SATISFACTORY		

BUREAU VERITAS ITALIA WELDING 66
IT FILE: 24.SF.IT1329.128
DATE: 22 MAR. 2024
WITNESSED ☐ REVIEWED ☐

Alternative radiographic examination result (QW-191): **NO**
Fillet weld-fracture test (QW-180): **NO** Length and percent of defects: **NO**
Macro examination (QW-184): **NO** Fillet size (mm): **NO** Concavity/convexity (mm): **NO**
Other tests: **NO**
Film or specimens evaluated by: **W.E. B&R / Third party inspector** Company: **Brembana & Rolle S.p.A.**
Mechanical tests conducted by: **Villa & Bonaldi** Laboratory test no.: **B&R S52 01/24**
Welding supervised by: **B&R S.p.A. Welding Supervisor**

Notes:
1) And unassigned metals of similar chemical composition to these metals

We certify that the statements in this record are correct and that the test weld were prepared, welded and tested in accordance with the requirements of the Section IX of the ASME Code BPV

PREPARED BY **A.SANDONA** | CHECKED AND APPROVED BY **N.TOSTO** | Date **22/03/2024**

BREMBANA&ROLLE

RECORD OF WELDER PERFORMANCE QUALIFICATION TESTS (WPQ)
(QW-301 Section IX ASME B.P.V Code)

W.P.Q. No. **S60 01/24**

Welder' s name: **TIMPONE PIERPAOLO** Identification No.: **S60**

TEST DESCRIPTION

Identific. of WPS followed: **CS GMAW FCAW** ■ Test coupon ☐ Production weld
Specificat. of base metal(s): **SA-516 Gr. 70** Thickness(mm): **34**

TESTING CONDITIONS AND QUALIFICATION LIMITS

WELDING VARIABLES (QW-350)	ACTUAL VALUES	RANGE QUALIFIED
Welding process(es):	GMAW FCAW	GMAW FCAW
Type (ie:manual,semi-auto) used:	SEMI-AUTO SEMI-AUTO	SEMI-AUTO SEMI-AUTO
Backing (metal, weld metal,double welded, etc.):	WITHOUT WITH	WITH OR WITHOUT / WITH
■ Plate ☐ Pipe (enter diameter if pipe or tube):	NO	73 mm AND OVER
Base metal P or S-No. to P or S-No.:	P-No. 1 to P-No. 1	P-No.1÷P-No.11,P34,P41÷P49 (see note 1)
Filler metal or electrode specification(s) (SFA):	5.18 5.20	
Filler metal or electrode classification(s):	ER70S-6 E71T-1/1M	
Filler metal F-No.:	6	6
With or without filler metal (GTAW or PAW):	N.A.	N.A.
Consumables inserts (GTAW or PAW):	N.A.	N.A.
Filler type (solid/metal or flux cored/powder) (GTAW or PAW):	N.A.	N.A.
Weld deposit "t" for each welding process:		
Process 1: GMAW 3 layers min. ☐ Yes ■ No	GMAW: 3 mm	GMAW: 3.3 mm
Process 2: FCAW 3 layers min. ■ Yes ☐ No	FCAW: 31 mm	FCAW: MAX TO BE WELDED
Weld deposit "t" for S.Circ.Arc.(GMAW-FCAW):	3 mm N.A.	3.3 mm N.A.
Welding position (1G,2G,6G,3F etc.):	3G 3G	Groove: F, V Groove: F, V
		Fillet: F, H, V Fillet: F, H, V
Vertical progression (uphill or downhill):	DOWNHILL UPHILL	DOWHHILL N.A.
Type of fuel gas (OFW):	N.A.	N.A.
Inert gas backing (GTAW or PAW or GMAW-FCAW):	WITHOUT	WITH OR WITHOUT
Transfer mode (spray/globular or pulse to short)(GMAW-FCAW):	SHORT ARC SPRAY ARC	SHORT / SPRAY,GLOBULAR,PULSE
GTAW current type/polarity (AC, DCEP, DCEN):	N.A.	N.A.
Other:	NO	NO

RESULTS

Visual Examination of Completed Weld (QW-302.4): **SATISFACTORY**

■ Bend test; ☐ Trans.root and face QW-462.3(a); ☐ Long.root and face QW-462.3(b); ■ Side bend QW-462.2;
☐ Pipe bend spec.,corrosion-resist.overlay QW-462.5(c); ☐ Plate bend spec.,corrosion-resist.overlay QW-462.5(d);
☐ Macro test for fusion QW-462.5(b); ☐ Macro test for fusion QW-462.5(e).

Type	Result	Type	Result
SIDE BEND	SATISFACTORY		
SIDE BEND	SATISFACTORY		

BUREAU VERITAS ITALIA WELDING 66
IT FILE: 24.SE.731320I.138
DATE: 29 MAR. 2024
WITNESSED ☐ REVIEW ☒

Alternative radiographic examination result (QW-191): **NO**
Fillet weld-fracture test (QW-180): **NO** Length and percent of defects: **NO**
Macro examination (QW-184): **NO** Fillet size (mm): **NO** Concavity/convexity (mm): **NO**
Other tests: **NO**
Film or specimens evaluated by: **W.E. B&R / Third party inspector** Company: **Brembana & Rolle S.p.A.**
Mechanical tests conducted by: **Villa & Bonaldi** Laboratory test no.: **B&R S60 01/24**
Welding supervised by: **B&R S.p.A. Welding Supervisor**

Notes:
1) And unassigned metals of similar chemical composition to these metals

I.W.T. A. Sandona IT/IWT/170065A issued by

We certify that the statements in this record are correct and that the test weld were prepared, welded and tested in accordance with the requirements of the Section IX of the ASME Code BPV

PREPARED BY **A.SANDONA** CHECKED AND APPROVED BY **N.TOSTO** Date **29/03/2024**

BREMBANA&ROLLE

RECORD OF WELDER PERFORMANCE QUALIFICATION TESTS (WPQ)
(QW-301 Section IX ASME B.P.V Code)

W.P.Q. No. **S79 01/24**

Welder' s name: **PADOVANI SIMONE** Identification No.: **S79**

TEST DESCRIPTION

Identific. of WPS followed: **CS GMAW FCAW** ■ Test coupon ☐ Production weld
Specificat. of base metal(s): **SA-516 Gr. 70** Thickness(mm): **34**

TESTING CONDITIONS AND QUALIFICATION LIMITS

WELDING VARIABLES (QW-350)	ACTUAL VALUES	RANGE QUALIFIED
Welding process(es):	GMAW FCAW	GMAW FCAW
Type (ie:manual,semi-auto) used:	SEMI-AUTO SEMI-AUTO	SEMI-AUTO SEMI-AUTO
Backing (metal, weld metal,double welded, etc.):	WITHOUT WITH	WITH OR WITHOUT / WITH
■ Plate ☐ Pipe (enter diameter if pipe or tube):	NO	73 mm AND OVER
Base metal P or S-No. to P or S-No.:	P-No. 1 to P-No. 1	P-No.1÷P-No.11,P34,P41÷P49 (see note 1)
Filler metal or electrode specification(s) (SFA):	5.18 5.20	
Filler metal or electrode classification(s):	ER70S-6 E71T-1/1M	
Filler metal F-No.:	6	6
With or without filler metal (GTAW or PAW):	N.A.	N.A.
Consumables inserts (GTAW or PAW):	N.A.	N.A.
Filler type (solid/metal or flux cored/powder) (GTAW or PAW):	N.A.	N.A.
Weld deposit "t" for each welding process:		
Process 1: GMAW 3 layers min. ☐ Yes ■ No	GMAW: 3 mm	GMAW: 3.3 mm
Process 2: FCAW 3 layers min. ■ Yes ☐ No	FCAW: 31 mm	FCAW: MAX TO BE WELDED
Weld deposit "t" for S.Circ.Arc.(GMAW-FCAW):	3 mm N.A.	3.3 mm N.A.
Welding position (1G,2G,6G,3F etc.):	3G 3G	Groove: F, V Groove: F, V Fillet: F, H, V Fillet: F, H, V
Vertical progression (uphill or downhill):	DOWNHILL UPHILL	DOWHHILL N.A.
Type of fuel gas (OFW):	N.A.	N.A.
Inert gas backing (GTAW or PAW or GMAW-FCAW):	WITHOUT	WITH OR WITHOUT
Transfer mode (spray/globular or pulse to short)(GMAW-FCAW):	SHORT ARC SPRAY ARC	SHORT / SPRAY,GLOBULAR,PULSE
GTAW current type/polarity (AC, DCEP, DCEN):	N.A.	N.A.
Other:	NO	NO

RESULTS

Visual Examination of Completed Weld (QW-302.4): **SATISFACTORY**

■ Bend test; ☐ Trans.root and face QW-462.3(a); ☐ Long.root and face QW-462.3(b); ■ Side bend QW-462.2;
☐ Pipe bend spec.,corrosion-resist.overlay QW-462.5(c); ☐ Plate bend spec.,corrosion-resist.overlay QW-462.5(d);
☐ Macro test for fusion QW-462.5(b); ☐ Macro test for fusion QW-462.5(e).

Type	Result	Type	Result
SIDE BEND	SATISFACTORY		
SIDE BEND	SATISFACTORY		

BUREAU VERITAS ITALIA WELDING 66
IT FILE: 24_SF-771525i-138
DATE: 22 MAR. 2024
WITNESSED ☐ REVIEW ☒

Alternative radiographic examination result (QW-191): **NO**
Fillet weld-fracture test (QW-180): **NO** Length and percent of defects: **NO**
Macro examination (QW-184): **NO** Fillet size (mm): **NO** Concavity/convexity (mm): **NO**
Other tests: **NO**
Film or specimens evaluated by: **W.E. B&R / Third party inspector** Company: **Brembana & Rolle S.p.A.**
Mechanical tests conducted by: **Villa & Bonaldi** Laboratory test no.: **B&R S79 01/24**
Welding supervised by: **B&R S.p.A. Welding Supervisor**

Notes:
1) And unassigned metals of similar chemical composition to these metals

We certify that the statements in this record are correct and that the test weld were prepared, welded and tested in accordance with the requirements of the Section IX of the ASME Code BPV

PREPARED BY: **A.SANDONA** CHECKED AND APPROVED BY: **N.TOSTO** Date: **22/03/2024**

BREMBANA&ROLLE

RECORD OF WELDER PERFORMANCE QUALIFICATION TESTS (WPQ)
(QW-301 Section IX ASME B.P.V Code)

W.P.Q. No. **S92 01/24**

Welder' s name: **BOUNGOU JEAN** Identification No.: **S92**

TEST DESCRIPTION

Identific. of WPS followed: **CS GMAW FCAW** ■ Test coupon ☐ Production weld
Specificat. of base metal(s): **SA-516 Gr. 70** Thickness(mm): **34**

TESTING CONDITIONS AND QUALIFICATION LIMITS

WELDING VARIABLES (QW-350)	ACTUAL VALUES	RANGE QUALIFIED
Welding process(es):	GMAW FCAW	GMAW FCAW
Type (ie:manual,semi-auto) used:	SEMI-AUTO SEMI-AUTO	SEMI-AUTO SEMI-AUTO
Backing (metal, weld metal,double welded, etc.):	WITHOUT WITH	WITH OR WITHOUT / WITH
■ Plate ☐ Pipe (enter diameter if pipe or tube):	NO	73 mm AND OVER
Base metal P or S-No. to P or S-No.:	P-No. 1 to P-No. 1	P-No.1÷P-No.11,P34,P41÷P49 (see note 1)
Filler metal or electrode specification(s) (SFA):	5.18 5.20	
Filler metal or electrode classification(s):	ER70S-6 E71T-1/1M	
Filler metal F-No.:	6	6
With or without filler metal (GTAW or PAW):	N.A.	N.A.
Consumables inserts (GTAW or PAW):	N.A.	N.A.
Filler type (solid/metal or flux cored/powder) (GTAW or PAW):	N.A.	N.A.
Weld deposit "t" for each welding process:		
Process 1: GMAW 3 layers min. ☐ Yes ■ No	GMAW: 3 mm	GMAW: 3.3 mm
Process 2: FCAW 3 layers min. ■ Yes ☐ No	FCAW: 31 mm	FCAW: MAX TO BE WELDED
Weld deposit "t" for S.Circ.Arc.(GMAW-FCAW):	3 mm N.A.	3.3 mm N.A.
Welding position (1G,2G,6G,3F etc.):	3G 3G	Groove: F, V Groove: F, V Fillet: F, H, V Fillet: F, H, V
Vertical progression (uphill or downhill):	DOWNHILL UPHILL	DOWHHILL N.A.
Type of fuel gas (OFW):	N.A.	N.A.
Inert gas backing (GTAW or PAW or GMAW-FCAW):	WITHOUT	WITH OR WITHOUT
Transfer mode (spray/globular or pulse to short)(GMAW-FCAW):	SHORT ARC SPRAY ARC	SHORT / SPRAY,GLOBULAR,PULSE
GTAW current type/polarity (AC, DCEP, DCEN):	N.A.	N.A.
Other:	NO	NO

RESULTS

Visual Examination of Completed Weld (QW-302.4): **SATISFACTORY**

■ Bend test; ☐ Trans.root and face QW-462.3(a); ☐ Long.root and face QW-462.3(b); ■ Side bend QW-462.2;
☐ Pipe bend spec.,corrosion-resist.overlay QW-462.5(c); ☐ Plate bend spec.,corrosion-resist.overlay QW-462.5(d);
☐ Macro test for fusion QW-462.5(b); ☐ Macro test for fusion QW-462.5(e).

Type	Result	Type	Result
SIDE BEND	SATISFACTORY		
SIDE BEND	SATISFACTORY		

BUREAU VERITAS ITALIA WELDING 66
IT FILE: 24.SF.7713291.I.3
DATE: 29 MAR. 2024
WITNESSED ☐ REVIEW ☒

Alternative radiographic examination result (QW-191): NO
Fillet weld-fracture test (QW-180): NO Length and percent of defects: NO
Macro examination (QW-184): NO Fillet size (mm): NO Concavity/convexity (mm): NO
Other tests: NO
Film or specimens evaluated by: **W.E. B&R / Third party inspector** Company: **Brembana & Rolle S.p.A.**
Mechanical tests conducted by: **Villa & Bonaldi** Laboratory test no.: **B&R S92 01/24**
Welding supervised by: **B&R S.p.A. Welding Supervisor**

Notes:
1) And unassigned metals of similar chemical composition to these metals

We certify that the statements in this record are correct and that the test weld were prepared, welded and tested in accordance with the requirements of the Section IX of the ASME Code BPV

International Institute of Welding
I.W. A. Sandonà
IT/IWT/17/0
issue date 15.06.2017

PREPARED BY **A.SANDONÀ** CHECKED AND APPROVED BY **M.TOSTO** Date **29/03/2024**

BREMBANA&ROLLE

RECORD OF WELDER PERFORMANCE QUALIFICATION TESTS (WPQ)
(QW-301 Section IX ASME B.P.V Code)

W.P.Q. No. **S61 04/20**

Welder' s name: **BENAISSOUN MOUNAIM** Identification No.: **S61**

TEST DESCRIPTION

Identific. of WPS followed: **8 GTAW SMAW** ■ Test coupon ☐ Production weld
Specificat. of base metal(s): **SA 240 Tp. 316L** Thickness(mm): **26**

TESTING CONDITIONS AND QUALIFICATION LIMITS

WELDING VARIABLES (QW-350)	ACTUAL VALUES	RANGE QUALIFIED
Welding process(es):	GTAW SMAW	GTAW SMAW
Type (ie:manual,semi-auto) used:	MANUAL	MANUAL
Backing (metal, weld metal,double welded, etc.):		
■ Plate ☐ Pipe (enter diameter if pipe or tube):	WITHOUT WITH	WITH & WITHOUT WITH
Base metal P or S-No. to P or S-No.:	N.A.	73 mm and OVER
	P-No.8 to P-No.8	PNo.1 ÷ 15F, 34, 41 ÷ 49
		(see note 1)
Filler metal or electrode specification(s) (SFA):	5.9 5.4	
Filler metal or electrode classification(s):	ER316L E316L-17	
Filler metal F-No.:	6 5	6 1-5 (with backing)
With or without filler metal (GTAW or PAW):	WITH N.A.	WITH N.A.
Consumables inserts (GTAW or PAW):	WITHOUT N.A.	WITHOUT N.A.
Filler type (solid/metal or flux cored/powder) (GTAW or PAW):	BARE SOLID N.A.	SOLID & METAL CORED N.A.
Weld deposit "t" for each welding process:		
Process 1: GTAW 3 layers min. ☐ Yes ■ No	GTAW: 2 mm	GTAW: 4 mm max.
Process 2: SMAW 3 layers min. ■ Yes ☐ No	SMAW: 24 mm	SMAW: max to be welded
Weld deposit "t" for S.Circ.Arc.(GMAW-FCAW):	N.A.	N.A.
Welding position (1G,2G,6G,3F etc.):	2G	Groove: F - H
		Fillet: F - H
Vertical progression (uphill or downl	N.A.	N.A.
Type of fuel gas (OFW):	N.A.	N.A.
Inert gas backing (GTAW or PAW or GMAW-FCAW):	WITH N.A.	WITH N.A.
Transfer mode (spray/globular or pulse to short)(GMAW-FCAW):	N.A.	N.A.
GTAW current type/polarity (AC, DCEP, DCEN):	DCEN N.A.	DCEN N.A.
Other:	NO	NO

RESULTS

Visual Examination of Completed Weld (QW-302.4): **SATISFACTORY**

☐ Bend test; ☐ Trans.root and face QW-462.3(a); ☐ Long.root and face QW-462.3(b); ☐ Side bend QW-462.2;
☐ Pipe bend spec.,corrosion-resist.overlay QW-462.5(c); ☐ Plate bend spec.,corrosion-resist.overlay QW-462.5(d);
☐ Macro test for fusion QW-462.5(b); ☐ Macro test for fusion QW-462.5(e).

Type	Result	Type	Result

Alternative radiographic examination result (QW-191): **No**
Fillet weld-fracture test (QW-180): **No** Length and percent of defects: /
Macro examination (QW-184): **No** Fillet size (mm): / Concavity/convexity (mm): **No**
Other tests: **UT SATISFACTORY (See report WPQ S61 04/20 UT)**
Film or specimens evaluated by: **Welding Engineer** Company: **Brembana & Rolle S.p.A.**
Mechanical tests conducted by: / Laboratory test no.: /
Welding supervised by: **B&R S.p.A. Welding Supervisor**

Notes:

1) And unassigned metals of similar chemical composition to these metals

We certify that the statements in this record are correct and that the test weld were prepared, welded and tested in accordance with the requirements of the Section IX of the ASME Code BPV

PREPARED BY **A.SANDONA** A. Sandonà IT/IWT/170065A issue date 15.06.2017
CHECKED AND APPROVED BY **N.TOSTO**
Date **15.04.2020**

BREMBANA&ROLLE

QUALIFIED WELDERS LOG YEAR 2024 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data 07/03/24 07/06/24 29/08/24

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
	S51													
CATOZZO DAVIDE	S52	GTAW			X		X		X					
		SMAW	X	X	X	X		X	X	X				
		SAW		X		X	X	X						3
		ESW	X			X			X					
		GMAW SEMIAUT.	X		X		X	X		X				
		GTAW MACH.												
		FCAW			X		X		X					
CICALA EMANUELE	S53	GTAW		X				X	X					
		SMAW		X	X	X	X	X		X				
		GMAW SEMIAUT.		X			X							
		SAW		X	X	X		X		X				
DIOMBANA SITA	S54	GTAW					X		X					
		SMAW	X	X		X	X	T	X	X				
		GMAW SEMIAUT.					X							
		SAW	X	X	X	X		X		X				
		GMAW MACHINE			X		X							
BALLOTTA ANDREA	S55	GTAW				X								
		SMAW	X	X	X	X	X	X	X					
		GMAW SEMIAUT.		X			X							
		SAW	X	X	X		X							
		ESW	X			X			X					
TUIVERI FEDERICO	S56	GTAW		X			X		X					
		SMAW		X	X	X	X	X	X	X				
LAZZARO FAUSTO	S57	GTAW			X			X						
		SMAW		X	X		X	X	X					
		SAW	X	X		X	X		X	X				
		GMAW SEMIAUT.	X				X		X					
		ESW		X	X	X	X	X		X				
		FCAW	X			X								
BETTIN LUCIANO	S58	GTAW	X			X			X					
		SMAW	X	X	X	X	X	X	X	X				
		SAW	X	X	X	X	X	X						
		GMAW SEMIAUT.		X			X							
		ESW	X			X								

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

BREMBANA&ROLLE

QUALIFIED WELDERS LOG YEAR 2024 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data 02/03/24 | 07/06/24 | 29/08/24

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MARTIN PARIDE	S59	SMAW	X			X		X						
		SAW	X	X	X	X	X		X					
		GMAW SEMIAUT.			X									
		ESW		X		X	X	X		X				
TIMPONE PIERPAOLO	S60	GTAW		X			X		X					
		SMAW	X	X	X	X	X	X	X					
		GMAW SEMIAUT.		X			X							
		SAW	X		X			X		X				
BENAISSOUN MONAIM	S61	GTAW	X		X		X		X	X				
		SMAW	X	X	X	X	X	X		X				
		SAW		X			X							
		GMAW SEMIAUT.	X				X							
		FCAW	X			X			X					
		ESW			X		X							
GARZOTTO MIRKO	S62	GTAW	X		X	X		X	X					
		SMAW		X				X		X				
		GMAW SEMIAUT.	X				X							
LUGATO LUCA	S63	SAW	X	X	X	X	X	X	X					
DAL LAGO DAVIDE	S64	GTAW						X	X					
		SMAW	X	X	X	X	X	X	X					
		GMAW SEMIAUT.	X	X			X	X						
		GTAW H.W.	X		X			X	X					
RUSSO VINCENZO	S65	SAW	X	X	X	X	X	X	X	X				
VUJIC PEDRAG	S66	SAW												
		ESW	X	X	X	X	X	X	X	X				
STORACI FEDERICO	S67	GTAW		X	X	X		X		X				
		SMAW		X	X	X	X	X	X					
FILIPPONE MASSIMILIANO	S68	GTAW	X			X		X		X				
		SMAW		X		X		X	X	X				
		GMAW SEMIAUT.		X	X		X							
		GMAW MACHINE	X		X			X						

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

BREMBANA&ROLLE

QUALIFIED WELDERS LOG YEAR 2024 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data

07/03/24 | 07/06/24

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LAZZARIN GUERRINO	S69	GTAW SMAW SAW ESW GMAW SEMIAUT. FCAW												
MANFO MICHAEL	S70	GTAW SMAW GMAW SEMIAUT. SAW GMAW MACHINE												
PASINATO FEDERICO	S71	GTAW SMAW SAW												
PERONI CORRADO	S72	GTAW SMAW												
MIRKO GIBBIN	S73	GTAW SMAW SAW ESW GMAW SEMIAUT.												
ZANELLATO OMAR	S74	SMAW SAW GMAW SEMIAUT. GTAW												
BELLOMIA FRANCESCO	S75	SMAW SAW GMAW SEMIAUT. ESW												
DEVICIENTI ANDREA	S76	GTAW SMAW GMAW SEMIAUT. FCAW SAW												

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

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QUALIFIED WELDERS LOG YEAR 2024 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data 07/03/24 07/06/24 28/08/24

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LEKAJ NICOLI	S77	SMAW	X			X		X	X	X				
		SAW	X			X		X	X	X				
		ESW		X	X		X							
		GMAW SEMIAUT.		X	X		X			X				
SALVO' CLAUDIO	S78	SMAW	X		X			X	X					
		SAW	X	X		X			X					
		ESW				X								
		GMAW SEMIAUT.		X			X	X		X				
PADOVANI SIMONE	S79	GTAW	X	X	X	X	X	X	X	X				
		SMAW	X	X	X	X	X	X	X	X				
		GMAW SEMIAUT.		X			X							
		GMAW MACHINE	X			X				X				
ZORAN ERMAN	S80	SMAW	X		X	X		X	X					
		SAW	X	X			X		X					
	S81													
	S82													
SCHRAULECH MORENO	S83	GTAW	X	X	X	X		X		X				
		SMAW	X	X	X	X	X	X	X	X				
LUCATO FABIO	S84	GTAW		X	X			X						
		SMAW	X		X	X	X	X	X	X				
	S85	GTAW												
		SMAW												
	S86	SMAW												
		SAW												
	S87													
CIOBANU VALENTIN	S88	GTAW	X			X		X		X				
		SMAW	X	X		X	X	X		X				
		SAW			X									
		GMAW SEMIAUT.			X									
		ESW						X	X					
FERRO CRISTIAN	S89	GTAW	X	X		X			X					
		SMAW	X	X	X	X	X	X	X	X				
		SAW	X	X	X	X	X	X						
		GMAW SEMIAUT.		X				X		X				

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

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PAGE 635/1016

BREMBANA&ROLLE

QUALIFIED WELDERS LOG YEAR 2024 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MELATO TIZIANO	S90	GTAW SMAW SAW	X X	X X	X X X	X	X X X	X X	X	X X				
DONÀ ANDREA	S91	GTAW SMAW SAW ESW	X X	X X	X X	X X	X X	X X	X X					
BONGOW JEAN GMAW / FCAW from April	S92	GTAW SMAW SAW GMAW/FCAW	X X	X X	X	X X	X X	X X X	X X X	X X				
	S93													
DI NATALE GIOSUÉ	S94	GTAW SMAW SAW	X X X	X X	X	X X	X X X		X X	X				
ALAIN MILOTIC	S95	SAW ESW	X	X X	X X	X	X	X	X X					
	S96													
	S97													
	S98													
	S99													
MIOTTO DENNIS	S100	SMAW SAW GTAW	X X	X X	X X X	X X	X X	X X	X					
	S101													

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

BREMBANA&ROLLE

QUALIFIED WELDERS LOG YEAR 2024 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
	S51													
CATOZZO DAVIDE	S52	GTAW												
		SMAW												
		SAW												
		ESW												
		GMAW SEMIAUT.												
		GTAW MACH.												
		FCAW									X			
CICALA EMANUELE	S53	GTAW												
		SMAW												
		GMAW SEMIAUT.												
		SAW									X			
											X			
DIOMBANA SITA	S54	GTAW												
		SMAW												
		GMAW SEMIAUT.												
		SAW												
		GMAW MACHINE									X			
											X			
BALLOTTA ANDREA	S55	GTAW												
		SMAW												
		GMAW SEMIAUT.												
		SAW												
		ESW									X			
											X			
TUIVERI FEDERICO	S56	GTAW												
		SMAW									X			
											X			
LAZZARO FAUSTO	S57	GTAW												
		SMAW												
		SAW												
		GMAW SEMIAUT.												
		ESW												
		FCAW									X			
											X			
BETTIN LUCIANO	S58	GTAW												
		SMAW												
		SAW												
		GMAW SEMIAUT.									X			
		ESW												

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

BREMBANA&ROLLE

QUALIFIED WELDERS LOG YEAR 2024 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MARTIN PARIDE	S59	SMAW									X			
		SAW												
		GMAW SEMIAUT.												
		ESW												
TIMPONE PIERPAOLO	S60	GTAW												
		SMAW												
		GMAW SEMIAUT.												
		FCAW SEMIAUT.									X			
		SAW									X			
BENAISSOUN MONAIM	S61	GTAW												
		SMAW												
		SAW												
		GMAW SEMIAUT.												
		FCAW												
		ESW												
GARZOTTO MIRKO	S62	GTAW									X			
		SMAW												
		GMAW SEMIAUT.												
LUGATO LUCA	S63													
		SAW												
DAL LAGO DAVIDE	S64	GTAW												
		SMAW									X			
		GMAW SEMIAUT.												
		GTAW H.W.									X			
RUSSO VINCENZO	S65	SAW												
VUJIC PEDRAG	S66	SAW												
		ESW									X			
STORACI FEDERICO	S67	GTAW												
		SMAW												
											X			
FILIPPONE MASSIMILIANO	S68	GTAW												
		SMAW												
		GMAW SEMIAUT.									X			
		GMAW MACHINE												

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

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QUALIFIED WELDERS LOG YEAR 2024 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
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Date - Data

08/04/24

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LAZZARIN GUERRINO	S69	GTAW												
		SMAW									X			
		SAW												
		ESW												
		GMAW SEMIAUT.									X			
		FCAW									X			
MANFO MICHAEL	S70	GTAW												
		SMAW									X			
		GMAW SEMIAUT.									X			
		SAW									X			
		GMAW MACHINE												
PASINATO FEDERICO	S71	GTAW												
		SMAW												
		SAW												
PERONI CORRADO	S72	GTAW												
		SMAW									X			
											X			
MIRKO GIBBIN	S73	GTAW												
		SMAW									X			
		SAW									X			
		ESW												
		GMAW SEMIAUT.												
ZANELLATO OMAR	S74	SMAW												
		SAW												
		GMAW SEMIAUT.												
		GTAW									X			
BELLOMIA FRANCESCO	S75	SMAW												
		SAW												
		GMAW SEMIAUT.												
		ESW									X			
DEVICIENTI ANDREA	S76	GTAW												
		SMAW												
		GMAW SEMIAUT.												
		FCAW												
		SAW												

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QUALIFIED WELDERS LOG YEAR 2024 "Albignasego/Marghera"

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09-01-2018

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Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LEKAJ NICOLI	S77	SMAW									X			
		SAW									X			
		ESW												
		GMAW SEMIAUT.												
SALVO' CLAUDIO	S78	SMAW												
		SAW												
		ESW												
		GMAW SEMIAUT.												
PADOVANI SIMONE	S79	GTAW									X			
		SMAW									X			
		GMAW SEMIAUT.												
		FCAW SEMIAUT.												
		GMAW MACHINE												
ZORAN ERMAN	S80	SMAW												
		SAW												
	S81													
	S82													
SCHRAULECH MORENO	S83	GTAW												
		SMAW									X			
LUCATO FABIO	S84	GTAW												
		SMAW									X			
	S85													
	S86													
	S87													
CIOBANU VALENTIN	S88	GTAW												
		SMAW												
		SAW												
		GMAW SEMIAUT.												
		ESW									X			
FERRO CRISTIAN	S89	GTAW												
		SMAW												
		SAW												
		GMAW SEMIAUT.									X			

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Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MELATO TIZIANO	S90	GTAW												
		SMAW									X			
		SAW									X			
DONÀ ANDREA	S91	GTAW												
		SMAW												
		SAW												
		ESW									X			
BONGOU JEAN	S92	GTAW												
		SMAW												
		SAW									X			
		GMAW SEMIAUT.									X			
		FCAW SEMIAUT.												
	S93													
DI NATALE GIOSUÉ	S94	GTAW												
		SMAW									X			
		SAW									X			
ALAIN MILOTIC	S95	SAW												
		ESW									X			
	S96													
	S97													
	S98													
	S99													
MIOTTO DENNIS	S100	GTAW												
		SMAW									X			
		SAW									X			
	S101													

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Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
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Date - Data 10/03/23 04/06/23

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
	S51													
CATOZZO DAVIDE	S52	GTAW	X			X			X					
		SMAW	X		X	X	X	X	X					
		SAW	X		X			X						
		ESW		X				X						
		GMAW SEMIAUT.		X	X	X	X		X					
		GTAW MACH.		X										
		FCAW		X			X		X					
	S53													
DIOMBANA SITA	S54	GTAW	X			X			X					
		SMAW	X		X	X	X	X						
		GMAW SEMIAUT.		X			X		X					
		SAW	X		X		X	X	X					
		GMAW machine		X	X	X								
BALLOTTA ANDREA	S55	GTAW	X			X			X					
		SMAW		X	X		X	X	X					
		GMAW SEMIAUT.		X			X		X					
		SAW	X		X	X	X	X	X					
		ESW	X		X	X	X		X					
	S56													
LAZZARO FAUSTO	S57	GTAW			X				X					
		SMAW		X	X	X	X	X	X					
		SAW	X		X	X	X	X	X					
		GMAW SEMIAUT.		X		X								
		ESW	X	X	X		X	X	X					
		FCAW	X				X							
BETTIN LUCIANO	S58	GTAW		X					X					
		SMAW	X		X	X	X	X						
		SAW	X	X	X	X	X	X	X					
		GMAW SEMIAUT.		X			X		X					
		ESW			X			X						

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Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MARTIN PARIDE	S59	SMAW		X		X		X						
		SAW	X		X			X	X					
		GMAW SEMIAUT.		X			X		X					
		ESW	X	X	X	X	X	X	X					
TIMPONE PERRADO (from June)	S60							X						
								X	X					
								X						
BENAISSOUN MONAIM	S61	GTAW		X		X			X					
		SMAW		X		X	X	X						
		SAW	X	X	X		X	X	X					
		GMAW SEMIAUT.	X			X			X					
		FCAW			X			X						
		ESW	X		X	X	X	X						
GARZOTTO MIRKO	S62	GTAW			X			X						
		SMAW		X				X						
		GMAW SEMIAUT.	X			X								
LUCATO LUCA (from February)	S63	SAW		X	X	X	X	X	X					
DI LAGO DAVIDE (from June)	S64	GTAW						X	X					
		SMAW						X	X					
		GMAW SEMIAUT.												
VINCENZO ROSSO (from February)	S65	SAW		X	X	X	X	X	X					
VUJIC PEDRAG (from February)	S66	SAW		X		X		X	X					
		ESW		X			X	X						
	S67													
FILIPPONE MASSIMILIANO	S68	GTAW		X			X							
		SMAW			X		X		X					
		GMAW SEMIAUT.	X	X		X		X						
		GTAW MACHINE		X	X	X			X					

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Prepared by - Preparato da
Approved by - Approvato da
Date - Data: 10/03/23 | 09/06/23

Welder's name / Nome del saldatore	Stamp	Process / Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LAZZARIN GUERRINO	S69	GTAW		X			X							
		SMAW	X		X	X	X	X	X					
		SAW	X		X				X					
		ESW	X						X					
		GMAW SEMIAUT.		X		X	X		X					
		FCAW			X	X		X						
MANFO MICHAEL	S70	GTAW			X			X						
		SMAW	X		X	X	X	X	X					
		GMAW SEMIAUT.		X			X							
		SAW	X	X	X	X			X					
		GMAW ROOT.		X	X		X	X						
	S71													
PERONI CORRADO	S72	GTAW		X	X	X		X						
		SMAW	X	X	X	X	X	X	X					
MIRKO GIBBIN	S73	GTAW		X		X		X						
		SMAW	X	X	X	X	X	X	X					
		SAW	X	X	X		X		X					
		ESW	X		X	X	X	X	X					
		GMAW SEMIAUT.		X			X							
ZANELLATO OMAR (from February)	S74	SMAW		X	X		X	X	X					
		SAW	X	X	X	X	X	X	X					
		GMAW SEMIAUT.	X			X			X					
		GTAW		X				X	X					
BELLOMIA FRANCESCO	S75	SMAW	X			X		X	X					
		SAW	X	X	X	X	X	X	X					
		GMAW SEMIAUT.		X			X							
		ESW		X	X		X	X						
DEVICIENTI ANDREA	S76	GTAW	X		X		X		X					
		SMAW	X	X	X	X			X					
		GMAW SEMIAUT.	X	X		X								
		FCAW			X				X					
		SAW		X			X							

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QUALIFIED WELDERS LOG YEAR 2023 "Albignasego/Marghera"

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09-01-2018

Prepared by - Preparato da: [signature] 10/03/23
Approved by - Approvato da: [signature] 09/06/23
Date - Data:

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LEKAJ NICOLI	S77	SMAW	X		X		X		X					
		SAW	X		X	X		X						
		ESW	X	X	X	X	X	X						
		GMAW SEMIAUT.		X			X							
SALVO' CLAUDIO	S78	SMAW	X		X	X		X	X					
		SAW	X	X	X			X						
		ESW		X			X							
		GMAW SEMIAUT.		X			X							
PADOVANI SIMONE	S79	GTAW			X				X					
		SMAW	X	X	X	X	X	X	X					
		GMAW SEMIAUT.	X	X		X	X	X						
		GMAW MACHINE		X			X							
ZORAN ERMAN	S80	SMAW		X		X		X						
		SAW	X	X	X	X	X		X					
	S81													
	S82													
SCHRAULECH MORENO	S83	GTAW		X		X	X	X						
		SMAW	X	X	X	X	X	X	X					
LUCATO FABIO	S84	GTAW	X	X		X	X	X	X					
		SMAW		X	X				X					
GALLO MICHAEL	S85	GTAW												
		SMAW												
FAWZI MOHAMED	S86	SMAW												
		SAW												
	S87													
CIOBANU VALENTIN	S88	GTAW			X		X		X					
		SMAW	X	X		X	X	X	X					
		SAW	X	X	X	X		X	X					
		GMAW SEMIAUT.	X				X							
		ESW		X	X		X	X						
RIZZATI ANTONELLO	S89	GTAW	X		X	X		X						
		SMAW	X		X			X						
		SAW		X			X							
		GMAW SEMIAUT.												

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10/03/23 | 09/06/23

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MELATO TIZIANO	S90	SMAW SAW		X X	X X	X	X X	X X	X					
DONÀ ANDREA	S91	GTAW SMAW SAW ESW	X X X	X X X	X X	X X	X	X X X	X X					
BONGOU JEAN	S92	GTAW SMAW SAW	X X	X X	X X	X X	X X	X X	X X					
	S93													
LEBARKY AYOUB	S94	GTAW SMAW SAW	X	X	X X	X X	X X	X X	X X					
ALAIN MILOTIC (from February)	S95	SAW ESW		X X	X	X X	X	X X	X					
	S96													
	S97													
	S98													
	S99													
MIOTTO DENNIS	S100	SMAW SAW GTAW	X X X	X X	X X X	X	X X	X X X	X X X					
	S101													

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Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
	S51													
CATOZZO DAVIDE	S52	GTAW								X	X	X	X	X
		SMAW								X		X	X	X
		SAW												
		ESW												
		GMAW SEMIAUT.									X			
		GTAW MACH.									X			
		FCAW										X		X
	S53													
DIOMBANA SITA	S54	GTAW									X			
		SMAW								X	X	X	X	
		GMAW SEMIAUT.								X			X	
		SAW								X		X		
		GMAW MACHINE									X			X
BALLOTTA ANDREA	S55	GTAW									X			X
		SMAW								X	X	X	X	
		GMAW SEMIAUT.												
		SAW								X		X	X	
		ESW								X	X	X		X
	S56													
LAZZARO FAUSTO	S57	GTAW												
		SMAW								X	X	X	X	X
		SAW												
		GMAW SEMIAUT.									X	X		
		ESW											X	
		FCAW								X	X	X		X
BETTIN LUCIANO	S58	GTAW												
		SMAW								X	X	X	X	X
		SAW												
		GMAW SEMIAUT.									X	X		
		ESW								X			X	

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Approved by - Approvato da
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09/09/23

07/12/23

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MARTIN PARIDE	S59	SMAW								X			X	
		SAW								X		X		X
		GMAW SEMIAUT.									X		X	
		ESW								X	X	X		X
TIMPONE PIERPAOLO SAW from August	S60	GTAW									X			X
		SMAW								X	X	X		X
		GMAW SEMIAUT.								X			X	
		SAW											X	
BENAISSOUN MONAIM	S61	GTAW								X	X		X	
		SMAW								X	X	X	X	X
		SAW										X		
		GMAW SEMIAUT.									X			X
		FCAW									X			
		ESW								X				
GARZOTTO MIRKO	S62	GTAW												X
		SMAW									X	X		
		GMAW SEMIAUT.								X	X		X	X
LUGATO LUCA	S63	SAW									X	X	X	
* DAL LAGO DAVIDE GTAW H.W. DI GEN. 24	S64	GTAW									X	X		X
		SMAW									X	X	X	X
		GMAW SEMIAUT.								X			X	
RUSSO VINCENZO	S65	SAW									X	X	X	X
VUJIC PEDRAG	S66	SAW									X	X	X	
		ESW								X				X
	S67													
FILIPPONE MASSIMILIANO	S68	GTAW									X		X	
		SMAW									X	X	X	X
		GMAW SEMIAUT.								X		X		X
		GMAW MACHINE								X			X	

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Approved by - Approvato da
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08/05/23

01/12/23

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LAZZARIN GUERRINO	S69	GTAW SMAW SAW ESW GMAW SEMIAUT. FCAW								X X X	X	X X	X X	X X
MANFO MICHAEL	S70	GTAW SMAW GMAW SEMIAUT. SAW GMAW MACHINE								X X	X X	X X X	X X X	X X
	S71													
PERONI CORRADO	S72	GTAW SMAW								X	X X	X X	X X	X X
MIRKO GIBBIN	S73	GTAW SMAW SAW ESW GMAW SEMIAUT.								X X	X X X	X X	X X	X X
ZANELLATO OMAR	S74	SMAW SAW GMAW SEMIAUT. GTAW								X	X X	X X X	X X	X X
BELLOMIA FRANCESCO	S75	SMAW SAW GMAW SEMIAUT. ESW								X X	X X	X X X	X X X	
DEVICIENTI ANDREA	S76	GTAW SMAW GMAW SEMIAUT. FCAW SAW								X X	X X	X X X	X X X	X X

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Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LEKAJ NICOLI	S77	SMAW								X	X	X	X	
		SAW												X
		ESW									X			
		GMAW SEMIAUT.												
SALVO' CLAUDIO	S78	SMAW								X	X	X	X	
		SAW												
		ESW									X			
		GMAW SEMIAUT.								X				
PADOVANI SIMONE	S79	GTAW								X	X	XX	X	X
		SMAW								X	X			
		GMAW SEMIAUT.								X				
		GMAW MACHINE												
ZORAN ERMAN	S80	SMAW								X			X	X
		SAW									X	X		
	S81													
	S82													
SCHRAULECH MORENO	S83	GTAW												
		SMAW								X	X	X	X	X
LUCATO FABIO	S84	GTAW										X		X
		SMAW								X	X	X	X	X
	S85	GTAW												
		SMAW												
	S86	SMAW												
		SAW												
	S87													
CIOBANU VALENTIN	S88	GTAW										X		X
		SMAW								X	X	X		X
		SAW								X	X	X	X	
		GMAW SEMIAUT.								X				X
		ESW								X				
	S89													

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

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QUALIFIED WELDERS LOG YEAR 2023 "Albignasego/Marghera"

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Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data

08/09/23 | 07/12/23

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MELATO TIZIANO	S90	SMAW SAW									X X	X X	X	X X
DONÀ ANDREA	S91	GTAW SMAW SAW ESW								X	X X	X X	X X	X
BONGOU JEAN	S92	GTAW SMAW SAW								X	X X	X X	X X	X X X
	S93													
LEBARKY AYOUB * DIMESSO DI SERVIZIO	S94	GTAW SMAW SAW								X	X X			
ALAIN MILOTIC	S95	SAW ESW									X X	X	X	X
	S96													
	S97													
	S98													
	S99													
MIOTTO DENNIS	S100	SMAW SAW GTAW								X X	X X	X X	X X	X X
	S101													

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1723001756-QC-DB-00017_02 - V25001A

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QUALIFIED WELDERS LOG YEAR 2022 "Albignasego/Marghera"

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Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
	S51													
CATOZZO DAVIDE	S52	GTAW			X		X		X			X		
		SMAW		X		X	X	X		X	X		X	X
		SAW	X		X				X			X		
		ESW				X					X			X
		GMAW SEMIAUT.	X	X			X			X		X		
		GTAW MACH.		X									X	
		FCAW			X	X			X	X	X			X
FORIN MAURO	S53	GTAW												
		SMAW												
		SAW												
		GMAW SEMIAUT.												
DIOMBANA SITA	S54	GTAW		X		X			X		X		X	
		SMAW	X	X	X		X	X		X	X	X		X
		GMAW SEMIAUT.	X			X			X		X		X	
		SAW		X	X		X	X		X		X		X
BALLOTTA ANDREA	S55	GTAW	X			X	X			X			X	
		SMAW		X	X		X		X	X		X		X
		GMAW SEMIAUT.	X			X		X			X		X	
		SAW	X	X	X		X		X	X	X	X		X
		ESW			X			X		X	X		X	X
BRUNELLO MAURO	S56	GTAW		X	X		X	X		X		X	X	X
		SMAW	X	X	X	X		X	X		X	X	X	X
		GMAW SEMIAUT.			X				X	X		X		
		FCAW	X			X					X			
LAZZARO FAUSTO	S57	GTAW		X		X		X	X	X			X	
		SMAW	X		X	X		X	X		X		X	X
		SAW	X	X	X		X		X	X		X		
		GMAW SEMIAUT.	X		X		X	X			X	X		X
		ESW	X			X			X			X	X	
		FCAW		X			X			X				X
BETTIN LUCIANO	S58	GTAW			X			X			X	X		
		SMAW	X	X		X		X	X		X		X	X
		SAW	X	X	X		X		X	X		X		
		GMAW SEMIAUT.		X				X				X	X	X
		ESW			X				X					

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

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QUALIFIED WELDERS LOG YEAR 2022 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
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Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MARTIN PARIDE	S59	SMAW		X		X	X			X		X		X
		SAW			X		X	X			X	X	X	X
		GMAW SEMIAUT.		X					X	X			X	
		ESW			X		X		X		X	X	X	X
SAVOGIN DANIELE	S60	GTAW	X	X		X		X		X		X	X	X
		SMAW		X	X	X	X		X	X	X	X	X	X
		SAW			X			X			X			X
		GMAW SEMIAUT.	X	X					X		X	X		
		FCAW			X		X							
		GMAW MACH.		X		X		X	X		X		X	
BENAISSOUN MONAIM	S61	GTAW		X			X		X		X		X	
		SMAW			X			X		X		X		X
		SAW		X		X	X		X	X	X	X	X	
		GMAW SEMIAUT.	X	X		X		X					X	X
		FCAW			X	X			X					X
		ESW				X		X		X		X	X	
GARZOTTO MIRKO	S62	GTAW	X		X			X						X
		SMAW	X	X					X			X		X
		GMAW SEMIAUT.			X					X				
CICALA EMANUELE	S63	GTAW												
		SMAW												
		SAW												
		GMAW												
SETTE FIORENZO	S64	GTAW		X	X			X	X		X		X	
		SMAW	X	X	X	X		X		X	X	X	X	X
		GMAW SEMIAUT.	X				X		X			X		
GARBIN LORENZO	S65	GTAW			X									
		SMAW	X	X	X		X		X	X				
		GMAW SEMIAUT.	X		X	X				X				
	S66													
PIVA PAOLO	S67	GTAW	X											
		SMAW				X		X		X		X	X	
		SAW		X	X		X		X		X	X		
		GMAW SEMIAUT.	X	X	X									
		FCAW			X									

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QUALIFIED WELDERS LOG YEAR 2022 "Albignasego/Marghera"

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Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
(from October) ~~ZANIRATO DAMIANO~~ FILIPPONE ALESSANDRO	S68	GTAW SMAW GMAW SEMIAUT. ~~FCAW~~ ~~SAW~~										X X	X X	X X
LAZZARIN GUERRINO	S69	GTAW SMAW SAW ESW GMAW SEMIAUT. FCAW	X X	X X X X	X X X X	X X	X X	X X X X	X X	X X X	X X X	X X X	X X	X X X
MANFO MICHAEL	S70	GTAW SMAW GMAW SEMIAUT. SAW	X X	X X	X X		X X	X X X	X X	X X	X X	X X	X X X	X X
NICOLINI ANTONIO	S71	GTAW SMAW SAW ESW GMAW SEMIAUT.	X X	X X X	X X	X X	X X	X X	X X	X X	X X	X X	X X X	X X
PERONI CORRADO	S72	GTAW SMAW	X X	X X	X X	X	X	X	X	X	X	X X	X	X X
MIRKO GIBBIN	S73	GTAW SMAW SAW ESW GMAW SEMIAUT.	X X	X X X X	X X X	X X X	X X	X X	X X	X X	X X	X X	X X	X X
ZANELLATO OMAR	S74	SMAW SAW GMAW SEMIAUT.	X X	X X X	X	X	X X	X	X	X X	X X	X X	X X	X
BELLOMIA FRANCESCO	S75	SMAW SAW GMAW SEMIAUT.	X	X X	X	X X	X	X	X	X X	X	X	X X	X X
DEVICIENTI ANDREA	S76	GTAW SMAW GMAW SEMIAUT. FCAW SAW	X X	X X X	X X	X X	X X	X X X	X X	X	X X	X X X	X X X	X X

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09-01-2018

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Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LEKAJ NICOLI	S77	SMAW												
		SAW												
		ESW												
		GMAW SEMIAUT.												
SALVO' CLAUDIO	S78	SMAW												
		SAW												
		ESW												
		GMAW SEMIAUT.												
PADOVANI SIMONE	S79	GTAW												
		SMAW												
		GMAW SEMIAUT.												
		GMAW MACHINE												
ZORAN ERMAN	S80	SMAW												
		SAW												
	S81													
	S82													
SCHRAULECH MORENO	S83	GTAW												
		SMAW												
LUCATO FABIO	S84	GTAW												
		SMAW												
GALLO MICHAEL	S85	GTAW												
		SMAW												
FAWZI MOHAMED	S86	SMAW												
		SAW												
CIOBANU VALENTIN	S88	GTAW												
		SMAW												
		SAW												
		GMAW SEMIAUT.												
RIZZATI ANTONELLO	S89	GTAW												
		SMAW												
		SAW												
		GMAW SEMIAUT.												

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QUALIFIED WELDERS LOG YEAR 2022 "Albignasego/Marghera"

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Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da																	
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Date - Data			16/03/22				10/06/22			08/09/22				09/12/22			
Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MELATO TIZIANO	S90	SMAW SAW	X X	X X	X X	X	X	X	X	X X	X X	X	X X	X X
DONÀ ANDREA	S91	GTAW SMAW SAW ESW	X	X X	X X	X X	X X	X	X X	X	X	X X X	X	X X
BONGOU JEAN	S92	GTAW SMAW SAW	X X	X X	X X	X	X X	X	X X	X X	X	X	X X	X X
	S93													
LEBARKY AYOUB	S94	GTAW SMAW SAW	X X	X X	X X	X	X	X X	X	X	X	X X	X	X X
	S95													
	S96													
	S97													
	S98													
	S99													
MIOTTO DENNIS	S100	SMAW SAW GTAW	X X	X X	X X	X X	X X	X	X	X X	X X	X X	X	X X
	S101													

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09-01-2018

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Date - Data

10/12/21

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
	S51													
CATOZZO DAVIDE	S52	GTAW											X	
		SMAW										X		
		SAW										X		
		ESW												X
		GMAW SEMIAUT.											X	
		GTAW MACH.												
		FCAW										X		
FORIN MAURO	S53	GTAW												
		SMAW												
		SAW												
		GMAW SEMIAUT.												
DIOMBANA SITA	S54	GTAW												
		SMAW											X	
		GMAW SEMIAUT.										X		X
		SAW											X	
												X		X
BALLOTTA ANDREA	S55	GTAW												
		SMAW										X		
		GMAW SEMIAUT.											X	X
		SAW										X		
		ESW										X		
														X
BRUNELLO MAURO	S56	GTAW												
		SMAW											X	
		GMAW SEMIAUT.										X		X
		FCAW												X
													X	
LAZZARO FAUSTO	S57	GTAW										X		
		SMAW											X	
		SAW										X		X
		GMAW SEMIAUT.											X	X
		ESW												X
		FCAW										X		
BETTIN LUCIANO	S58	GTAW											X	
		SMAW										X		
		SAW										X		
		GMAW SEMIAUT.												X
		ESW											X	

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Prepared by - Preparato da														
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Date - Data													10/12/21	
Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MARTIN PARIDE	S59	SMAW										X	X	
		SAW											X	
		GMAW SEMIAUT.										X	X	
		ESW											X	
SAVOGIN DANIELE	S60	GTAW										X		
		SMAW										X		
		SAW											X	
		GMAW SEMIAUT.												
		FCAW										X		
		GMAW MACH.											X	X
BENAISSOUN MONAIM	S61	GTAW										X		
		SMAW											X	X
		SAW										X		
		GMAW SEMIAUT.										X		
		FCAW												
		ESW												X
GARZOTTO MIRKO	S62	GTAW										X		
		SMAW										X		
		GMAW SEMIAUT.												X
CICALA EMANUELE	S63	GTAW										X		X
		SMAW										X		
		SAW												X
		GMAW												
SETTE FIORENZO	S64	GTAW											X	X
		SMAW										X		X
		GMAW SEMIAUT.												X
GARBIN LORENZO	S65	GTAW											X	
		SMAW										X		
		GMAW SEMIAUT.											X	
	S66													
PIVA PAOLO	S67	GTAW										X		
		SMAW											X	X
		SAW										X		
		GMAW SEMIAUT.												
		FCAW												X

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Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
ZANIRATO DAMIANO	S68	GTAW												
		SMAW												
		GMAW SEMIAUT.												
		FCAW												
		SAW												
LAZZARIN GUERRINO	S69	GTAW												
		SMAW										X		
		SAW											X	X
		ESW										X	X	
		GMAW SEMIAUT.										X		
		FCAW											X	
MANFO MICHAEL	S70	GTAW										X		
		SMAW											X	X
		GMAW SEMIAUT.										X		
		SAW										X	X	X
NICOLINI ANTONIO	S71	GTAW											X	
		SMAW											X	X
		SAW										X		X
		ESW											X	
		GMAW SEMIAUT.										X		
PERONI CORRADO	S72	GTAW										X		X
		SMAW										X	X	X
MIRKO GIBBIN	S73	GTAW										X		
		SMAW											X	X
		SAW										X	X	
		ESW												X
		GMAW SEMIAUT.										X		
ZANELLATO OMAR	S74	SMAW										X		
		SAW										X	X	X
		GMAW SEMIAUT.											X	X
BELLOMIA FRANCESCO	S75	SMAW										X		X
		SAW											X	X
		GMAW SEMIAUT.											X	
DEVICIENTI ANDREA	S76	GTAW										X		X
		SMAW										X		X
		GMAW SEMIAUT.											X	
		FCAW											X	
		SAW												X

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Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LEKAJ NICOLI	S77	SMAW										X		
		SAW											X	X
		ESW										X		
		GMAW SEMIAUT.											X	
SALVO' CLAUDIO	S78	SMAW										X		
		SAW											X	
		ESW												X
		GMAW SEMIAUT.										X		
PADOVANI SIMONE	S79	GTAW											X	
		SMAW										X	X	X
		GMAW SEMIAUT.											X	X
		GMAW MACHINE											X	
ZORAN ERMAN	S80	SMAW												
		SAW												
	S81												X	X
													X	
	S82													
SCHRAULECH MORENO	S83	GTAW										X		X
		SMAW											X	X
LUCATO FABIO	S84	GTAW										X		
		SMAW											X	X
GALLO MICHAEL	S85	GTAW											X	
		SMAW										X		X
FAWZI MOHAMED	S86	SMAW											X	
		SAW										X	X	X
CIOBANU VALENTIN	S88	GTAW										X		
		SMAW											X	X
		SAW										X		X
		GMAW SEMIAUT.											X	
RIZZATI ANTONELLO	S89	GTAW											X	
		SMAW												X
		SAW												
		GMAW SEMIAUT.										X	X	

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Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MELATO TIZIANO	S90	SMAW SAW										X X		X X
DONÀ ANDREA	S91	GTAW SMAW SAW ESW										X X	X	X X X
BONGOU JEAN	S92	GTAW SMAW SAW										X X	X X	X X
	S93													
LEBARKY AYOUB	S94	GTAW SMAW SAW										X X X	X	X X
	S95													
	S96													
	S97													
	S98													
	S99													
MIOTTO DENNIS	S100	SMAW SAW										X X	X	X X
	S101													

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Approved by - Approvato da
Date - Data 11/03/21 11/06/21 10/09/21

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
	S51													
CATOZZO DAVIDE	S52	GTAW		X			X			X				
		SMAW	X		X	X		X	X		X	X		
		SAW		X	X		X			X		X		
		ESW		X			X				X			
		GMAW SEMIAUT.	X			X		X						
		GTAW MACH.		X			X							
		FCAW			X			X		X		X		
FORIN MAURO	S53	GTAW			X			X						
		SMAW		X			X		X	X	X			
		SAW			X			X						
		GMAW SEMIAUT.		X			X				X			
DIOMBANA SITA	S54	GTAW	X			X			X					
		SMAW	X			X		X	X	X				
		GMAW SEMIAUT.		X	X					X	X	X		
BALLOTTA ANDREA	S55	GTAW	X			X		X	X			X		
		SMAW	X		X		X			X	X			
		GMAW SEMIAUT.		X		X		X		X		X		
		SAW	X		X	X	X		X		X	X		
		ESW		X	X			X		X	X	X		
BRUNELLO MAURO	S56	GTAW	X	X		X		X	X					
		SMAW		X	X		X			X	X	X		
		GMAW SEMIAUT.	X			X		X	X					
		FCAW		X		X		X		X				
LAZZARO FAUSTO	S57	GTAW			X			X						
		SMAW		X		X	X		X	X	X	X		
		SAW	X		X			X						
		GMAW SEMIAUT.		X		X	X		X	X		X		
		ESW		X			X				X			
		FCAW	X			X		X	X					
BETTIN LUCIANO	S58	GTAW		X			X							
		SMAW	X		X	X		X	X		X	X		
		SAW	X	X		X	X		X	X		X		
		GMAW SEMIAUT.		X	X	X		X	X			X		
		ESW		X					X					

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

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QUALIFIED WELDERS LOG YEAR 2021 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da																
Approved by - Approvato da																
Date - Data			11/03/21			11/06/21			10/09/21							
Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December		
MARTIN PARIDE	S59	SMAW	X			X				X		X				
		SAW		X		X		X	X		X					
		GMAW SEMIAUT.			X		X			X		X				
		ESW	X	X		X		X	X		X					
SAVOGIN DANIELE	S60	GTAW	X			X		X	X		X	X				
		SMAW	X	X	X		X			X	X	X				
		SAW		X		X		X	X		X					
		GMAW SEMIAUT.	X			X	X			X	X	X				
		FCAW			X	X		X	X							
		GMAW MACH.		X					X		X					
BENAISSOUN MONAIM	S61	GTAW		X		X		X				X				
		SMAW		X		X	X			X	X	X				
		SAW	X		X	X		X	X		X					
		GMAW SEMIAUT.			X		X		X		X	X				
		FCAW		X		X		X	X							
		ESW	X		X		X		X	X	X					
GARZOTTO MIRKO	S62	GTAW			X			X				X				
		SMAW		X		X			X			X				
		GMAW SEMIAUT.	X					X								
CICALA EMANUELE	S63	GTAW	X			X				X						
		SMAW		X	X			X				X				
		SAW	X			X			X			X				
		GMAW			X			X			X					
SETTE FIORENZO	S64	GTAW	X			X		X		X	X					
		SMAW		X	X	X	X		X			X				
		GMAW SEMIAUT.	X			X		X			X					
GARBIN LORENZO	S65	GTAW			X		X			X	X					
		SMAW	X	X		X			X	X		X				
		GMAW SEMIAUT.	X		X			X		X						
	S66															
PIVA PAOLO	S67	GTAW		X			X					X				
		SMAW	X	X		X		X		X	X					
		SAW	X		X	X	X		X	X		X				
		GMAW SEMIAUT.		X				X		X	X	X				
		FCAW		X			X			X						

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

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QUALIFIED WELDERS LOG YEAR 2021 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da														
Approved by - Approvato da														
Date - Data			11/03/21			11/06/21			10/09/21					
Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
ZANIRATO DAMIANO	S68	GTAW	X		X		X	X						
		SMAW	X	X		X	X		X					
		GMAW SEMIAUT.			X	X		X						
		FCAW		X										
		SAW		X	X		X		X					
LAZZARIN GUERRINO	S69	GTAW	X			X			X			X		
		SMAW	X	X				X		X	X			
		SAW		X	X		X		X	X	X	X		
		ESW	X	X		X		X		X				
		GMAW SEMIAUT.			X				X		X	X		
		FCAW	X			X		X				X		
MANFO MICHAEL	S70	GTAW		X			X			X		X		
		SMAW		X	X	X			X		X			
		GMAW SEMIAUT.	X		X			X		X		X		
NICOLINI ANTONIO	S71	GTAW		X					X					
		SMAW	X		X		X			X	X			
		SAW		X	X	X		X	X	X		X		
		ESW		X			X				X			
		GMAW SEMIAUT.	X			X		X		X		X		
PERONI CORRADO	S72	GTAW		X	X			X						
		SMAW	X	X	X	X	X	X	X	X	X	X		
MIRKO GIBBIN	S73	GTAW			X	X		X		X		X		
		SMAW	X	X		X			X		X			
		SAW	X	X	X		X			X		X		
		ESW	X	X		X		X	X		X			
		GMAW SEMIAUT.			X			X				X		
ZANELLATO OMAR	S74	SMAW	X			X			X			X		
		SAW		X	X		X	X		X		X		
		GMAW SEMIAUT.		X		X			X		X			
BELLOMIA FRANCESCO	S75	SMAW	X	X		X			X			X		
		SAW	X		X	X	X	X		X	X			
		GMAW SEMIAUT.		X		X			X					
DEVICIENTI ANDREA	S76	GTAW		X	X				X		X	X		
		SMAW	X	X	X		X	X		X		X		
		GMAW SEMIAUT.	X			X			X					
		FCAW		X		X				X				
		SAW		X		X		X			X			

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QUALIFIED WELDERS LOG YEAR 2021 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data 11/12/21 11/06/21 10/09/21

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LEKAJ NICOLI	S77	SMAW	X		X		X		X			X		
		SAW		X		X		X		X	X			
		ESW	X	X		X	X		X	X		X		
		GMAW SEMIAUT.			X			X			X			
SALVO' CLAUDIO	S78	SMAW		X	X			X		X	X	X		
		SAW	X			X	X		X	X				
		ESW		X		X		X		X	X			
		GMAW SEMIAUT.		X	X				X			X		
PADOVANI SIMONE	S79	GTAW	X	X										
		SMAW	X	X	X	X	X	X	X					
		GMAW SEMIAUT.		X		X			X	X	X	X		
		GMAW MACHINE		X				X						
ZORAN ERMAN	S80	SMAW			X				X					
		SAW	X	X				X						
	S81													
	S82													
SCHRAULECH MORENO	S83	GTAW		X	X	X		X		X	X	X		
		SMAW	X	X	X	X	X	X	X	X	X			
LUCATO FABIO	S84	GTAW	X		X	X		X		X		X		
		SMAW		X			X	X	X	X	X			
GALLO MICHAEL	S85	GTAW	X		X			X						
		SMAW		X		X	X		X	X	X	X		
FAWZI MOHAMED	S86	SMAW	X			X		X			X			
		SAW		X	X	X	X		X	X		X		
	S87													
CIOBANU VALENTIN	S88	GTAW		X			X			X		X		
		SMAW	X			X		X	X		X			
		SAW		X	X	X	X			X		X		
		GMAW SEMIAUT.	X	X		X			X		X	X		
RIZZATI ANTONELLO	S89	GTAW			X				X					
		SMAW	X	X		X				X				
		SAW			X			X						
		GMAW SEMIAUT.			X				X			X		

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QUALIFIED WELDERS LOG YEAR 2021 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da															
Approved by - Approvato da															
Date - Data															
Welder's name Nome del saldatore	**Stamp**	**Process Procedimento**	January	February	March	April	May	June	July	August	September	October	November	December
MELATO TIZIANO	S90	SMAW SAW		X X	X X	X X		X X		X X		X X		
DONÀ ANDREA	S91	GTAW SMAW SAW ESW	X X	X	X X	X X	X X	X X	X	X	X X X	X X		
BONGOU JEAN	S92	GTAW SMAW SAW	X	X X	X	X X	X	X X	X X	X X	X	X X		
	S93													
	S94													
	S95													
	S96													
	S97													
	S98													
	S99													
MIOTTO DENNIS	S100	SMAW SAW	X X	X X	X	X	X X	X	X	X	X X	X X		
	S101													

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QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da														
Approved by - Approvato da														
Date - Data														
Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
	S51													
CATOZZO DAVIDE	S52	GTAW										X		
		SMAW										X		X
		SAW											X	
		ESW											X	
		GMAW SEMIAUT.												
		GTAW MACH.										X		
		FCAW										X		
FORIN MAURO	S53	GTAW												X
		SMAW										X		
		SAW										X		
		GMAW SEMIAUT.										X		
DIOMBANA SITA	S54	GTAW											X	
		SMAW										X		
		GMAW SEMIAUT.										X	X	
BALLOTTA ANDREA	S55	GTAW										X		X
		SMAW										X		X
		GMAW SEMIAUT.											X	
		SAW												X
		ESW										X		
BRUNELLO MAURO	S56	GTAW										X		
		SMAW										X		X
		GMAW SEMIAUT.											X	
		FCAW												X
LAZZARO FAUSTO	S57	GTAW												X
		SMAW										X		X
		SAW										X	X	X
		GMAW SEMIAUT.											X	
		ESW											X	
		FCAW										X		
BETTIN LUCIANO	S58	GTAW											X	
		SMAW										X		X
		SAW										X	X	X
		GMAW SEMIAUT.												
		ESW										X	X	

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QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.3
09-01-2018

Prepared by - Preparato da			
Approved by - Approvato da			
Date - Data			

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MARTIN PARIDE	S59	SMAW										X	X	
		SAW										X		X
		GMAW SEMIAUT.												X
		ESW										X	X	
SAVOGIN DANIELE	S60	GTAW										X	X	
		SMAW										X	X	X
		SAW											X	
		GMAW SEMIAUT.										X		X
		FCAW												X
		GMAW MACH.											X	
BENAISSOUN MONAIM	S61	GTAW											X	
		SMAW										X	X	X
		SAW											X	
		GMAW SEMIAUT.												X
		FCAW										X		
		ESW										X		
GARZOTTO MIRKO	S62	GTAW												X
		SMAW											X	
		GMAW SEMIAUT.										X		
CICALA EMANUELE	S63	GTAW										X		
		SMAW										X		X
		SAW											X	
		GMAW												X
SETTE FIORENZO	S64	GTAW										X		
		SMAW										X	X	X
		GMAW SEMIAUT.											X	
GARBIN LORENZO	S65	GTAW											X	
		SMAW										X	X	X
		GMAW SEMIAUT.										X		
FECCHIO FABRIZIO	S66	GTAW										X		X
		SMAW											X	X
		GMAW												
PIVA PAOLO	S67	GTAW												X
		SMAW										X		
		SAW										X	X	X
		GMAW SEMIAUT.											X	
		FCAW												X

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QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da														
Approved by - Approvato da														
Date - Data														
Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
ZANIRATO DAMIANO	S68	GTAW												
		SMAW										X	X	
		GMAW SEMIAUT.											X	X
		FCAW												
		SAW										X		
LAZZARIN GUERRINO	S69	GTAW												
		SMAW										X	X	
		SAW											X	X
		ESW												
		GMAW SEMIAUT.										X	X	
		FCAW											X	
MANFO MICHAEL	S70	GTAW												
		SMAW											X	
		GMAW SEMIAUT.											X	X
NICOLINI ANTONIO	S71	GTAW												
		SMAW											X	X
		SAW											X	X
		ESW										X	X	
		GMAW SEMIAUT.												
												X		
PERONI CORRADO	S72	GTAW										X	X	
		SMAW										X	X	X
MIRKO GIBBIN	S73	GTAW											X	
		SMAW										X		X
		SAW										X	X	
		ESW											X	
		GMAW SEMIAUT.										X		X
ZANELLATO OMAR	S74	SMAW										X		
		SAW										X	X	X
		GMAW SEMIAUT.											X	X
BELLOMIA FRANCESCO	S75	SMAW										X		X
		SAW										X	X	X
		GMAW SEMIAUT.											X	
DEVICIENTI ANDREA	S76	GTAW											X	
		SMAW										X	X	X
		GMAW SEMIAUT.											X	
		FCAW												X
		SMAW SAW										X	X	

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QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

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Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LEKAJ NICOLI	S77	SMAW										X		
		SAW										X		
		ESW											X	X
		GMAW SEMIAUT.										X	X	X
SALVO' CLAUDIO	S78	SMAW												
		SAW										X	X	X
		ESW										X		
		GMAW SEMIAUT.											X	
PADOVANI SIMONE	S79	GTAW										X		
		SMAW										X		
		GMAW SEMIAUT.										X	X	X
		GMAW MACHINE												X
ZORAN ERMAN	S80	SMAW											X	
		SAW											X	X
	S81													
	S82													
SCHRAULECH MORENO	S83	GTAW												
		SMAW										X	X	X
LUCATO FABIO	S84	GTAW												
		SMAW										X	X	X
GALLO MICHAEL	S85	GTAW												
		SMAW										X	X	X
FAWZI MOHAMED	S86	SMAW												
		SAW										X	X	X
	S87													
CIOBANU VALENTIN	S88	GTAW												
		SMAW										X	X	X
		SAW										X	X	X
		GMAW SEMIAUT.												
RIZZATI ANTONELLO	S89	GTAW												
		SMAW											X	X
		SAW										X		
		GMAW SEMIAUT.												X

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Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MELATO TIZIANO	S90	SMAW SAW										X X	X	X
DONÀ ANDREA	S91	GTAW SMAW SAW ESW										X X	X X	X X
BONGOU JEAN	S92	GTAW SMAW SAW										X X	X X X	X
	S93													
	S94													
	S95													
	S96													
	S97													
	S98													
	S99													
MIOTTO DENNIS	S100	SMAW SAW										X X	X X	X
	S101													

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09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
	S51													
CATOZZO DAVIDE	S52	GTAW								X				
		SMAW							X		X			
		SAW							X		X			
		ESW												
		GMAW SEMIAUT.								X				
		GTAW MACH.							X					
		FCAW							X	X				
FORIN MAURO	S53	GTAW							X					
		SMAW								X	X			
		SAW							X					
		GMAW SEMIAUT.								X	X			
	S54													
BALLOTTA ANDREA	S55	GTAW								X				
		SMAW								X				
		GMAW SEMIAUT.							X					
		SAW									X			
		ESW							X					
BRUNELLO MAURO	S56	GTAW							X	X				
		SMAW								X				
		GMAW SEMIAUT.									X			
		FCAW							X		X			
LAZZARO FAUSTO	S57	GTAW									X			
		SMAW								X				
		SAW							X	X				
		GMAW SEMIAUT.									X			
		ESW									X			
		FCAW								X				
BETTIN LUCIANO	S58	GTAW								X	X			
		SMAW								X				
		SAW							X		X			
		GMAW SEMIAUT.												
		ESW							X					

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Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MARTIN PARIDE	S59	SMAW							X					
		SAW								X				
		GMAW SEMIAUT.									X			
		ESW							X	X	X			
SAVOGIN DANIELE	S60	GTAW												
		SMAW							X	X	X			
		SAW							X		X			
		GMAW SEMIAUT.								X				
		FCAW								X				
		GMAW MACH.							X					
BENAISSOUN MONAIM	S61	GTAW								X				
		SMAW							X	X				
		SAW							X		X			
		GMAW SEMIAUT.							X					
		FCAW								X				
		ESW									X			
GARZOTTO MIRKO	S62	GTAW												
		SMAW								X	X			
		GMAW SEMIAUT.							X		X			
CICALA EMANUELE	S63	GTAW												
		SMAW							X	X	X			
		SAW								X				
		GMAW							X		X			
	S64													
	S65													
FECCHIO FABRIZIO	S66	GTAW												
		SMAW							X	X	X			
		GMAW												
PIVA PAOLO	S67	GTAW												
		SMAW								X	X			
		SAW							X					
		GMAW SEMIAUT.								X				
		FCAW							X	X				

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QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
ZANIRATO DAMIANO *AGGIUNG. SAW	S68	GTAW SMAW GMAW SEMIAUT. FCAW							X	X	X X			
LAZZARIN GUERRINO	S69	GTAW SMAW SAW ESW GMAW SEMIAUT. FCAW							X X	X X X	X X			
	S70													
NICOLINI ANTONIO	S71	GTAW SMAW SAW ESW GMAW SEMIAUT.							X X	X	X X X			
PERONI CORRADO	S72	GTAW SMAW							X X	X				
MIRKO GIBBIN	S73	GTAW SMAW SAW ESW GMAW SEMIAUT.							X	X X	X X			
ZANELLATO OMAR	S74	SMAW SAW GMAW SEMIAUT.							X	X	X X			
BELLOMIA FRANCESCO	S75	SMAW SAW GMAW SEMIAUT.							X	X X	X			
DEVICIENTI ANDREA * AGG. SAW	S76	GTAW SMAW GMAW SEMIAUT. FCAW							X	X X X	X X			

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

BREMBANA&ROLLE

QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
LEKAJ NICOLI	S77	SMAW SAW ESW GMAW SEMIAUT.							X X	 X X	X X			
SALVO' CLAUDIO	S78	SMAW SAW ESW GMAW SEMIAUT.							 X	X	X X			
PADOVANI SIMONE	S79	GTAW SMAW GMAW SEMIAUT. GMAW MACHINE							X X X	X X	X			
ZORAN ERMAN	S80	SMAW SAW							X	 X	X			
	S81													
	S82													
SCHRAULECH MORENO	S83	GTAW SMAW							 X	X	X X			
LUCATO FABIO	S84	GTAW SMAW									X X			
GALLO MICHAEL	S85	GTAW SMAW							X X	X				
FAWZI MOHAMED	S86	SMAW SAW							X	 X	X X			
	S87													
CIOBANU VALENTIN	S88	GTAW SMAW SAW GMAW SEMIAUT.							X X	X X	X X			
RIZZATI ANTONELLO	S89	GTAW SMAW SAW GMAW SEMIAUT.							X	X X	 X			

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

BREMBANA&ROLLE

QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
MELATO TIZIANO	S90	SMAW SAW							X	X X	X			
DONÀ ANDREA	S91	GTAW SMAW SAW ESW							X X	X X				
BONGOU JEAN	S92	GTAW SMAW SAW							X	X X	X X			
	S93													
	S94													
	S95													
	S96													
	S97													
	S98													
	S99													
MIOTTO DENNIS	S100	SMAW SAW							X X	X	X			
	S101													

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

BREMBANA&ROLLE

QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da: Filippo Gobbi
Approved by - Approvato da: Filippo Gobbi
Date - Data: 23/03/20 | 13/08/20

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
	S51													
CATOZZO DAVIDE	S52	GTAW		X			X							
		SMAW	X		X	X		X						
		SAW		X			X							
		ESW			X			X						
		GMAW SEMIAUT.	X			X		X						
		GTAW MACH.		X			X							
FORIN MAURO	S53	GTAW	X			X								
		SMAW		X	X		X	X						
		SAW	X			X		X						
		GMAW SEMIAUT.		X			X							
	S54													
BALLOTTA ANDREA	S55	GTAW		X			X							
		SMAW		X		X		X						
		GMAW SEMIAUT.	X				X							
		SAW	X		X	X	X	X						
BRUNELLO MAURO	S56	GTAW				X								
		SMAW	X	X			X	X						
		GMAW SEMIAUT.	X		X	X		X						
LAZZARO FAUSTO	S57	SMAW	X	X		X		X						
		SAW	X		X	X	X							
		GMAW SEMIAUT.	X			X		X						
		ESW		X	X		X	X						
BETTIN LUCIANO	S58	SMAW	X			X	X							
		SAW	X	X	X		X	X						
		GMAW SEMIAUT.				X								
		ESW	X			X								
		GTAW	X				X							

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

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QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December		
MARTIN PARIDE	S59	SMAW SAW GMAW SEMIAUT. ESW														
SAVOGIN DANIELE	S60	GTAW SMAW GMAW MACH.														
BENAISSOUN MONAIM	S61	GTAW SMAW SAW GMAW														
GARZOTTO MIRKO	S62	GTAW SMAW GMAW SEMIAUT. GTAW MACH.														
CICALA EMANUELE	S63	GTAW SMAW SAW GMAW														
	S64															
	S65															
FECCHIO FABRIZIO	S66	GTAW SMAW														
PIVA PAOLO	S67	SMAW SAW GMAW SEMIAUT.														
ZANIRATO DAMIANO	S68	GTAW SMAW														

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

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QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da																
Approved by - Approvato da																
Date - Data			13/06/20			13/06/20										
Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December		
LAZZARIN GUERRINO	S69	GTAW SMAW SAW ESW GTAW MACH.	X X X	 X 	 X X X	X X 	 X X	X X X 								
	S70															
NICOLINI ANTONIO	S71	SMAW GMAW SEMIAUT. SAW	 X	X X X	 X	X X	 X X	X 								
PERONI CORRADO	S72	GTAW SMAW	X X	 X	 X	X 	 X	X 								
MIRKO GIBBIN	S73	GTAW SMAW SAW GMAW	X X X X	 X X	 X 	X X X	X X 	 X X X								
ZANELLATO OMAR	S74	SMAW GMAW SEMIAUT. SAW	 X X	X X	 X	 X 	X X	 X X								
BELLOMIA FRANCESCO	S75	SMAW SAW GMAW SEMIAUT.	X X 	 X 	X X	 X 	X X X	X X								
DEVICIENTI ANDREA	S76	GTAW SMAW	X X	X X	 X	X 	X 	 X								
LEKAJ NICOLI	S77	SMAW GMAW SEMIAUT. SAW ESW	X X	 X 	X X X X	 X 	X X X	X X X								
SALVO' CLAUDIO	S78	SMAW GMAW SEMIAUT. ESW SAW	 X X	X 	 X 	 X 	 X X	X 								
PADOVANI SIMONE	S79	GTAW SMAW GMAW MACHINE GMAW SEMIAUT.	X X 	 X X	X X	X X 	 X X X	X X								

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

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QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da																
Approved by - Approvato da																
Date - Data				13/03/20			13/06/20									
Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December		
ZORAN ERMAN	S80	SMAW SAW	X	X		X X		X								
	S81															
	S82															
SCHRAULECH MORENO	S83	GTAW SMAW	X X	X	X X	X	X X	X								
LUCATO FABIO	S84	GTAW SMAW	X	X	X	X	X	X								
GALLO MICHAEL	S85	GTAW SMAW	X X	X	X	X	X	X								
FAWZI MOHAMED	S86	SMAW SAW	X X	X	X	X	X	X X								
	S87															
CIOBANU VALENTIN	S88	GTAW SMAW SAW GMAW	X X	X X	X X X	X X	X X	X X								
RIZZATI ANTONELLO	S89	GTAW SMAW SAW GMAW	X X X	X X	X X	X	X	X								
MELATO TIZIANO	S90	SMAW SAW	X X	X	X	X	X	X								

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

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QUALIFIED WELDERS LOG YEAR 2020 "Albignasego/Marghera"

Document Nr. WL-01 rev.0
09-01-2018

Prepared by - Preparato da
Approved by - Approvato da
Date - Data 13/03/20 | 13/06/20

Welder's name Nome del saldatore	Stamp	Process Procedimento	January	February	March	April	May	June	July	August	September	October	November	December
DONÀ ANDREA	S91	GTAW SMAW SAW ESW	X X X	X	X X X	X X	X X	X X						
BONGOU JEAN	S92	GTAW SMAW SAW	X X	X X	X	X X	X X	X X						
	S93													
	S94													
	S95													
	S96													
	S97													
	S98													
	S99													
MIOTTO DENNIS	S100	SMAW SAW	X X	X	X X	X	X	X						
	S101													
	S102													

Note: The card is updated every three months at least - Lascheda è aggiornata con scadenza minima trimestrale

1723001756-QC-DB-00017_02 - V25001A

Fabrication site: Albignasego – PD – ITALY

Section 12

Manufacturing & NDE procedures (NDE, PMI,forming ,...) / NDE Operators List & Qualifications

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTI MARINO
Document Title:	NON DESTRUCTIVE EXAMINATIONS PROCEDURES H2 STORAGE VESSEL	Sheet 1 of 76 Date: 15/03/2024 Rev: 03

Base Load Power Hub (BLPH)

NON DESTRUCTIVE EXAMINATION PROCEDURES (NDE)
H2 STORAGE VESSEL

Document Number: 1723001756-NDT-P[illegible]

Document Class: 2

ROSETTI MARINO

1	APPROVED - WORK MAY PROCEED
2N	REVISE AND RE-SUBMIT - DO NOT PROCEED
2Y	REVISE AND RE-SUBMIT - WORK MAY PROCEED
3	REJECTED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
Comandini Massimo Level III NDT EN - ISO9712 WI CSWIP 3.1	18-03-2024

Rev.	Date	Description	Prepared	Reviewed	Approved
03	15/03/2024	Accepted for construction (ACF)	M.Rampazzo	P.Franzolin	M.Galli
02	16/02/2024	Accepted for construction (ACF)	M.Rampazzo	P.Franzolin	M.Galli
01	25/01/2024	Issue for Review (IFR)	M.Rampazzo	P.Franzolin	M.Galli
00	24/11/2023	Issue for Review (IFR)	M.Rampazzo	P.Franzolin	M.Galli

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**NON DESTRUCTIVE EXAMINATIONS PROCEDURES H2 STORAGE VESSEL**	Sheet 2 of 76 Date: 15/03/2024 Rev: 03

Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
01	Issue for Review (IFR)
02	Accepted for construction (AFC)
03	Accepted for construction (AFC)

HOLDS LIST

No.	Description
1	
2	
3	
4	

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B&R GROUP PROCEDURE

23096-QNDE

NDE PROCEDURE INDEX

Attach	Procedure Title	Proced.N°
▶	RADIOGRAPHIC EXAMINATION PROCEDURE ON WELDS WITH WALL THICKNESS UP TO 250mm	001 RT 21
	LIQUID PENETRANT TEST PROCEDURE	002 PT 21
▶	MAGNETIC PARTICLE INSPECTION PROCEDURE	003 MT 21
▶	WET FLUORESCENT MAGNETIC PARTICLE INSPECTION PROCEDURE WITH Dual Colors MATERIAL	003 MTD 21
▶	ULTRASONIC MANUAL INSPECTION PROCEDURE OF FERRITIC WELDS	004 UTA 21
	ULTRASONIC MANUAL INSPECTION PROCEDURE OF WELD OVERLAY	004 UTB
	ULTRASONIC MANUAL INSPECTION PROCEDURE OF INCONEL 625 WELDS	004 UTC
	ULTRASONIC MANUAL INSPECTION PROCEDURE OF STAINLESS STEEL AND NICKEL ALLOY MATERIAL	004 UTD
	PROCEDURE FOR HELIUM LEAK TEST ON PRESSURIZZED COMPONENTS	005 LT
	HELIUM LEAK TEST PROCEDURE by SNIFFERMETHOD FOR TUBE TO TUBESHEET INNER BORE WELDING	005 LT IBW
▶	DIMENSIONAL TEST PROCEDURE	006 DC 21
	DIMENSIONAL CHECK PROCEDURE for LINEARITY / STRAIGHTNESS	006 DC 21 LS
▶	VISUAL TEST PROCEDURE	007 VT 21
▶	HARDNESS TEST PROCEDURE	008 HB
	HARDNESS TEST PROCEDURE by POLDI	008 HBP
	POSITIVE MATERIAL INSPECTION PROCEDURE by X-RAY	009 PMX
	POSITIVE MATERIAL INSPECTION PROCEDURE by SPECTROMETER	009 PMS
	FERRITE CHECK EXAMINATION PROCEDURE	010 FE
	COPPER-SULPHATE TEST PROCEDURE	011 CS

B&R GROUP PROCEDURE

23096-QNDE

NDE ADDITIONAL REQUIREMENTS

General

- Company specifications valid for all NDE procedures:
  123A90-DDL-MAC-SP-50026_0.

- Reference documents valid for all NDE procedures:
  Replace SNT-TC-1A ed.2016 with SNT-TC-1A ed.2020.

- All NDE operators are qualified with both the SNT TC-1A method and the UNI EN ISO 9712 method.

Procedure N°001 RT 21

Section 5.3 IQI
Delete EN462 & Replace ISO 19232 with ISO 19232-1
(Ref.com.N°1 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

Section 2 Reference documents
Replace SNT-TC-1A ed.2016 with SNT-TC-1A ed.2020
(Ref.com.N°2 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

Procedure N°003 MT 21

The extension of the MT test is 100%
(Ref.com.N°3 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

The dwell time post welding of the MT test is 24hrs
(Ref.com.N°4 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

Procedure N°003 MTD 21

The extension of the MTD test is 100%
(Ref.com.N°5 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

The dwell time post welding of the MTD test is 24hrs
(Ref.com.N°6 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

Procedure N°004 UTA 21

Calibration Block will be made of the same material specification, product form, and heat treatment condition as the material being inspected
(Ref.com.N°7 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

Probes used for each thickness range (40-44mm),see tables below
(Ref.com.N°8 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

PROBES-SAMPLE				
Manufacturer	GE-KK	GE-KK	GE-KK	GE-KK
Brand name	SWB 45-2 E	SWB 60-2 E	SWB 70-2 E	B4S E
Serial number	58414-51513	58415-51645	58416-51629	57746-58833
Wave type	SHEAR	SHEAR	SHEAR	LONGITUDINAL
Beam angle	45°	60°	70°	0°
Frequency	2 Mhz	2 Mhz	2 Mhz	4 Mhz
Size	14X14mm	14X14mm	14X14mm	Ø 24mm
Search unit cable type & Length	Coaxial – 1,3 Mt.	Coaxial – 1,3 Mt.	Coaxial – 1,3 Mt.	Coaxial – 1,3 Mt.

B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

ADDITIONAL REQUIREMENTS

PROBES-SAMPLE				
Manufacturer	GE-KK	GE-KK	GE-KK	
Brand name	MWB45-4 E	MWB60-4 E	MWB70-4 E	
Serial number	56927-78535	56928-76227	56929-82334	
Wave type	SHEAR	SHEAR	SHEAR	
Beam angle	45°	60°	70°	
Frequency	4 Mhz	4 Mhz	4 Mhz	
Size	8X9mm	8X9mm	8X9mm	
Search unit cable type & Length	Coaxial – 1,3 Mt.	Coaxial – 1,3 Mt.	Coaxial – 1,3 Mt.	

PROBES-SAMPLE				
Manufacturer	GE-KK	GE-KK		
Brand name	B2S E	MSEB 4		
Serial number	57745-70234	57462-53475		
Wave type	LONGITUDINAL	LONGITUDINAL		
Beam angle	0°	0°		
Frequency	4 Mhz	4 Mhz		
Size	Ø 3.5x10mm	Ø 3.5x10mm		
Search unit cable type & Length	Coaxial – 1,3 Mt.	Coaxial – 1,3 Mt.		

The extension of the UTA test is 100%
(Ref.com.N°9 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

The dwell time post welding of the MTD test is 24hrs
(Ref.com.N°9 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

Procedure N°006 DC 21

Section 4

The dimensional check shall be performed after each working steps (includes Dimensional Verification /Orientation/Levelness/Projection of nozzles and flanges)

(Ref.com.N°11 Doc.1723001756-NDT-PRO-00009_CRS_CODE2)

B&R GROUP PROCEDURE

RADIOGRAPHIC EXAMINATION PROCEDURE ON WELDS WITH WALL THICKNESS UP TO 250 mm

PR.N° 001 RT 21

REV.0

REFERENCE DOCUMENTS:	
ASME BPV CODE SECTIONS I,VIII div.1,VIII div.2,IX	2021 Edition
ASME Power Piping B31.1	2020 Edition
ASNT Recommended Practice SNT-TC-1A	2016 Edition

A.I.

LROA verification ltd 0094
Witnessed Monitored Reviewed
ALESSANDRO MONASTRA
Ref. No.: AI 13420 B
Office: Milan
28 DIC. 2021

LROA verification ltd 0094
Witnessed Monitored Reviewed
GIANLUCA CESTARI
Ref. No.: 16408 AE
Office: Milan
28/12/2021

A.I.

LROA verification ltd 0094
Witnessed Monitored Reviewed
LUCA RIVAROLI
Ref. No.: Rev. 0
Office: Milan
28 DIC. 2021

LROA verification ltd 0094
Witnessed Monitored Reviewed
FLAVIO ZANON
Ref. No.: 13421
Office: Milan
18-05-2022

VILLA E BONALDI
NDT LEVEL III
ISO 9712/SNT-TC-1A
Botti Daniel
28/12/2021

Rev.	Date	Description	Issued by	Approved by TP	Reviewed& Approved Lev.III
0	28-12-2021	Revised as per new Edition of ASME Code.	M. Fiammingo	N. Tosto	D. Botti

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 001 RT 21

REV.0

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5.	ATTREZZATURA	5.	EQUIPMENT
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7.	ESAME	7.	EXAMINATION
8.	VALUTAZIONE	8.	EVALUATION
9.	CRITERI DI ACCETTABILITA’	9.	ACCEPTANCE STANDARD
10.	RAPPORTO	10.	REPORT
11.	RIPARAZIONE	11.	REPAIR

1. SCOPO	1. SCOPE
Questo documento definisce i requisiti minimi applicati da B&R per eseguire l'esame radiografico di saldature di testa dei componenti e delle tubazioni, costruiti in accordo al codice ASME, indicati in prima pagina. Le saldature da esaminare saranno eseguite fra lamiere, forgiati, tubi e fusioni di materiali ferrosi o non-ferrosi fino a uno spessore di 250 mm. La dimostrazione della densità e dell'immagine del penetrametro (IQI) richiesto da questa procedura, visibili sulle radiografie di produzione, saranno considerate come prova soddisfacente del rispetto di questa procedura. La sezione del codice applicabile all'oggetto da esaminare sarà specificata nella RX Map emessa dall'ispettore del Controllo Qualità prima dell'esame radiografico.	This document defines the minimum B&R requirements to perform radiographic examination of butt welds on their component and piping manufactured according to the referenced ASME code. Welds to be radiographically examined shall be welds between plates, forgings, pipes and castings of either ferrous and non-ferrous materials up to 250 mm thicker. Demonstration of the density and image quality indicator (IQI) image requirement of this written procedure on production radiographs shall be considered satisfactory evidence of compliance with this procedure. The applicable code section to the object being examined shall be specified in the RX Map issued by the Quality Control Inspector before the radiographic examination.

2 DOCUMENTI DI RIFERIMENTO	2 REFERENCE DOCUMENTS
ASME BPVC Section I, V, VIII div. 1, VIII div. 2, IX edizione 2021 ASME B31.1 ed. 2020 ASNT "Recommended Practice" SNT-TC-1A ed. 2016	ASME BPVC Section I, V, VIII div. 1, VIII div. 2, IX 2021 edition ASME B31.1 2020 ASNT "Recommended Practice" SNT-TC-1A ed. 2016

3. PERSONALE	3. PERSONNEL
Il personale che esegue, valuta e certifica i risultati del controllo sarà qualificato e certificato almeno al livello II in accordo alla "Written Practice" aziendale che soddisfa i requisiti della SNT-TC-1A e ASME BPVC sez. V art. 1 Mandatory Appendix III.	Personnel performing, evaluating and certifying the results of the examination shall be qualified and certified at least level II in accordance with the company Written practice which satisfies the Recommended Practice SNT-TC-1A and ASME BPVC sec. V art. 1 Mandatory Appendix III.

4. REQUISITI GENERALI	4. GENERAL REQUIREMENTS
4.1 Condizioni superficiali Le superfici delle saldature possono essere nelle condizioni di come-saldato, molato, lavorato di macchina o raccordate con il materiale base in accordo ai requisiti a disegno. Il sovrammetallo, se presente, non deve eccedere il massimo permesso dalla sezione del codice di riferimento, come mostrato in Tabella 1. Saranno applicati i valori in Tabella 1 a meno di richieste più restrittive specificate sul disegno. Le irregolarità superficiali, interne (se accessibili) e esterne, saranno rimosse con un metodo adeguato fino al livello necessario, in modo che l'immagine radiografica risultante di ogni irregolarità non mascheri o sia confusa con l'immagine di discontinuità.	4.1 Surface conditioning The weld joint finished surfaces may be in as welded condition, ground, machined or may be flush with the base material according to drawing requirements. The weld crown, if present, shall not exceed the maximum permitted values of the referencing Code Section as shown in Table 1. The values shown in Table 1 shall be applied unless more stringent values are required by the drawing. The weld ripples or weld surface irregularities on both the inside (where accessible) and outside shall be removed by any suitable process to such a degree that the resulting radiographic image due to any irregularities cannot mask or be confused with the image of any discontinuity.

Table 1a /Tabella 1a **ASME Sect. I**		
Nominal Thickness Spessore nominale *(mm)*	**Circumferential Joints in Pipe and Tubing** Saldature Circonferenziali in tubazioni	**Other welds** Altre saldature
Up to/*fino a* 3	2.5	2.5
Over/*oltre* 3 to/*a* 5 incl.	3.0	2.5
Over/*oltre* 5 to/*a* 13 incl.	4.0	2.5
Over/*oltre* 13 to/*a* 25 incl.	5.0	2.5
Over/*oltre* 25 to/*a* 50 incl.	6.0	3.0
Over/*oltre* 50 to/*a* 75 incl.	Note (1)	4.0
Over/*oltre* 75 to/*a* 100 incl.	Note (1)	5.5
Over/*oltre* 100 to/*a* 125 incl.	Note (1)	6.0
Over/*oltre* 125	Note (1)	8.0
Note: (1) The greater of 6 mm or 1/8 time the width of the weld in mm / Il maggiore fra 6 mm e 1/8 della larghezza della saldatura		

Table 1b / Tabella 1b **ASME Sect. VIII div. 1**		
Nominal Thickness Spessore nominale *(mm)*	**Category B & C Butt Welds** Saldature di testa Categoria B & C	**Other welds** Altre saldature
less than/*meno di* 2.4	2.4	0.8
2.4 to/*a* 4.8 incl.	3.2	1.6
Over/*oltre* 4.8 to/*a* 13 incl.	4.0	2.4
Over/*oltre* 13 to/*a* 25 incl.	4.8	2.4
Over/*oltre* 25 to/*a* 51 incl.	5	3.2
Over/*oltre* 51 to/*a* 76 incl.	6	4
Over/*oltre* 76 to/*a* 102 incl.	6	6
Over/*oltre* 102 to/*a* 127 incl.	6	6
Over/*oltre* 127	8	8

Table 1c / Tabella 1c **ASME Sect. VIII div. 2**		
Section Thickness Spessore della sezione *(mm)*	**Circumferential joints in pipe and tubing** Saldature circonferenziali di tubi	**Other welds** Altre saldature
less than/*meno di* 2.5	2.5	0.8
2.5 to/*a* 5 escl.	2.5	1.5
From/*da* 5 to/*a* 13 escl.	3	2.5
From/*da* 13 to/*a* 25 escl.	4.0	2.5
From/*da* 25 to/*a* 50 escl.	4.0	3
From/*da* 50 to/*a* 76 escl.	4.0	4.0
From/*da* 76 to/*a* 100 escl.	5.5	5.5
From/*da* 100 to/*a* 125 escl.	6	6
From/*da* 125 and over/ e *oltre*	8	8

Table 1d / Tabella 1d		**for Design Temperature as per ASME B31.1**	
Thickness of base metal Spessore del metallo base *(mm)*	**750 °F** (400 °C)	**350÷750 °F** (175÷400 °C)	**<350 °F** (175 °C)
Up to/*fino a* 3.0 incl.	2.0	2.5	5.0
Over 3.0 to/*a* 5.0 incl.	2.0	3.0	5.0
Over/*oltre* 5.0 to/*a* 13 incl.	2.0	4.0	5.0
Over/*oltre* 13 to/*a* 25 incl.	2.5	5.0	5.0
Over/*oltre* 25 to/*a* 50 incl.	3.0	6.0	6.0
Over/*oltre* 50	4.0	The greater of 6 mm or 1/8 times the width of the weld in mm *Il maggiore fra 6 mm e 1/8 della larghezza della saldatura in mm*	

Table 1 / Tabella 1 - **Maximum weld reinforcements** / *Massimo sovrammetallo di saldatura*

4.2 Radiazione retrodiffusa Una lettera “B” in piombo, con dimensione minima di ½ in. (13 mm) in altezza e 1/16 in. (1,6 mm) in spessore, sarà applicata al retro di ogni cassetta durante ogni esposizione per determinare l’influenza della radiazione retrodiffusa sull’immagine radiografica. La lettera “B” in piombo deve essere posto in una posizione tale da apparire all'interno di una zona della radiografia che soddisfi i requisiti del para. T-282 (Para. 8.2.1 & 8.2.2 di questa procedura).	4.2 Backscatter radiation A lead symbol “B”, with minimum dimensions of ½ in. (13 mm) in height and 1/16 in. (1,6 mm) in thickness, shall be attached to the back of each film holder during each exposure to determine if backscatter radiation is exposing the film. The lead symbol “B” shall be placed in a location so that it would appear within an area on the radiograph that meets the requirements of para.T-282 (Para. 8.2.1 & 8.2.2 of this procedure).
4.3 Sistema di identificazione Sarà utilizzato un sistema di identificazione appropriato e permanente su ogni radiografia, riconducibile alla parte in esame e che si permanente per il periodo di conservazione richiesto della radiografia: simbolo B&R/V&B, nr. di fabbrica e area (nr. di saldatura e tratto radiografico) appariranno come immagini radiografiche; la data della radiografia apparirà come immagine radiografica o sarà chiaramente e permanentemente applicata mediante timbratura prima dell’emissione del rapporto. In ogni caso, queste informazioni non devono oscurare l’area	4.3 System of identification A system shall be used to produce permanent identification on each radiograph, traceable to the part being examined and that is permanent for the required retention period of the radiograph: B&R/V&B symbol, serial nr. and area (weld nr. and area) shall appear as radiographic images; date of examination shall appear as radiographic image or shall be plainly and permanently included before the RT report issue. In any case, this information shall not obscure the area of interest.

d'interesse. La figura 1 mostra il sistema di identificazione.	The figure 1 shows the identification system.

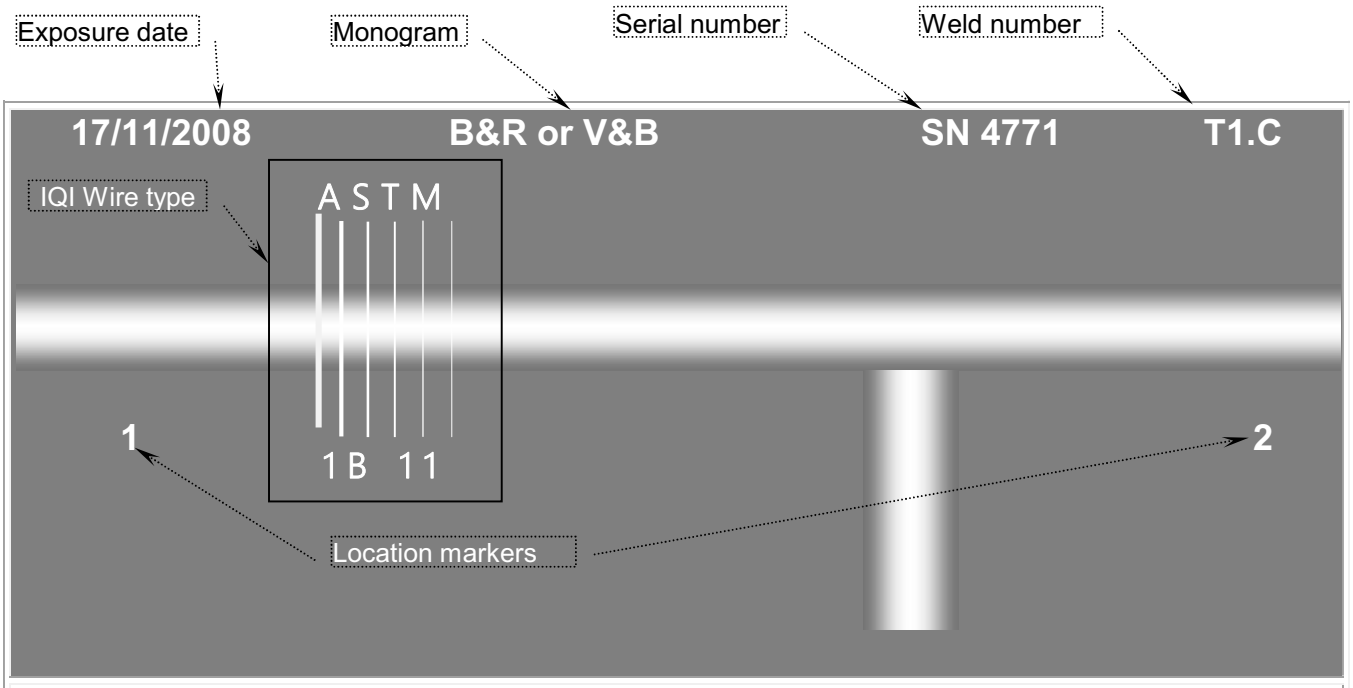


Figure 1 – System of identification
Figura 1 – Sistema di identificazione

5. ATTREZZATURA	5. EQUIPMENT
5.1 Pellicole Le radiografie saranno eseguite utilizzando pellicole radiografiche industriali. Lo standard ASME/ASTM, SE-999, o I paragrafi da 23 a 26 dello standard ASME/ASTM SE-94 saranno utilizzati come guida per il processo delle pellicole,eccetto che la sezione 8.1 della SE-999 non e' richiesta. La tabella 2 indica i tipi di pellicole che saranno utilizzati.	5.1 Film Radiographs shall be made using industrial radiographic films. Standard Guide for Controlling the Quality of Industrial Radiographic Film Processing, SE-999, or paragraphs 23 through 26 of Standard Guide for Radiographic examination SE-94 shall be used as a guide for processing films,except that Section 8.1 of SE-999 in not required. The Table 2 shows the films which can be used.

SE1815 Class	Manufacturer			
	AGFA	KODAK		
Special	Structurix D2	None		
I	Structurix D3	M100		
I	Structurix D4	MX125		
I	Structurix D5	T200		
II	Structurix D7	AA400		

Table 2 – Films type
Tabella 2 – Tipi di pellicole

5.2 Schermi di rinforzo Saranno utilizzati schermi di rinforzo a diretto contatto con le pellicole durante l'esposizione. Il materiale degli schermi sarà piombo o rame. Lo spessore degli schermi in piombo normalmente utilizzati sarà come mostrato in Tabella 3.	5.2 Intensifying screens Intensifying screens in direct contact with the film during the exposure shall be used. The screen material will be lead or copper. The lead screen thickness as shown in the following Table 3 shall be normally used.

Radiation *Tipo di Radiazione*				**Screen Thickness /** *Spessore schermo* **(mm)**	
				Front / *Anteriore*	**Back /** *Posteriore*
X-ray up to *Raggi X fino a*			120 KV	--	0.10
X-ray up to *Raggi X fino a*	120	to *a*	450 KV	0.05 min	0.10 min
Ir 192 e Se75				0.05 min	0.10 min
Co 60				0.15	0.25 min

Table 3 – Intensifying screens
Tabella 3 – Schermi di rinforzo

5.3 Indicatori di qualità d'immagine (Penetrametri) Saranno utilizzati penetra metri (IQI) a filo prodotti e identificati in accordo ai requisiti dello standard ASME/ASTM SE-747, ad eccezione che il numero del filo maggiore o il numero identificativo possono essere omessi. I penetrametri standard ASME sono indicati nella Tabella 4. Penetrametri a filo, prodotti e identificati in accordo allo standard EN-462 o ISO19232, possono essere utilizzati a condizione che il diametro del filo essenziale sia uguale o inferiore a quello del filo essenziale standard ASME richiesto, e a condizione che siano dello stesso materiale. La tabella 4 definisce l'equivalenza fra i penetrametri degli standard ASME/ ASTM SE-747 e EN-462 o ISO19232.	5.3 Image Quality Indicator IQI's shall be wire type. Wire-type IQI'ss shall be manufactured and identified in accordance with the requirements or alternates allowed in SE-747, except that the largest wire number or the identity number may be omitted. ASME standard IQIs shall consist of those in the following Table 4. Wire IQIs designed and manufactured in accordance with EN-462 or ISO 19232 may be used provided their essential wire diameter is equal to or less than required ASME standard IQI essential wire, and provided the material IQI requirements are met. The following table 4 shows the equivalence between the SE-747 wire and the EN-462 or ISO 19232 wire.

ASME/ASTM SE/E747			EN 462-1		
Set	wire ident. filo	Ø inches (mm)	Ø mm	wire ident. filo	set
			0,050	W19	
			0,063	W18	
	1	0.0032 (0.08)	0,080	W17	13 xx EN
	2	0.004 (0.10)	0,100	W16	
	3	0.005 (0.13)	0,125	W15	
A	4	0.0063 (0.16)	0,16	W14	
	5	0.008 (0.20)	0,20	W13	10 xx EN
	6	0.010 (0.25)	0,25	W12	
	7	0.013 (0.33)	0,32	W11	
	8	0.016 (0.41)	0,40	W10	
B	9	0.020 (0.51)	0,50	W9	
	10	0.025 (0.64)	0,63	W8	6 xx EN
	11	0.032 (0.81)	0,80	W7	
	12	0.040 (1.02)	1,00	W6	
	13	0.050 (1.27)	1,25	W5	
C	14	0.063 (1.60)	1,60	W4	
	15	0.080 (2.03)	2,00	W3	1 xx EN
	16	0.100 (2.54)	2,50	W2	
	17	0.126 (3.20)	3,20	W1	
	18	0.160 (4.06)			
	19	0.200 (5.08)			
D	20	0.250 (6.35)			
	21	0.320 (8.13)			

Table 4 – Equivalence between SE747 and EN462 IQI's and ISO 19232 IQI's

Tabella 4 – Equivalenza fra penetrametri SE747 e EN462 e ISO 19232

5.4 Attrezzature per la lettura dei radiogrammi Le attrezzature per la lettura devono fornire una retro illuminazione di intensità tale da non causare riflessi, ombre, o bagliori sulla radiografia. L'attrezzatura utilizzata per l'interpretazione deve fornire una sorgente di luce regolabile, sufficiente a vedere il filo designato per lo specifico campo di densità. Le condizioni di lettura saranno tali per cui la luce proveniente dall'esterno del bordo del radiogramma o attraverso zone a bassa densità del radiogramma non interferiscano con l'interpretazione.	5.4 Facilities for viewing of radiographs Viewing facilities shall provide subdued background lighting of an intensity that will not cause troublesome reflections, shadows, or glare on the radiograph. Equipment used to view radiographs for interpretation shall provide a variable light source sufficient for the essential IQI designated wire to be visible for the specified density range. The viewing conditions shall be such that light from around the outer edge of the radiograph or coming through low-density portions of the radiograph does not interfere with interpretation.
5.5 Sorgenti di radiazione Saranno utilizzate le seguenti sorgenti di radiazione: a) Unità a raggi X fino a 450 KV; b) Sorgenti a raggi γ tipo Ir 192; c) Sorgenti a raggi γ Se 75; d) Sorgenti a raggi γ tipo Co 60.	5.5 Radiation sources The following radiation sources shall be used: a) X-ray units less than 450 KV; b) γ-ray source type Ir 192; c) γ-ray source type Se 75; d) γ-ray source type Co 60.
5.6 Densitometro Un densitometro sarà utilizzato per valutare la densità delle pellicole.	5.6 Densitometer A densitometer shall be used for judging film density.

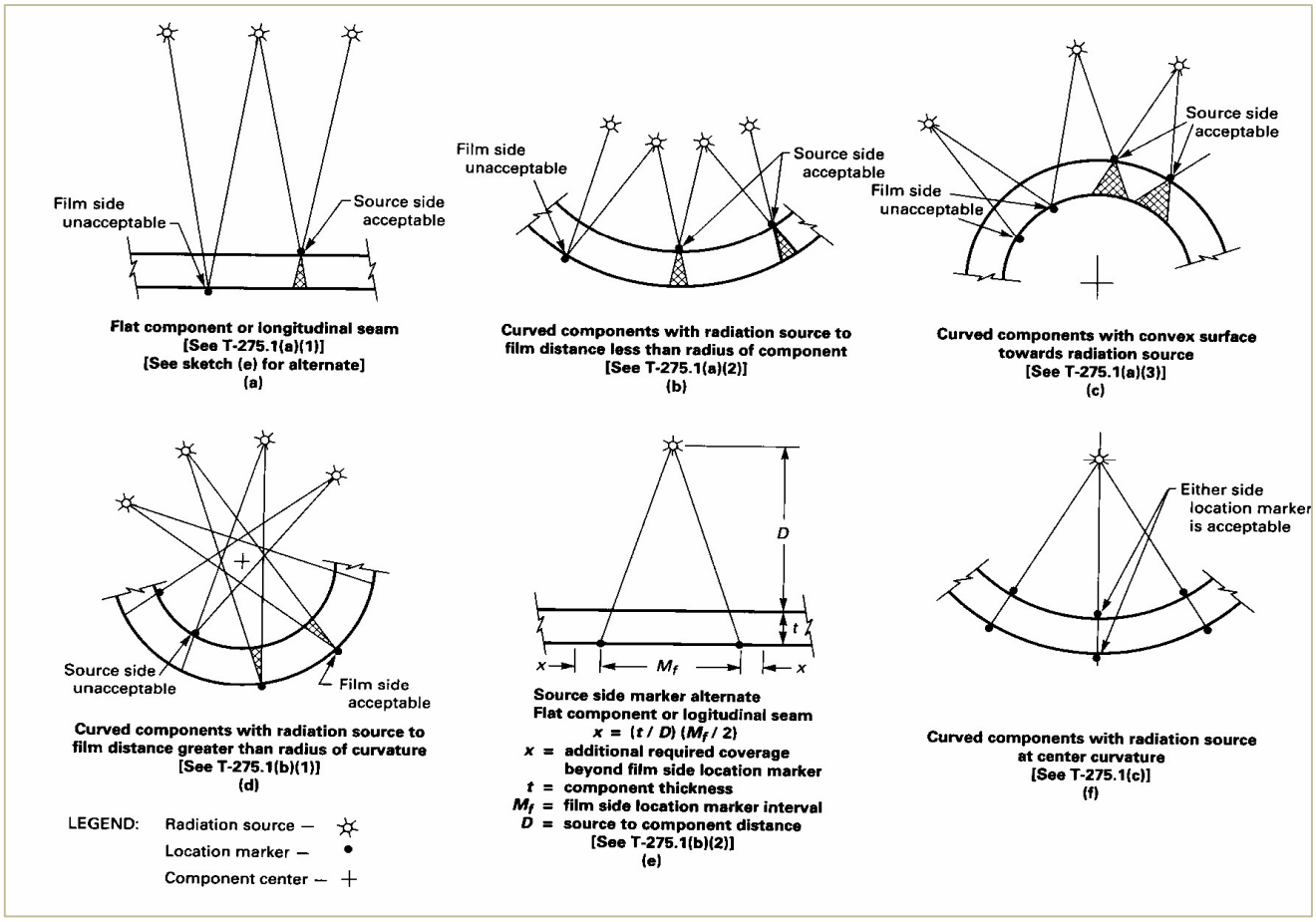
6. CALIBRAZIONE	6. CALIBRATION
6.1 Dimensione della sorgente Per la verifica della dimensione della sorgente, saranno accettabili le pubblicazioni del fornitore o del costruttore quali manuali tecnici, curve di decadimento, o dichiarazioni scritte che documentino la dimensione attuale o massima della sorgente o della macchia focale. Se non disponibili le pubblicazioni del fornitore o del costruttore la dimensione della sorgente sarà determinate come segue: a) Per macchine a raggi X fino a 450 KV, la dimensione della macchia focale può essere determinata secondo il metodo del “pinhole” o in accordo allo standard SE-1165. b) Per sorgenti γ, la dimensione può essere determinate in accordo allo standard SE-1114.	6.1 Source size The equipment manufacturer’s or supplier’s publications, such as technical manuals, decay curves, or written statements documenting the actual or maximum source size or focal spot, shall be acceptable as source size verification. When manufacturer’s or supplier’s publications are not available, source size may be determined as follows: a) For X-ray machine operating at 450 KV and less, the focal spot size may be determined by the pinhole method, or in accordance with SE-1165. b) For γ-ray source, the source size may be determined in accordance with SE-1114.
6.2 Densitometro Il densitometro sarà calibrato almeno ogni 90 giorni come di seguito specificato: a) Sarà utilizzata una “step tablet” o un film a gradini standard nazionale, riconducibile a una “step tablet” che abbia almeno 5 valori di densità compresa fra 1.0 e 4.0. Il film a gradini deve essere stato verificato entro l’ultimo anno per comparazione con una “step tablet” standard nazionale a meno che, prima del suo primo utilizzo, sia stato mantenuto in un imballo sigillato a tenuta di luce e di umidità sigillato come fornito dal produttore. Il film a gradini può essere utilizzato senza verifica per un anno dopo l’apertura, purché entro la data di scadenza dichiarata dal produttore. b) Saranno seguite passo passo le istruzioni fornite dal produttore del densitometro. c) Saranno letti i valori di densità più vicini a 1.0, 2.0, 3.0, e 4.0 della “step tablet” o del film a gradini. d) Il densitometro è accettabile se i valori di densità letti non variano più di ± 0.05 del valore indicato sulla “step tablet” standard o sul film a gradini. La calibrazione del densitometro sopradescritta sarà documentata, ma la lettura di ogni valore non sarà registrata. Una verifica periodica della calibrazione, effettuata come sopra descritto, sarà effettuata all’inizio di ogni turno di lavoro, dopo 8 ore di uso continuativo, o dopo ogni sostituzione dell’apertura, qualsiasi sia il primo evento. Il densitometro è accettabile se i valori di densità letti non variano più di ± 0.05 del valore determinato in c). Le verifiche periodiche non saranno registrate.	6.2 Densitometer Densitometer shall be calibrated at least every 90 days during use as follows: a) A national standard step tablet or a step wedge calibration film, traceable to a national standard step tablet and having at least 5 steps with neutral densities from at least 1.0 through 4.0, shall be used. The step wedge calibration film shall have been verified within the last year by comparison with a national standard step tablet unless, prior to first use, it was maintained in a light-tight and waterproof sealed package as supplied by the Manufacturer. Step wedge calibration films may be used without verification for one year upon opening, provided it is within the manufacturer’s stated shelf life. b) The densitometer manufacturer’s step-by-step instructions for the operation of the densitometer shall be followed. c) Shall be read, the density steps closest to 1.0, 2.0, 3.0, and 4.0 on the national standard step tablet or step wedge calibration film. d) The densitometer is acceptable if the density readings do not vary by more than ± 0.05 density units from the actual density stated on the national standard step tablet or step wedge calibration film. Densitometer calibration required above shall be documented, but the actual readings for each step do not have to be recorded. Periodic calibration verification checks shall be performed as described above at the beginning of each shift, after 8 hr of continuous use, or after change of apertures, whichever comes first. The densitometer is acceptable if the density readings are within ± 0.05 of the calibration readings determined in c) above. Periodic verification checks

	do not have to be recorded.

7. ESAME	7. EXAMINATION
7.1 Tecnica radiografica La tecnica di esposizione a parete singola sarà utilizzata ovunque pratico. Quando l'uso della tecnica a parte singola non sarà ritenuto pratico, si utilizzerà la tecnica di esposizione a parete doppia. Un numero adeguato di esposizioni sarà effettuato per dimostrare che la copertura richiesta è stata ottenuta.	7.1 Radiographic technique A single-wall exposure technique shall be used for radiography whenever practical. When it is not practical to use a single-wall technique, a double-wall technique shall be used. An adequate number of exposure shall be made to demonstrate that required coverage has been obtained.
7.1.1 Tecnica a parete singola Nella tecnica a parte singola, la radiazione passa solo attraverso una parete della saldatura, la quale è mostrata sulla pellicola per l'accettabilità.	7.1.1 Single-wall technique In the single-wall technique, the radiation passes through only one wall of the weld, which is viewed for acceptance on the radiograph.
7.1.2 Tecnica a doppia parete Quando l'uso della tecnica a parte singola non sarà ritenuto pratico, si utilizzerà una delle seguenti tecniche di esposizione a parete doppia. *(a) Lettura a parte singola.* In questa tecnica la radiazione passa attraverso due pareti e solo quella dal lato film è mostrata sulla pellicola per l'accettabilità. Quando è richiesta una copertura al 100% di saldature circonferenziali, saranno eseguite almeno tre esposizioni a 120 gradi l'una dall'altra. *(b) Lettura a parete doppia*. Per saldature fino a 3 ½ in. (89 mm) di diametro nominale esterno, può essere utilizzata una tecnica in cui la radiazione passa attraverso due pareti ed entrambe sono mostrate sulla stessa pellicola per l'accettabilità. Per la tecnica di lettura a parete doppia, sarà utilizzato solo il penetrametro lato sorgente. Si avrà cura di assicurare che la massima sfumatura geometrica ammessa sia rispettata. Nel caso in cui la massima sfumatura geometrica non possa essere rispettata, sarà utilizzata la tecnica di lettura a parete singola. 1. Il fascio di radiazioni può essere inclinato rispetto all'asse centrale, di un angolo sufficiente a separare le immagini delle due pareti in modo tale che non ci sia sovrapposizione fra le due aree da interpretare. Quando è richiesta una copertura al 100%, saranno eseguite almeno due esposizioni a 90 gradi fra loro per ogni giunto. 2. In alternativa, la saldatura può essere radiografata con il fascio di radiazioni posizionato in modo che le immagini delle due pareti siano sovrapposte fra loro. Quando è richiesta una copertura al 100%, saranno eseguite almeno tre esposizioni a 60 gradi o a 120 gradi fra loro. 3. Saranno eseguite esposizioni aggiuntive quando la copertura richiesta non può essere ottenuta con il minimo di esposizioni indicate sopra.	7.1.2 Double-wall technique When it is not practical to use a single-wall technique, one of the following double-wall technique shall be used. *(a) Single-wall viewing.* In this technique the radiation passes through two walls and only the weld on the film-side wall is viewed for acceptance on the radiograph. When complete coverage is required for circumferential welds, a minimum of three exposures taken 120 deg. To each other shall be made. *(b) Double-wall viewing*. For welds 3 ½ in. (89 mm) or less in nominal outside diameter, a technique may be used in which the radiation passes through two walls and the weld in both walls is viewed for acceptance on the same radiograph. For double-wall viewing, only a source-side IQI shall be used. Care should be exercised to ensure that the required geometric unsharpness is not exceeded. If the geometric unsharpness requirement cannot be met, then single-wall viewing shall be used. 1. The radiation beam may be offset from the plane of the weld at an angle sufficient to separate the images of the source-side and film-side portions of the weld so that there is no overlap of the areas to be interpreted. When complete coverage is required, a minimum of two exposure taken 90 deg. To each other shall be made for each joint. 2. As an alternative, the weld may be radiographed with the radiation beam positioned so that the images of both walls are superimposed. When complete coverage is required, a minimum of three exposures taken at either 60 deg. Or 120 deg. To each other shall be made for each joint. 3. Additional exposures shall be made if the required radiographic coverage cannot be obtained using the minimum number of exposures indicated here above.

7.2 Energia della radiazione L'energia della radiazione impiegata deve permettere di ottenere la densità richiesta e di vedere l'immagine del penetrametro richiesto da questo documento.	7.2 Radiation energy The radiation energy employed for any radiographic technique shall achieve the density and IQI image requirements of this document.
7.3 Direzione della radiazione La direzione dell'asse centrale della radiazione sarà per quanto praticabile centrata nell'area d'interesse.	7.3 Direction of radiation The direction of the central beam of radiation shall be centered on the area of interest whenever practical.
7.4 Sfumatura geometrica La sfumatura geometrica della radiografia sarà determinata con la formula seguente: Ug = F x d / D dove Ug = sfumatura geometrica F = la massima dimensione della sorgente, proiettata (o macchia focale effettiva) nel piano perpendicolare alla distanza D dall'oggetto radiografato, mm. D = distanza dalla sorgente di radiazioni all'oggetto radiografato, mm. d = distanza dal lato sorgente dell'oggetto radiografato alla pellicola, mm. "D" e "d" saranno determinate approssimativamente all'area d'interesse	7.4 Geometric Unsharpness Geometric Unsharpness of the radiograph shall be determined in accordance with: Ug = F x d / D where Ug = geometric unsharpness F = the maximum projected dimension of the radiating source (or effective focal spot) in the plan perpendicular to the distance D from the weld or object being radiographed, mm. D = distance from source of radiation to weld or object being radiographed, mm. d = distance from source side of weld or object being radiographed to the film, mm. "D" and "d" shall be determined at the approximate center of the area of interest
7.5 Marcatori I marcatori (Vedi figura 2), che devono apparire come immagine radiografica sulla pellicola, saranno posizionati sulla parte, non sulla cassetta. La loro posizione sarà marcata permanentemente sulla superficie della parte radiografata quando permesso, o su una mappa, in modo da rendere che l'area sia accuratamente rintracciabile alla propria posizione sulla parte, per il periodo richiesto di archiviazione del la radiografia. Deve essere data evidenza sulla radiografia che la copertura richiesta è stata ottenuta. I marcatori saranno posizionati come di seguito specificato. I marcatori saranno posizionati sul <u>lato sorgente</u> quando si radiografano i seguenti soggetti: 1) giunti longitudinali in componenti cilindrici o conici; 2) componenti sferici o curvi il cui lato concavo è verso la sorgente e quando la distanza "sorgente-oggetto" è inferiore del raggio interno del componente; 3) componenti sferici o curvi il cui lato convesso è lato sorgente. I marcatori saranno posizionati <u>lato film</u> radiografando componenti sferici e curvi il cui lato concavo sia verso la sorgente e quando la distanza "sorgente-oggetto" è maggiore del raggio interno.	7.5 Location markers Location markers (see Figure 2), which are to appear as radiographic images on the film, shall be placed on the part, not on the exposure holder/cassette. Their locations shall be permanently marked on the surface of the part being radiographed when permitted, or on a map, in a manner permitting the area on a radiograph to be accurately traceable to its location on the part, for the required retention period of the radiograph. Evidence shall also be provided on the radiograph that required coverage of the region being examined has been obtained. Location markers shall be placed as follows. Location markers shall be placed on the <u>source side</u> when radiographing the following: 1) longitudinal joints in cylindrical or conical components; 2) curved or spherical components whose concave side is toward the source and when the "source-to-material" distance is less than the inside radius of the component; 3) curved or spherical components whose convex side is toward the source. Location markers shall be placed on the <u>film side</u> when radiographing either curved or spherical components whose concave side is toward the source and when the "source-to-material" distance is greater than the inside radius.

I marcatori saranno posizionati indifferentemente lato sorgente o lato film radiografando componenti sferici o curvi il cui lato concavo è verso la sorgente e la distanza “sorgente-oggetto” sia uguale al raggio interno del componente.	Location markers may be placed on either the source or film side when radiographing either curved or spherical components whose concave side is toward the source and the “source-to-material” distance equals the inside radius of the component.



7.6 Selezione del penetrametro Il penetrametro sarà scelto della stessa lega di materiale identificato nello standard SE-747, come applicabile, o di una lega di materiale di minore assorbimento del materiale radiografato.	7.6 IQI selection IQIs shall be selected from either the same alloy material group or grade as identified in SE-747, as applicable, or from an alloy material group or grade with less radiation absorption than material being radiographed.
7.6.2 Dimensione Il filo essenziale scelto sarà come specificato in Tabella 6. *(a) Saldature con sovrametallo.* Lo spessore sul quale è basata la scelta del penetrametro è lo spessore nominale della parete singola più il sovrametallo	7.6.2 Size The designated hole IQI or essential wire shall be as specified in Table 6. *(a) Welds with reinforcements.* The thickness on which the IQI is based is the nominal single-wall material thickness plus the weld reinforcement

stimato essere presente su entrambe le superfici (I.D. e O.D.). Il valore stimato dello spessore di sovrametallo sarà rappresentativo delle condizioni della saldatura e non eccederà il massimo permesso da questo documento. La misura fisica dello spessore di sovrametallo effettivo non è richiesta. I piattini di supporto non saranno considerati parti dello spessore nella scelta dell'IQI. *(b) Saldature senza sovrametallo.* Lo spessore sul quale è basata la scelta del penetrametro è lo spessore nominale della singola parete del materiale. I piattini di supporto non saranno considerati parti dello spessore nella scelta dell'IQI. *(c) Valori attuale.* Riguardo i capoversi *(a)* e *(b)* di cui sopra, quando lo spessore attuale del materiale/saldatura è misurato, la selezione dell'IQI può essere basata su tali valori conosciuti.	thickness estimated to be present on both sides of the weld (I.D. and O.D.). The values used for the estimated weld reinforcement thicknesses shall be representative of the weld conditions and shall not exceed the maximum permitted by this document. Physical measurement of the actual weld reinforcements is not required. Backing rings or strips shall not be considered as part of the thickness in IQI selection. *(b) Welds without reinforcement.* The thickness on which the IQI is based is the nominal single-wall material thickness. Backing rings or strips shall not be considered as part of the thickness in IQI selection. *(c) Actual values.* With regard to *(a)* and *(b)* above, when the actual material/weld thickness is measured, IQI selection may be based on these known values.

Nominal Single-Wall Material Thickness range *Campo di spessori nominale singola parete*		**IQI essential wire** / *Filo essenziale Penetrametro*			
		Source Side / *Lato sorgente*		**Film Side** / *Lato film*	
in.	mm	SE 747	EN 462-1	SE 747	EN 462-1
Up to 0.25, incl.	Up to 6.4, incl.	**5**	***W13***	**4**	***W14***
Over 0.25 through 0.375	Over 6.4 through 9.5	**6**	***W12***	**5**	***W13***
Over 0.375 through 0.50	Over 9.5 through 12.7	**7**	***W11***	**6**	***W12***
Over 0.50 through 0.75	Over 12.7 through 19.0	**8**	***W10***	**7**	***W11***
Over 0.75 through 1.00	Over 19.0 through 25.4	**9**	***W9***	**8**	***W10***
Over 1.00 through 1.50	Over 25.4 through 38.1	**10**	***W8***	**9**	***W9***
Over 1.50 through 2.00	Over 38.1 through 50.8	**11**	***W7***	**10**	***W8***
Over 2.00 through 2.50	Over 50.8 through 63.5	**12**	***W6***	**11**	***W7***
Over 2.50 through 4.00	Over 63.5 through 101.6	**13**	***W5***	**12**	***W6***
Over 4.00 through 6.00	Over 101.6 through 152.4	**14**	***W4***	**13**	***W5***
Over 6.00 through 8.00	Over 152.4 through 203.2	**16**	***W2***	**14**	***W4***
Over 8.00 through 10.00	Over 203.2 through 254.0	**17**	***W1***	**16**	***W2***

Table 6 – IQI selection

Tabella 6 – Selezione del penetrametro

7.7 Uso del penetrametro Il penetrametro sarà posizionato sul lato sorgente della parte da esaminare, ad eccezione delle condizioni descritte di seguito. Quando l'inaccessibilità impedisce il posizionamento manuale del penetrametro lato sorgente, il penetrametro sarà posizionato lato film a contatto con la parte in esame. Una lettera "F" in piombo sarà posizionata adiacente o sul penetrametro.	7.7 Use of IQI to monitor radiographic examination The IQI(s) shall be placed on the source side of the part being examined, except for the condition described here below. Where inaccessibility prevents hand placing the IQI(s) on the source side, the IQI(s) shall be placed on the film side in contact with the part being examined. A lead letter "F" shall be placed adjacent

Il penetrametro a fili sarà posizionato sulla saldatura in modo che la lunghezza dei fili sia perpendicolare alla lunghezza della saldatura. I numeri di identificazione e, quando utilizzata, la lettera “F”, non sarà nell’area di interesse eccetto quando la condizione geometrica renda ciò impraticabile. Quando una o più cassette sono utilizzate per una singola esposizione, almeno un’immagine di penetrametro apparirà su ogni radiografia eccetto quanto indicato in 7.7.1 di seguito. Se i limiti di densità prescritti sono raggiunti utilizzando più di un penetrametro, uno sarà rappresentativo dell’area d’interesse più chiara e l’altro della zona più scura; le aree a densità intermedie saranno considerate di valore accettabile.	to or on the IQI(s). The wire-type IQI(s) shall be placed on the weld so that the length of the wires is perpendicular to the length of the weld. The identification numbers and, when used, the lead letter “F”, shall not be in the area of interest except when geometric configuration makes it impractical. When one or more film holders are used for an exposure, at least one IQI image shall appear on each radiograph except as outlined in 7.7.1 below. If the requirements of radiographic density are met using more than one IQI, one shall be representative of the lightest area of interest and the other the darkest area of interest; the intervening densities on the radiograph shall be considered as having acceptable density.
7.7.1 Casi speciali *(1)* Per componenti cilindrici dove la sorgente è posizionata sull’asse del componente per una singola esposizione, sono necessari almeno tre penetrametri, posizionati approssimativamente a 120 gradi fra loro, nelle seguenti condizioni: quando la circonferenza completa è radiografata utilizzando una o più cassette, o; quando si radiografa una sezione o più sezioni di circonferenza, dove la lunghezza fra le estremità fra le sezioni più esterne è intorno a 240 gradi o più, utilizzando una o più cassette. Il posizionamento di film addizionali può essere necessario per ottenere la necessaria spaziatura dei penetrametri. *(2)* Per componenti cilindrici dove la sorgente è posizionata sull’asse del componente per una singola esposizione, sono richiesti almeno tre penetrametri, con uno posizionato ad ogni estremità del tratto di circonferenza radiografata e uno approssimativamente al centro del tratto, alle seguenti condizioni: quando una sezione di circonferenza, la cui lunghezza è maggiore di 120 gradi e inferiore a 240, è radiografata utilizzando un’unica cassetta, o; quando una o più sezioni di circonferenza, dove la distanza fra le estremità delle sezioni più esterne copre meno di 240 gradi, è radiografata utilizzando più di una cassetta. *(3)* In *(1)* e *(2)* sopra, dove sezioni di saldature longitudinali incrociano le circonferenziali sono radiografate simultaneamente con le saldature circonferenziali, un IQI supplementare sarà posto su ogni longitudinale nel punto più lontano dall’incrocio con la circonferenziale radiografata.	7.7.1 Special cases *(1)* For cylindrical components where the source is placed on the axis of the component for a single exposure, at least three IQIs, spaced approximately 120 deg. apart, are required under the following conditions: when the complete circumference is radiographed using one or more film holders, or; when a section or sections of the circumference, where the length between the ends of the outermost sections span 240 or more deg., is radiographed using one or more film holders. Additional film locations may be required to obtain necessary IQI spacing *(2)* For cylindrical components where the source is placed on the axis of the component for a single exposure, at least three IQI(s), with one placed at each end of the span of the circumference radiographed and one in the approximate center of the span, are required under the following conditions: when a section of the circumference, the length of which is greater 120 deg. and less then 240 deg., is radiographed using just one film holder, or; when a section or sections of the circumference, where the length between the ends of the outermost sections span less than 240 deg., is radiographed using more than one film holder. *(3)* In *(1)* and *(2)* above, where sections of longitudinal welds adjoining the circumferential weld are radiographed simultaneously with the circumferential weld, an additional IQI shall be placed on each longitudinal weld at the end of the section most remote from the junction with the circumferential weld being radiographed.

8. VALUTAZIONE	8. EVALUATION
8.1 Qualità delle radiografie Tutte le radiografie saranno esenti da difetti meccanici, chimici o altro, la cui estensione mascheri o possa essere confusa con l'immagine di discontinuità nell'area di interesse dell'oggetto radiografato. Tali difetti includono, ma non sono limitati a: nebbia, difetti di trattamento quali striature, segni d'acqua, o chimiche, graffi, ditate, pieghe, sporcizia, segni elettrostatici, macchie, o strappi, false indicazioni dovute agli schermi difettosi.	8.1 Quality of radiographs All radiographs shall be free from mechanical, chemical, or other blemishes to the extent that they do not mask and are not confused with the image of any discontinuity in the area of interest of the object being radiographed. Such blemishes include, but are not limited to: fogging, processing defects such as streaks, watermarks, or chemical stains, scratches, finger marks, crimps, dirtiness, static marks, smudges, or tears, false indications due to defective screens.
8.2.1 Densità radiografica La densità del film nella zona adiacente al filo designato dell'IQI e nell'area di interesse sarà 1.8 minimo per lettura in film singolo di radiografie eseguite con sorgenti a raggi X e 2.0 minimo per radiografie eseguite con sorgenti a raggi gamma. Per lettura composita di esposizione a film multiplo, ogni film del set avrà una densità minima di 1.3. La densità massima sarà 4.0 per lettura singola o composita. Una tolleranza dello 0.05 in densità è ammessa per la variazione fra le letture dei densitometri.	8.2.1 Radiographic density The transmitted film density through the radiographic image adjacent to the designated wire of a wire IQI and the area of interest shall be 1.8 minimum for single film viewing for radiographs made with any X-ray source and 2.0 minimum for radiographs made with a gamma ray source. For composite viewing of multiple film exposure, each film of the composite set shall have a minimum density of 1.3. The maximum density shall be 4.0 for either single or composite viewing. A tolerance of 0.05 in density is allowed for variations between densitometer readings.
8.2.2 Variazione della densità (a) La densità della radiografia ovunque sull'area di interesse non deve: (1) variare di oltre -15% o +30% dalla densità attraverso il corpo dell'IQI a fori designato adiacente al foro essenziale o adiacente al filo essenziale di un filo di tipo IQI, e (2) eccedere gli intervalli di minima / massima densità consentiti e specificati nel par. 8.2.1 Quando si calcola la variazione ammissibile della densità, il calcolo può essere arrotondato con un'approssimazione di 0,1 entro l'intervallo specificato al precedente paragrafo 8.2.1.	8.2.2 Density Variation. (a) The density of the radiograph anywhere through the area of interest shall not: (1) vary by more than minus 15% or plus 30% from the density through the designated hole-type IQI adjacent to the essential hole or adjacent to the essential wire of a wire-type IQI, and (2) exceed the minimum/maximum allowable density ranges specified in para. 8.2.1. When calculating the allowable variation in density, the calculation may be rounded to the nearest 0.1 within the range specified in para. 8.2.1.
8.3 Sensibilità dell'IQI Le radiografie saranno eseguite con una tecnica di sensibilità sufficiente a mostrare il filo essenziale dell'IQI a fili. Le radiografie mostreranno anche i numeri e le lettere di identificazione dell'IQI. Se l'immagine del filo essenziale non è visibile su ognuno dei film in una tecnica a film multiplo, ma è visibile in lettura composita, l'interpretazione è permessa solo in lettura composita.	8.3 IQI sensitivity Radiography shall be performed with a technique of sufficient sensitivity to display the essential wire of a wire IQI. The radiographs shall also display the IQI identifying numbers and letters. If the essential wire IQI image do not show on any film in a multiple film technique, but do show in composite film viewing, interpretation shall be permitted only by composite film viewing.
8.4 Eccessiva radiazione retrodiffusa Se un'immagine chiara della lettera "B", descritta in 4.2, appare su un fondo scuro della radiografia, la protezione dalla retrodiffusione è insufficiente e la radiografia sarà considerata inaccettabile. Un'immagine scura della lettera "B" su fondo chiaro	8.4 Excessive backscatter If a light image of the "B", as described in 4.2, appears on a darker background of a radiograph, protection from backscatter is insufficient and the radiograph shall be considered unacceptable. A dark image of the "B" on a lighter background is not

non sarà causa di scarto.	cause for rejection.
8.5 Limiti di sfumatura geometrica La sfumatura geometrica della radiografia non dovrebbe eccedere i seguenti limiti, il superamento di tali limiti non comporterà il rigetto della radiografia a meno delle condizioni indicate nelle note a fondo tabella:	8.5 Geometric unsharpness limitation Geometric unsharpness of the radiograph should not exceeding the following, but the radiograph shall not be rejected when exceeding those limits unless as specified at the bottom of the table:

Material thickness / *Spessore del materiale* **in. (mm)**	**Ug maximum** / *Ug massima* **in. (mm)**
Under 2 (50)	0.020 (0.51)
2 through 3 (50 – 75)	0.030 (0.76)
Over 3 through 4 (75 – 100)	0.040 (1.02)
Greater than 4 (10)	0.070 (1.78)
Per caldaie costruite in accordo al codice BPV sez. I, quando ogni combinazione dei parametri radiografici produce una sfumatura geometrica eccedente 1,8 mm saranno utilizzati gli UT. Per tubazioni costruite in accordo al codice Power Piping B31.1, i valori di sfumatura geometrica eccedenti 2,0 mm saranno proibiti.	For boilers manufactured according to BPV code sect. I, when any combination of radiographic parameters produces a geometric unsharpness exceeding 1,8 mm, then UT shall be used. For piping manufacture according to Power Piping code B31.1, geometric unsharpness exceeding 2,0 mm shall be prohibited.

8.6 Valutazione del costruttore B&R è responsabile della verifica, interpretazione, e accettabilità delle radiografie nella loro completezza per assicurarne la conformità con i requisiti dell'Articolo 2 del codice ASME Sez. V e le altre sezioni applicabili del codice. Come supporto per la verifica e la valutazione, la documentazione della tecnica radiografica richiesta di seguito sarà completata prima della valutazione. Il Rapporto Radiografico sarà completato durante la valutazione. I dettagli della tecnica e il Rapporto Radiografico accompagneranno le radiografie. L'accettazione sarà completata prima della presentazione delle radiografie e della relativa documentazione all'ispettore.	8.6 Evaluation by manufacturer B&R shall be responsible for the review, interpretation, and acceptance of the completed radiographs to assure compliance with the requirements of Article 2 of ASME Code Sect. V and the other applicable ASME Code section. As an aid to the review and evaluation, the radiographic technique documentation required here below shall be completed prior to the evaluation. The Radiographic Test Report shall be completed during the evaluation. The radiographic technique details and the Radiographic Test Report shall accompany the radiographs. Acceptance shall be completed prior to presentation of the radiographs and accompanying documentation to the inspector.
9. CRITERI DI ACCETTABILITA'	**9. ACCEPTANCE STANDARD**
Sarà utilizzato uno dei seguenti criteri di accettabilità secondo la sezione del codice ASME che regola la costruzione in esame. Il criterio di accettabilità applicabile sarà definito sulla RX-map emessa dal Ispettore del Controllo Qualità prima dell'esecuzione del controllo radiografico.	One of the following acceptance standards shall be used according to the ASME Code section governing the manufacturing being examined. The applicable acceptance standard shall be specified on the RX Map issued by the Quality Control Inspector before the radiographic test.
9.1 Terminologia *a) Indicazioni tondeggianti.* Indicazioni con una lunghezza massima di tre volte la larghezza o meno sulla radiografia sono definite indicazioni tondeggianti. Tali indicazioni possono essere circolari, ellittiche, coniche, o irregolari nella forma e possono avere	9.1 Terminology *a) Rounded Indications.* Indications with a maximum length of three times the width or less on the radiograph are defined as rounded indications. These indications may be circular, elliptical, conical, or irregular in shape and may have tails. When

code. Valutando la dimensione di un'indicazione, la coda sarà inclusa. Le indicazioni possono essere di qualsiasi natura nella saldatura, quali porosità, scorie o tungsteno. *b) Indicazioni allineate.* Una sequenza di Quattro o più indicazioni tondeggianti saranno considerate allineate quando esse formano una linea parallela alla lunghezza della saldatura disegnata attraverso il centro delle due indicazioni più esterne. *c) Spessore t.* "*t*" è lo spessore di saldatura, del materiale resistente alla pressione, o il più sottile fra le sezioni saldate, comunque il minore. Se una saldatura a piena penetrazione include una saldatura d'angolo, lo spessore di gola sarà incluso in "*t*". *d) Densità dell'immagine.* La densità dell'indicazione all'interno dell'immagine può variare e non è criterio per accettabilità o scarto. *e) Indicazione tondeggiante rilevante.* Solo indicazioni tondeggianti oltre le seguenti dimensioni saranno considerate rilevanti. 1/10 *t* per *t* meno di 3 mm 0.4 mm per *t* da 3 mm a 6 mm incl. 0.8 mm per *t* maggiore di 6 mm a 50 mm incl. 1.6 mmper *t* maggiore di 50 mm.	evaluating the size of an indication, the tail shall be included. The indication may be from any source in the weld, such as porosity, slag or tungsten. *b) Aligned Indications.* A sequence of four or more rounded indications shall be considered to be aligned when they touch a line parallel to the length of the weld drawn through the centre of the two outer rounded indications. *c) Thickness t.* "*t*" is the thickness of the weld, of the pressure-retaining material, or of the thinner of the sections being joined, whichever is least. If a full penetration weld includes a fillet weld, the thickness of the fillet weld throat shall be included in "*t*". *d) Image Density.* Density within the image of the indication may vary and is not a criterion for acceptance or rejection. *e) Relevant rounded Indications.* Only those rounded indications which exceed the following dimensions shall be considered relevant. 1/10 *t* for *t* less than 3 mm 0.4 mm for *t* from 3 mm to 6 mm incl. 0.8 mm for *t* greater than 6 mm to 50 mm incl. 1.6 mm for *t* greater than 50 mm.
9.2 Criteri di accettabilità per radiografia Full Le seguenti discontinuità sono considerate inaccettabili: (1) ogni indicazione caratterizzata come cricca o zona di incomplete fusione o penetrazione; (2) ogni altra indicazione allungata sulla radiografia che abbia una lunghezza maggiore di: a) 6 mm per *t* fino a 19 mm. b) 1/3 *t* per *t* da 19 a 57 mm. c) 19 mm per *t* oltre 57 mm. (3) ogni gruppo di indicazioni allineate che abbiano una lunghezza cumulative maggiore di *t* in un tratto lungo *12 t*, eccetto quando la distanza fra le successive imperfezioni eccede *6L* dove *L* è la lunghezza dell'imperfezione più lunga del gruppo; (4) indicazioni tondeggianti oltre quanto specificato dai criteri standard indicati al paragrafo A-250 del codice ASME BPV Sezione I (da applicare anche per ASME B31.1) o indicati nell'Appendix 4 del codice ASME BPV Sezione VIII division 1 o indicati al paragrafo 7.5.3.2 ASME BPV Code Section VIII division 2, quello applicabile alla saldatura in esame. (5) Solo per componenti costruiti in accordo al codice ASME BPV sez. VIII div. 2 e tubazioni costruite in accordo a ASME B31.1, le condizioni interne della radice saranno ritenute non accettabili quando la variazione di densità o della luminosità dell'immagine non sono repentine. Le indicazioni	9.2 Acceptance criteria for Full radiography The following discontinuities are considered unacceptable: (1) any indication characterized as a cracks or zone of incomplete fusion or penetration; (2) any other elongated indication on the radiograph which has length greater than: a) 6 mm for *t* up to 19 mm. b) 1/3 *t* for *t* from 19 to 57 mm. c) 19 mm for *t* over 57 mm. (3) any group of aligned indications that have an aggregate length greater than *t* in a length of *12 t*, except when the distance between the successive imperfections exceeds *6L* where *L* is the length of the longest imperfection in the group; (4) rounded indications in excess of that specified by the acceptance standards given in A-250 of ASME BPV Code Section I (applicable too for piping by ASME B31.1) or given in Appendix 4 of ASME BPV Code Section VIII division 1, or given in paragraph 7.5.3.2 of ASME BPV Code Section VIII division 2 as applicable to the weld being examined. (5) Only for components manufactured according to ASME BPVC sect. VIII div. 2 and piping manufactured to ASME B31.1, internal root weld conditions are acceptable when density or image brightness change as indicated in the radiograph

lineari sulla radiografia a entrambe le estremità di tali condizioni saranno valutate in accordo agli altri punti di questo paragrafo.	is not abrupt. Linear indications on the radiograph at either edge of such conditions shall be evaluated in accordance with other sections of this paragraph.
9.3 Criteri di accettabilità radiografia Spot (UW-52 del codice ASME BPV VIII div. 1) *(a)* Le saldature di testa da radiografare a spot saranno esaminate localmente come specificato di seguito. *(b) Estensione minima dell'esame a spot* *(1)* Uno spot sarà esaminato per ogni recipiente, ogni 50 ft (15 m) di saldatura o frazione fra quelle per le quali è stata selezionata l'efficienza alla colonna (b) della Tabella UW-12. Comunque, per recipienti o parti identiche, ognuna con meno di 50 ft (15 m) di saldatura per le quali è stata selezionata l'efficienza alla colonna (b) della Tabella UW-12, i 50 ft (15 m) di incremento possono essere rappresentati da un unico spot. *(2)* Per ogni incremento di saldatura da esaminre, un numero sufficiente di spot radiografici sarà eseguito per esaminare la saldatura di ogni saldatore o operatore di saldatura. Nelle condizioni in cui due o più saldatori o operatori di saldatura eseguono passate in una stessa saldatura, o su due lati di una stessa saldatura, uno spot può rappresentare il lavoro di tutti i saldaotori e operatori di saldatura. *(3)* Ogni spot sarà eseguito appena possibile dopo il completamento dell'incremento di saldatura da esaminare. La posizione dello spot sarà scelta dall'Ispettore dopo il completamento dell'incremento di saldatura da esaminare, eccetto quando l'Ispettore è stato notificato in adeguato anticipo e non può essere presente o effettuare la scelta, B&R può esercitare il proprio giudizio per selezionare lo spot. *(4)* Le radiografie da eseguire per soddisfare le regole di altri paragrafi (ad esempio UW-9(d), UW-11(a)(5)(b) e UW-14(b)) non saranno utilizzati per soddisfare i requisiti per l'esame a spot. *(c) Criteri per l'esame a spot* L'esame a spot sarà eseguito in accordo alle tecniche descritte in questo documento. La lunghezza minima dello spot sarà di 6 in. Le saldature esaminate a spot saranno valutate secondo I seguenti criteri: *(1)* Sono inaccettabili le saldature nelle quali le idicazioni sono caratterizzate come cricche o zone di incomplete fusione o penetrazione. *(2)* Le saldature nelle quali le indicazioni sono caratterizzate come inclusioni di scoria o cavità saranno inaccettabili se la lunghezza di ogni indicazione è maggiore di 2/3*t* dove *t* è lo spessore come definito in 9.1 di questo	9.3 Acceptance criteria for Spot radiography (UW-52 of ASME BPV code sect. VIII div. 1) *(a)* Butt welded joints which are to be spot radiographed shall be examined locally as provided herein. *(b) Minimum extent of spot radiographic examination* *(1)* One spot shall be examined on each vessel for each 50 ft (15 m) increment of weld or fraction thereof for which a joint efficiency from column (b) of Table UW-12 is selected. However, for identical vessels or parts, each with less than 50 ft (15 m) of weld for which a joint efficiency from column (b) of Table UW-12 is selected, 50 ft (15 m) increments may be represented by one spot examination. *(2)* For each increment of weld to be examined, a sufficient number of spot radiographs shall be taken to examine the welding of each welder or welding operator. Under conditions where two or more welders or welding operators make weld layers in a joint, or on the two sides of a double-welded butt joint, one spot may represent the work of all welders or welding operators. *(3)* Each spot examination shall be made as soon as practicable after completion of the increment of weld to be examined. The location of the spot shall be chosen by the Inspector after completion of the increment of welding to be examined, except that when the Inspector has been notified in advance and cannot be present or otherwise make the selection, B&R may exercise his own judgment in selecting the spots. *(4)* Radiographs required at specific locations to satisfy the rules of other paragraphs (such as UW-9(d), UW-11(a)(5)(b) and UW-14(b)) shall not be used to satisfy the requirements for spot radiography. *(c) Standards for spot radiographic examination* Spot examination shall be made in accordance with the technique described in this document. The minimum length of spot radiograph shall be 6 in. The acceptability of welds examined by spot radiography shall be judged by the following standard: *(1)* Welds in which indications are characterized as cracks or zones of incomplete fusion or penetration shall be unacceptable. *(2)* Welds in which indications are characterized as slag inclusions or cavities shall be unacceptable if the length of any such indication is greater than 2/3*t* where *t* is the thickness as

documento. Se più indicazioni contenute nelle limitazioni qui sopra sono allineate, la saldatura sarà ritenuta accettabile quando la soma delle maggiori dimensioni di tali indicazioni non è maggiore di *t* per ogni 6*t* di lunghezza della saldatura (o in proporzione per radiografie più corte di 6*t*) e se l'indicazione più lunga fra quelle considerate sono separate da almeno 3*L* di metallo saldato dove *L* è la lunghezza dell'indicazione più lunga. La lunghezza massima di ogni indicazione accettabili sarà ¾ in. (19 mm). Ogni indicazione più corta di ¼ in. (6 mm) sarà accettabile per ogni spessore di lamiera. *(3)* Le indicazioni tondeggianti non sono criterio di accettabilità delle saldature che non debbano essere radiografate completamente. *(d) Valutazione e riesame* *(1)* Quando la radiografia a spot, secondo le regole sopra, è accettabile, l'intero incremento di saldatura rappresentato datale radiografia è accettabile. *(2)* Quando uno spot, eseguito come sopra, è stato esaminato e la radiografia scopre saldature che non rispettano i minimi requisiti di qualità specificati sopra, saranno eseguiti due spot aggiuntivi per lo stesso incremento di saldatura in posizione lontana dal precedente. Le posizioni di questi spot aggiuntivi saranno determinati dall'Ispettore o dal fabbricante come previsto per lo spot originale. Le aree di saldatura riparate saranno esaminate radiograficamente in accordo ai precedenti requisiti di questo paragrafo 9.4. *(a)* Se i due spot aggiuntivi esaminati mostrano che la saldatura soddisfa i requisiti sopra elencati, l'intero incremento di saldatura rappresentato dalle tre radiografie è accettabile a condizione che I difetti scoperti dal primo spot siano rimossi e l'area riparata di saldatura. *(b)* Se anche uno dei due spot aggiuntivi mostra che la saldatura non soddisfa I requisiti di qualità sopra indicati, l'intero incremento di saldatura sarà rigettato. L'intero incremento di saldatura rappresentato sarà radiografato completamente e tutti i difetti saranno riparati. *(c)* La riparazione della saldatura sarà eseguita in accordo al paragrafo 11 di questo documento 11 e il giunto riparato o risaldato sarà esaminato radiograficamente a spot in una posizione secondo i precedenti requisiti di questo paragrafo.	defined in 9.1 of this document. If several indications within the above limitation exist in line, the welds shall be judged acceptable if the sum of the longest dimensions of all such indications is not more than *t* in a length of 6*t* (or proportionately for radiographs shorter than 6*t*) and if the longest indications considered are separated by at least 3*L* of acceptable weld metal where *L* is the length of the longest indication. The maximum length of acceptable indications shall be ¾ in. (19 mm). Any such indications shorter than ¼ in. (6 mm) shall be acceptable for any plate thickness. *(3)* Rounded indications are not a factor in the acceptability of welds not required to be fully radiographed. *(d) Evaluation and retests* *(1)* When a spot radiographed as required above, is acceptable, the entire weld increment represented by this radiograph is acceptable. *(2)* When a spot, radiographed as required above, has been examined and the radiograph discloses welding which does not comply with the minimum quality requirements above, two additional spots shall be radiographically examined in the same weld increment at locations away from the original spot. The locations of these additional spots shall be determined by the Inspector or fabricator as provided for the original spot examination described above. The weld repaired area shall be radiographically examined in accordance with the foregoing requirements of this paragraph 9.4. *(a)* If the two additional spots examined show welding which meets the minimum quality requirements above, the entire weld increment represented by the three radiographs is acceptable provided the defects disclosed by the first of the three radiographs are removed and the area repaired by welding. *(b)* If either of the two additional spots examined shows welding which does not comply with the minimum quality requirements above, the entire increment of weld represented shall be rejected. The entire increment of weld represented shall be completely radiographed and all defects need be corrected. *(c)* Repair welding shall be performed as per paragraph 11 of this document and the rewelded or repaired joint shall be spot radiographically examined at one location in accordance with the foregoing requirements of this paragraph.
9.4 Criteri di accettabilità per la qualifica di saldatori Le radiografie per la qualifica di saldatori e di operatori di saldatura saranno valutate in accordo al codice	9.4 Acceptance criteria for welders qualification RT for qualification of welders and welder operators shall be evaluated according with ASME Sect. IX paragraph QW-191 instead of the above

ASME Sez. IX paragrafo QW-191 anziché in accordo ai requisiti precedenti.	requirements

10. RAPPORTO	**10. REPORT**
10.1 Documentazione di dettaglio della tecnica radiografica B&R GROUP preparerà e documenterà i dettagli della tecnica radiografica. Come minimo, le seguenti informazioni saranno fornite. (a) identificazione, es.: comm/No ordine e numero di fabbrica (se applicabile) (b) la mappa (se utilizzata) del piazzamento dei marcatori (c) numero di radiografie (esposizioni) (d) voltaggio o tipo di isotopo utilizzato (e) dimensione della macchia focale (*F* al par. 7.4 di questo documento) (f) tipo di materiale base e spessore, spessore di saldatura, spessore del rinforzo, quanto applicabile (g) distanza sorgente-oggetto (*D* al par. 7.4 di questo documento) (h) distanza fra oggetto lato sorgente e film (*d* al par. 7.4 di questo documento) (i) produttore e designazione del film (j) numero di film in ogni cassetta (k) esposizione singola- o doppia-parete (l) lettura singola- o doppia-parete	10.1 Radiographic technique documentation detail B&R GROUP shall prepare and document the radiographic technique details. As a minimum, the following information shall be provided. (a) identification, e.g.; job/contract number and serial number (if applicable) (b) the dimensional map (if used) of location marker placement (c) number of radiographs (exposures) (d) X-ray voltage or isotope type used (e) source size (*F* in par. 7.4 of this document) (f) base material type and thickness, weld thickness, weld reinforcement thickness, as applicable (g) source-to- object distance (*D* in par. 7.4 of this document) (h) distance from source side object to film (*d* in par. 7.4 of this document) (i) film manufacturer and Manufacturer's type/designation (j) number of film in each film holder/cassette (k) single- or double-wall exposure (l) single- or double-wall viewing
10.2 Rapporto radiografico B&R GROUP preparerà il Rapporto Radiografico. Il Rapporto conterrà almeno le seguenti informazioni: (a) elenco di ogni tratto radiografato (b) dettagli della tecnica radiografica elencati in 10.1 (c) valutazione e disposizione delle saldature esaminate (d) identificazione del rappresentante B&R che esegue l'accettazione finale delle radiografie (e) data della valutazione B&R	10.2 Radiographic test report B&R GROUP shall prepare the Radiographic Test Report. As a minimum, the following information shall be provided: (a) a listing of each radiograph location (b) the technique details listed in 10.1 (c) evaluation and disposition of the weld(s) examined (d) identification of the B&R's representative who performed the final acceptance of the radiographs (e) date of the B&R's evaluation

11. RIPARAZIONE	**11. REPAIR**
Tutte le discontinuità eccedenti i criteri di accettabilità saranno rimosse con mezzi adeguati e riparate in accordo a una procedura approvata. L'area riparata sarà esaminata dopo la riparazione in accordo con la presente procedura; il film dell'area riparata sarà identificata con la lettera "R" in piombo.	All discontinuities in excess to acceptance standards shall be removed by suitable means and repaired according to approved procedure. The repaired area shall be examined after repair in accordance with this procedure; the film of the area repaired shall be identified with lead letter "R".

B&R GROUP PROCEDURE

MAGNETIC PARTICLE INSPECTION PROCEDURE

PR.N° 003 MT 21 | REV.0

REFERENCE DOCUMENTS:	
ASME BPV CODE SECTIONS I,VIII div.1,VIII div.2,IX	2021 Edition
ASME Power Piping B31.1	2020 Edition
ASME Recommended Practice SNT-TC-1A	2016 Edition

A.I.

LRQA verification ltd 0094
Witnessed Monitored Reviewed
ALESSANDRO MONTANA 13420 B
Ref. No..
Office: Milan
28 DIC. 2021

LRQA verification ltd 0094
Witnessed Monitored Reviewed
GIANLUCA CESTARI Accepted
Ref. No.: 16498 AI
Office: Milan 27/12/2021

A.I.

LRQA verification ltd 0094
Witnessed Monitored Reviewed
LUCA RIVAROLI 13007 AI/IS - B N R
Ref. No.. Rev. 0
Office: Milan
28 DIC. 2021

LRQA verification ltd 0094
Witnessed Monitored Reviewed
FLAVIO ZANON ACCEPTED
Ref. No.. 13421
Office: Milan 18-05-2022

THIS PROCEDURE HAS BEEN DEMONSTRATED TO THE A.I. ON: 21/12/20
THIS PROCEDURE IS CERTIFIED BEING IN ACCORDANCE TO ASME SEC. V T-150
DEMONSTRATION STILL VALID FOR REV.0

VILLA E. BONALDI
NDT LEVEL III
ISO 9712/SNT-TC-1A
Botti Daniel
20/12/2021

Rev.	Date	Description	Issued by	Approved by TP	Reviewed& Approved Lev.III
0	28-12-2021	Revised as per new Edition of ASME Code.	M. Fiammingo	N. Tosto	D. Botti

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 003 MT 21

REV.0

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1 SCOPO	1 SCOPE
Questo documento definisce i requisiti minimi applicati da B&R GROUP per eseguire l'esame con particelle magnetiche a umido e a secco di saldature, forgiati, raccordi, fusioni, lamiere dei componenti e delle tubazioni costruiti in accordo ai codici ASME indicati in prima pagina. La presente procedura sarà applicata su materiali ferromagnetici di ogni forma e dimensione con la tecnica del giogo. Questa procedura sarà dimostrata a soddisfazione dell'A.I. in accordo al paragrafo T-150 del codice ASME BPV sez. V. Questa procedura sarà dimostrata a soddisfazione dell'A.I. in accordo al paragrafo T-150 del codice ASME BPV sez. V. Una modifica di un requisito nella tabella T-721, identificato come una variabile essenziale, richiede la riqualificazione della procedura tramite una dimostrazione.	This document defines the minimum B&R GROUP requirements to perform either wet and dry magnetic particle examination on welds, forgings, fittings, castings, plates of their component and piping manufactured according to the referenced ASME code. This procedure shall be applied to ferromagnetic materials of any shape and size by Yoke technique. This procedure shall be demonstrated to satisfaction of the A.I. as per art. T-150 of the ASME BPV code sect. V. This procedure shall be demonstrated to satisfaction of the A.I. as per art. T-150 of the ASME BPV code sect. V. A change of a requirement in Table T-721, identified as an essential variable from the specified value, or range of values, shall require requalification of the written procedure by demonstration.

2 DOCUMENTI DI RIFERIMENTO	2 REFERENCE STANDARDS
ASME BPVC Sezioni I, V, VIII div. 1, VIII div.2, IX ed. 2021 ASME B31.1 ed 2020 ASNT SNT-TC-1A ed. 2016	ASME BPVC Section I, V, VIII div. 1, VIII div. 2, IX 2021 ed. ASME B31.1 2020 ed. ASNT SNT-TC-1A ed 2016

3. PERSONALE	3. PERSONNEL
Il personale che esegue, valuta e certifica i risultati del controllo sarà qualificato e certificato almeno al livello II in accordo alla Written Practice aziendale che soddisfa i requisiti della SNT-TC-1A e ASME BPVC sez. V art. 1 Mandatory Appendix III.	Personnel performing, evaluating and certifying the results of the examination shall be qualified and certified at least level II in accordance with the company Written practice which satisfies the Recommended Practice SNT-TC-1A 1A and ASME BPVC sec. V art. 1 Mandatory Appendix III.

4. APPARECCHIATURA	4. EQUIPMENT
4.1 Strumento L'esame con particelle magnetiche sarà eseguito con Giogo in corrente alternata (AC). Saranno utilizzati apparecchi CIGIEMME (Twist) o equivalenti.	*4.1 Apparatus* To perform Magnetic Particle examination an Electromagnetic Yoke AC shall be used. The apparatus by CIGIEMME (Twist) or equivalent shall be used.
4.2 Rivelatore Le particelle ferromagnetiche utilizzate per l'esame soddisfano i seguenti requisiti. (a) Le particelle avranno un trattamento per ottenere una colorazione (pigmenti fluorescenti o non-fluorescenti o entrambi) da renderle	*4.2 Examination medium* The finely divided ferromagnetic particles used for the examination shall meet the following requirements. (a) Particles type. The particles shall be treated to impart color (fluorescent pigments, nonflurescent pigments, or both) in order to make

molto visibili (contrastanti) in contrasto con il fondo della superficie in esame. (b) Polveri. Saranno utilizzate particelle a umido e a secco e il relativo liquido di sospensione, che soddisfino le specifiche applicabili elencate nella SE-709. (c) Limiti di temperatura. Le particelle a umido saranno utilizzate fino a 50° C e le particelle a secco saranno utilizzate fino a 300 °C. Le particelle usate saranno scelte fra una di quelle elencate nella tabella seguente:	them highly visible (contrasting) against the background of the surface being examined. (b) Particles. Dry and Wet particles and suspension vehicles in accordance with the applicable specifications listed in SE-709 shall be used. (c) Temperature limitation. Wet Particles shall be used up to 50° C, and dry particles shall be used up to 300 °C. The particles to be used shall be one of that listed in the following table:

Type of powder *Tipo di polvere*	**TYPE** *Tipo*	**COLOUR** *Colore*	**SIZE** *Dimensione* (µm)	**MANUFACTURER** *Produttore*
WET / *Umido*	K35 Suspended in "Kerosenoil" or "H_2O + A38 (or A44)"	BLACK *Nero*	5÷7	CIGIEMME
	BW2	BLACK *Nero*	3	NDT
	PAD 35/50 Suspended in Water	BLACK *Nero*	5÷7	CIGIEMME
	PAD 31-73/50 Suspended in Water	FLUORESCENT *Fluorescente*	2÷4	CIGIEMME
	FLOW FINDER FW1	FLUORESCENT *Fluorescente*	2÷4	NDT
	K31-73 Suspended in "Kerosenoil" or "H_2O + A38 (or A44)"	FLUORESCENT *Fluorescente*	2÷4	CIGIEMME
DRY / *Secco*	10.160 DRY RO	RED *Rosso*	100	NDT

Note	***Remarks***
La polvere nera ad umido tipo K35 & PAD 35/50 CIGIEMME può essere utilizzata con la vernice di contrasto V42 Vecoplast. La polvere nera ad umido tipo BW2 NDT può essere utilizzata con la vernice di contrasto WBL5.	CIGIEMME Black wet powder K35 & PAD 35/50 can be used with the surface contrast varnish type V42 Vecoplast. NDT Black wet powder BW2 can be used with the surface contrast varnish type WBL5.

5. REQUISITI GENERALI	**5. MISCELLANEOUS REQUIREMENTS**
5.1 Surface conditioning Normalmente si ottengono risultati soddisfacenti quando la superficie è nelle condizioni di come-saldato, come-laminato, come-fuso o come-forgiato. La preparazione della superficie mediante molatura o lavorazione di macchina può essere necessaria nel caso in cui le irregolarità possano mascherare indicazioni dovute a discontinuità. Prima dell'esame, la superfice da controllare e l'area adiacente per almeno 25 mm sarà asciutta e libera	*5.1 Surface conditioning* Satisfactory results are usually obtained when the surface are in the as-welded, as-rolled, as-cast or as-forged conditions. However, surface preparation by grinding or machining may be necessary where surface irregularities could mask indications due to discontinuities. Prior to magnetic particle examination, the surface to be examined and all adjacent areas within at least 25

da sporco, grasso, garze, scaglie, flusso di saldatura e spruzzi, olio, o altro materiale estraneo che potrebbe interferire con l'esame. La pulizia può essere effettuata con detergenti, solventi organici, soluzioni disincrostanti, solventi di vernice, grassaggio a vapore, sabbiatura o granigliatura, o mediante ultrasuoni.	mm shall be dry and free of all dirt, grease, lint, scale, welding flux and spatter, oil, or other extraneous matter that could interfere with the examination. Cleaning may be accomplished using detergents, organic solvents, descaling solution, paint removers, vapor degreasing, sand or grit blasting, or ultrasonic cleaning methods.
5.2 Aumento del contrasto superficiale Un rivestimento non-magnetico può essere applicato dall'operatore sulla superficie non rivestita nella quantità sufficiente per aumentare il contrasto delle particelle. Quando un rivestimento non-magnetico è applicato temporaneamente sulla superficie non rivestita nella quantità sufficiente per aumentare il contrasto, sarà dimostrato che le indicazioni possono essere individuate attraverso il rivestimento. Non è necessario misurare lo spessore del rivestimento.	*5.2 Nonmagnetic surface contrast enhancement* Nonmagnetic surface contrasts may be applied by the examiner to uncoated surfaces, only in amounts sufficient to enhance particle contrast. When nonmagnetic surface contrast enhancement is used, it shall be demonstrated that indications can be detected through the enhancement coating. Thickness measurement of this nonmagnetic surface contrast enhancement is not required.

6. TECNICA	**6. TECHNIQUE**
6.1 Tecnica Sarà utilizzata la tecnica di magnetizzazione con giogo elettromagnetico.	*6.1 Technique* The Electromagnetic Yoke magnetization technique shall be used.
6.2 Tecnica con giogo Per questa tecnica sarà utilizzato un giogo elettromagnetico a corrente alternata.	*6.2 Yoke technique* For this technique, alternating current electromagnetic yokes shall be used.

7. CALIBRAZIONE	**7. CALIBRATION**
7.1 Capacità di sollevamento del giogo Prima di ogni uso, la capacità di magnetizzazione del giogo elettromagnetico deve essere stata controllata Ogni giogo elettromagnetico in corrente alternata deve avere una capacità di sollevamento di almeno 4,5 Kg alla massima apertura dei poli con il contatto simile a quello da utilizzare in esame. Ogni peso sarà misurato con uno strumento di un costruttore riconosciuto e inciso con il proprio peso nominale prima dell'uso. Un peso necessita di essere verificato solo se danneggiato in modo tale da poter avere potenzialmente perso materiale.	*7.1 Lifting power of yokes* Prior to each use, the magnetizing power of electromagnetic yokes shall have been checked. Each alternating current electromagnetic yoke shall have a lifting power of at least 4,5 Kg at the maximum pole spacing, with contact similar to what will be used during the examination. Each weight shall be weighed with a scale from a reputable manufacturer and stenciled with the applicable nominal weight prior to first use. A weight need only be verified again if damaged in a manner that could have caused potential loss of material.
7.2 Misuratore di intensità di luce I misuratori di luce, sia visibile sia UV-A, saranno calibrati annualmente o quando lo strumento ha subito riparazioni. Se lo strumento non è in uso per un anno o più, la calibrazione sarà effettuata prima dell'uso. Il massimo errore ammesso per i misuratori di luce sia visibile sia fluorescente (UV-A) è ± 10% del valore di lettura.	*7.2 Light meters* Light meters, both visible and UV-A light meters, shall be calibrated at least once a year or whenever the meter has been repaired. If meters have not been in use for one year or more, calibration shall be done before being used. The maximum admitted error for both visible and fluorescent (UV-A) light meters is ± 10% of read value.

8. ESAME	8. EXAMINATION
8.1 Esame preliminare Prima di eseguire l'esame con particelle magnetiche, sarà eseguito il controllo della superficie da esaminare per individuare ogni discontinuità aperta in superficie che potrebbe non attrarre e trattenere le particelle magnetiche a causa della propria larghezza.	*8.1 Preliminary examination* Before the magnetic particle examination is conducted, a check of the examination surface shall be conducted to locate any discontinuity surface openings which may not attract and hold magnetic particles because of their width.
8.2 Direzione di magnetizzazione Almeno due esami separati saranno eseguiti su ogni area. Al secondo esame, le linee di flusso magnetico saranno approssimativamente perpendicolari a quelle del primo esame.	*8.2 Direction of magnetization* At least two separate examination shall be performed on each area. During the second examination, the lines of magnetic flux shall be approximately perpendicular to those used during the first examination.
8.3 Metodo d'esame Le particelle magnetiche utilizzate saranno a umido, e possono essere sia fluorescenti sia non fluorescenti. L'esame sarà condotto con il metodo continuo. Le particelle a secco saranno utilizzate per le riprese delle saldature; le particelle a umido saranno utilizzate per le saldature finite e per gli altri materiali base. *(a) Particelle a secco*. La corrente di magnetizzazione rimarrà attiva mentre le particelle vengono applicate e mentre l'eccesso di particelle viene rimosso. *(b) Particelle a umido*. La corrente di magnetizzazione sarà applicata dopo l'applicazione delle particelle. Il flusso di particelle sarà fermato con l'applicazione della corrente. Particelle magnetiche da bombolette spray o pompe possono essere applicate prima e/o durante l'applicazione della corrente. Le particelle magnetiche possono essere applicate contemporaneamente alla corrente di magnetizzazione se esse non sono applicate direttamente sulla superficie in esame e sono lasciate scorrere sopra la superficie in esame oppure se sono applicate direttamente alla superficie in esame con bassa velocità, insufficiente a rimuovere le particelle accumulate.	*8.3 Method of examination* The ferromagnatic particles used in an examination medium shall wet, and may be either fluorescent or nonfluorescent. Examination(s) shall be done by the continuous method. Dry particles shall be used for weld back-gauging; wet particles shall be used for finished welds and others base materials. *(a) Dry particles*. The magnetizing current shall remain on while the examination medium is being applied and while any excess of the examination medium is removed. *(b) Wet particles*. The magnetizing current shall be turned on after the particles have been applied. Flow of particles shall stop with the application of current. Wet particles applied from aerosol spray cans or pump may be applied before and/or during magnetizing current is applied. Wet particles may be applied during the application of magnetizing current if they are not applied directly to the examination area and are allowed to flow over the examination area or are applied directly to the examination area with low velocities insufficient to remove accumulated particles.
8.4 Estensione dell'esame L'esame sarà condotto con una sovrapposizione sufficiente a garantire il 100% della copertura alla sensibilità richiesta. Per grandi aree sarà tracciata una griglia per garantire la copertura dell'intera area da esaminare.	*8.4 Examination coverage* All examination shall be conducted with sufficient overlap to assure 100% coverage at the required sensitivity. A grid shall be used for large areas to guarantee the complete coverage of the area to be examined.

8.5 Rimozione delle particelle in eccesso L'accumulo eccessivo di particelle sarà rimosso pulendo adeguatamente la superficie come richiesto da para. 5.1 e l'esame sarà ripetuto nell'area così ricondizionata.	*8.5 Excess particle removal* Accumulations of excess particles in examinations shall be removed the surface adequately cleaned as specified in para. 5.1 and the examination repeated.
8.6 Interpretazione L'interpretazione individuerà se un'indicazione è falsa, non rilevante, o rilevante. Indicazioni false e non rilevanti dovranno essere dimostrate come tali. L'interpretazione sarà effettuata per identificare la posizione e la natura delle indicazioni.	*8.6 Interpretation* The interpretation shall identify if an indication as false, non-relevant, or relevant. False and non-relevant indications shall be proven as false or non-relevant. Interpretation shall be carried out to identify the locations of indications and the character of the indication.
8.6.1 Particelle magnetiche colorate Le discontinuità superficiali sono indicate dall'accumulo di particelle magnetiche che contrastano con la superficie in esame. Il colore delle particelle magnetiche sarà sufficientemente diverso dal colore della superficie. Un'intensità luminosa di almeno 1076 Lx è necessaria sulla superficie da esaminare per assicurare una adeguata sensibilità durante l'esame e la valutazione delle indicazioni. L'intensità della luce della sorgente di luvce bianca, naturale o supplementare, sarà misurata con un luxmetro prima della valutazione delle indicazioni oppure sarà utilizzata una sorgente di luce verificata. La verifica della sorgente di luce è richiesto che sia dimostrata una sola volta, documentata, e mantenuta la registrazione in archivio.	8.6.1 Visible (Colour contrast) magnetic particles Surface discontinuities are indicated by accumulations of magnetic particles which should contrast with the examination surface. The colour of the magnetic particles shall be sufficiently different than the color of the examination surface. A minimum light intensity of 1076 Lx is required on the surface to be examined to ensure adequate sensitivity during the examination and evaluation of indications. The light intensity, natural or supplemental white light source, shall be measured with a white light meter prior to the evaluation of indications or a verified light source shall be used. Verification of light source is required to be demonstrated only one time, documented, and maintained on file.
8.6.2 Particelle magnetiche fluorescenti Con le particelle magnetiche fluorescenti, il processo è essenzialmente lo stesso delle particelle colorate, con l'eccezione che l'esame è eseguito usando una luce ultravioletta chiamata *luce nera*. L'esame sarà eseguito nel modo seguente: *(a)* sarà eseguito in area oscurata con un massimo di 21.5Lx da verificare sulla superficie in esame tramite uno strumento di misura calibrato . *(b)* L'operatore sarà nell'area oscurata per almeno 5 minuti prima di eseguire l'esame per adeguare i propri occhi alla visione oscurata. Se l'operatore utilizza occhiali o lenti, queste non devono essere fotosensibili. *(c)* L'area da esaminare deve essere illuminata con una luce UV-A che operi nel campo compreso fra 320mm e 400mm. *(d)* La luce UV-A avrà un'intensità minima di 1000 $\mu W/cm^2$ sulla superficie della parte in	8.6.2 Fluorescent magnetic particles With fluorescent magnetic particles, the process is essentially the same as per visible magnetic particles, with the exception that the examination is performed using an ultraviolet light called *black light*. The examination shall be performed as follows: *(a)* It shall be performed in a darkened area with a maximum ambient with light level of 21.5Lx measure with a calibrated with light meter at the examination surface. *(b)* The examiner shall be in the darkened area for at least 5 min prior to performing the examination to enable their eyes to adapt to dark viewing. If the examiner wears glasses or lenses, they shall not be photosensitive. *(c)* The examination area shall be illuminated with UV-A lights that operate in the range between 320mm and 400mm. *(d)* UV-A light shall achieve a minimum of 1000 $\mu W/cm^2$ on the surface of the part being

esame durante tutto l'esame. *(e)* Riflettori, filtri, vetri e lenti saranno controllati e puliti prima dell'uso. Riflettori, filtri, vetri e lenti rotti o incrinati saranno rimpiazzati immediatamente. *(f)* L'intensità della luce UV-A sarà misurata con uno strumento di misura per luce UV-A prima dell'uso, ogni volta che si spegne o si sostituisce, e al termine dell'esame o di serie d'esami. (g) Lampade a vapori di mercurio producono una luce UV-A con lunghezza d'onda 365 nm per indurre fluorescenza. Sorgenti UV-A con un LED UV-A o con una serie di LED UV-A avranno un'emissione caratteristica comparabile a quella di altre sorgenti UV-A. Le sorgenti UV-A a LED soddisferanno i requisiti della SE-2297 e della SE-3022. Sorgenti di luce UV-A a LED saranno certificate in conformità ai requisiti della SE-3022 e/o ASTM E3022.	examined throughout the examination. *(e)* Reflectors, filters, glasses, and lenses shall be checked and, if necessary, cleaned prior to use. Cracked or broken reflectors, filters, glasses, or lenses shall be replaced immediately. *(f)* The UV-A light intensity shall be measured with a UV-A light meter prior to use, whenever the light power source is interrupted or changed, and at the completion of the examination or series of examinations. *(g)* Mercury vapor arc lamps produce UV-A wavelength of 365 nm for inducing fluorescence. LED UV-A sources using a single UV-A LED or an array of UV-A LEDs shall have emission characteristics comparable to those of other UV-A sources. LED UV-A sources shall meet the requirements of SE-2297 and SE-3022. LED UV-A light sources shall be certified as meeting the requirements of SE-3022 and/or ASTM E3022.
8.7 Smagnetizzazione Il magnetismo residuo prodotto con la tecnica del Giogo in AC non richiede la smagnetizzazione.	*8.7 Demagnetization* Residual magnetism by the AC Yoke techinique shall not require demagnetization.
8.8 Pulizia dopo l'esame Dopo l'esame, la parte sarà pulita mediante spazzola, aria compressa o stracci.	*8.8 Post-examination cleaning* After examination, the examined part shall be cleaned by brush, compressed air or cloths.

9. VALUTAZIONE	**9. EVALUATION**
Discontinuità in superficie o appena sotto sono indicate dalla ritenzione del mezzo d'esame. Comunque, irregolarità superficiali dovute a segni di lavorazioni di macchina o altre condizioni superficiali possono produrre false indicazioni. Ogni indicazione discutibile o dubbia sarà riesaminata per stabilire se rilevante o falsa. Il ricondizionamento della superficie può precedere la ripetizione dell'esame. Quando un'indicazione è dimostrata non rilevante, non è necessario investigare altre indicazioni non rilevanti dello stesso tipo. Indicazioni non rilevanti che potrebbero mascherare indicazioni di difetti sono inaccettabili. Ampi accumuli di particelle che possono mascherare, indicazioni di discontinuità, sono proibite, e tali aree saranno pulite e riesaminate.	Discontinuities on or near the surface are indicated by retention of the examination medium. However, localized surface irregularities due to machining marks or other surface conditions may produce false indications. Any questionable or doubtful indications shall be re-examined to determine whether or not they are relevant. Surface conditioning may precede the re-examination. After an indication has been verified to be non relevant, it is not necessary to re investigate repetitive non relevant indication of the same type. Non relevant indication that would mask indication of defects are unacceptable. Broad areas of particle accumulation, which might mask indications from discontinuities, are prohibited, and such areas shall be cleaned and re-examined.
9.1 Criteri di accettabilità Questi criteri di accettabilità sono i più restrittivi fra gli standards elencati come riferimento di questo documento. Indicazioni rilevanti sono quelle risultanti da	*9.1 Acceptance standards* These acceptance standards are the most stringent of the standards and code referenced in this document. Relevant indications are those which result from mechanical discontinuities. Linear indications are

discontinuità meccaniche. Indicazioni lineari sono le indicazioni che hanno lunghezza maggiore di tre volte la larghezza. Indicazioni tondeggianti sono indicazioni circolari o ellittiche che hanno la lunghezza inferiore a tre volte la larghezza. Un'indicazione di discontinuità può essere più larga della discontinuità che la causa; comunque il parametro per l'accettabilità o lo scarto sarà la dimensione dell'indicazione e non la dimensione della discontinuità. Solo indicazioni con dimensioni maggiori di 1,5 mm saranno considerate rilevanti. Tutte le superfici esaminate saranno esenti da: (a) indicazioni lineari rilevanti; (b) indicazioni rilevanti tondeggianti maggiori di 5 mm; (c) Quattro o più indicazioni rilevanti tondeggianti disposte in linea separate da 1,5 mm o meno fra le estremità; (d) dieci o più indicazioni in ogni 3870 mm^2 di superficie con dimensione maggiore dell'area non eccedente 150 mm con l'area calcolata nella condizione più sfavorevole delle indicazioni da valutare; (e) indicazioni riconducibili a cricche, indipendentemente dalle condizioni superficiali	those indications in which the length is more than three times the width. Rounded indications are indications which are circular or elliptical with the length less than three times the width. An indication of a discontinuity may be larger than the discontinuity that causes it; however, the size of the indication and not the size of the discontinuity is the basis of acceptance or rejection. Only indications with major dimensions greater than 1,5 mm shall be considered relevant. All surfaces examined shall be free of: (a) relevant linear indications; (b) relevant rounded indications greater than 5 mm; (c) four or more relevant rounded indications in a line separated by 1,5 mm or less edge to edge; (d) ten or more indications in any 3870 mm^2 of surface with the major dimension of this area not to exceed 150 mm with the area taken in the most unfavourable location relative to the indications being evaluated; (e) crack like indications detected, irrespective of surface conditions

10. DOCUMENTAZIONE	**10. DOCUMENTATION**
10.1 Registrazione delle indicazioni 10.1.1 Indicazioni accettabili Le indicazioni accettabili non saranno registrate.	*10.1 Recording of indications* 10.1.1 Nonrejectable indications Nonrejectable indications shall not be recorded.
10.1.2 Indicazioni non accettabili Le indicazioni non accettabili saranno registrate, ad eccezione di quelle rilevate durante le riprese a rovescio delle saldature. Come minimo saranno registrati il tipo di indicazione (lineare o tondeggiante), posizione ed estensione (lunghezza o diametro o allineate).	10.1.2 Rejectable indications Rejectable indications shall be recorded, except rejectable indications found during weld back gouging. As a minimum, the type of indications (linear or rounded), location and extent (length or diameter or aligned) shall be recorded.
10.2 Registrazione dell'esame Al termine dell'esame sarà emesso un Rapporto dall'operatore qualificato; il rapporto conterrà almeno I seguenti dati: a) commessa, identificazione della parte; b) identificazione della procedura e revisione c) tecnica; d) apparecchiatura e tipo di corrente utilizzati; e) particelle magnetiche; f) documenti di riferimento;	*10.2 Examination records* After examination a Magnetic Particle Report shall be issued by qualified personnel; the Report shall contain at least the followings: a) job, part identification; b) procedure identification and revision; c) technique; d) magnetic particle equipment and type of current; e) magnetic particles; f) reference documents;

g) materiale e spessore; h) stato del materiale; i) mappa o registrazione delle indicazioni come da paragrafo 10.1 e risultato dell'esame; j) strumento di illuminazione; k) identificazione e qualifica dell'operatore; l) data di esecuzione dell'esame.	g) material and thickness; h) material status; i) map or record of indications as per 10.1 and result of examination; j) lighting equipment; k) identification and qualification of operator; l) date of examination were performed.

11. RIPARAZIONE	**11. REPAIR**
Tutte le discontinuità eccedenti I criteri di accettabilità saranno rimosse da parte del costruttore, con mezzi adeguati e riparate in accordo a una procedura approvata. L'area riparata sarà riesaminata dopo la riparazione in accordo con la presente procedura.	All discontinuities in excess to acceptance standards shall be removed, by the manufacturer, by suitable means and repaired according to approved procedure. The repaired area shall be re-examined after repair in accordance with this procedure.

B&R GROUP PROCEDURE

WET FLUORESCENT MAGNETIC PARTICLE INSPECTION PROCEDURE WITH DUAL COLORS PERFOMED IN UNDARKNED AREA

PR.N° 003 MTD 21

REV.0

REFERENCE DOCUMENTS:	
ASME BPV CODE SECTIONS I,VIII div.1,VIII div.2,IX	2021 Edition
ASME Power Piping B31.1	2020 Edition
ASME Recommended Practice SNT-TC-1A	2016 Edition

☒ LRQA verification ltd ☐ 0094 ☐
☐ Witnessed ☐ Monitored ☒ Reviewed
FLAVIO ZANON
Ref. No.. 13421
Office: Milan
LRQA
Accepted
18-05-2022

A.I.

☐ LRQA verification ltd ☐ 0094 ☐
☐ Witnessed ☐ Monitored ☐ Reviewed
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AI 13420 B
28 DIC. 2021
LRQA

☐ LRQA verification ltd ☐ 0094 ☐
☐ Witnessed ☐ Monitored ☒ Reviewed
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Ref. No.: 16405 AI
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LRQA
Accepted

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☒ LRQA verification ltd ☐ 0094 ☐
☐ Witnessed ☐ Monitored ☒ Reviewed
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Accepted
28 DIC. 2021
LRQA

VILLA C. BONALDI
NDT LEVEL III
ISO 9712/SNT-TC-1A
Botti Daniel
28/12/2021

THIS PROCEDURE HAS BEEN DEMONSTRATED TO THE A.I. ON: 21/02/20
THIS PROCEDURE IS CERTIFIED BEING IN ACCORDANCE TO ASME SEC. V T-150
DEMONSTRATION STILL VALID FOR REV.0

Rev.	Date	Description	Issued by	Approved by TP	Reviewed& Approved Lev.III
0	28-12-2021	Revised as per new Edition of ASME Code.	M. Fiammingo	N. Tosto	D. Botti

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 003 MTD 21

REV.0

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1 SCOPO	1 SCOPE
Questo documento definisce i requisiti minimi applicati da B&R GROUP per eseguire l'esame con particelle magnetiche a umido di saldature, forgiati, raccordi, fusioni, lamiere dei componenti e delle tubazioni costruiti in accordo ai codici ASME indicati in prima pagina. La presente procedura sarà applicata su materiali ferromagnetici di ogni forma e dimensione con la tecnica del giogo. Questa procedura sarà dimostrata a soddisfazione dell'A.I. in accordo al paragrafo T-150 del codice ASME BPV sez. V. Questa procedura sarà dimostrata a soddisfazione dell'A.I. in accordo al paragrafo T-150 del codice ASME BPV sez. V. Una modifica di un requisito nella tabella T-721, identificato come una variabile essenziale, richiede la riqualificazione della procedura tramite una dimostrazione.	This document defines the minimum B&R GROUP requirements to perform either wet magnetic particle examination on welds, forgings, fittings, castings, plates of their component and piping manufactured according to the referenced ASME code. This procedure shall be applied to ferromagnetic materials of any shape and size by Yoke technique. This procedure shall be demonstrated to satisfaction of the A.I. as per art. T-150 of the ASME BPV code sect. V. This procedure shall be demonstrated to satisfaction of the A.I. as per art. T-150 of the ASME BPV code sect. V. A change of a requirement in Table T-721, identified as an essential variable from the specified value, or range of values, shall require requalification of the written procedure by demonstration.

2 DOCUMENTI DI RIFERIMENTO	2 REFERENCE STANDARDS
ASME BPVC Sezioni I, V, VIII div. 1, VIII div.2, IX ed. 2021 ASME B31.1 ed 2020 ASNT SNT-TC-1A ed. 2016	ASME BPVC Section I, V, VIII div. 1, VIII div. 2, IX 2021 ed. ASME B31.1 2020 ed. ASNT SNT-TC-1A ed. 2016

3. PERSONALE	3. PERSONNEL
Il personale che esegue, valuta e certifica i risultati del controllo sarà qualificato e certificato almeno al livello II in accordo alla Written Practice aziendale che soddisfa i requisiti della SNT-TC-1A e ASME BPVC sez. V art. 1 Mandatory Appendix III.	Personnel performing, evaluating and certifying the results of the examination shall be qualified and certified at least level II in accordance with the company Written practice which satisfies the Recommended Practice SNT-TC-1A 1A and ASME BPVC sec. V art. 1 Mandatory Appendix III.

4. APPARECCHIATURA	4. EQUIPMENT
4.1 Strumento L'esame con particelle magnetiche sarà eseguito con Giogo in corrente alternata (AC). Saranno utilizzati apparecchi CIGIEMME (Twist) o equivalenti.	*4.1 Apparatus* To perform Magnetic Particle examination an Electromagnetic Yoke AC shall be used. The apparatus by CIGIEMME (Twist) or equivalent shall be used.
4.2 Rivelatore Le particelle ferromagnetiche utilizzate per l'esame soddisfano i seguenti requisiti. (a) Le particelle avranno un trattamento per ottenere una colorazione (pigmenti fluorescenti o non-fluorescenti o entrambi) da renderle molto visibili (contrastanti) in contrasto con il fondo della superficie in esame.	*4.2 Examination medium* The finely divided ferromagnetic particles used for the examination shall meet the following requirements. (a) Particles type. The particles shall be treated to impart color (fluorescent pigments, nonflurescent pigments, or both) in order to make them highly visible (contrasting) against the background of the surface being examined.

(b) Polveri. Saranno utilizzate particelle a umido e a secco e il relativo liquido di sospensione, che soddisfino le specifiche applicabili elencate nella SE-709. (c) Limiti di temperatura. Le particelle a umido saranno utilizzate fino a 50° C. Le particelle usate saranno scelte fra una di quelle elencate nella tabella seguente:	(b) Particles. Dry and Wet particles and suspension vehicles in accordance with the applicable specifications listed in SE-709 shall be used. (c) Temperature limitation. Wet Particles shall be used up to 50° C. The particles to be used shall be one of that listed in the following table:

Type of powder *Tipo di polvere*	**TYPE** *Tipo*	**COLOUR** *Colore*	**SIZE** *Dimensione* (µm)	**MANUFACTURER** *Produttore*
WET / *Umido*	LA 150/2 Dual colors Suspended in "H_2O + A44"	FLUORESCENT *Fluorescente*	2÷8	CIGIEMME
WET / *Umido*	FLAW FINDER FW 1 C Dual-Colored Suspended in H2O	FLUORESCENT *Fluorescente*	2÷8	NDT

5. REQUISITI GENERALI	**5. MISCELLANEOUS REQUIREMENTS**
5.1 Condizioni superficiali Normalmente si ottengono risultati soddisfacenti quando la superficie è nelle condizioni di come-saldato, come-laminato, come-fuso o come-forgiato. La preparazione della superficie mediante molatura o lavorazione di macchina può essere necessaria nel caso in cui le irregolarità possano mascherare indicazioni dovute a discontinuità. Prima dell'esame, la superfice da controllare e l'area adiacente per almeno 25 mm sarà asciutta e libera da sporco, grasso, garze, scaglie, flusso di saldatura e spruzzi, olio, o altro materiale estraneo che potrebbe interferire con l'esame. La pulizia può essere effettuata con detergenti, solventi organici, soluzioni disincrostanti, solventi di vernice, grassaggio a vapore, sabbiatura o granigliatura, o mediante ultrasuoni.	*5.1 Surface conditioning* Satisfactory results are usually obtained when the surface are in the as-welded, as-rolled, as-cast or as-forged conditions. However, surface preparation by grinding or machining may be necessary where surface irregularities could mask indications due to discontinuities. Prior to magnetic particle examination, the surface to be examined and all adjacent areas within at least 25 mm shall be dry and free of all dirt, grease, lint, scale, welding flux and spatter, oil, or other extraneous matter that could interfere with the examination. Cleaning may be accomplished using detergents, organic solvents, descaling solution, paint removers, vapor degreasing, sand or grit blasting, or ultrasonic cleaning methods.

6. TECNICA	**6. TECHNIQUE**
6.1 Tecnica Sarà utilizzata la tecnica di magnetizzazione con giogo elettromagnetico.	*6.1 Technique* The Electromagnetic Yoke magnetization technique shall be used.
6.2 Tecnica con giogo Per questa tecnica sarà utilizzato un giogo elettromagnetico a corrente alternata.	*6.2 Yoke technique* For this technique, alternating current electromagnetic yokes shall be used.

7. CALIBRAZIONE	**7. CALIBRATION**
7.1 Capacità di sollevamento del giogo Prima di ogni uso, la capacità di magnetizzazione del giogo elettromagnetico deve essere stata controllata	*7.1 Lifting power of yokes* Prior to each use, the magnetizing power of electromagnetic yokes shall have been checked.

Ogni giogo elettromagnetico in corrente alternata deve avere una capacità di sollevamento di almeno 4,5 Kg alla massima apertura dei poli con il contatto simile a quello da utilizzare in esame. Ogni peso sarà misurato con uno strumento di un costruttore riconosciuto e inciso con il proprio peso nominale prima dell'uso. Un peso necessita di essere verificato solo se danneggiato in modo tale da poter avere potenzialmente perso materiale.	Each alternating current electromagnetic yoke shall have a lifting power of at least 4,5 Kg at the maximum pole spacing, with contact similar to what will be used during the examination. Each weight shall be weighed with a scale from a reputable manufacturer and stenciled with the applicable nominal weight prior to first use. A weight need only be verified again if damaged in a manner that could have caused potential loss of material.
7.2 Misuratore di intensità di luce I misuratori di luce, sia visibile sia UV-A, saranno calibrati annualmente o quando lo strumento ha subito riparazioni. Se lo strumento non è in uso per un anno o più, la calibrazione sarà effettuata prima dell'uso. Il massimo errore ammesso per i misuratori di luce sia visibile sia fluorescente (UV-A) è ± 10% del valore di lettura.	*7.2 Light meters* Light meters, both visible and UV-A light meters, shall be calibrated at least once a year or whenever the meter has been repaired. If meters have not been in use for one year or more, calibration shall be done before being used. The maximum admitted error for both visible and fluorescent (UV-A) light meters is ± 10% of read value.

8. ESAME	**8. EXAMINATION**
8.1 Esame preliminare Prima di eseguire l'esame con particelle magnetiche, sarà eseguito il controllo della superficie da esaminare per individuare ogni discontinuità aperta in superficie che potrebbe non attrarre e trattenere le particelle magnetiche a causa della propria larghezza.	*8.1 Preliminary examination* Before the magnetic particle examination is conducted, a check of the examination surface shall be conducted to locate any discontinuity surface openings which may not attract and hold magnetic particles because of their width.
8.2 Direzione di magnetizzazione Almeno due esami separati saranno eseguiti su ogni area. Al secondo esame, le linee di flusso magnetico saranno approssimativamente perpendicolari a quelle del primo esame.	*8.2 Direction of magnetization* At least two separate examination shall be performed on each area. During the second examination, the lines of magnetic flux shall be approximately perpendicular to those used during the first examination.
8.3 Metodo d'esame Le particelle magnetiche utilizzate saranno a umido fluorescenti. L'esame sarà condotto con il metodo continuo. Le particelle a umido saranno utilizzate per le saldature finite e per gli altri materiali base. *(b) Particelle a umido*. La corrente di magnetizzazione sarà applicata dopo l'applicazione delle particelle. Il flusso di particelle sarà fermato con l'applicazione della corrente. Particelle magnetiche da bombolette spray o pompe possono essere applicate prima e/o durante l'applicazione della corrente. Le particelle magnetiche possono essere applicate contemporaneamente alla corrente di magnetizzazione se esse non sono applicate direttamente sulla superficie in esame e sono lasciate scorrere sopra la superficie in esame oppure se sono applicate direttamente alla	*8.3 Method of examination* The ferromagnatic particles used in an examination shall be wet fluorescent, Examination(s) shall be done by the continuous method. Wet particles shall be used for finished welds and others base materials. *(b) Wet particles*. The magnetizing current shall be turned on after the particles have been applied. Flow of particles shall stop with the application of current. Wet particles applied from aerosol spray cans or pump may be applied before and/or during magnetizing current is applied. Wet particles may be applied during the application of magnetizing current if they are not applied directly to the examination area and are allowed to flow over the examination area or are applied directly to the examination area with low velocities insufficient to remove accumulated particles.

superficie in esame con bassa velocità, insufficiente a rimuovere le particelle accumulate.	
8.4 Estensione dell'esame L'esame sarà condotto con una sovrapposizione sufficiente a garantire il 100% della copertura alla sensibilità richiesta. Per grandi aree sarà tracciata una griglia per garantire la copertura dell'intera area da esaminare.	*8.4 Examination coverage* All examination shall be conducted with sufficient overlap to assure 100% coverage at the required sensitivity. A grid shall be used for large areas to guarantee the complete coverage of the area to be examined.
8.5 Rimozione delle particelle in eccesso L'accumulo eccessivo di particelle sarà rimosso con un leggero flusso d'aria secca a bassa pressione. La corrente d'esame deve essere mantenuta durante la rimozione delle particelle in eccesso.	*8.5 Excess particle removal* Accumulations of excess particles in examinations shall be removed with a light dry air stream. The examination current or power shall be maintained while removing the excess particles.
8.6 Interpretazione L'interpretazione individuerà se un'indicazione è falsa, non rilevante, o rilevante. Indicazioni false e non rilevanti dovranno essere dimostrate come tali. L'interpretazione sarà effettuata per identificare la posizione e la natura delle indicazioni.	*8.6 Interpretation* The interpretation shall identify if an indication as false, non-relevant, or relevant. False and non-relevant indications shall be proven as false or non-relevant. Interpretation shall be carried out to identify the locations of indications and the character of the indication.
8.6.1 Particelle magnetiche fluorescenti Le discontinuità superficiali sono indicate dall'accumulo di particelle magnetiche che contrastano con la superficie in esame. L'esame sarà eseguito nel modo seguente: *(a)* sarà eseguito in un area dove l'intensità di luce bianca dev'essere ≤ 1000 lux. *(b)* La luce UV-A avrà un'intensità minima di 2200 $\mu W/cm^2$ con una distanza di 400mm max sulla superficie della parte in esame durante tutto l'esame. *(c)* L'area da esaminare deve essere illuminata con una luce UV-A che operi nel campo compreso fra 320nm e 400nm *(d)* Riflettori e filtri saranno controllati e puliti prima dell'uso. Filtri rotti o incrinati saranno rimpiazzati immediatamente. *(e)* L'intensità della luce UV-A sarà misurata con uno strumento di misura UV-A prima dell'uso, ogni volta che si spegne o si sostituisce, e al termine dell'esame o di serie d'esami. *(f)* Lampade a vapori di mercurio producono una luce UV-A con lunghezza d'onda 365 nm per indurre fluorescenza. Sorgenti UV-A con un LED UV-A o con una serie di LED UV-A avranno un'emissione caratteristica comparabile a quella di altre sorgenti UV-A. Le sorgenti UV-A a LED soddisferanno i requisiti della SE-2297 e della SE-3022. Sorgenti di luce UV-A a LED saranno certificate in conformità ai requisiti della SE-3022 e/o	*8.6.1 Fluorescent magnetic particles* Surface discontinuities are indicated by accumulations of magnetic particles which should contrast with the examination surface. The examination shall be performed as follows: *(a)* It shall be performed in a area with light intensity ≤1000 lux. *(b)* The UV-A light shall achieve a minimum of 2200 $\mu W/cm^2$ at 400mm max distance on the surface of the part being examined throughout the examination. *(c)* The examination area shall be illuminated with UV-A lights that operate in the range between 320nm and 400nm. *(d)* Reflectors and filters shall be checked and cleaned prior to use. Cracked or broken filters shall be replaced immediately. *(e)* The UV-A light intensity shall be measured with a UV-A light meter prior to use, whenever the light power source is interrupted or changed, and at the completion of the examination or series of examinations. *(f)* Mercury vapor arc lamps produce UV-A wavelength of 365 nm for inducing fluorescence. LED UV-A sources using a single UV-A LED or an array of UV-A LEDs shall have emission characteristics comparable to those of other UV-A sources. LED UV-A sources shall meet the requirements of SE-2297 and SE-3022. LED UV-A light sources shall be certified as meeting the requirements of SE-3022 and/or ASTM E3022.

ASTM E3022.	
8.7 Smagnetizzazione Il magnetismo residuo prodotto con la tecnica del Giogo in AC non richiede la smagnetizzazione.	*8.7 Demagnetization* Residual magnetism by the AC Yoke techinique shall not require demagnetization.
8.8 Pulizia dopo l'esame Dopo l'esame, la parte sarà pulita mediante spazzola, aria compressa o stracci.	*8.8 Post-examination cleaning* After examination, the examined part shall be cleaned by brush, compressed air or cloths.

9. VALUTAZIONE	**9. EVALUATION**
Discontinuità in superficie o appena sotto sono indicate dalla ritenzione del mezzo d'esame. Comunque, irregolarità superficiali dovute a segni di lavorazioni di macchina o altre condizioni superficiali possono produrre false indicazioni. Ogni indicazione discutibile o dubbia sarà riesaminata per stabilire se rilevante o falsa. Il ricondizionamento della superficie può precedere la ripetizione dell'esame. Quando un'indicazione è dimostrata non rilevante, non è necessario investigare altre indicazioni non rilevanti dello stesso tipo. Indicazioni non rilevanti che potrebbero mascherare indicazioni di difetti sono inaccettabili. Ampi accumuli di particelle che possono mascherare, indicazioni di discontinuità, sono proibite, e tali aree saranno pulite e riesaminate.	Discontinuities on or near the surface are indicated by retention of the examination medium. However, localized surface irregularities due to machining marks or other surface conditions may produce false indications. Any questionable or doubtful indications shall be re-examined to determine whether or not they are relevant. Surface conditioning may precede the re-examination. After an indication has been verified to be non relevant, it is not necessary to re investigate repetitive non relevant indication of the same type. Non relevant indication that would mask indication of defects are unacceptable. Broad areas of particle accumulation, which might mask indications from discontinuities, are prohibited, and such areas shall be cleaned and re-examined.
9.1 Criteri di accettabilità Questi criteri di accettabilità sono i più restrittivi fra gli standards elencati come riferimento di questo documento. Indicazioni rilevanti sono quelle risultanti da discontinuità meccaniche. Indicazioni lineari sono le indicazioni che hanno lunghezza maggiore di tre volte la larghezza. Indicazioni tondeggianti sono indicazioni circolari o ellittiche che hanno la lunghezza inferiore a tre volte la larghezza. Un'indicazione di discontinuità può essere più larga della discontinuità che la causa; comunque il parametro per l'accettabilità o lo scarto sarà la dimensione dell'indicazione e non la dimensione della discontinuità. Solo indicazioni con dimensioni maggiori di 1,5 mm saranno considerate rilevanti. Tutte le superfici esaminate saranno esenti da: (a) indicazioni lineari rilevanti; (b) indicazioni rilevanti tondeggianti maggiori di 5 mm; (c) Quattro o più indicazioni rilevanti tondeggianti disposte in linea separate da 1,5 mm o meno fra le estremità; (d) dieci o più indicazioni in ogni 3870 mm^2 di superficie con dimensione maggiore dell'area non eccedente 150 mm con l'area	*9.1 Acceptance standards* These acceptance standards are the most stringent of the standards and code referenced in this document. Relevant indications are those which result from mechanical discontinuities. Linear indications are those indications in which the length is more than three times the width. Rounded indications are indications which are circular or elliptical with the length less than three times the width. An indication of a discontinuity may be larger than the discontinuity that causes it; however, the size of the indication and not the size of the discontinuity is the basis of acceptance or rejection. Only indications with major dimensions greater than 1,5 mm shall be considered relevant. All surfaces examined shall be free of: (a) relevant linear indications; (b) relevant rounded indications greater than 5 mm; (c) four or more relevant rounded indications in a line separated by 1,5 mm or less edge to edge; (d) ten or more indications in any 3870 mm^2 of surface with the major dimension of this area not to exceed 150 mm with the area taken in the most unfavourable location relative to the indications being evaluated;

calcolata nella condizione più sfavorevole delle indicazioni da valutare; (e) indicazioni riconducibili a cricche, indipendentemente dalle condizioni superficiali	(e) crack like indications detected, irrespective of surface conditions

10. DOCUMENTAZIONE	10. DOCUMENTATION
10.1 Registrazione delle indicazioni 10.1.1 Indicazioni accettabili Le indicazioni accettabili non saranno registrate.	*10.1 Recording of indications* 10.1.1 Nonrejectable indications Nonrejectable indications shall not be recorded.
10.1.2 Indicazioni non accettabili Le indicazioni non accettabili saranno registrate, ad eccezione di quelle rilevate durante le riprese a rovescio delle saldature. Come minimo saranno registrati il tipo di indicazione (lineare o tondeggiante), posizione ed estensione (lunghezza o diametro o allineate).	10.1.2 Rejectable indications Rejectable indications shall be recorded, except rejectable indications found during weld back gouging. As a minimum, the type of indications (linear or rounded), location and extent (length or diameter or aligned) shall be recorded.
10.2 Registrazione dell'esame Al termine dell'esame sarà emesso un Rapporto dall'operatore qualificato; il rapporto conterrà almeno I seguenti dati: a) commessa, identificazione della parte; b) identificazione della procedura e revisione; c) tecnica; d) apparecchiatura e tipo di corrente utilizzati; e) particelle magnetiche; f) documenti di riferimento; g) materiale e spessore; h) stato del materiale; i) mappa o registrazione delle indicazioni come da paragrafo 10.1 e risultato dell'esame; j) strumento di illuminazione; k) identificazione e qualifica dell'operatore; l) data di esecuzione dell'esame.	*10.2 Examination records* After examination a Magnetic Particle Report shall be issued by qualified personnel; the Report shall contain at least the followings: a) job, part identification; b) procedure identification and revision; c) technique; d) magnetic particle equipment and type of current; e) magnetic particles; f) reference documents; g) material and thickness; h) material status; i) map or record of indications as per 10.1 and result of examination; j) lighting equipment; k) identification and qualification of operator; l) date of examination were performed.

11. RIPARAZIONE	11. REPAIR
Tutte le discontinuità eccedenti I criteri di accettabilità saranno rimosse da parte del costruttore, con mezzi adeguati e riparate in accordo a una procedura approvata. L'area riparata sarà riesaminata dopo la riparazione in accordo con la presente procedura.	All discontinuities in excess to acceptance standards shall be removed, by the manufacturer, by suitable means and repaired according to approved procedure. The repaired area shall be re-examined after repair in accordance with this procedure.

B&R GROUP PROCEDURE

ULTRASONIC MANUAL INSPECTION PROCEDURE of FERRITIC WELDS

PR.N° 004 UTA 21

REV.0

REFERENCE DOCUMENTS:	
ASME BPV CODE SECTIONS I,VIII div.1,VIII div.2,IX	2021 Edition
ASME Power Piping B31.1	2020 Edition
ASME Recommended Practice SNT-TC-1A	2016 Edition

A.I.

LRQA verification ltd ☐ 0094 ☐
☐ Witnessed ☐ Monitored ☐ Reviewed
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2 8 DIC. 2021

LRQA verification ltd ☑ 0094 ☐
☐ Witnessed ☐ Monitored ☑ Reviewed
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Accepted
28/12/2021

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LRQA verification ltd ☑ 0094 ☐
☐ Witnessed ☐ Monitored ☑ Reviewed
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LRQA verification ltd ☐ 0094 ☐
☐ Witnessed ☐ Monitored ☑ Reviewed
FLAVIO ZANON
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Office: Milan
ACCEPTED
18-05-2022

THIS PROCEDURE HAS BEEN DEMONSTRATED TO THE A.I. ON: 21/02/2020
THIS PROCEDURE IS CERTIFIED BEING IN ACCORDANCE TO ASME SEC. V T-150
DEMOSTRATION STILL VALID FOR REV.0

VILLA & BONALDI
NDT LEVEL III
ISO 9712/SNT-TC-1A
Botti Daniel
28/12/2021

Rev.	Date	Description	Issued by	Approved by TP	Reviewed& Approved Lev.III
0	28-12-2021	Revised as per new Edition of ASME Code.	M. Fiammingo	N. Tosto	D. Botti

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 004 UTA 21

REV.0

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 004 UTA 21

REV.0

1. SCOPO	1. SCOPE
Questo documento definisce il metodo di controllo ultrasonoro manuali a eco impulso dei giunti di testa e d'angolo, in acciaio ferritico, non di tubazioni, da 8 mm a 250 mm di spessore, della produzione B&R GROUP. Questo documento deve essere utilizzato assieme alla Work Instruction che specifica i dettagli della tecnica operativa per ogni tipo e dimensioni di giunto saldato La sezione del codice applicabile all'oggetto da esaminare sarà specificata nella Work Instruction emessa dall'ispettore del Controllo Qualità prima dell'esame ad ultrasuoni. Una modifica di un requisito nella tabella T-421 o nella tabella nell' appendice mandatoria applicabile alla tecnica in questione, identificato come una variabile essenziale, richiede la riqualificazione della procedura.	This document describes the methods to perform pulse-echo manual contact ultrasonic examination of non-piping ferritic steel butt- and corner- joint, from 8 mm to 250 mm of thickness, of B&R GROUP production. This document shall be used together with a Work Instruction which specify detailed technique for each size and type of weld joint. The applicable code section to the object being examined shall be specified in the Work Instruction issued by the Quality Control Inspector before the ultrasonic examination. A change of a requirement in Table T-421 or the table in the Mandatory Appendix applicable to the technique in use, identified as an essential variable from the specified value, or range of values, shall require requalification of the written procedure.

2. DOCUMENTI DI RIFERIMENTO	2. REFERENCE DOCUMENTS
ASME BPV Code sect. V, I, VIII div. 1 e 2 edizione 2021 ASNT "Recommended Practice" SNT-TC-1A ed. 2016	ASME BPV Code sect. V, I, VIII div. 1 and 2 2021 ed. ASNT "Recommended Practice" SNT-TC-1A ed. 2016

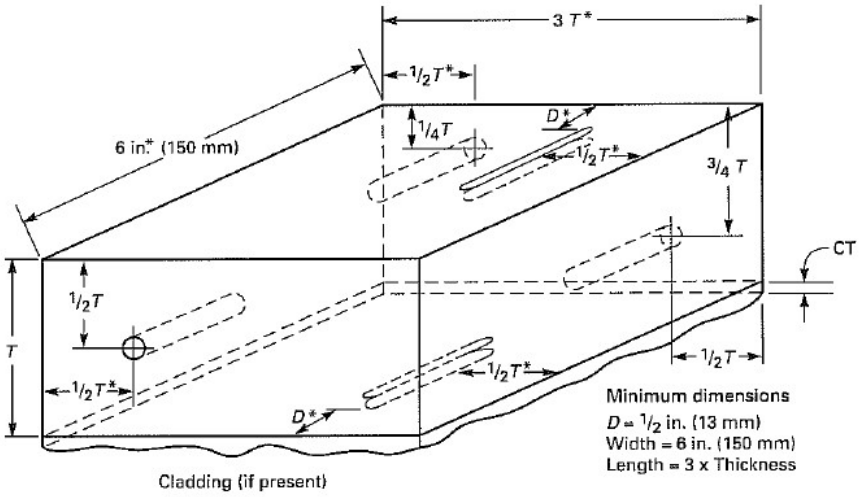
3. QUALIFICA DEL PERSONALE	3. PERSONNEL QUALIFICATION
Il personale che esegue il controllo, valuta e certifica i risultati del controllo sarà qualificato e certificato almeno al livello II in accordo alla Written Practice B&R GROUP, che soddisfa i requisiti della SNT-TC-1A e ASME BPVC sez. V art. 1 Mandatory Appendix III.	Personnel performing the examination, evaluating and certifying the results of the examination shall be qualified and certified at least level II in accordance with B&R GROUP company Written practice, which satisfies the Recommended Practice SNT-TC-1A and ASME BPVC sec. V art. 1 Mandatory Appendix III.

4. ATTREZZATURA	4. EQUIPMENT
4.1 Requisiti dello strumento Sarà utilizzato uno strumento ultrasuoni a eco-impulso. Lo strumento sarà in grado di generare frequenze oltre il campo compreso fra 1 MHz e 5 MHz e sarà provvisto di un regolatore del guadagno a scatti di 2.0 dB o inferiore. Se lo strumento è provvisto di un controllo del "damping", esso potrà essere utilizzato a condizione di non ridurre la sensibilità d'esame. Il controllo della soglia (reject) sarà spento per tutto l'esame, a meno che non sia dimostrato che esso non influenzi la linearità dell'esame. Lo strumento, quando necessario per la tecnica utilizzata, sarà provvisto di due connessioni per le	4.1 Instrument requirements A pulse-echo type of ultrasonic instrument shall be used. The instrument shall be capable of operation at frequencies over the range of at least 1 MHz to 5 MHz and shall be equipped with a stepped gain control in units of 2.0 dB or less. If the instrument has a damping control, it may be used if it does not reduce the sensitivity of the examination. The reject control shall be in the "off" position for all examinations, unless it can be demonstrated that it does not affect the linearity of the examination. The instrument, when required because of the technique being used, shall have both send and receive jacks for operation of dual search units or a

attività da condurre con sonde a doppio cristallo o con due sonde separate. I seguenti strumenti digitali o equivalenti possono essere utilizzati: GE type USM35X, USN60L,Phasor, Olympus Epoch 600,Sonatest Prisma	single search unit with send and receive transducers. The following digital instruments or equivalent shall be used: GE type USM35X, USN60L,Phasor, Olympus Epoch 600,Sonatest Prisma
4.2 Sonde La frequenza nominale sarà compresa fra 2 MHz e 5 MHz. Sonde con zoccoli sagomati potranno essere usate per migliorare l'accoppiamento. L'angolo delle sonde deve essere compreso fra 45° e 70° con onde trasversali e dimensioni del cristallo compreso fra 8x9 e 20x22 mm. Sonde GE Sensing Inspection, Krautkramer, Gilardoni, Panametrics, IMG, o equivalenti potranno essere utilizzate. Le Work Instruction definiranno le sonde da usare per ogni tipo e dimensione di giunto saldato.	4.2 Search units The nominal frequency shall be from 2 MHz to 5 MHz. Search units with contoured contact wedges may be used to aid ultrasonic coupling. The angle beam of search unit shall be from 45° to 70° with shear waves and crystal size between 8x9 to 20x22 mm. Search unit manufactured by GE Sensing Inspection, Krautkramer, Gilardoni, Panametrics, IMG or equivalent can be used. The Work Instruction shall define the search unit to be used for each type and size of weld joint.
4.3 Accoppiante L'accoppiante, incluso gli additivi, non sarà deteriorante per il materiale da esaminare; cellulosa o gel possono essere utilizzati.	4.3 Couplant The couplant, including additives, shall not be detrimental to the material being examined; tylose or gel can be used.
4.4 Blocchi di calibrazione 4.4.1 *Riflettori*. Fori laterali saranno utilizzati per definire il livello di riferimento primario del sistema di controllo. Il diametro dei riflettori di riferimento sarà come definito in figura 1.	4.4 Calibration block 4.4.1 *Reflectors*. Side drilled holes reflectors shall be used to establish primary reference responses of the equipment. The reflectors diameter shall be as defined in figure 1.
4.4.2 *Materiale*. Il materiale con cui il blocco sarà fabbricato sarà dello stesso tipo di prodotto e materiale o di equivalente gruppo P-number del quale fa parte il materiale in esame. Per lo scopo di questo paragrafo, i materiali di P-nos. 1, 3, 4, 5A fino a 5C e 15A fino a 15C come definiti nel codice ASME BPV sez. IX si considerano equivalenti.	4.4.2 *Material*. The material from which the block is fabricated shall be of the same product form and material specification or equivalent P-number grouping as one of the materials being examined. For the purposes of this paragraph, P-nos. 1, 3, 4, 5A through 5C, and 15A through 15F materials as defined in ASME BPV code sect. IX are considered equivalent.
4.4.3 *Qualità*. Prima della fabbricazione, il materiale del blocco sarà completamente esaminato con un a sonda diritta. Le aree contenenti indicazioni eccedenti l'eco di fondo residua saranno esclusi dal percorso ultrasuoni richiesto per raggiungere i vari riflettori di calibrazione.	4.4.3 *Quality*. Prior to fabrication, the block material shall be completely examined with a straight beam search unit. Areas that contain an indication exceeding the remaining back-wall reflection shall be excluded from the beam paths required to reach the various calibration reflectors.
4.4.4 *Trattamento termico*. Il blocco di calibrazione avrà almeno il minimo trattamento di rinvenimento richiesto dalla specifica del materiale for il proprio tipo e grado.	4.4.4 *Heat treatment*. The calibration block shall receive at least the minimum tempering treatment required by the material specification for the type and grade.
4.4.5 *Finitura superficiale*. La finitura della superficie di scansione del blocco sarà rappresentativa della finitura superficiale del componente d esaminare.	4.4.5 *Surface finish*. The finish on the scanning surface of the block shall be representative of the scanning surface finishes on the component to be examined.
4.4.6 *Curvatura del blocco*. Per l'esame di materiali dove il diametro della superficie d'esame è maggiore di 500 mm, può essere utilizzato un	4.4.6 *Block curvature*. For examinations in materials where the examination surface diameter is greater than 500 mm, a block of essentially the

blocco essenzialmente della stessa curvatura, o alternativamente un blocco piano. Per l'esame di materiali dove il diametro della superficie d'esame è inferiore o uguale a 500 mm, sarà utilizzato un blocco curvo. U blocco di calibrazione curvo può essere utilizzato per l'esame di materiali aventi una curvatura compresa fra 0,9 e 1,5 volte il diametro del blocco di calibrazione. La Work Instruction definirà la configurazione del blocco da usare per ogni tipo e dimensione di giunto saldato.	same curvature, or alternatively, a flat basic calibration block may be used. For examinations in materials where the examination surface diameter is equal to or less than 500 mm, a curved block shall be used. A single curved basic calibration block may be used for examinations in the range of curvature from 0,9 to 1,5 times the basic calibration block diameter. The Work Instruction shall define the block configuration to be used for each type and size of weld joint.
4.4.7 *Configurazione del blocco*. La configurazione e I riflettori del blocco di calibrazione saranno come mostrato in fig. 1° e 1b. La dimensione del blocco e la posizione dei riflettori saranno adeguate ad eseguire la calibrazione per l'angolo del fascio da utilizzare.	4.4.7 *Block Configuration*. The basic calibration block configuration and reflectors shall be as shown in fig. 1a and 1b. The block size and reflector locations shall be adequate to perform calibration for the beam angle used.
4.4.8 *Spessore del blocco*. Lo spessore del blocco sarà come indicato in fig. 1° e 1b. La Work Instruction definirà lo spessore del blocco da utilizzare.	4.4.8 *Block Thickness*. The basic calibration block thickness shall be as shown in fig. 1a and 1b. The Work Instruction shall specify the basic calibration block thickness to be used.

FIG. T-434.2.1 NON-PIPING CALIBRATION BLOCKS



Weld Thickness, t, in. (mm)	Calibration Block Thickness, T, in. (mm)	Hole Diameter, in. (mm)
Up to 1 (25)	3/4 (19) or t	3/32 (2.5)
Over 1 (25) through 2 (50)	1 1/2 (38) or t	1/8 (3)
Over 2 (50) through 4 (100)	3 (75) or t	3/16 (5)
Over 4 (100)	$t \pm 1$ (25)	[Note (1)]

Notch Dimensions, in. (mm)
Notch depth = 2% T
Notch width = 1/4 (6) max.
Notch length = 1 (25) min.

* Minimum dimension.

GENERAL NOTES:

(a) Holes shall be drilled and reamed 1.5 in. (38 mm) deep minimum, essentially parallel to the examination surface.

(b) For components equal to or less than 20 in. (500 mm) in diameter, calibration block diameter shall meet the requirements of T-434.1.7.2. Two sets of calibration reflectors (holes, notches) oriented 90 deg from each other shall be used. Alternatively, two curved calibration blocks may be used.

(c) The tolerance for hole diameter shall be ± 1/32 in. (0.8 mm). The tolerance for hole location through the calibration block thickness (i.e., distance from the examination surface) shall be ± 1/8 in. (3 mm).

(d) For blocks less than 3/4 in. (19 mm) in thickness, only the 1/2 T side-drilled hole and surface notches are required.

(e) All holes may be located on the same face (side) of the calibration block, provided care is exercised to locate all the reflectors (holes, notches) to prevent one reflector from affecting the indication from another reflector during calibration. Notches may also be in the same plane as the in-line holes (See Appendix J, Fig. J-431). As in Fig. J-431, a sufficient number of holes shall be provided for both angle and straight beam calibrations at the 1/4 T, 1/2 T, and 3/4 T depths.

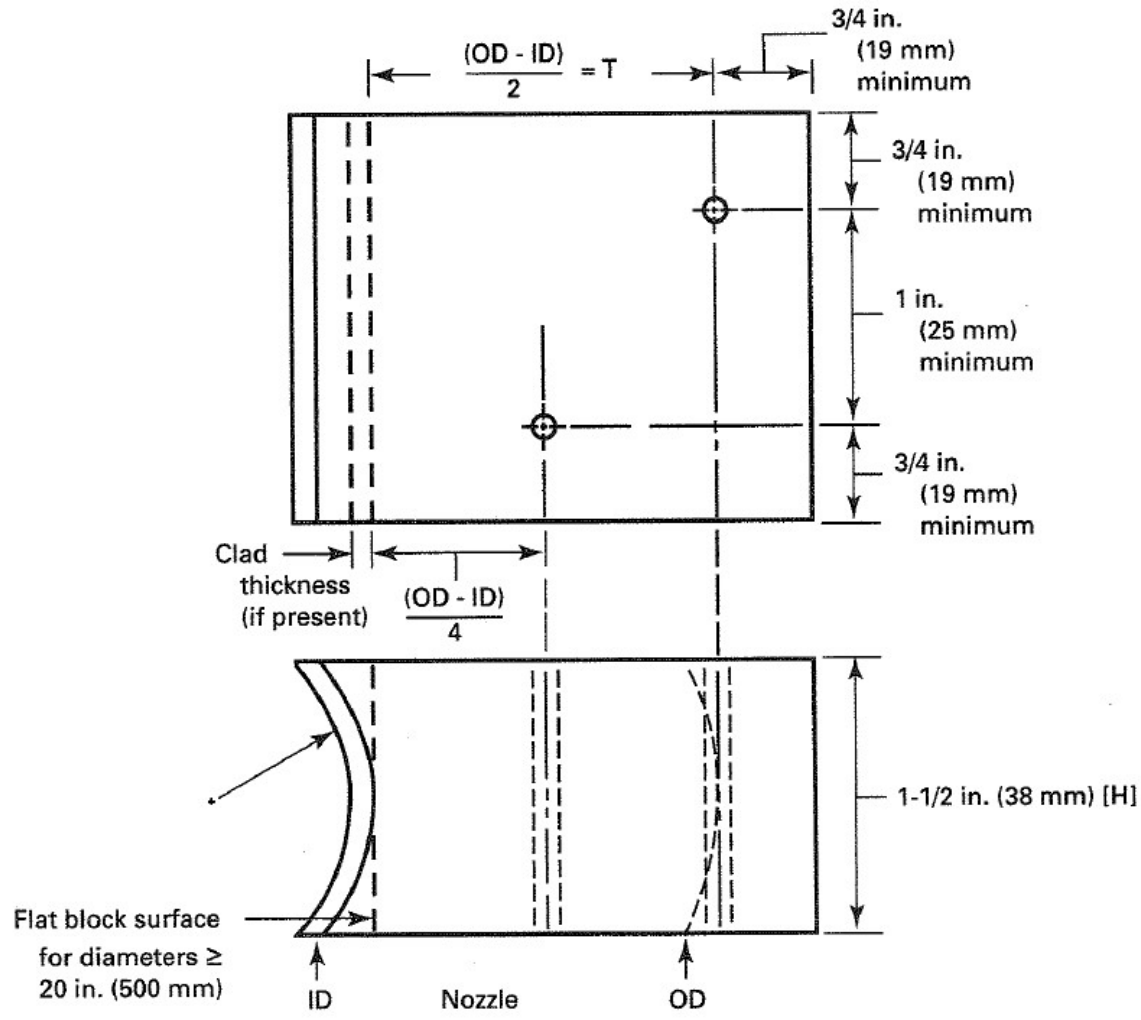
(f) Notch depths shall be 1.6% T minimum to 2.2% T maximum. When cladding is present, notch depth on the cladding side of the block shall be increased by the cladding thickness, CT (i.e., 1.6% T + CT minimum to 2.2% T + CT maximum).

(g) Maximum notch width is not critical. Notches may be made by EDM or with end mills up to 1/4 in. (6.4 mm) in diameter.

(h) Weld thickness, t, is the nominal material thickness for welds without reinforcement or, for welds with reinforcement, the nominal material thickness plus the estimated weld reinforcement not to exceed the maximum permitted by the referencing Code Section. When two or more base material thicknesses are involved, the calibration block thickness, T, shall be determined by the average thickness of the weld; alternatively, a calibration block based on the greater base material thickness may be used provided the reference reflector size is based upon the average weld thickness.

NOTE:

(1) For each increase in weld thickness of 2 in. (50 mm) or fraction thereof over 4 in. (100 mm), the hole diameter shall increase 1/16 in. (1.5 mm).



GENERAL NOTES:

(a) The thickness (T) of the calibration block (OD – ID)/2 shall be selected for the maximum nozzle wall thickness under the nozzle attachment weld.

(b) Side-drilled holes shall be drilled and reamed the full height [H] of the block.

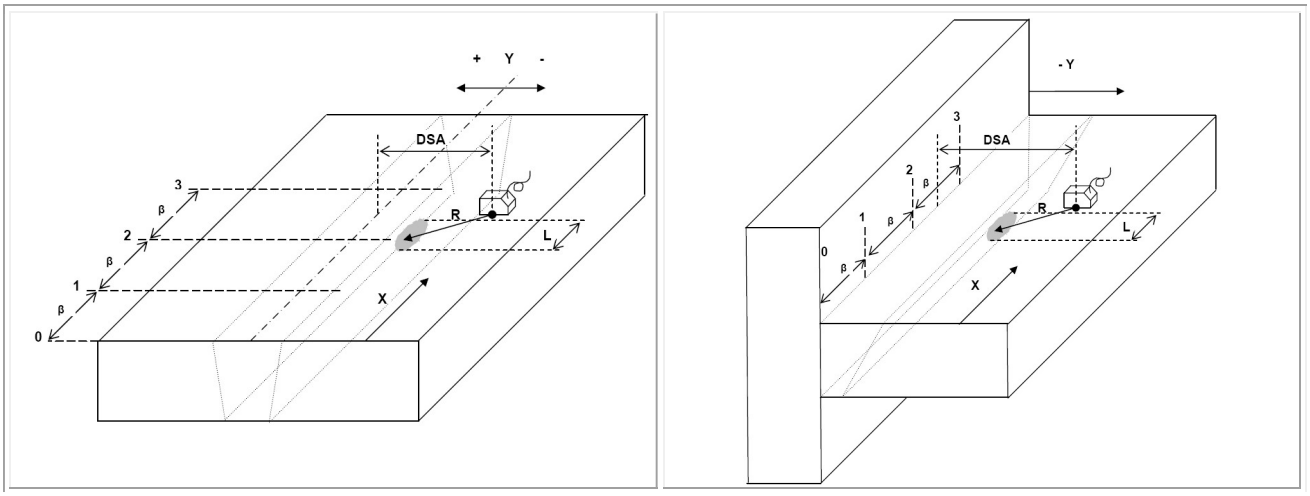
(c) The diameter of the side-drilled holes shall be selected for the maximum nozzle wall thickness per (a) above and Fig. T-434.2.1.

(d) For nozzle side examinations, when the wall thickness of the calibration block exceeds 2 in. (50 mm), additional side-drilled holes shall be placed in the block as required in the table below.

Calibration Block Wall Thickness, in. (mm)	Hole Location, $\frac{5}{8}$ T	Hole Location, $\frac{3}{4}$ T	Hole Location, $\frac{7}{8}$ T
> 2 (50) through 3 (75)	...	X	...
> 3 (75)	X	X	X

Figure 1b – Calibration block for straight beam examination of nozzle side weld fusion zone and adjacent parent metal
Figura 1b – Blocco di calibrazione per esame con sonda diritta della zona di fusione e del materiale base lato bocchello

5. GENERALITA'	5. GENERAL
5.1 Identificazione delle aree di saldatura in esame La posizione delle saldature e la loro identificazione sarà come da mappa di saldatura o disegno di fabbricazione applicabile. Ogni saldatura sarà localizzata e identificata con un sistema di punti di riferimento. Il sistema definisce la linea di riferimento di ogni saldatura e la designazione di intervalli regolari lungo l'intero sviluppo della saldatura. La lunghezza degli intervalli sarà di 400 mm a meno di diversa indicazione sul rapporto UT. Per le saldature circonferenziali il punto d'inizio standard sarà la generatrice a 0 gradi del recipiente. I punti di riferimento di ogni intervallo saranno numerati in senso orario guardando dall'alto il recipiente o, per recipienti orizzontali, guardando dall'entrata del fluido o, per i collettori di caldaia, guardando dal lato destro della caldaia. L'inizio delle saldature longitudinali sarà considerato l'asse della saldatura circonferenziale nella parte alta del recipiente o, per recipienti orizzontali, guardando dall'entrata del fluido o, per i collettori di caldaia, guardando dal lato destro della caldaia. Per saldature bocchello-mantello **set-in** la linea di riferimento corrisponde alla superficie esterna del bocchello. Per saldature bocchello-mantello **set-on** la linea di riferimento corrisponde alla superficie esterna del mantello. Il punto 0 della saldatura corrisponde al punto più alto del bocchello. Il punto 0 della saldatura per bocchelli orientate verticalmente corrisponde alla generatrice 0 gradi del recipiente o, per recipienti orizzontali, al punto più vicino all'entrata del fluido o, per i collettori di caldaia, al punto più a destra della caldaia. Lo sviluppo angolare della saldatura seguirà il senso orario dalla superficie esterna. Le indicazioni da registrare dovranno fare riferimento a un sistema di coordinate come quello mostrato nella figura 2.	5.1 Identification of welds examination areas Welds locations and their identification shall be as per applicable fabrication weld map or fabrication drawing. Each weld shall be located and identified by a system of reference points as per figure 2. The system identifies the reference line and designates regular intervals along the length of the weld. The intervals length shall be 400 mm unless otherwise recorded on the UT report. For circumferential welds the standard starting point shall be the 0 deg axis of the vessel. The reference points of intervals shall be numbered in a clockwise direction, as viewed from the top of the vessel or, for horizontal vessels, from the inlet end of the vessel or, for Drum, from the right side of the Boiler. Longitudinal welds shall be laid out from the center line of circumferential welds at the top end of the weld or, for horizontal vessels, the end of the weld closest to the inlet end of the vessel or, for Drum, from the right side of the Boiler. For nozzles-to-shell **set-in** welds the reference circle shall fall on the external surface of the nozzle. For nozzles-to-shell **set-on** welds the reference circle shall fall on the external surface of the shell. The 0 deg point on the weld shall be the top of the nozzle. The 0 deg point for welds of vertically oriented nozzles shall be located at the 0 deg axis of the vessel or, for horizontal vessels, the point closest to the inlet end of the vessel or for Drum, from the right side of the Boiler. Angular layout of the weld shall be made clockwise on the external surface. Each indication to be recorded shall refer to a coordinate system as shown in the following figure 2.



2a) Butt-joint 2b) Corner-joint

Figure 2 – Coordinate system for indication location
Figura 2 – Sistema di coordinate per definire la localizzazione delle indicazioni

6. TECNICA	6. TECHNIQUE
Sarà utilizzato un fascio angolato a onde trasversali, dove l'angolo di incidenza nello zoccolo produce solo onde trasversali rifratte nel materiale in esame. Sarà utilizzata la tecnica manuale a contatto a eco impulso.	Angle beam shear waves, where incident angles in wedges produce only refracted shear waves in the material under examination, shall be used. Manual contact pulse-echo technique shall be used.

7. CALIBRAZIONE	7. CALIBRATION
7.1 Controllo della linearità dello strumento La "Linearità dell'altezza dello schermo" e la "Linearità del controllo di amplificazione" saranno verificati a intervalli non eccedenti i tre mesi per gli strumenti analogici e non eccedenti un anno per gli strumenti digitali, comunque prima di iniziare a usarli. 7.1.1 Linearità dell'altezza dello schermo. La linearità dell'altezza dello schermo sarà valutata in accordo alla Mandatory appendix I del codice ASME sez. V art. 4. 7.1.2 Linearità del controllo di amplificazione. La Linearità del controllo di amplificazione dello strumento sarà valutata in accordo alla Mandatory appendix II del codice ASME sez. V art. 4	7.1 Instrument linearity check The "Screen High Linearity" and the "Amplitude Control Linearity" shall be met at intervals not to exceed three months for analog type instruments and one year for digital type instruments, or prior to first use thereafter. 7.1.1 Screen Height Linearity. The ultrasonic instrument's Screen Height Linearity shall be evaluated in accordance with Mandatory appendix I of ASME sect. V art. 4 7.1.2 Amplitude Control Linearity. The ultrasonic instrument's Amplitude Control linearity shall be evaluated in accordance with Mandatory appendix II of ASME sect. V art. 4
7.2 Requisiti generali di calibrazione 7.2.1 *Sistema ultrasonoro*. La calibrazione includerà il sistema ultrasonoro complete e sarà eseguita prima dell'inizio e del sistema nel campo di spessori in esame. 7.2.2 *Superficie di calibrazione*. La calibrazione sarà eseguita dalla superficie (convessa o concava) corrispondente alla superficie del	7.2 General calibration requirements 7.2.1 *Ultrasonic system*. Calibrations shall include the complete ultrasonic system and shall be performed prior to use of the system in the thickness range under examination. 7.2.2 *Calibration surface*. Calibration shall be performed from the surface (convex or concave) corresponding to the surface of the

componente dalla quale sarà eseguito l'esame.	component from which the examination will be performed.
7.2.3 *Accoppiante*. Sarà utilizzato per l'esame lo stesso accoppiante utilizzato per la calibrazione.	7.2.3 *Couplant*. The same couplant to be used during the examination shall be used for calibration.
7.2.4 *Zoccoli di contatto*. Saranno utilizzati per l'esame gli stessi zoccoli di contatto utilizzati durante la calibrazione.	7.2.4 *Contact wedges*. The same contact wedges to be used during examination shall be used for calibration.
7.2.5 *Regolazioni dell'apparecchio*. Ogni regolazione che influenza la linearità dello strumento (es. filtri, soglia, damping o altro) saranno nella stessa posizione per la calibrazione, verifica della calibrazione, controllo della linearità dello strumento, e esame.	7.2.5 *Instrument controls*. Any control which affect instrument linearity (e.g., filters, reject, damping or clipping) shall be in the same position for calibration, calibration checks, instrument linearity checks, and examination.
7.2.6 *Temperatura*. La differenza di temperature fra il blocco di calibrazione e la superficie d'esame sarà contenuta entro 25°F (14°C).	7.2.6 *Temperature*. The temperature differential between the calibration block and examination surface shall be within 25°F (14°C).
7.3 Calibrazione del sistema per la tecnica Distanza Ampiezza 7.3.1 *Blocco di calibrazione*. La calibrazione sarà eseguita utilizzando il blocco indicato in fig. 1a e, quando applicabile, 1b.	7.3 System calibration for Distance Amplitudes Technique 7.3.1 *Calibration block*. Calibrations shall be performed utilizing the calibration block shown in fig. 1a and, where applicable, 1b.
7.3.2 *Tecniche*. Sarà utilizzata una tecnica adeguata per la calibrazione dei fasci angolati e, dove applicabile, la calibrazione dei fasci diritti. La calibrazione deve produrre un a curva che copra il campo utilizzato per l'esame. La curva prodotta darà la possibilità agli echi equivalenti al 20% del livello di riferimento di raggiungere sullo schermo un'altezza non inferiore al 20% dell'altezza dello schermo (FSH) su tutto il percorso ultrasonoro interessato all'esame. Quando sarà necessario l'esame potrà essere diviso in più fasi (es. Prima il primo mezzo nodo e successivamente il secondo mezzo nodo). Il fascio angolato sarà diretto verso il riflettore di riferimento che produce la massima risposta nel campo di interesse. L'amplificazione sarà regolata in modo che la risposta sai all'80% ±5% dell'altezza dello schermo. Questo sarà il livello di riferimento primario. Successivamente la sonda sarà manipolata, senza cambiare la regolazione dello strumento, per ottenere la massima risposta dagli altri riflettori di riferimento al relativo percorso ultrasonoro fino a generare la curva Correzione Distanza-Ampiezza (DAC). Queste regolazioni stabiliranno sia la profondità di campo, sia la correzione distanza ampiezza.	7.3.2 *Techniques*. An adequate technique shall be used to provide angle beam calibrations and, where applicable, straight beam calibration. The Calibration shall provide a curve covering the sweep range to be used for the examination. The drawn curve shall assuring the capability to show on the screen echoes equivalent to 20% of the reference level not less than 20% of FSH (Full Screen Height) over the entire interesting ultrasonic path. When necessary the examination can be divided in more than one step (eg., at first the 1st half Vee path and after the 2nd half Vee path). The angle beam shall be directed toward the calibration reflector that yields the maximum response in the area of interest. The gain control shall be set so that this response is 80% ±5% of full screen height. This shall be the primary reference level. The search unit shall then be manipulated, without changing instrument setting, to obtain the maximum responses from other calibration reflectors at their beam paths to generate the distance-amplitude correction (DAC) curve. These calibrations shall establish both the distance range calibration and the distance amplitude correction.
7.3.3 *Calibrazione sonde angolate*. La calibrazione deve comprendere le seguenti misurazioni: (a) calibrazione del campo di misura;	7.3.3 *Angle Beam Calibration*. The calibration shall provide the following measurement: (a) distance range calibration;

(b) distanza-ampiezza; La misura dell'ampiezza d'eco dell'intaglio nel blocco di calibrazione non sarà eseguita.	(b) distance-amplitude. The echo amplitude measurement from the surface notch in the basic calibration block shall not be performed.
7.3.4 *Calibrazione sonde diritte*. La calibrazione deve comprendere le seguenti misurazioni: (a) calibrazione del campo di misura; (b) distanza-ampiezza;	7.3.4 *Straight Beam Calibration*. The calibration shall provide the following measurement: (a) distance range calibration; (b) distance-amplitude.
NOTA: *La calibrazione della sonda diritta definite in questo paragrafo è applicabile per l'esame di giunti d'angolo e non è necessaria per l'esame del materiale base per localizzare i riflettori che limitino l'esame del volume di saldatura con il fascio angolato, come descritto in 8.2.*	REMARKS: *The straight beam calibration defined in this paragraph is applicable for the corner-joint examination and it is not necessary for the base material examination for reflectors that can limit the ability of the angle beam to examine the weld volume as described in 8.2.*
7.4 Conferma della calibrazione 7.4.1 *Variazioni del sistema*. Quando qualsiasi parte del sistema d'esame è cambiata, sarà eseguita una verifica della calibrazione sul blocco di calibrazione per verificare che il campo di misura e la regolazione della sensibilità soddisfino I requisiti del punto 7.4.3.	7.4 Calibration confirmation 7.4.1 *System changes*. When any part of the examination system is changed, a calibration check shall be made on the basic calibration block to verify that distance range points and sensitivity settings satisfy the requirements of 7.4.3.
7.4.2 *Controllo della calibrazione*. Ogni 4 ore e al termine di ogni esame o serie di esami simili, e quando sia cambiato l'operatore, sarà eseguito un controllo della calibrazione su almeno un riflettore del blocco di riferimento o utilizzando un simulatore di segnale. Il campo di misura e I valori di sensibilità registrati soddisferanno i requisiti del punto 7.4.3.	7.4.2 *Calibration checks*. A calibration check on at least one of the reflector in the basic calibration block or a check using a simulator shall be performed each 4 hours and at the completion of each examination or series of similar examinations, and when examination personnel are changed. The distance range and sensitivity values recorded shall satisfy the requirements of 7.4.3.
7.4.3 *Valori di accettabilità della verifica*. *Punti del campo di misura*. Se ogni punto del campo di misura si è spostato sull'asse dei tempi per più del 10% del valore letto o per più del 5% del fondo scala, il maggiore fra i due, correggere il campo di misura e annotare le correzioni sui fogli di registrazione. Tutte le indicazioni registrate dall'ultima calibrazione o verifica valida saranno riesaminate e I loro valori corretti o ri-registrati sui fogli di registrazione. *Regolazione della sensibilità*. Se la regolazione della sensibilità è cambiata più del 20% o 2 dB dall'ampiezza iniziale, correggere la calibrazione della sensibilità e annotare la correzione sui fogli di registrazione. Se al regolazione della sensibilità è diminuita, tutte le registrazioni dall'ultima calibrazione o verifica valida saranno cancellati e l'area reltiva a questi dati sarà riesaminata. Se la regolazione della sensibilità è aumentata, tutte le indicazioni registrate dall'ultima calibrazione o verifica valida saranno riesaminate e i relativi valori saranno corretti o ri-registrati sui fogli di registrazione.	7.4.3 *Confirmation acceptance values*. *Distance Range Points*. If any distance range points has moved on the sweep line by more than 10% of the distance reading or 5% of full sweep, whichever is greater, correct the distance range calibration and note the correction in the examination record. All recorded indications since the last valid calibration or calibration check shall be re-examined and their values shall be changed on the data sheets or re-recorded. *Sensitivity settings*. If any sensitivity setting has changed by more than 20% or 2 dB of its amplitude, correct the sensitivity calibration and note the correction in the examination record. If the sensitivity settings has decreased, all data sheets since the last valid calibration check shall be marked void and the area covered by the voided data shall be re-examined. If the sensitivity settings has increased, all recorded indications since the last valid calibration or calibration check shall be re-examined and their values shall be changed on the data sheets or re-recorded.

8. ESAME	8. EXAMINATION
8.1 Estensione generale dell'esame 8.1.1 *Estensione dell'esame*. Il volume da controllare sarà esaminato muovendo la sonda sulla superficie di scansione in modo da garantire la completa copertura con ogni sonda prevista. La Work Instruction definisce le sonde da utilizzare, la loro posizione e l'area di scansione per ognuna di esse. La figura sottostante mostra l'area di scansione per il controllo a "V" completa. (a) Ogni passata della sonda si sovrappone alla successiva per almeno il 10% della dimensione del trasduttore (elemento piezoelettrico) parallela alla direzione di indicizzazione delle passate. (b) L'oscillazione della sonda è permessa se è dimostrata l'adeguata sovrapposizione fra le passate. L'area da esaminare sarà il metallo d'apporto e il materiale base su entrambi i lati della saldatura, per almeno 10 mm.	8.1 General examination coverage 8.1.1 *Examination coverage*. The volume to be scanned shall be examined by moving the search unit over the scanning surface so as to scan the entire examination volume for each required search unit. The Work Instruction shall define the search unit to be used, their position and the scanning area for each one. The figure below shows the minimum scanning area for the entire "V" path examination. (a) Each pass of the search unit shall overlap a minimum of 10% of the transducer (piezoelectric element) dimension parallel to the direction of scan indexing. (b) Oscillation of the search unit is permitted if it can be demonstrated that overlapping coverage is provided. The area to be examined shall be the weld metal and the base material on each side of the weld for at least the 10 mm zone width.

2 = Scanning surface length / Lunghezza della superficie di scansione

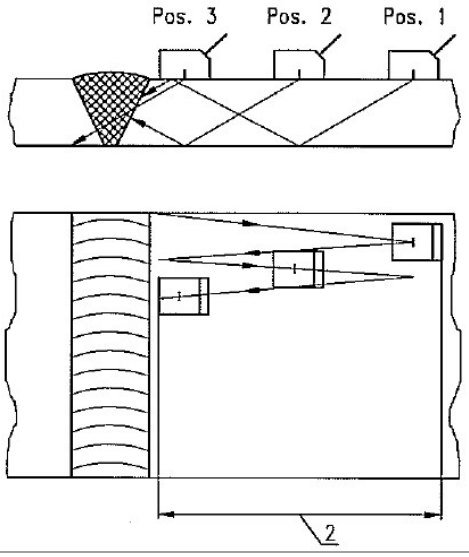


Figure 2 – Typical scanning area
Figura 2 – Area di scansione tipica

8.1.2 *Frequenza di ripetizione dell'impulso*. La frequenza di ripetizione dell'impulso sarà sufficientemente bassa da garantire che un segnale da un riflettore, posto alla massima distanza nel volume da esaminare, torni alla	8.1.2 *Pulse repetition rate*. The pulse repetition rate shall be small enough to assure that a signal from a reflector located at the maximum distance in the examination volume will arrive back at the search unit before the next pulse is

sonda prima che l'impulso successivo sia prodotto dal trasduttore.	placed on the transducer.
8.1.3 *Velocità di scansione*. La velocità di scansione non eccederà 6 in./s (150 mm/s).	8.1.3 *Rate of search unit movement*. The rate of the search unit movement (scanning speed) shall not exceed 6 in./s (150 mm/s).
8.1.4 *Livello di sensibilità durante la scansione*. Il livello di sensibilità durante la scansione sarà regolato almeno 6 dB più del livello di riferimento; comunque l'amplificazione sarà incrementata di un valore addizionale tale che nessun riflettore di calibrazione produca un'indicazione inferiore al 40% FSH. Alternativamente, il livello di sensibilità durante la scansione può essere regoalto a 14 dB più del livello di riferimento (Questa amplificazione aggiuntiva trasforma la curva DAC in una curva pari al 20% DAC cosicché le indicazioni eccedenti il 20% DAC possono essere facilmente individuate e valutate). Il rumore di fondo dovrà essere inferiore di almeno 12 dB rispetto al livello di valutazione.	8.1.4 *Scanning sensitivity level*. The scanning sensitivity level shall be set a minimum of 6 dB higher than the reference level gain setting; anyway the gain shall be increased an additional amount so that no calibration reflector indication is less than 40% FSH. Alternatively, the scanning sensitivity level may be set at 14 dB higher than the reference level gain setting (This additional gain makes the reference DAC curve a 20% DAC curve so that the indications exceeding 20% DAC may be easily identified and evaluated). The noise shall be at least 12 dB lesser than the evaluation level.
8.1.5 *Preparazione della superficie*. Quando il materiale base o la superficie della saldatura interferiscono con l'esame, il materiale base o la saldatura saranno condizionati secondo necessità per permettere l'esame.	8.1.5 *Surface preparation*. When the base material or weld surface interferes with the examination, the base material or weld shall be prepared as needed to permit the examination.
8.2 Tecnica distanza ampiezza La scansione dei giunti saldati sarà eseguita con una sonda angolata sia in direzione parallela sia in direzione trasversale (4 scansioni) all'asse di saldatura. Prima di eseguire l'esame con sonda angolata, sarà eseguito un esame con sonda diritta del volume di materiale base attraverso il quale deve passare il fascio angolato per localizzare ogni riflettore che limiti la possibilità del fascio angolato di esaminare il volume di saldatura.	8.2 Distance amplitude technique Weld joints shall be scanned with an angle beam search unit in both parallel and transverse directions (4 scans) to the weld axis. Before performing the angle beam examinations, a straight beam examination shall be performed on the volume of base material through which the angle beams will travel to locate any reflectors that can limit the ability of the angle beam to examine the weld volume.
8.2.1 *Tecnica fascio angolato*. La sonda e l'angolo scelti saranno secondo il livello B della EN1714 come appropriato alla configurazione da esaminare e saranno tali da rilevare i riflettori di calibrazione lungo tutto il percorso richiesto. La Work Instruction definisce, per ogni tipo di giunto, l'angolo/I e la posizione di scansione per ogni sonda. Per rilevare riflettori paralleli alla saldatura, il fascio angolato sarà diretto approssimativamente in direzione perpendicolare all'asse di saldatura su entrambi i lati (es. da due direzioni) sulla stessa superficie quando possibile. La sonda sarà manipolata in modo che l'energia ultrasonora passi attraverso il volume di saldatura da esaminare e l'adiacente	8.2.1 *Angle beam technique*. The search unit and beam appropriate for the configuration being examined and shall be capable of detecting the calibration reflectors, over the required angle beam path. The Work Instruction shall define, for each weld joint type, the angle beam/s and the scanning position for each search unit. To detect reflectors parallel to the weld seam, the angle beam shall be directed at approximate right angles to the weld axis from both sides of the weld (i.e., from two directions) on the same surface when possible. The search unit shall be manipulated so that the ultrasonic energy pass through the required volume of weld and adjacent base material. To detect reflectors transverse to the weld

materiale base.
Per rilevare riflettori trasversali alla saldatura, il fascio angolato sarà diretto essenzialmente parallelo all'asse di saldatura. La sonda sarà manipolata in modo che l'energia ultrasonora passi attraverso il volume di saldatura da esaminare e l'adiacente materiale base. La sonda sarà ruotata di 180 gradi e l'esame ripetuto. Se il sovrammetallo di saldatura non è lavorato di macchina o molato, l'esame sarà eseguito dal materiale base su entrambi i lati del sovrametallo in entrambe le direzioni lungo l'asse di saldatura.
L'accesso limitato alle saldature non è previsto. Tutti i giunti da esaminare saranno considerati prima dell'esame e la Work Instruction definirà in dettaglio le sonde e la loro posizione di scansione per ogni tipo di giunto da controllare. Ogni variazione alla presente procedura richiede una revisione del documento prima della sua applicazione.

seam, the angle beam shall be directed essentially parallel to the weld axis. The search unit shall be manipulated so that the ultrasonic energy passes through the required volume of weld and adjacent base material. The search unit shall be rotated 180 deg and the examination repeated. If the weld cap is not machined or ground flat, the examination shall be performed from the base material on both sides of the weld cap in both weld axis directions.

Restricted Access Weld is not expected. All the joint to be examined shall be considered before the examination and the detailed Work Instruction shall clearly define each weld configuration and the relevant search unit and their scanning position. Any change to this procedure shall require a revision of the document before its application.

9. VALUTAZIONE

9.1 Generalità
E' risaputo che non tutti i riflettori siano indice di discontinuità, dato che alcune discontinuità metallurgiche e condizioni geometriche possono produrre indicazioni non rilevanti. In questa categoria sono incluse segregazioni di lamiera nella zona termicamente alterata che diventano riflettenti dopo la fabbricazione. All'esame con fascio diritto, esse possono apparire come indicazioni isolate o allineate. All'esame con fascio angolato, indicazioni che si determinano provenire da condizioni superficiali (come la geometria della radice di saldatura) o variazioni della struttura metallurgica in materiali austenitici (come l'interfaccia fra placcature di saldatura automatico-manuali) possono essere classificate come indicazioni geometriche. L'identità, la massima ampiezza di risposta, la posizione, e l'estensione di riflettori che generano indicazioni geometriche saranno registrate. [Per esempio: attacco interno, 200% DAC, 1 in. (25 mm) sopra l'asse di saldatura, sulla superficie interna, da 90 a 95 gradi]. Saranno seguite le seguenti fasi per classificare una indicazione come geometriche:
(a) Interpretare l'area contenente il riflettore in accordo a questa procedura.
(b) Disegnare e verificare le coordinate del riflettore. Preparare uno schizzo della sezione che mostri la posizione del riflettore e le discontinuità superficiali come radice e rastrematura.
(c) Verificare I disegni di fabbricazione o di preparazione della saldatura. Oltre tecniche

9. EVALUATION

9.1 General
It is recognized that not all ultrasonic reflectors indicate flaws, since certain metallurgical discontinuities and geometric conditions may produce indications that are not relevant. Included in this category are plate segregates in the heat affected zone that become reflective after fabrication. Under straight beam examination, these may appear as spot or line indications. Under angle beam examination, indications that are determined to originate from surface conditions (such as weld root geometry) or variations in metallurgical structure in austenitic materials (such as the automatic-to-manual weld clad interface) may be classified as geometric indications.

The identity, maximum amplitude, location, and extent of reflector causing a geometric indication shall be recorded. [For example: internal attachment, 200% DAC, 1 in. (25 mm) above center line, on the inside surface, from 90 deg to 95 deg].
The following steps shall be taken to classify an indication as geometric:
(a) Interpret the area containing the reflector in accordance with this procedure.
(b) Plot and verify the reflectors coordinates. Prepare a cross-sectional sketch showing the reflector position and surface discontinuities such as root and counterbore.

(c) Review fabrication or weld preparation drawings. Other ultrasonic techniques or non-destructive

ultrasuoni o metodi di controllo non distruttivo possono essere d'aiuto nel determinare la reale posizione, dimensione e orientamento.	examination methods may be helpful in determining a reflector's true position, size, and orientation.
9.2 Livello di valutazione Tutte le indicazioni maggiori del 20% (-14 dB) del livello di riferimento saranno investigate per l'estensione in cui possono essere valutati in termini di criteri di accettabilità di questo documento.	9.2 Evaluation level All indications greater than 20% (-14 dB) of the reference level shall be investigated to the extent that they can be evaluated in terms of acceptance criteria in this document.
9.3 Valutazione dei riflettori da laminazione I riflettori valutati come provenienti da laminazione nel materiale base che interferiscono con la scansione del volume in esame richiederanno una modifica della tecnica a fascio angolato in modo da controllare il massimo volume possibile, e saranno annotate nelle registrazioni dell'esame.	9.3 Evaluation of laminar reflectors Reflectors evaluated as laminar reflectors in base material which interfere with the scanning of examination volumes shall require the angle beam examination technique to be modified such that the maximum feasible volume is examined, and shall be noted in the record of examination.
9.4 Determinazione della lunghezza dell'indicazione La lunghezza dell'indicazione sarà determinate con la tecnica della caduta di 6 dB. Dal punto di massima risposta dell'indicazione, muovere la sonda parallelamente alla discontinuità, in entrambe le direzioni, fino che l'eco diminuisce di 6 dB. La distanza fra i due punti corrispondenti alla caduta di 6 dB sarà registrata come lunghezza dell'indicazione.	9.4 Indication length determination The indication length shall be determined by the 6 dB drop technique. From the maximum response of the indication move the probe along a line parallel to the discontinuity, on both directions, until the echo drops for 6 dB. The distance between the two point corresponding to the 6 dB drops shall be recorded as indication length.

10. CRITERI DI ACCETTABILITA'	**10. ACCEPTANCE STANDARDS**
Cricche, mancanze di fusione o mancanze di penetrazione sono inaccettabili indipendentemente dalla loro lunghezza. Altre imperfezioni sono inaccettabili se la loro indicazione eccede il livello di riferimento e la loro lunghezza eccede i seguenti valori: (a) 6 mm per *t* fino a 19 mm (b) 1/3 *t* per *t* da 19 mm a 57 mm (c) 19 mm per *t* oltre 57 mm Dove *t* è lo spessore della saldatura escludendo ogni eventuale rinforzo. Per saldature di testa fra due spessori differenti, *t* è quello inferiore fra i due.	Cracks, lack of fusion, or incomplete penetration are unacceptable regardless of length. Other imperfection are unacceptable if the indication exceeds the reference level and their length exceeds the following: (a) 6 mm for *t* up to 19 mm (b) 1/3 *t* for *t* from 19 mm to 57 mm (c) 19 mm for *t* over 57 mm Where *t* is the thickness of the weld being examined. For a butt weld joining two members having different thicknesses at the weld, *t* is the thinner of these two thicknesses.

11. DOCUMENTAZIONE	**11. DOCUMENTATION**
11.1 Registrazione delle indicazioni Le indicazioni inaccettabili saranno registrate. Le indicazioni accettabili saranno registrate se la loro risposta massima sarà uguale o superiore al 50% DAC.	11.1 Recording indications Rejectable indications shall be recorded. Non-rejectable indications shall be recorded when having a maximum response equal or higher than 50% DAC.
11.2 Registrazioni dell'esame Per ogni esame ultrasuoni saranno registrate le seguenti informazioni: (a) identificazione della procedura e revisione; (b) identificazione dello strumento ultrasuoni (incluso il numero di serie del costruttore) (c) identificazione delle sonde (incluso il numero	11.2 Examination records For each ultrasonic examination, the following information shall be recorded: (a) procedure identification and revision; (b) ultrasonic instrument identification (including manufacturer's serial number) (c) search unit(s) identification (including

di serie del costruttore, frequenza, e dimensione); (d) angolo utilizzato; (e) accoppiante utilizzato, marca o tipo; (f) cavi utilizzati, tipo e lunghezza; (g) attrezzature speciali quando utilizzate (sonde, zoccoli, scarpe, attrezzature automatiche di scansione, attrezzature di registrazione, ecc.) (i) identificazione del blocco di calibrazione; (j) livello di amplificazione dello strumento e, se utilizzati, e regolazione di damping e soglia; (k) dati della calibrazione [incluso i riflettori di riferimento, ampiezza delle indicazioni, e lettura delle distanze]; (l) identificazione e posizione della saldatura o del volume scansionato; (m) superfici dalle quali l'esame viene condotto, incluso le condizioni superficiali; (n) mappa o registrazione delle indicazioni inaccettabili individuate o le aree esenti; (o) aree ad accesso limitato o saldature inaccessibili; (p) identità e livello di qualifica del personale che esegue l'esame; (q) data dell'esame. Identificazione del programma computerizzato e la relative revisioni non faranno parte della registrazione perché non utilizzati (Vedi par. 1: Eco impulso manuale).	manufacturer's serial number, frequency, and size); (d) beam angle used ; (e) couplant used, brand name or type; (f) search unit cable(s) used, type and length; (g) special equipment when used (search units, wedges, shoes, automatic scanning equipment, recording equipment, etc.) (i) calibraton block identification; (j) instrument level gain and, if used, damping and reject setting(s); (k) calibration data [including reference reflector(s) indication amplitude(s), and distance reading(s)]; (l) identification and location of weld or volume scanned; (m) surface(s) from which the examination was conducted, including surface conditions; (n) map or record of rejectable indications detected or area cleared; (o) areas of restricted access or inaccessible welds; (p) examination personnel identity and qualification level; (q) date of examination. Computerized program identification and revision shall not be part of the record because it shall not be used (See par. 1: Manual pulse echo).
11.3 Rapporto Sarà emesso un rapporto dell'esame. Il rapporto includerà tutte le registrazioni indicate in 11.1 e 11.2 sopra. Il rapporto sarà archiviato e mantenuto in accordo al Sistema di Qualità Aziendale.	11.3 Report A report of the examination shall be made. The report shall include those records indicated in 11.1 and 11.2 above. The report shall be filed and maintained in accordance with the Company Quality System.

12. RIPARAZIONE	**12. REPAIR**
Tutte le discontinuità eccedenti i criteri di accettabilità saranno rimosse con mezzi adeguati e riparate in accordo a una procedura approvata. L'area riparata sarà controllata dopo la riparazione in accordo con la presente procedura.	All discontinuities in excess to acceptance standards shall be removed by suitable means and repaired according to approved procedure. The repaired area shall be re-examined after repair in accordance with this procedure.

B&R GROUP PROCEDURE

DIMENSIONAL CHECK PROCEDURE

PR.N° 006 DC 21 REV.0

REFERENCE DOCUMENTS:	
ASME BPV CODE SECTIONS I,VIII div.1,VIII div.2,IX	2021 Edition
ASME Power Piping B31.1	2020 Edition
TEMA Standard	10th Edition 2019

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REVIEW FOR COMPLIANCE WITH REFERENCE CODE / DOCUMENT REVISION

Date	Code Edition	TP

Rev.	Date	Description	Issued by	Reviewed by	Approved by TP
0	28-12-2021	Issued for approval	M. Fiammingo	S.L Rigobon	N. Tosto

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 006 DC 21

REV.0

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 006 DC 21

REV.0

1. Scope	1. Scopo
1.1 This procedure describes the method and the technique used to carry out dimensional check on pressure vessel or components manufactured in B&R Group shop or at site.	1.1 Questa procedura descrive il metodo e la tecnica utilizzati per eseguire il controllo dimensionale sul serbatoio a pressione o sui componenti fabbricati nelle officine del B&R Group o in sito.

2. Responsibility	2. Responsabilità
1.2 The responsibility of the dimensional control is to Quality Control personnel under the guidance of Quality Control Manager.	1.2 La responsabilità del controllo dimensionale è del personale addetto al controllo qualità sotto la guida del Responsabile del Controllo Qualità.

3. Measuring instrument and device	3. Strumento e dispositivo di misurazione
3.1 The dimensional check is carried out using calibrated instruments.	3.1 Il controllo dimensionale viene eseguito utilizzando strumenti calibrati.
3.2 Dimensional instruments used for checking in are those listed in the calibrated instrument list and include, but are not limited to: - tape measures - callipers - micrometer for internal/external measures - go/no go gauges - goniometers - UT instrument for thickness check - tactile comparator for gasket contact surface areas (Rubert 319 or equivalent) - templates - gages for welds (bridge cam gage, hi-lo gage, fillet gage, etc.)	3.2 Gli strumenti dimensionali utilizzati per il controllo sono quelli elencati nell'elenco degli strumenti calibrati e includono, ma non sono limitati a: - metri a nastro - calibri - micrometro per misure interne / esterne - calibri passa/ non passa - goniometri - Strumento UT per controllo spessore - comparatore tattile per le superfici di contatto della guarnizione (Rubert 319 o equivalente) - dime - calibri per saldature (calibro a ponte, calibro hi-lo, calibro filettato, ecc.)

4. Dimensional check performance	4. Svolgimento del controllo dimensionale
4.1 The following dimensions shall normally be checked: - Thickness of all vessel components/parts - inside/outside diameter of tubular components - out of roundness of cilindrical shell/sections - straightness of complete vessel - nozzles, internal/external attachments and supports position - flanges/forgings dimensional checks including gasket contact surface areas - inside/outside, thickness dimensions and type of gaskets - stud bolts/nuts threading and finishing - holes and ligaments tolerances for tube sheets and baffles - shape and thickness for formed heads and expansion bellows	4.1 Le seguenti dimensioni devono essere normalmente controllate: - Spessore di tutti i componenti / parti dell'apparecchio - diametro interno / esterno dei componenti tubolari - per rotondità di mantelli / sezioni cilindriche - rettilineità dell'apparecchio completo - bocchelli, attacchi interni / esterni e posizione dei supporti - controlli dimensionali delle flange / forgiati, comprese le superfici di contatto della guarnizione - interno / esterno, dimensioni dello spessore e tipo di guarnizioni - filettatura e finitura dadi/bulloni - tolleranze di fori e di accoppiamento di piastre

	tubiere e diaframmi - forma e spessore di fondi e giunti di dilatazione

5. Dimensional check time	**5. Tempo di controllo dimensionale**
5.1 The dimensional check shall be performed on receiving of rough materials and subsequently after each working steps. Finally dimensional check shall be performed on complete vessel before and after PWHT, if any, and in any case before pressure test when requested by relevant Code and/or Purchaser/User spec's a dimensional check shall be performed also after pressure test.	5.1 Il controllo dimensionale deve essere eseguito al ricevimento di materiali grezzi e successivamente dopo ciascuna fase di lavorazione. Infine, il controllo dimensionale deve essere effettuato su tutto l'apparecchio prima e dopo PWHT, se presente, e comunque prima della prova di pressione, quando richiesto dal Codice pertinente e / o dalle specifiche dell'acquirente/utilizzatore, un controllo dimensionale deve essere eseguito anche dopo la prova di pressione.

6. Dimensional check acceptance	**6. Accettabilità del controllo dimensionale**
6.1 All dimensions of the pressure vessel/components shall be in accordance with the relevant drawing, Code/standard and Purchaser/User specifications (See Table 1). In case that some dimensions are found out of the required tolerances, the Purchaser/User shall be advised in order to solve the problem. After that an "AS BUILT DRAWING" shall be issued for final approval and enclosed in the Data Book.	6.1 Tutte le dimensioni del recipiente a pressione/dei componenti devono essere conformi al relativo disegno, Codice/norma e specifiche Acquirente/Utente (Vedi tabella 1). Nel caso in cui alcune dimensioni dovessero risultare fuori dalle tolleranze richieste, l'Acquirente/Utilizzatore sarà avvisato al fine di risolvere il problema. Successivamente verrà emesso un "DISEGNO AS BUILT" per l'approvazione finale e allegato al Data Book.

TABLE 1

DIMENSIONAL CHECK	ACCEPTANCE CRITERIA
PERMISSIBLE OUT-OF-ROUNDNESS	ASME VIII Div.1 UG-80
	ASME VIII Div.2 Para. 4.3
	ASME I PG-80
TOLERANCE FOR FORMED HEADS	ASME VIII Div.1 UG-81
	ASME VIII Div.2 Para. 4.3
	ASME I PG-81
ALIGNMENT TOLERANCE	ASME VIII Div.1 UW-33
	ASME VIII Div.2 Para. 6.1.6
	ASME I PW-33

7. Reports	7. Certificazione
6.2 All intermediate dimensional checks carried out shall be recorded on the Quality Control Plan by the Quality Control Inspector, signing for acceptance the step.	6.2 Tutte i controlli dimensionali devono essere riportati e firmati sul Piano del controllo Qualità da parte dell'ispettore del controllo Qualità .
6.3 Final dimensional checks shall be properly reported by the Quality Control Inspector (sketch of the item showing actual results for main and interface dimensions)	6.3 Il controlli dimensionali finale deve essere opportunamente certificato dall'ispettore del controllo Qualità (uno schizzo del Item che mostra i risultati effettivi delle dimensioni principali e di interfaccia).

B&R GROUP PROCEDURE

VISUAL TEST PROCEDURE

PR.N° 007 VT 21 REV.0

REFERENCE DOCUMENTS:	
ASME BPV CODE SECTIONS I,VIII div.1,VIII div.2,IX	2021 Edition
ASME Power Piping B31.1	2020 Edition
ASME Recommended Practice SNT-TC-1A	2016 Edition

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28/12/2021

Rev.	Date	Description	Issued by	Approved by TP	Reviewed& Approved Lev.III
0	28-12-2021	Revised as per new Edition of ASME Code.	M.Flammingo	N. Tosto	D. Botti

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 007 VT 21

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 007 VT 21

REV.0

1 SCOPO	1 SCOPE
Questo documento definisce le modalità di esecuzione dell'esame visivo diretto da effettuare sui principali sulle saldature, nelle condizioni di come saldato, molato, lavorato di macchina, come finito, dei prodotti e delle costruzioni di B&R Group che debbano rispettare le normative indicate al paragrafo successivo. Il disegno di fabbricazione definisce il codice di riferimento da utilizzare per l'esame visivo.	This document describes the direct visual examination of welds, in the as-finished, as-welded, ground, machined or flushed with the base material condition. Weld shall be done on product and constructions of B&R Group which are to be in accordance with the documents referenced in the following paragraph. The fabrication drawing shall define the applicable code section for the visual examination.

2 STANDARDS DI RIFERIMENTO	2 REFERENCE STANDARDS
ASME BPVC Section I, V, VIII div. 1, VIII div. 2, IX edizione 2021 ASME B31.1 ed. 2020	ASME BPVC Section I, V, VIII div. 1, VIII div. 2, IX edizione 2021 ASME B31.1 ed. 2020

3. PERSONALE	3. PERSONNEL
L'esame VT sarà eseguito da personale qualificato e certificato come di seguito: a) Istruito nei fondamentali dell'esame VT b) Addestrato in produzione per familiarizzare con l'apparenza e l'interpretazione delle indicazioni dei difetti di saldatura per almeno due mesi c) Esame di capacità visiva, verificata almeno annualmente, per assicurare l'acuità visiva corretta o naturale di almeno un occhio in modo tale che il candidato sia capace di leggere almeno il carattere Jaeger 1 o Times Roman 3,5 a una distanza di 38 cm d) Esaminato oralmente o per iscritto e esaminato in applicazione pratica per eseguire l'esame VT richiesto e l'interpretazione dei risultati. La certificazione del personale è responsabilità del QCM e non ha scadenza a condizione che la continuità non subisca un'interruzione maggiore di 1 anno.	VT examination shall be performed by personnel qualified and certified as follow: a) Instructed in the fundamentals of the Visual examination b) Trained on-job to familiarize with the appearance and interpretation of indications of weld defects for at least two months c) Near-vision acuity examined, at least once each year, to ensure natural or corrected acuity in at least one eye such that the applicant is capable of reading a minimum of Jaeger number 1 or Times Roman 3,5 at a distance of 38 cm. d) Oral or written examined and performance examined to perform the required VT examination and interpretation of results The personnel certification is responsibility of QCM and shall not expire until its activity is interrupted for a period longer than 1 year.

4 ATTREZZATURA	4 EQUIPMENT
Saranno utilizzati dime, calibri, calibri per saldatura e strumenti di illuminazione adeguati all'esame da eseguire. Esempi di calibri e dime da utilizzare sono indicati nelle figure 1 e 2. Dime potranno essere costruite con materiale rigido e sottile come faesite, cartone, alluminio o altro materiale idoneo.	Equipment used to carry out measurements shall be gauge, calipers, welds gauge and lighting equipment suitable for the examination to be performed. Weld gauges suitable for the examination are shown in the Figures 1 and 2 as example. Gauges can be manufactured by suitable materials as faesite, cardboard, aluminium.



Figure 1 – Cambridge Gauge / Calibro Cambridge



Figure 2 – Profile Gauges / Dima di profilo

5 REQUISITI GENERALI	5 GENERAL REQUIREMENTS
Le superfici da esaminare devono essere direttamente accessibili e gli spazi tali da potere avvicinare l'occhio a una distanza non maggiore di 600 mm con un'angolazione non inferiore a 30° (vedi figura 3). Per migliorare l'angolazione di visuale può essere impiegato uno specchio; una lente di ingrandimento può altresì essere impiegata durante l'esecuzione dell'esame. Un'intensità luminosa di 1000 lux è richiesta sulla superficie da esaminare per assicurare una adeguata sensibilità durante l'esame e la valutazione delle indicaz	The surfaces to be examined shall be directly accessible as sufficient as to place the eye within 24 in. (600 mm) at an angle not less than 30 degree (see fig. 3). Mirrors may be used to improve the angle of vision, and aids as magnifying lens may be used to assist examination. A minimum light intensity of 1000 lux is required on the surface to be examined to ensure adequate sensitivity during the examination and evaluation of indications

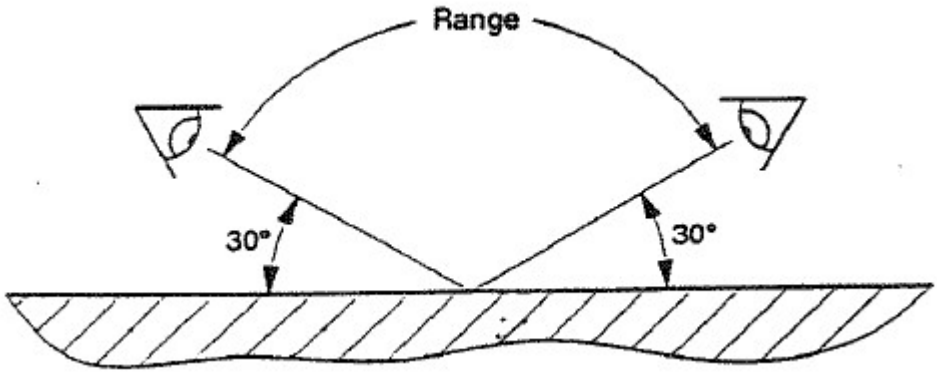

Figura 3 – Access for examination / Angolo di visuale

Prima dell'esame, la superfice da controllare e l'area adiacente per almeno 1 in. (25,4 mm) sarà asciutta e libera da sporco, grasso, garze, scaglie, flusso di saldatura e spruzzi, olio, o altro materiale estraneo che potrebbe interferire con l'esame.ioni.	Prior to visual examination, the surface to be examined and all adjacent areas within at least 1 in. (25,4 mm) shall be dry and free of all dirt, grease, lint, scale, welding flux and spatter, oil, or other extraneous matter that could interfere with the examination.

6. ESAME	**6. EXAMINATION**
6.1 Generalità I materiali base e le saldature saranno esaminate per verificarne la correttezza in accordo ai criteri di accettabilità definiti nel presente documento e saranno controllati i parametri indicati nei seguenti paragrafi.	6.1 General The raw materials and finished welds shall be examined to determine whether it meets the acceptance standard defined in this document and the items defined in the following paragraphs shall be checked
6.2 Pulizia e finitura I materiali base saranno esaminati per controllare che ogni materiale estraneo sia stato rimosso, che non ci siano incisioni dovute a urti di corpi solidi o deformazioni, segni di surriscaldamento da molatura o intagli provocati da molatura. Le saldature saranno esaminate per verificare che tutte le scorie siano state rimosse, che non ci siano incisioni dovute a urti di corpi solidi o deformazioni, segni di surriscaldamento da molatura o intagli provocati da molatura. Inoltre sarà verificato che il profilo del metallo d'apporto si raccordi regolarmente con il materiale base adiacente.	6.2 Cleaning and dressing Raw materials shall be examined to check all extraneous material has been removed, there are no tool impressions or blow marks, overheating of the joint due to grinding is avoided and that grinding marks and an uneven finish are also avoided. The weld shall be examined to check that all slag has been removed by manual or mechanical means, there are no tool impressions or blow marks, overheating of the joint due to grinding is avoided and that grinding marks and an uneven finish are also avoided. Furthermore it shall be verified that the joint merges smoothly with the parent metal without under flushing.
6.3 Profilo e dimensioni I materiali base saranno controllati per verificare che la loro forma, dimensione e finitura superficiale rispettino i requisiti dell'ordine o del progetto applicabile. Le saldature saranno esaminate per verificare che il profilo della saldatura e la dimensione del sovrametallo non eccedano i criteri di accettabilità, che la superficie sia regolare e la dimensione delle maglie sia uniforme e regolare, che la larghezza della saldatura sia regolare lungo tutta la sua lunghezza e sia conforme a quanto previsto nei documenti di saldatura e criteri di accettabilità di questo documento. Nel caso di saldature di testa sarà verificato il completo riempimento della preparazione di saldatura.	6.3 Profile and dimensions The raw material shall be examined to check their shape and size and surface finishing meet the requirement of their applicable purchase order, or design requirements. The weld shall be examined to check that the profile of the weld face and the height of any excess weld metal meet the requirements of the acceptance standard, the surface of the weld is regular, the weld width is consistent over the whole of the joint and that it means the requirements given in the weld drawing and the acceptance standard of this document. In the case of butt welds, it shall be checked that the weld preparation has been completely filled.
6.4 Radice della saldatura e superfici Le parti di saldatura visibilmente accessibili, anche con specchi o endoscopi, saranno esaminate per verificare la corretta penetrazione, la presenza dei terminali di saldatura senza ritiri o cavità eccedenti i criteri di accettabilità; saranno verificate le incisioni e rilevata l'eventuale presenza di altre discontinuità per controllare che non eccedano i criteri di accettabilità. Sarà verificata l'assenza dei segni o altre discontinuità lasciati dagli attacchi temporanei e	6.4 Weld root and surfaces The visually accessible parts of the welds shall be examined, using optical aids as necessary, for deviation from the acceptance standard for penetration, root concavity and any burn-through or shrinkage grooves, any undercuts, any imperfection does not exceed the acceptance standard. It shall be verified that any attachment temporarily welded to the object are removed so that the objects is not damaged.

dalla loro successiva rimozione.	

7. CRITERI DI ACCETTABILITA'	7. ACCEPTANCE STANDARDS
Tutti i materiali base e le saldature saranno accettabili quando soddisfano le dimensioni definite nei disegni costruttivi e nelle specifiche di saldatura (WPS). Inoltre le saldature finite saranno accettabili se i seguenti criteri saranno soddisfatti.	All raw material and weld shall be acceptable when they satisfy the shape and size defined by the construction drawing and by the Welding Procedure Specification. Furthermore all completed welds shall be acceptable when the following criteria are satisfied.
7.1 Criteri di accettabilità delle imperfezioni Le seguenti indicazioni sono inaccettabili a) cricche – superficie esterna b) incisioni sulla superficie che siano più profonde di 1.0 mm, o riducano lo spessore minimo richiesto della sezione. c) sovrammetallo di saldatura oltre quanto indicato nella Tabella applicabile 1a o 1b o 1c. d) mancanza di fusion in superficie e) mancanza di penetrazione (si applica solo quando la superficie interna è prontamente accessibile) f) ogni altra indicazione lineare più lunga di 5.0 mm g) porosità superficiali a forma tondeggiante che abbiano dimensioni maggiori di 5.0 mm oppure quattro o più indicazioni tondeggianti separate da 2.0 mm o meno fra le estremità in ogni direzione . Indicazioni tondeggianti sono quelle circolari o ellittiche aventi la lunghezza inferiore a tre volte la loro larghezza.	7.1 Imperfection Acceptance Standard The following indications are unacceptable a) cracks – external surface b) undercut on the surface that is greater than 1.0 mm deep, or encroaches on the minimum required section thickness. c) weld reinforcement greater than specified in the applicable Table 1a, or 1b or 1c. d) lack of fusion on surface e) incomplete penetration (applies only when inside surface is readily accessible) f) any other linear indications greater than 5.0 mm long g) surface porosity with rounded indications having dimensions greater than 5.0 mm or four or more rounded indications separated by 2.0 mm or less edge to edge in any direction. Rounded indications are indications that are circular or elliptical with their length less than three times their width.

Maximum weld reinforcement in mm for ASME Sect. I
Massimo sovrammetallo in mm per ASME Sez. I

Nominal Thickness Spessore nominale *(mm)*	**Circumferential Joints in Pipe and Tubing** Saldature Circonferenziali in tubazioni	**Other welds** Altre saldature
Up to/*fino a* 3	2.5	2.5
Over/*oltre* 3 to/*a* 5 incl.	3.0	2.5
Over/*oltre* 5 to/*a* 13 incl.	4.0	2.5
Over/*oltre* 13 to/*a* 25 incl.	5.0	2.5
Over/*oltre* 25 to/*a* 50 incl.	6.0	3.0
Over/*oltre* 50 to/*a* 75 incl.	Note (1)	4.0
Over/*oltre* 75 to/*a* 100 incl.	Note (1)	5.5
Over/*oltre* 100 to/*a* 125 incl.	Note (1)	6.0
Over/*oltre* 125	Note (1)	8.0

Note:
(1) The greater of 6 mm or 1/8 time the width of the weld in mm / Il maggiore fra 6 mm e 1/8 della larghezza della saldatura

Table 1a
Tabella 1a

Maximum weld reinforcement in mm for ASME Sect. VIII div. 1 Massimo sovrammetallo in mm per ASME Sez. VIII div. 1		
Nominal Thickness Spessore nominale *(mm)*	**Category B & C Butt Welds** Saldature di testa Categoria B & C	**Other welds** Altre saldature
less than/*meno di* 2.4	2.5	0.8
2.4 to/*a* 4.8 incl.	3	1.5
Over/*oltre* 4.8 to/*a* 13 incl.	4	2.5
Over/*oltre* 13 to/*a* 25 incl.	5	2.5
Over/*oltre* 25 to/*a* 51 incl.	6	3
Over/*oltre* 51 to/*a* 76 incl.	6	4
Over/*oltre* 76 to/*a* 102 incl.	6	5.5
Over/*oltre* 102 to/*a* 127 incl.	6	6
Over/*oltre* 127	8	8
Table 1b Tabella 1b		

Maximum weld reinforcement in mm for ASME Sect. VIII div. 2 Massimo sovrammetallo in mm per ASME Sez. VIII div. 1		
Nominal Thickness Spessore nominale *(mm)*	**Circumferential joints in pipe and tubing** Saldature circonferenziali di tubi	**Other welds** Altre saldature
less than/*meno di* 2.5	2.5	0.8
Over/*da* 2.5 to/*a* 5 incl.	2.5	1.5
Over/*da* 5 to/*a* 13 incl.	3	2.5
Over/*da* 13 to/*a* 25 incl.	4.0	2.5
Over/*da* 25 to/*a* 50 incl.	4.0	3
Over/*da* 50 to/*a* 76 incl.	4.0	4.0
Over/*da* 76 to/*a* 100 incl.	5.5	5.5
Over/*da* 100 to/*a* 125 incl.	6	6
Over/*oltre* 125	8	8
Table 1b2 Tabella 1b2		

Maximum weld reinforcement (in mm) for Design Temperature as per ASME B31.1 Massimo sovrammetallo (in mm) secondo la Temperatura di progetto per ASME B31.1		
Thickness of base metal Spessore del metallo base *(mm)*	**>750 °F** (>400 °C)	**≤750 °F** (≤400 °C)
Up to/*fino a* 3.0 incl.	2.0	2.5
Over 3.0 to/*a* 5.0 incl.	2.0	3.0
Over/*oltre* 5.0 to/*a* 13 incl.	2.0	4.0
Over/*oltre* 13 to/*a* 25 incl.	2.5	5.0
Over/*oltre* 25 to/*a* 50 incl.	3.0	6.0
Over/*oltre* 50	4.0	The greater of 6 mm or 1/8 times the width of the weld in mm *Il maggiore fra 6 mm e 1/8 della larghezza della saldatura in mm*
Table 1c Tabella 1c		

8. DOCUMENTAZIONE	8. DOCUMENTATION
Al termine dell'esame la conformità dei materiali base e delle saldature esaminate sarà registrata sull'apposito foglio di lavorazione. Un rapporto sarà emesso per la costruzione completa al termine del processo di fabbricazione, includente anche il controllo dimensionale; il rapporto conterrà almeno i seguenti dati: Identificazione del componente Numero e revisione del disegno applicabile Dichiarazione di conformità ai documenti applicabili Firma e nominativo dell'operatore Data di completamento dell'esame.	After examination the conformity of the examined raw material or the examined weld shall be recorded on the applicable travel sheet. A Report shall be issued for the complete weldment at the end of the fabrication process together with the dimensional check result; the Report shall contain at least the followings: Component identification Applicable drawing number and revision Statement of Conformity to the applicable documents Signature and name of operator Date of examination completion.

9. RIPARAZIONE	9. REPAIR
Tutte le discontinuità eccedenti i criteri di accettabilità saranno rimosse con mezzi adeguati e riparate in accordo a una procedura approvata. L'area riparata sarà riesaminata dopo la riparazione in accordo con la presente procedura.	All discontinuities in excess to acceptance standards shall be removed by suitable means and repaired according to approved procedure. The repaired area shall be re-examined after repair in accordance with this procedure.

B&R GROUP PROCEDURE

HARDNESS TEST PROCEDURE

PR.N° 008 HB

REV.0

REFERENCE DOCUMENTS:	
ASME BPV CODE SECTIONS I,VIII div.1,VIII div.2,IX	2021 Edition
ASME Power Piping B31.1	2020 Edition
Q.C.Manual	

Rev.	Date	Description	Issued by	Reviewed by	Approved by TP
0	28-12-2021	Issued for approval	M. Fiammingo	S.L Rigobon	N. Tosto

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 008 HB

REV.0

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4.	EQUIPMENT	4.	ATTREZZATURA
5.	TESTING	5.	TEST
6.	ACCEPTANCE CRITERIA	6.	CRITERI DI ACCETTAZIONE
7.	REPORT	7.	RAPPORTO

B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 008 HB

REV.0

1. Scope	1. Scopo
1.1 This procedure describes the method used in B&R Group to perform hardness test on welded joints in the areas of base metal (BM), heat affected zone (HAZ), and deposited weld metal (WM). Hardness test shall be performed on welded joints of ferritic materials (carbon steel, low alloy steel).	1.1 Questa procedura descrive il metodo utilizzato in B&R Group per eseguire test di durezza su giunti saldati nelle aree del metallo di base (BM), della zona interessata dal calore (HAZ) e del metallo di saldatura depositato (WM). La prova di durezza deve essere eseguita su giunti saldati di materiali ferritici (acciaio al carbonio, acciaio a bassa lega).

2. Responsibility	2. Responsabilità
2.1 Checking of hardness is responsibility of the personnel of Q.C. Department, under guidance of Quality Control Manager. The operators shall be fully trained and conversant with the equipment used.	2.1 Il controllo della durezza è responsabilità del personale del Dipartimento di Q.C. sotto la guida del responsabile del controllo qualità. Gli operatori devono avere una formazione completa e avere familiarità con le attrezzature utilizzate.

3. Surface preparation	3. Preparazione della superficie
3.1 The welds to be checked shall be ground flush with the adjacent base metal and the areas to be tested shall be smooth.	3.1 Le saldature da controllare devono essere rettificate a filo con il metallo di base adiacente e le aree da testare devono essere lisce.

4. Equipment	4. Attrezzatura
4.1 Hardness test on BM, HAZ and WM shall be performed by use of BRINELL,TELEBRINELL portable instrument or other equivalent type. The diameter of the indentation ball shall not be less than 7 mm and not more than 10 mm.	4.1 La prova di durezza su BM, HAZ e WM deve essere eseguita utilizzando strumenti portatili BRINELL, TELEBRINELL o altri tipi equivalenti. Il diametro della sfera di rientranza non deve essere inferiore a 7 mm e non superiore a 10 mm.
4.2 When specified/accepted by Customer/User spec's hardness test shall/could be performed by use of Poldi instrument.	4.2 Se specificato / accettato dal cliente / utente, la prova di durezza deve / potrebbe essere eseguita mediante l'uso dello strumento Poldi.

5. Testing	5. Test
5.1 Hardness testing shall be performed on longitudinal / circumferential and nozzle butt welds. Other type of joints shall be tested if so required by Customer/User spec's. Hardness test shall be performed, when required and the joint is accessible, on the side of the welds in contact with process medium. The test shall be performed after the last heat treatment foreseen for the joints to be checked, if any.	5.1 Le prove di durezza devono essere eseguite su saldature di testa longitudinali / circonferenziali e ugello. Altri tipi di giunti devono essere testati se richiesto dalle specifiche del cliente / utente. La prova di durezza deve essere eseguita, quando richiesto e il giunto è accessibile, sul lato delle saldature a contatto con il mezzo di processo. La prova deve essere eseguita dopo l'ultimo trattamento termico previsto per l'eventuale controllo delle articolazioni.

6. Acceptance criteria	6. Criteri di accettazione
6.1 The hardness shall not exceed the following values:	6.1 La durezza non deve superare i seguenti valori:

MATERIAL P NUMBER	MAXIMUM HB
PN 1 Group 1-2	200
PN 1 Group 3	230
PN 1 Group 4	250
PN 3 Group 3	250
PN 4	225
PN 5	235
PN 7-8	240

7. Report	7. Rapporto
7.1 An hardness test report shall be filled out after each examination.	7.1 Dopo ogni esame deve essere compilato un rapporto di prova di durezza.

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05	ROSETTI MARINO
Document Title:	NDE OPERATORS LIST AND QUALIFICATIONS H2 STORAGE VESSEL	Sheet 1 of 57 Date: 18/03/2024 Rev: 03

Base Load Power Hub (BLPH)

ROSETTI MARINO

1	APPROVED - WORK MAY PROCEED
2N	REVISE AND RE-SUBMIT - DO NOT PROCEED
2Y	REVISE AND RE-SUBMIT - WORK MAY PROCEED
3	REJECTED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
Comandini Massimo Level III NDT EN - ISO9712 WI CSWIP 3.1	21-03-2024

TORS LIST AND QUALIFICATIONS
H2 STORAGE VESSEL

umber: 1723001756-NDT-LIS-00010

Document Class: 2

Rev.	Date	Description	Prepared	Reviewed	Approved
03	18/03/2024	Accepted for construction (ACF)	M.Rampazzo	P.Franzolin	M.Galli
02	06/03/2024	Accepted for construction (ACF)	M.Rampazzo	P.Franzolin	M.Galli
01	06/02/2024	Issue for Review (IFR)	M.Rampazzo	P.Franzolin	M.Galli
00	30/11/2023	Issue for Review (IFR)	M.Rampazzo	P.Franzolin	M.Galli

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTIMARINO
Document Title:	**NDE OPERATORS LIST AND QUALIFICATIONS** **H2 STORAGE VESSEL**	Sheet 2 of 57 Date: 18/03/2024 Rev: 03

Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
01	Issue for Review (IFR)
02	Accepted for construction (AFC)
03	Accepted for construction (AFC)

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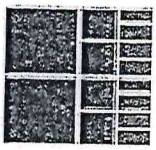

LIST OF NDE METHODS / NDE OPERATORS

Doc BR-NDE Rev.19

Name	NDE level	NDE Method	Qualification	Employer
S. Pellegrino	2	PT/ MT/LT/ TOFD/ PHA	UNI EN ISO 9712	BREMBANA&ROLLE BG
M. Bertarelli	2	VT/ MT/ UT/ TOFD/ PHA	UNI EN ISO 9712	BREMBANA&ROLLE PD
D. Borgato	2	UT/ MT/ PT	UNI EN ISO 9712	BREMBANA&ROLLE PD
M. Fiammingo	2	VT/PT/MT	UNI EN ISO 9712	BREMBANA&ROLLE PD
	3	UT/ToFD/PHA	UNI EN ISO 9712	
M. Galli	2	VT/ PT/ MT/ RT/ UT	UNI EN ISO 9712	BREMBANA&ROLLE PD
F. Gonella	2	PT/MT/UT/LT	UNI EN ISO 9712	BREMBANA&ROLLE PD
SL.Rigobon	2	MT/ PT/ VT/ UT/ RT/ LT	UNI EN ISO 9712	BREMBANA&ROLLE PD
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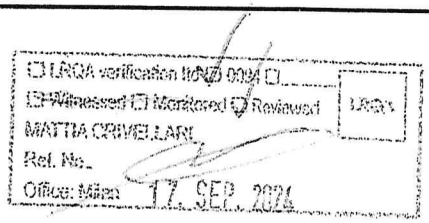
M. Spina	2	LT	UNI EN ISO 9712	BREMBANA&ROLLE PD
N. Trolio	2	MT/ PT/ VT/ UT/ RT/ LT/ TOFD/ PHA	UNI EN ISO 9712	BREMBANA&ROLLE PD
S. Volpato	2	PT/ MT/ RT/ VT	UNI EN ISO 9712	BREMBANA&ROLLE PD

Rev.	Date	Issue	Issued by T.D.	Approved by QA
19	05/02/2024	19th issue	M. Fiammingo	SL. Rigobon
18	08/02/2023	18th issue	M. Fiammingo	SL. Rigobon
17	05/07/2022	17th issue	M. Fiammingo	SL. Rigobon
16	20/12/2021	16th issue	M. Fiammingo	SL. Rigobon





PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-23-03397-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non-Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Salvatore Pellegrino (ID # 6405)

Nato a / *born in*: Gela (CL) Italy

Il / *on*: 26 Aug 1997

Per il metodo / *For the method*
Penetrant Testing (PT)

Per i settori / *For the sectors*
Pre- and in-service testing which includes manufacturing

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Data ultima revisione / *Date last revision*: ----------

Emesso / *Issued*: 30 Sep 2023

Valido dal / *Valid from*: 30 Sep 2023

Scadenza / *Expiry date*: 29 Sep 2028

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

CLADA verification Id N° 009 CL
Witnessed Monitored Reviewed
MATTIA CRIVELLARI
Ref. No.
Office: Milan 17 SEP 2024

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Salvatore Pellegrino (ID # 6405)

Nato a / *born in*: Gela (CL) Italy

Il / *on*: 26 Aug 1997

Per il metodo / *For the method*
Magnetic Testing (MT)

Per i settori / *For the sectors*
Pre- and in-service testing which includes manufacturing

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Emesso / *Issued*: 30 Sep 2023

Valido dal / *Valid from*: 30 Sep 2023

Scadenza / *Expiry date*: 29 Sep 2028

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

LRQA verification id: 9924
Effective Monitored Reviewed
MATTIA CESARI LASI
Rel. No.
Office: Milan 17. SEP. 2023

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N° IND-20-02140-C

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Titolare del certificato / *Certificate holder*
Pellegrino Salvatore (ID # 6405)

Nato a / *born in*: Gela (CL)

Il / *on*: 26 Aug 1997

Per il metodo / *for the method:*
Leak Testing (LT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

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Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jul 2020

Scadenza / *Expiry date*: 19 Jul 2025

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

MATTIA CIVIELLO
17 SET. 2020

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ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
PRS N° 012C
Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC Mutual Recognition Agreement

CERTIFICATO DI LIVELLO 2
LEVEL 2 CERTIFICATE

N° 34249/PND/C

Si certifica la qualificazione per esami in Prove Non Distruttive al **LIVELLO 2**
*This is to certify qualification by examinations in Non-Destructive Testing at the **LEVEL 2***

di / of

Pellegrino Salvatore Antonio

nato a / *born in* Gela (CL)

il / *on* 26 agosto 1997

per il metodo / *for the method:*

UT (Ultrasuoni)

per i settori / *for the sectors:*

PS (Plurisettoriale) - AP (TOFD) - AP (Phased Array)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712.
This certificate is issued according to UNI EN ISO 9712.

Autorizzazione ad Operare del Datore di lavoro *Employer Authorization to practice*	Il Presidente del Comitato Tecnico *The President of Technical Committee*	L'Amministratore Unico *The Administrator*
	Dr. Ing. G. Porco	*Dr. Ing. M. Crepaldi*

Data Delibera: 20/01/2020
Approval Date

Data Scadenza: 20/01/2025 C
Expiry Date

IROA verification (if any)
Mandatory Mandatory Renewal
MATTIA CREVELLARI
Ref. No.
Office: Milan 17 SET. 2021

AIPnD

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PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-21-01887-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Bertarelli Marco (ID # 2623)

Nato a / *born in*: Venezia (VE) Il / *on*: 9 May 1981

Per il metodo / *for the method:*
Magnetic Testing (MT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 29 Jun 2021 Scadenza / *Expiry date*: 28 Jun 2026

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

CLRQA verification in VR 004 CL
Witnessed Partially Removed
MATTIA CRIVELLARI
Ref. No.:
Office: Milan 17 SET. 2021

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-21-03152-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Bertarelli Marco (ID # 2623)

Nato a / *born in*: Venezia (VE) Il / *on*: 9 May 1981

Per il metodo / *for the method:*
Ultrasonic Testing (UT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 30 Nov 2021 Scadenza / *Expiry date*: 29 Nov 2026

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

LPQA verification for legal
Witnessed Monitored Reviewed
MATTIA CROVELLARI
Ref. No.
Office: Milan 17 SET. 2021

BUREAU VERITAS

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
PRS N° 076C
Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC mutual Recognition Agreements

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-21-02482-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Bertarelli Marco (ID # 2623)

Nato a / *born in*: Venezia (VE) Il / *on*: 9 May 1981

Per il metodo / *for the method:*
Ultrasonic Testing / Time of Flight Diffraction - Phased Array (UT/TOFD-PA)

Questo certificato di tecnica è valido solo unitamente al relativo certificato di metodo in corso di validità / This technique certificate is valid only if together with relative valid method certificate

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 23 Sep 2021 Scadenza / *Expiry date*: 22 Sep 2026

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

☐ LPOA verification for M only ☐
☐ Personnel Professional IV Professional ☐
MOTTA CRIVELLARI
Ref. No.
Office: Milan 17. SEP. 2021

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PRS N°0076

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore

NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-24-02142-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2

It certifies the qualification for Non-Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*

Marco Bertarelli (ID # 2623)

Nato a / *born in*: Venezia (VE) Italy Il / *on*: 9 May 1981

Per il metodo-tecnica / F*or the method-tecnique:*

Visual Testing (VT)

Per i settori / F*or the sectors*:

Pre- and in-service testing which includes manufacturing (s)

(composed by product sector c-f-w-t-wp-m)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2022 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND

This certificate is issued according to UNI EN ISO 9712:2022 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Emesso / *Issued:* 11 Jun 2024 Valido dal / *Validity start date*: 16 May 2024

Data ultima revisione / *Date last revision:* ---------- Scadenza / *Expiry date*: 15 May 2029

Responsabile Tecnico di Schema

NDT Scheme Chief

Luca Rossi

☐ LRQA verification no ☐ 0094 ☐

☐ Witnessed ☐ Monitored ☐ Reviewed LRQA

MATTIA CRIVELLARI

Ref. No.

Office: Milan 17 SET. 2024

to check the certificate: https://bvchecker.revo.network

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PRS N°0076

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore

NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-24-00625-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2

It certifies the qualification for Non-Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*

Denis Borgato (ID # 13203)

Nato a / *born in*: Padova (PD) Italy Il / *on*: 4 Sep 1973

Per il metodo-tecnica / F*or the method-tecnique:*

Penetrant Testing (PT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)

APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / F*or the sectors*:

Pre- and in-service testing which includes manufacturing (s)

(composed by product sector c-f-w-t-wp-m)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2022 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND

This certificate is issued according to UNI EN ISO 9712:2022 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Emesso / *Issued:* 1 Mar 2024 Valido dal / *Validity start date*: 15 Mar 2024

Data ultima revisione / *Date last revision:* ---------- Scadenza / *Expiry date*: 14 Mar 2029

Responsabile Tecnico di Schema

NDT Scheme Chief

Luca Rossi

☐ LROA verification no. ☐ ☐ ☐

☐ Witnessed ☐ Monitored ☐ Reviewed LROA

MATTIA ORIVELLARI

Rel. no.

Office: Milan 17 FEB 2024

to check the certificate: https://bvchecker.revo.network

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PRS N°0076

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore

NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-24-00623-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2

It certifies the qualification for Non-Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*

Denis Borgato (ID # 13203)

Nato a / *born in*: Padova (PD) Italy Il / *on*: 4 Sep 1973

Per il metodo-tecnica / *For the method-tecnique:*

Ultrasonic Testing (UT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)

APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *For the sectors*:

Pre- and in-service testing which includes manufacturing (s)

(composed by product sector c-f-w-t-wp-m)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2022 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND

This certificate is issued according to UNI EN ISO 9712:2022 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Emesso / *Issued:* 1 Mar 2024 Valido dal / *Validity start date*: 15 Mar 2024

Data ultima revisione / *Date last revision:* ---------- Scadenza / *Expiry date*: 14 Mar 2029

Responsabile Tecnico di Schema

NDT Scheme Chief

Luca Rossi

to check the certificate: https://bvchecker.revo.network

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PRS N°0076

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore

NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-24-00149-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2

It certifies the qualification for Non-Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*

Matteo Fiammingo (ID # 2625)

Nato a / *born in*: Dolo (VE) Italy

Il / *on*: 30 Mar 1985

Per il metodo-tecnica / *For the method-tecnique:*

Visual Testing (VT)

Per i settori / *For the sectors*:

Pre- and in-service testing which includes manufacturing (s)

(composed by product sector c-f-w-t-wp-m)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2022 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND

This certificate is issued according to UNI EN ISO 9712:2022 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Emesso / *Issued:* 22 Jan 2024

Valido dal / *Validity start date*: 22 Jan 2024

Data ultima revisione / *Date last revision:* ----------

Scadenza / *Expiry date*: 21 Jan 2029

Responsabile Tecnico di Schema

NDT Scheme Chief

Luca Rossi

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PRS N°0076

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore

NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-24-00147-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2

It certifies the qualification for Non-Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*

Matteo Fiammingo (ID # 2625)

Nato a / *born in*: Dolo (VE) Italy Il / *on*: 30 Mar 1985

Per il metodo-tecnica / *For the method-tecnique:*

Penetrant Testing (PT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)

APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *For the sectors*:

Pre- and in-service testing which includes manufacturing (s)

(composed by product sector c-f-w-t-wp-m)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2022 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND

This certificate is issued according to UNI EN ISO 9712:2022 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Emesso / *Issued:* 22 Jan 2024 Valido dal / *Validity start date*: 22 Jan 2024

Data ultima revisione / *Date last revision:* ---------- Scadenza / *Expiry date*: 19 Dec 2028

Responsabile Tecnico di Schema

NDT Scheme Chief

Luca Rossi

LRQA verification ref. 62 9004 03

Authorised ☐ Monitored ☐ Reviewed

MATTIA CRIVELLARI

Ref. No.

Office: Milan 17 DEC 2024

to check the certificate: https://bvchecker.revo.network

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PRS N°0076

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore

NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-24-00148-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2

It certifies the qualification for Non-Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*

Matteo Fiammingo (ID # 2625)

Nato a / *born in*: Dolo (VE) Italy Il / *on*: 30 Mar 1985

Per il metodo-tecnica / F*or the method-tecnique:*

Magnetic Testing (MT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)

APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / F*or the sectors*:

Pre- and in-service testing which includes manufacturing (s)

(composed by product sector c-f-w-t-wp-m)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2022 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND

This certificate is issued according to UNI EN ISO 9712:2022 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Emesso / *Issued:* 22 Jan 2024 Valido dal / *Validity start date*: 22 Jan 2024

Data ultima revisione / *Date last revision:* ---------- Scadenza / *Expiry date*: 19 Dec 2028

Responsabile Tecnico di Schema

NDT Scheme Chief

Luca Rossi

to check the certificate: https://bvchecker.revo.network

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PRS N°0076

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore

NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-24-02144-R

Si certifica la qualifica in Prove Non Distruttive al Livello 3

It certifies the qualification for Non-Destructive Testing at the level 3

Titolare del certificato / *Certificate holder*

Matteo Fiammingo (ID # 2625)

Nato a / *born in*: Dolo (VE) Italy

Il / *on*: 30 Mar 1985

Per il metodo-tecnica / *For the method-tecnique:*

Ultrasonic Testing (UT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)

APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *For the sectors*:

Pre- and in-service testing which includes manufacturing (s)

(composed by product sector c-f-w-t-wp-m)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2022 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND

This certificate is issued according to UNI EN ISO 9712:2022 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Emesso / *Issued:* 11 Jun 2024

Valido dal / *Validity start date*: 1 Aug 2024

Data ultima revisione / *Date last revision:* ----------

Scadenza / *Expiry date*: 31 Jul 2029

Responsabile Tecnico di Schema

NDT Scheme Chief

Luca Rossi

☐ LROA verification (cl. ☐ only) ☐

☐ Witnessed ☐ Monitored ☐ Reviewed

MATTIA CREVELLARI

Rel. No.:

Office: Milan

to check the certificate: https://bvchecker.revo.network

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PRS N°0076

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore

NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-24-02146-R

Si certifica la qualifica in Prove Non Distruttive al Livello 3

It certifies the qualification for Non-Destructive Testing at the level 3

Titolare del certificato / *Certificate holder*

Matteo Fiammingo (ID # 2625)

Nato a / *born in*: Dolo (VE) Italy Il / *on*: 30 Mar 1985

Per il metodo-tecnica / F*or the method-tecnique:*

Ultrasonic Testing / Phased Array (UT/PA)

Questo certificato di tecnica è valido solo unitamente al relativo certificato di metodo in corso di validità / This technique certificate is valid only if together with relative valid method certificate

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)

APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / F*or the sectors*:

Pre- and in-service testing which includes manufacturing (s)

(composed by product sector c-f-w-t-wp-m)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2022 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND

This certificate is issued according to UNI EN ISO 9712:2022 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Emesso / *Issued:* 11 Jun 2024 Valido dal / *Validity start date*: 1 Aug 2024

Data ultima revisione / *Date last revision:* ---------- Scadenza / *Expiry date*: 31 Jul 2029

Responsabile Tecnico di Schema

NDT Scheme Chief

Luca Rossi

to check the certificate: https://bvchecker.revo.network

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-22-00096-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Galli Massimiliano (ID # 9393)

Nato a / *born in*: Cascina (PI) Il / *on*: 3 May 1969

Per il metodo / *for the method:*
Visual Testing (VT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jan 2022 Scadenza / *Expiry date*: 19 Jan 2027

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

BUREAU VERITAS

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO
PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-22-00093-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Galli Massimiliano (ID # 9393)

Nato a / *born in*: Cascina (PI) Il / *on*: 3 May 1969

Per il metodo / *for the method:*
Penetrant Testing (PT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3 1 3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

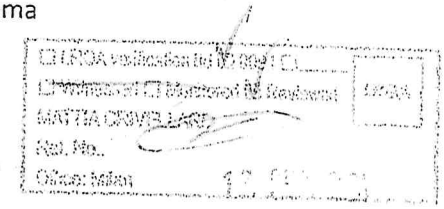
Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jan 2022 Scadenza / *Expiry date*: 19 Jan 2027

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi



PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-22-00095-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Galli Massimiliano (ID # 9393)

Nato a / *born in*: Cascina (PI) Il / *on*: 3 May 1969

Per il metodo / *for the method:*
Magnetic Testing (MT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jan 2022 Scadenza / *Expiry date*: 19 Jan 2027

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-22-00097-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Galli Massimiliano (ID # 9393)

Nato a / *born in*: Cascina (PI) Il / *on*: 3 May 1969

Per il metodo / *for the method:*
Radiographic Testing (RT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jan 2022 Scadenza / *Expiry date*: 19 Jan 2027

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-22-00094-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Galli Massimiliano (ID # 9393)

Nato a / *born in*: Cascina (PI) Il / *on*: 3 May 1969

Per il metodo / *for the method:*
Ultrasonic Testing (UT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1 3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors:*
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jan 2022 Scadenza / *Expiry date*: 19 Jan 2027

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-02925-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Gonella Francesco (ID # 4811)

Nato a / *born in*: Abano Terme (PD) Il / *on*: 3 Jul 1978

Per il metodo / *for the method:*
Penetrant Testing (PT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 24 Oct 2019 Scadenza / *Expiry date*: 23 Oct 2024

Autorizzazione del datore di lavoro
Employer authorizing
BREMBANA & ROLLE S.P.A.
Albignasego (PD) V.le delle Industrie 35 - 35020
P. IVA IT07348970158 - C.F. 00226780161

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-20-02171-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Gonella Francesco (ID # 4811)

Nato a / *born in*: Abano Terme (PD) Il / *on*: 3 Jul 1978

Per il metodo / *for the method:*
Magnetic Testing (MT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 15 Oct 2020 Scadenza / *Expiry date*: 14 Oct 2025

Autorizzazione del datore di lavoro
Employer authorizing
BREMBANA & ROLLE S.P.A.

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

Firma titolare del certificato
Signature of certificate holder

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-20-01465-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Gonella Francesco (ID # 4811)

Nato a / *born in*: Abano Terme (PD) Il / *on*: 3 Jul 1978

Per il metodo / *for the method:*
Ultrasonic Testing (UT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jul 2020 Scadenza / *Expiry date*: 19 Jul 2025

Autorizzazione del datore di lavoro
Employer authorizing
BREMBANA & POLLE S.P.A.
Albignasego (PD) Via delle Industrie 35 - 35020
P. IVA IT07348970158 - C.F. 00226780161

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-20-02137-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Gonella Francesco (ID # 4811)

Nato a / *born in*: Abano Terme (PD) Il / *on*: 3 Jul 1978

Per il metodo / *for the method:*
Leak Testing (LT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jul 2020 Scadenza / *Expiry date*: 19 Jul 2025

Autorizzazione del datore di lavoro
Employer authorizing
BREMBANA & ROLLE S.P.A.

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

Firma titolare del certificato
Signature of certificate holder

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BUREAU VERITAS

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO
PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-00845-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Rigobon Simon Luca (ID # 3669)

Nato a / *born in*: Camposanpiero (PD) Il / *on*: 14 Feb 1974

Per il metodo / *for the method:*
Visual Testing (VT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 1 Apr 2019 Scadenza / *Expiry date*: 31 Mar 2024

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-00844-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Rigobon Simon Luca (ID # 3669)

Nato a / *born in*: Camposanpiero (PD) Il / *on*: 14 Feb 1974

Per il metodo / *for the method:*
Penetrant Testing (PT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3 1 3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 1 Apr 2019 Scadenza / *Expiry date*: 31 Mar 2024

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-00843-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Rigobon Simon Luca (ID # 3669)

Nato a / *born in*: Camposanpiero (PD) Il / *on*: 14 Feb 1974

Per il metodo / *for the method:*
Magnetic Testing (MT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 1 Apr 2019 Scadenza / *Expiry date*: 31 Mar 2024

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-20-01840-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Rigobon Simon Luca (ID # 3669)

Nato a / *born in*: Camposanpiero (PD) Il / *on*: 14 Feb 1974

Per il metodo / *for the method:*
Radiographic Testing (RT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 10 Jul 2020 Scadenza / *Expiry date*: 9 Jul 2025

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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BUREAU VERITAS

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
PRS N° 07GC

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-03778-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Rigobon Simon Luca (ID # 3669)

Nato a / *born in*: Camposanpiero (PD) Il / *on*: 14 Feb 1974

Per il metodo / *for the method:*
Ultrasonic Testing (UT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 14 Nov 2019 Scadenza / *Expiry date*: 13 Nov 2024

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-20-01841-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Rigobon Simon Luca (ID # 3669)

Nato a / *born in*: Camposanpiero (PD) Il / *on*: 14 Feb 1974

Per il metodo / *for the method:*
Leak Testing (LT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 8 Apr 2020 Scadenza / *Expiry date*: 7 Apr 2025

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-21-01901-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Saccarola Paolo (ID # 8344)

Nato a / *born in*: Venezia (VE) Il / *on*: 29 Jun 1973

Per il metodo / *for the method:*
Visual Testing (VT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 31 May 2021 Scadenza / *Expiry date*: 30 May 2026

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-21-01903-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Saccarola Paolo (ID # 8344)

Nato a / *born in*: Venezia (VE) Il / *on*: 29 Jun 1973

Per il metodo / *for the method:*
Penetrant Testing (PT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 31 May 2021 Scadenza / *Expiry date*: 30 May 2026

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 07GC

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-21-01902-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Saccarola Paolo (ID # 8344)

Nato a / *born in*: Venezia (VE)

Il / *on*: 29 Jun 1973

Per il metodo / *for the method:*
Magnetic Testing (MT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 31 May 2021

Scadenza / *Expiry date*: 30 May 2026

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-22-00098-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Saccarola Paolo (ID # 8344)

Nato a / *born in*: Venezia (VE)

Il / *on*: 29 Jun 1973

Per il metodo / *for the method:*
Radiographic Testing / Radiographic Interpretation (RT/RI)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1 3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors:*
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jan 2022

Scadenza / *Expiry date*: 19 Jan 2027

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N°0076

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore

NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-24-00146-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2

It certifies the qualification for Non-Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*

Alessandro Sandonà (ID # 3670)

Nato a / *born in*: Monselice (PD) Italy Il / *on*: 11 Jul 1979

Per il metodo-tecnica / F*or the method-tecnique:*

Visual Testing (VT)

Per i settori / F*or the sectors*:

Pre- and in-service testing which includes manufacturing (s)

(composed by product sector c-f-w-t-wp-m)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2022 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND

This certificate is issued according to UNI EN ISO 9712:2022 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Emesso / *Issued:* 22 Jan 2024 Valido dal / *Validity start date*: 22 Jan 2024

Data ultima revisione / *Date last revision:* ---------- Scadenza / *Expiry date*: 21 Dec 2028

Responsabile Tecnico di Schema

NDT Scheme Chief

Luca Rossi

to check the certificate: https://bvchecker.revo.network

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-00865-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Sandonà Alessandro (ID # 3670)

Nato a / *born in*: Monselice (PD) Il / *on*: 11 Jul 1979

Per il metodo / *for the method:*
Penetrant Testing (PT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3 1 3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 2 Apr 2019 Scadenza / *Expiry date*: 1 Apr 2024

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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BUREAU VERITAS

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO
PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-00866-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Sandonà Alessandro (ID # 3670)

Nato a / *born in*: Monselice (PD) Il / *on*: 11 Jul 1979

Per il metodo / *for the method:*
Magnetic Testing (MT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3 1 3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 2 Apr 2019 Scadenza / *Expiry date*: 1 Apr 2024

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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BUREAU VERITAS

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-00864-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Sandonà Alessandro (ID # 3670)

Nato a / *born in*: Monselice (PD)

Il / *on*: 11 Jul 1979

Per il metodo / *for the method:*
Radiographic Testing / Radiographic Interpretation (RT/RI)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3 1 3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 2 Apr 2019

Scadenza / *Expiry date*: 1 Apr 2024

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-00867-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Sandonà Alessandro (ID # 3670)

Nato a / *born in*: Monselice (PD) Il / *on*: 11 Jul 1979

Per il metodo / *for the method:*
Ultrasonic Testing (UT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 2 Apr 2019 Scadenza / *Expiry date*: 1 Apr 2024

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-20-02138-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Spina Mauro (ID # 6409)

Nato a / *born in*: Monselice (PD) Il / *on*: 28 Nov 1972

Per il metodo / *for the method:*
Leak Testing (LT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jul 2020 Scadenza / *Expiry date*: 19 Jul 2025

Autorizzazione del datore di lavoro
Employer authorizing
BREMBANA & ROLLE S.P.A.

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

Firma titolare del certificato
Signature of certificate holder

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-22-03426-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non-Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Nicola Trolio (ID # 5053)

Nato a / *born in*: Abano Terme (PD) Italy Il / *on*: 29 Mar 1989

Per il metodo / *For the method*
Visual Testing (VT)

Per i settori / *For the sectors*
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *Issued*: 6 Oct 2022 Scadenza / *Expiry date*: 5 Oct 2027

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

to check the certificate: https://bvchecker.revo.network

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-22-02299-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Trolio Nicola (ID # 5053)

Nato a / *born in*: Abano Terme (PD) Il / *on*: 29 Mar 1989

Per il metodo / *for the method:*
Penetrant Testing (PT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 6 Oct 2022 Scadenza / *Expiry date*: 5 Oct 2027

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-22-02300-C

Si certifica la qualifica in Prove Non Distruttive al Livello2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Trolio Nicola (ID # 5053)

Nato a / *born in*: Abano Terme (PD) Il / *on*: 29 Mar 1989

Per il metodo / *for the method:*
Magnetic Testing (MT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 6 Oct 2022 Scadenza / *Expiry date*: 5 Oct 2027

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-03359-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Trolio Nicola (ID # 5053)

Nato a / *born in*: Abano Terme (PD) Il / *on*: 29 Mar 1989

Per il metodo / *for the method:*
Ultrasonic Testing (UT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 14 Nov 2019 Scadenza / *Expiry date*: 13 Nov 2024

Autorizzazione del datore di lavoro
Employer authorizing

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

Firma titolare del certificato
Signature of certificate holder

17 SEP 2024

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-20-01842-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Trolio Nicola (ID # 5053)

Nato a / *born in*: Abano Terme (PD) Il / *on*: 29 Mar 1989

Per il metodo / *for the method:*
Leak Testing (LT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 8 Apr 2020 Scadenza / *Expiry date*: 7 Apr 2025

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

17 SEP 2024

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-22-00099-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Trolio Nicola (ID # 5053)

Nato a / *born in*: Abano Terme (PD) Il / *on*: 29 Mar 1989

Per il metodo / *for the method:*
Radiographic Testing / Radiographic Interpretation (RT/RI)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3 1 3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1 3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 20 Jan 2022 Scadenza / *Expiry date*: 19 Jan 2027

Autorizzazione del datore di lavoro
Employer authorizing

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

Firma titolare del certificato
Signature of certificate holder
Nicola Trolio

17 SEP 2024

PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-20-01842-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Trolio Nicola (ID # 5053)

Nato a / *born in*: Abano Terme (PD) Il / *on*: 29 Mar 1989

Per il metodo / *for the method:*
Leak Testing (LT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 8 Apr 2020 Scadenza / *Expiry date*: 7 Apr 2025

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

17 SEP 2024

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CICPND
CENTRO ITALIANO
DI COORDINAMENTO
PER LE PROVE NON DISTRUTTIVE

Via C. Pisacane, 46
20025 Legnano (MI)
PEC: info@pec.cicpnd.it
C.F. e P.I. 09510020150

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO
PRS n° 012C
Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC Mutual Recognition Agreement

CERTIFICATO DI LIVELLO 2
LEVEL 2 CERTIFICATE

N° 36308/PND/C

Si certifica la qualificazione per esami in Prove Non Distruttive al **LIVELLO 2**
*This is to certify qualification by examinations in Non-Destructive Testing at the **LEVEL 2***

di / of

Trolio Nicola

nato a / *born in* **Abano Terme (PD)**

il / *on* **29 marzo 1989**

per il metodo / *for the method:*

Tofd (UT/TOFD)

per i settori / *for the sectors:*

Collaudo pre e in servizio che comprende la fabbricazione

(c; f; w; t; wp; p)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012.
This certificate is issued according to UNI EN ISO 9712:2012.

Firma persona certificata
Signature of certificate holder

Direttore Generale
General Manager

Reggiani Michael
M. Reggiani

Data Delibera: 28/06/2022
Approval Date

Data Scadenza: 31/05/2027 R
Expiry Date

17 SEP 2024

AIPnD

CICPND
CENTRO ITALIANO
DI COORDINAMENTO
PER LE PROVE NON DISTRUTTIVE

Via C. Pisacane, 46
20025 Legnano (MI)
PEC: info@pec.cicpnd.it
C.F. e P.I. 09510020150

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO
PRS N° 012C
Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC Mutual Recognition Agreement

CERTIFICATO DI LIVELLO 2
LEVEL 2 CERTIFICATE

N° 36307/PND/C

Si certifica la qualificazione per esami in Prove Non Distruttive al **LIVELLO 2**
This is to certify qualification by examinations in Non-Destructive Testing at the LEVEL 2

di / of

Trolio Nicola

nato a / *born in* **Abano Terme (PD)**

il / *on* **29 marzo 1989**

per il metodo / *for the method:*

Phased Array (UT/PA)

per i settori / *for the sectors:*

Collaudo pre e in servizio che comprende la fabbricazione

(c; f; w; t; wp; p)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012.
This certificate is issued according to UNI EN ISO 9712:2012.

Firma persona certificata
Signature of certificate holder

.....

Direttore Generale
General Manager

Reggiani Michael
M. Reggiani

Data Delibera: 28/06/2022
Approval Date

Data Scadenza: 31/05/2027 R
Expiry Date

17 SEP 2024

AIPnD

PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-03791-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Volpato Silvano (ID # 5648)

Nato a / *born in*: Dolo (VE)

Il / *on*: 17 Oct 1970

Per il metodo / *for the method:*
Visual Testing (VT)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 21 Jun 2019

Scadenza / *Expiry date*: 20 Jun 2024

Autorizzazione del datore di lavoro
Employer authorizing

Firma titolare del certificato
Signature of certificate holder

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

17 SEP 2024

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-19-03790-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Volpato Silvano (ID # 5648)

Nato a / *born in*: Dolo (VE)

Il / *on*: 17 Oct 1970

Per il metodo / *for the method:*
Penetrant Testing (PT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 21 Jun 2019

Scadenza / *Expiry date*: 20 Jun 2024

Autorizzazione del datore di lavoro
Employer authorizing

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

Firma titolare del certificato
Signature of certificate holder

17 SEP 2024

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-20-00518-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Volpato Silvano (ID # 5648)

Nato a / *born in*: Dolo (VE) Il / *on*: 17 Oct 1970

Per il metodo / *for the method:*
Magnetic Testing (MT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 4 Mar 2020 Scadenza / *Expiry date*: 3 Mar 2025

Autorizzazione del datore di lavoro
Employer authorizing

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

Firma titolare del certificato
Signature of certificate holder

17 SEP 2024

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PRS N° 076C

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore
NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-20-00519-R

Si certifica la qualifica in Prove Non Distruttive al Livello 2
It certifies the qualification for Non Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*
Volpato Silvano (ID # 5648)

Nato a / *born in*: Dolo (VE) Il / *on*: 17 Oct 1970

Per il metodo / *for the method:*
Radiographic Testing (RT)

APPROVAZIONE PER ESECUZIONE DI PROVE NON DISTRUTTIVE secondo l'Allegato I paragrafo 3.1.3 della direttiva attrezzature a pressione 2014/68/UE PED (CEN/TR 15589 Route A)
APPROVAL FOR EXECUTION OF NON-DESTRUCTIVE TESTING as per Annex I paragraph 3.1.3 of pressure equipment directive 2014/68/UE PED (CEN/TR 15589 Route A)

Per i settori / *for the sectors*:
Pre- and in-service testing which includes manufacturing

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2012 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND
This certificate is issued according to UNI EN ISO 9712:2012 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Data ultima revisione / *Date last revision*: ----------

Emesso / *issued*: 4 Mar 2020 Scadenza / *Expiry date*: 3 Mar 2025

Autorizzazione del datore di lavoro
Employer authorizing

Responsabile Tecnico di Schema
NDT Scheme Chief
Luca Rossi

Firma titolare del certificato
Signature of certificate holder

17 SEP 2024

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BUREAU VERITAS 1828

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ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO

PRS N°0076

PROVE NON DISTRUTTIVE: Certificato di Qualifica Operatore

NON-DESTRUCTIVE TESTING: Operator Qualification Certificate

N° IND-24-01652-C

Si certifica la qualifica in Prove Non Distruttive al Livello 2

It certifies the qualification for Non-Destructive Testing at the level 2

Titolare del certificato / *Certificate holder*

Michele Rampazzo (ID # 13611)

Nato a / *born in*: Dolo (VE) Italy

Il / *on*: 13 Feb 1991

Per il metodo-tecnica / *For the method-tecnique:*

Visual Testing (VT)

Per i settori / *For the sectors*:

Pre- and in-service testing which includes manufacturing (s)

(composed by product sector c-f-w-t-wp-m)

Il presente certificato viene rilasciato in conformità alla Norma UNI EN ISO 9712:2022 e Regolamento Bureau Veritas IT-IND-REG-01_NDT.IND

This certificate is issued according to UNI EN ISO 9712:2022 and Bureau Veritas Rule IT-IND-REG-01_NDT.IND

Emesso / *Issued:* 14 May 2024

Valido dal / *Validity start date*: 14 May 2024

Data ultima revisione / *Date last revision:* ----------

Scadenza / *Expiry date*: 13 May 2029

Responsabile Tecnico di Schema

NDT Scheme Chief

Luca Rossi

☐ LRQA verification ltd ☑ 6094 ☐

☐ Witnessed ☐ Monitored ☑ Reviewed LRQA

MATTIA CRIVELLARI

Ref. No.:

Office: Milan 17 SEP 2024

to check the certificate: https://bvchecker.revo.network

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Fabrication site: Albignasego – PD – ITALY

Section 13

Non Destructive Tests Certificates (RX, UT, PM, LP, Hardness, etc.)

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA MT 01*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 19-26

Descrizione del materiale: Material Description: BEVELS OF WELDS OF MANHOLES TO LEFT AND RIGHT HEADS **M1-M2**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG **Surface conditions**	GROUND	
Time	PWHT BEFORE ☑	AFTER ☐	HYDROTEST BEFORE ☑	AFTER ☐	
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke
Apparecchio / Equipment type	Twist
Costruttore / Manufacturer	DIMART
N° serie / Serial no.	JY4-066
Corrente / Current	☑ AC ☐ DC
Distanza / Distance	MAX. 150mm cross
Potere di sollevamento / Lifting	4,5 kg

Schema metodo di magnetizzazione Magnetization method sketch

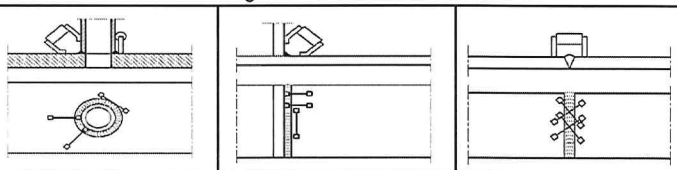


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	n.a.
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY QC.MANAGER M. GALLI DATE: / /	17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 16 Apr 24	**Data**/Date 16 Apr 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA-MT-1A*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 18-25

Descrizione del materiale: Material Description: WELDS OF TEMPORARY LIFTING DEVICES ON HEADS

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	AS WELDED

Time	PWHT		HYDROTEST	
	BEFORE ☑	AFTER ☐	BEFORE ☑	AFTER ☐

Dis. N° / Dwg. No. 23096-01-EGA1

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MT 21	PR.N° 003 MT 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke
Apparecchio / Equipment type	Twist
Costruttore / Manufacturer	DIMART
N° serie / Serial no.	JY4-066
Corrente / Current	☑ AC ☐ DC
Distanza / Distance	MAX. 150mm cross
Potere di sollevamento / Lifting	4,5 kg

Schema metodo di magnetizzazione Magnetization method sketch

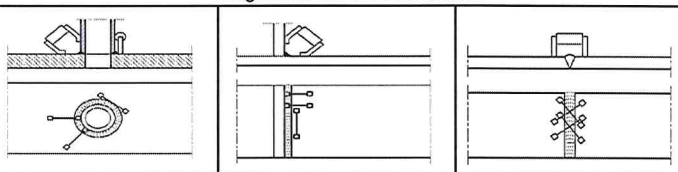


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	CGM VECOPLAST
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	- LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☐ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	> 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	~~>2200 µW/cm2~~ at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M.GALLI DATE : / /	0036 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 21 May 24	**Data**/Date 21 May 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

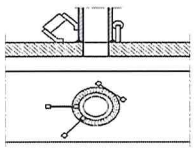
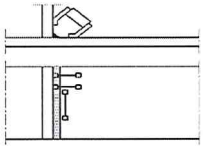
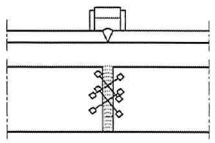
N°. Documento Document No.	*23096-01-SNA MT 02*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 22

Descrizione del materiale: Material Description: WELD OF MANHOLES TO LEFT HEAD **M1**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	AS WELDED
Time	PWHT BEFORE ☑ AFTER ☐		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique		**Schema metodo di magnetizzazione** Magnetization method sketch		
Tipo / Type	Electromagnetic Yoke			
Apparecchio / Equipment type	Twist			
Costruttore / Manufacturer	DIMART			
N° serie / Serial no.	JY4-066			
Corrente / Current	☑ AC ☐ DC			
Distanza / Distance	MAX. 150mm cross			
Potere di sollevamento / Lifting	4,5 kg	Fig. a)	Fig. b)	Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	n.a.
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO II LEV. SNT-TC-UA UT-TOFD-PHA-MT-PT-RT-VT 2 LEVEL UNI EN ISO 9712 UT-TOFD-PHA-MT-PT-RT-VT DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY QC MANAGER M.GALLI DATE: / /	0034 LRQA 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 20 May 24	**Data**/Date 20 May 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA MT 03*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 29

Descrizione del materiale: Material Description: WELD OF MANHOLES TO RIGHT HEAD **M2**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	AS WELDED
Time	PWHT BEFORE ☑ AFTER ☐		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke
Apparecchio / Equipment type	Twist
Costruttore / Manufacturer	DIMART
N° serie / Serial no.	JY4-066
Corrente / Current	☑ AC ☐ DC
Distanza / Distance	MAX. 150mm cross
Potere di sollevamento / Lifting	4,5 kg

Schema metodo di magnetizzazione Magnetization method sketch

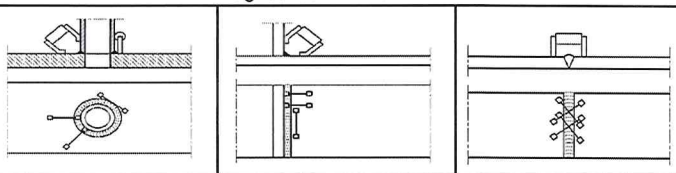


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	n.a.
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M.GALLI DATE : / /	17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP 2024
Data/Date 24 May 24	**Data**/Date 24 May 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA MT 04*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 32

Descrizione del materiale: Material Description: BEVELS OF LONGITUDINAL WELDS **L1÷L5**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	GROUND
Time	PWHT BEFORE ☑ AFTER ☐		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke
Apparecchio / Equipment type	Twist
Costruttore / Manufacturer	DIMART
N° serie / Serial no.	JY4-066
Corrente / Current	☑ AC ☐ DC
Distanza / Distance	MAX. 150mm cross
Potere di sollevamento / Lifting	4,5 kg

Schema metodo di magnetizzazione Magnetization method sketch

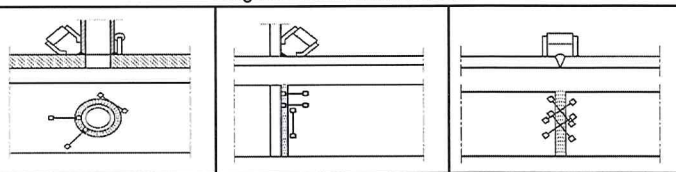


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	**n.a.**
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M.GALLI DATE: / /	17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17 SEP 2024
Data/Date START 13/03/24 END 02/04/24	**Data**/Date START 13/03/24 END 02/04/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA MT 05*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 35

Descrizione del materiale: Material Description: LONGITUDINAL WELDS **L1÷L5**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	AS WELDED
Time	PWHT BEFORE ☑ AFTER ☐		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke		
Apparecchio / Equipment type	Twist		
Costruttore / Manufacturer	DIMART		
N° serie / Serial no.	JY4-066		
Corrente / Current	☑ AC	DC ☐	
Distanza / Distance	MAX. 150mm cross		
Potere di sollevamento / Lifting	4,5 kg		

Schema metodo di magnetizzazione Magnetization method sketch

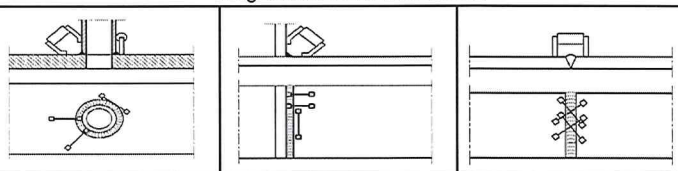


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	n.a.
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY QC MANAGER M. GALLI DATE : / /	0084 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 21 May 24	**Data**/Date 21 May 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA MT 06*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 38

Descrizione del materiale: Material Description: BEVELS OF WELDS OF NOZZLES TO COURSES 1 & 5: **5N-1N-3N-4N-K1-K2-2N**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	GROUND
Time	PWHT BEFORE ☑ AFTER ☐		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke	
Apparecchio / Equipment type	Twist	
Costruttore / Manufacturer	DIMART	
N° serie / Serial no.	JY4-066	
Corrente / Current	☑ AC	DC ☐
Distanza / Distance	MAX. 150mm cross	
Potere di sollevamento / Lifting	4,5 kg	

Schema metodo di magnetizzazione Magnetization method sketch

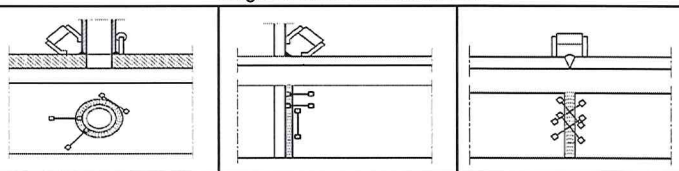


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	n.a.
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	**Tipo** Type	**Descrizione** Description	**Localizzazione** Location	**Risultato** Result	**Documentazione grafica (se necessaria)** Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO II LEV. MT-TC-IR UT-TOFD-PHA-MT-PT-RT-VT 2 LEVEL UNI EN ISO 9712 UT-TOFD-PHA-MT-PT-RT-VT-TT DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY QC MANAGER M.GALLI DATE : / /	0084 LRQA 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 21/05/24	Data/Date 21/05/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA MT 07*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 41

Descrizione del materiale: Material Description: WELDS OF NOZZLES TO COURSES 1 & 5: **5N-1N-3N-4N-K1-K2-2N**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	AS WELDED
Time	PWHT BEFORE ☑ AFTER ☐		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke		
Apparecchio / Equipment type	Twist		
Costruttore / Manufacturer	DIMART		
N° serie / Serial no.	JY4-066		
Corrente / Current	☑ AC	DC ☐	
Distanza / Distance	MAX. 150mm cross		
Potere di sollevamento / Lifting	4,5 kg		

Schema metodo di magnetizzazione Magnetization method sketch

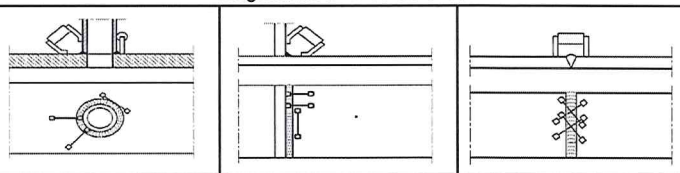


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	**n.a.**
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification	**SI**/YES ☑	NO/NO ☐	
Loc./Test place	Albignasego(PD)		
Accettato/Accepted ☑	**Non Accettato**/NotAccepted ☐	**RNC N°**/NCR No	

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY QC MANAGER M.GALLI DATE : / /	0084 LRQA 17 SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 25/06/24	**Data**/Date 25/06/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

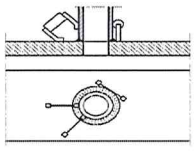
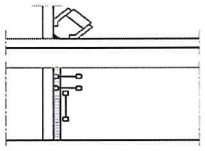
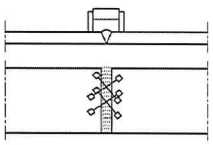
N°. Documento Document No.	*23096-01-SNA MT 08*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 44

Descrizione del materiale: Material Description: BEVELS OF CIRCUMFERENTIAL WELDS **C2-C3-C4-C5**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	GROUND
Time	PWHT BEFORE ☑ AFTER ☐		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique		**Schema metodo di magnetizzazione** Magnetization method sketch		
Tipo / Type	Electromagnetic Yoke			
Apparecchio / Equipment type	Twist			
Costruttore / Manufacturer	DIMART			
N° serie / Serial no.	JY4-066			
Corrente / Current	☑ AC DC ☐			
Distanza / Distance	MAX. 150mm cross			
Potere di sollevamento / Lifting	4,5 kg	Fig. a)	Fig. b)	Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	n.a.
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C. MANAGER M. GALLI DATE: / /	0084 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 29 Apr 24	**Data**/Date 29 Apr 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA MT 09*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 47

Descrizione del materiale: Material Description: CIRCUMFERENTIAL WELDS **C2-C3-C4-C5**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG **Surface conditions**	GROUND	
Time	PWHT BEFORE ☑	AFTER ☐	HYDROTEST BEFORE ☑	AFTER ☐	
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke	
Apparecchio / Equipment type	Twist	
Costruttore / Manufacturer	DIMART	
N° serie / Serial no.	JY4-066	
Corrente / Current	☑ AC	☐ DC
Distanza / Distance	MAX. 150mm cross	
Potere di sollevamento / Lifting	4,5 kg	

Schema metodo di magnetizzazione Magnetization method sketch

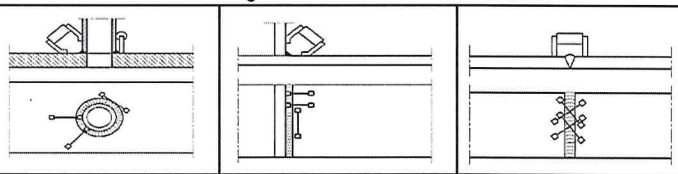


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	**n.a.**
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY QC MANAGER M.GALLI DATE: / /	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 1119 Milan Office 17. SEP. 2024	17. SEP. 2024
Data/Date 25/06/24	**Data**/Date 25/06/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA MT 10*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 50

Descrizione del materiale: Material Description: BEVELS OF CIRCUMFERENTIAL WELDS OF HEADS TO SHELL **C1-C6**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	GROUND

Time	PWHT		HYDROTEST	
	BEFORE ☑	AFTER ☐	BEFORE ☑	AFTER ☐

Dis. N° / Dwg. No. 23096-01-EGA1

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke		
Apparecchio / Equipment type	Twist		
Costruttore / Manufacturer	DIMART		
N° serie / Serial no.	JY4-066		
Corrente / Current	☑ AC	DC ☐	
Distanza / Distance	MAX. 150mm cross		
Potere di sollevamento / Lifting	4,5 kg		

Schema metodo di magnetizzazione Magnetization method sketch

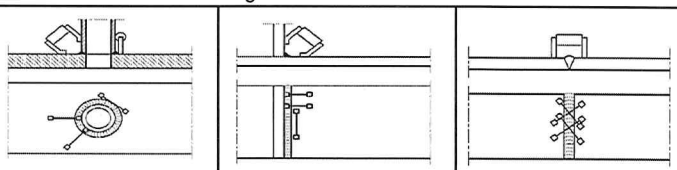


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	**n.a.**
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO (PD) - ITALY Q.C. MANAGER M. GALLI DATE : / /	0094 LRQA 17 SEP 2024	LRQA Verification Limited ~~EU Witnessed~~ ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 01/07/24	Data/Date 01/07/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

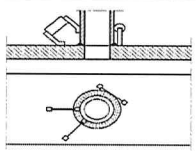
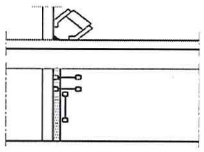
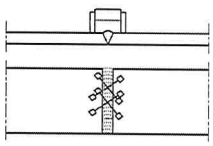
N°. Documento Document No.	*23096-01-SNA MT 11*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 53

Descrizione del materiale: Material Description: CIRCUMFERENTIAL WELDS OF HEADS TO SHELL **C1-C6**

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	AS WELDED
Time	PWHT BEFORE ☑ AFTER ☐		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique		**Schema metodo di magnetizzazione** Magnetization method sketch		
Tipo / Type	Electromagnetic Yoke			
Apparecchio / Equipment type	Twist			
Costruttore / Manufacturer	DIMART			
N° serie / Serial no.	JY4-066			
Corrente / Current	☑ AC ☐ DC			
Distanza / Distance	MAX. 150mm cross			
Potere di sollevamento / Lifting	4,5 kg	Fig. a)	Fig. b)	Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	**n.a.**
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY QC.MANAGER M.GALLI DATE: / /	17 SEP. 2024	LRQA Verification Limited ☐ Witnessed ☐ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 25/06/24	**Data**/Date 25/06/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA MT 12*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 56

Descrizione del materiale: Material Description: BEVELS OF WELDS OF INTERNAL AND EXTERNAL ATTACHMENTS (INCLUDING SADDLES AND LIFTING DEVICES)

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	GROUND		
Time	PWHT BEFORE ☑	AFTER ☐	HYDROTEST BEFORE ☑	AFTER ☐			
Dis. N° / Dwg. No.	23096-01-EGA1						

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke		
Apparecchio / Equipment type	Twist		
Costruttore / Manufacturer	DIMART		
N° serie / Serial no.	JY4-066		
Corrente / Current	☑ AC	DC ☐	
Distanza / Distance	MAX. 150mm cross		
Potere di sollevamento / Lifting	4,5 kg		

Schema metodo di magnetizzazione Magnetization method sketch

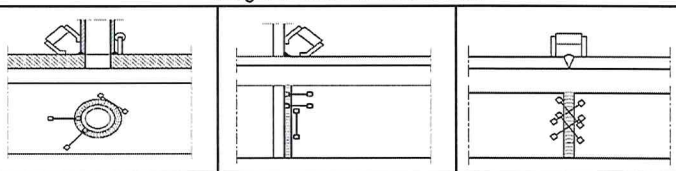


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	n.a.
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY QC.MANAGER M. SALLI DATE : / /	LRQA 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 17/06/24	**Data**/Date 17/06/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

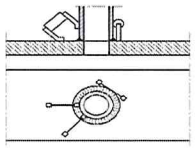
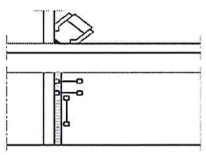
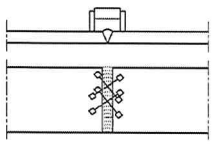
N°. Documento Document No.	23096-01-SNA MT 13
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 59

Descrizione del materiale: Material Description: WELDS OF INTERNAL AND EXTERNAL ATTACHMENTS (INCLUDING SADDLES AND LIFTING DEVICES)

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	AS WELDED
Time	PWHT BEFORE ☑ AFTER ☐		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique		**Schema metodo di magnetizzazione** Magnetization method sketch		
Tipo / Type	Electromagnetic Yoke			
Apparecchio / Equipment type	Twist			
Costruttore / Manufacturer	DIMART			
N° serie / Serial no.	JY4-066			
Corrente / Current	☑ AC DC ☐			
Distanza / Distance	MAX. 150mm cross			
Potere di sollevamento / Lifting	4,5 kg	Fig. a)	Fig. b)	Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	n.a.
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO (PD) - ITALY Q.C. MANAGER M. GALLI DATE: / /	0084 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 25/06/24	Data/Date 25/06/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA MT 14*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 62

Descrizione del materiale: Material Description: REMOVED ATTACHMENTS AREAS

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	GROUND
Time	PWHT BEFORE ☑ AFTER ☐		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke
Apparecchio / Equipment type	Twist
Costruttore / Manufacturer	DIMART
N° serie / Serial no.	JY4-066
Corrente / Current	☑ AC ☐ DC
Distanza / Distance	MAX. 150mm cross
Potere di sollevamento / Lifting	4,5 kg

Schema metodo di magnetizzazione Magnetization method sketch

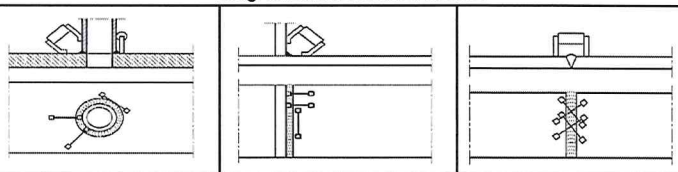


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	n.a.
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA&ROLLE NICOLA TROLIO III LEV. SNT-TC-IA UT-MOD-PHA-MT-PT-RT-ET IV LEVEL UNI EN ISO 9712 UT-MOD-PHA-MT-PT-RT-ET-AT DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M.GALLI DATE : / /	0094 RINA 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 25/06/24	Data/Date 25/06/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

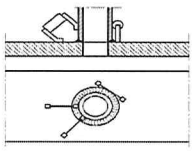
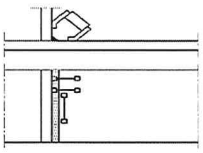
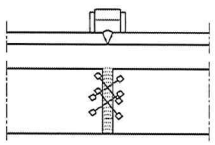
N°. Documento Document No.	23096-01-SNA-MTA-1
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	Ordine N° P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	Disegno Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	N° Fabbrica Serial No.	23096-01-SNA
Sigla Item	V25001 A	P.C.Q. N°. Q.C.P. No.	23096-01-QCPA step 69-70-71

Descrizione del materiale: Material Description:
- ALL BUTT JOINTS AND WELDS OF INTERNAL AND EXTERNAL ATTACHMENTS
- REMOVED ATTACHMENTS AREAS

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	AS WELDED / GROUND
Time	PWHT BEFORE ☐ AFTER ☑		HYDROTEST BEFORE ☑ AFTER ☐		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique		**Schema metodo di magnetizzazione** Magnetization method sketch		
Tipo / Type	Electromagnetic Yoke			
Apparecchio / Equipment type	Twist			
Costruttore / Manufacturer	DIMART			
N° serie / Serial no.	JY4-066			
Corrente / Current	☑ AC ☐ DC			
Distanza / Distance	MAX. 150mm cross			
Potere di sollevamento / Lifting	4,5 kg	Fig. a)	Fig. b)	Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	**n.a.**
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA&ROLLE NICOLA TROLIO III LIV. SNT-TC-1A UT-TOFD-PHA-RT-PT-RT-VT 2 LEVEL UNI EN ISO 9712 UT-TOFD-PHA-RT-PT-RT-VT-LT DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO (PD) - ITALY Q.C.MANAGER M.GALLI DATE: / /	17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 02/08/24	Data/Date 02/08/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO MAGNETOSCOPICO
MAGNETIC PARTICLES EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA-MTH-1*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 80

Descrizione del materiale: Material Description: - EXTERNAL SIDE OF ALL BUTT JOINTS

Material	P.N.1	**Sp.** / Thk. [mm]	SEE DWG	**Surface conditions**	AS WELDED / GROUND
Time	PWHT BEFORE ☐ AFTER ☑		HYDROTEST BEFORE ☐ AFTER ☑		
Dis. N° / Dwg. No.	23096-01-EGA1				

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance criteria
23096-QNDE rev.03 / 003-MTD 21	PR.N° 003 MTD 21 rev.0 para. 9.1 ASME VIII/2 7.5.6.2 ; ASME V - Art.7 Ed. 2021

Tecnica di magnetizzazione Magnetization technique

Tipo / Type	Electromagnetic Yoke
Apparecchio / Equipment type	Twist
Costruttore / Manufacturer	DIMART
N° serie / Serial no.	JY4-066
Corrente / Current	☑ AC ☐ DC
Distanza / Distance	MAX. 150mm cross
Potere di sollevamento / Lifting	4,5 kg

Schema metodo di magnetizzazione Magnetization method sketch

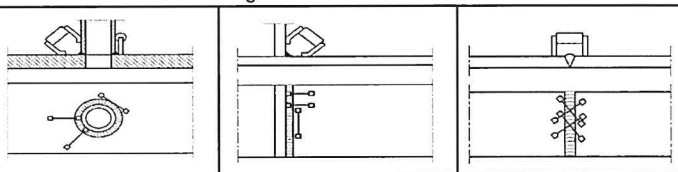


Fig. a) Fig. b) Fig. c)

Metodo d'ispezione Inspection method

Contrasto colore / Color Contrast	☐ **Secco** / Dry	**Polvere** / Powder	**n.a.**	**Contrast paint**	n.a.
Fluorescente / Fluorescent	☑ **Umido** / Wet	**Marca** / Trade mark	C.G.M.	**Prodotto** / Product	-LA150/2 (fluorescent) -LKS35 (color contrast)
Illuminazione / Viewing conditions	☑ **Luce Bianca** / White light	☑ **Luce Nera** / Black Light		**luminosità di fondo** / ambient light Intensity	<1000 lux (fluorescent) > 1076 lux (color contrast)
	Tipo / Type	Portable lamp		**Lung.onda** / Wave lenght	>2200 µW/cm2 at 400mm

Risultato Result

Registrazione delle indicazioni / Recording of indications	none.

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO (PD) - ITALY Q.C.MANAGER DATE: / /	0039 LRQA 17/03/2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17/03/2024
Data/Date 09/08/24	**Data**/Date 09/08/24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI DUREZZE
HARDNESS TEST REPORT

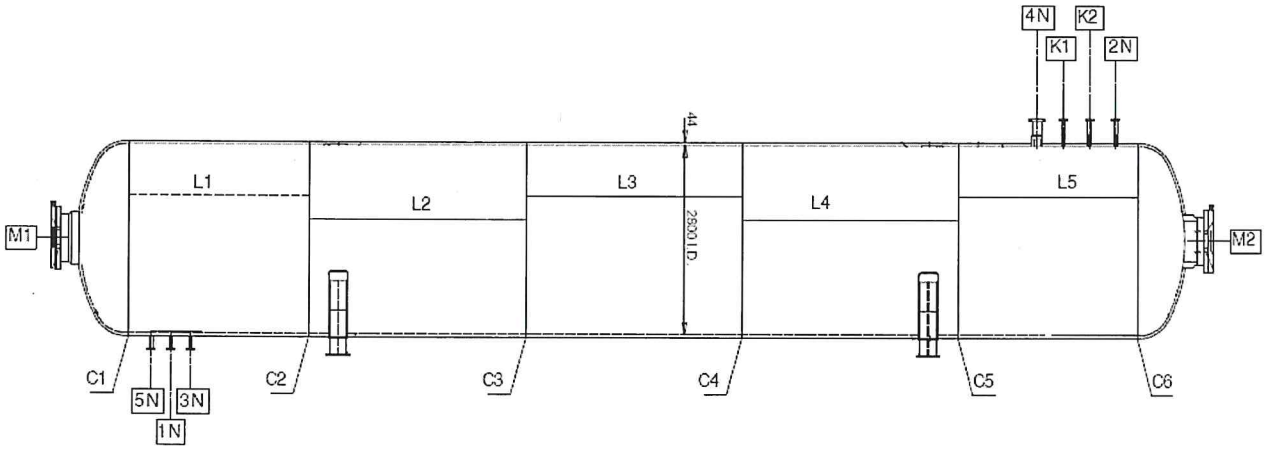
N°. Documento / Document No.	23096-01-SNA-HB01
Pagina / Page	1 di / of 2

Cliente / Customer	ROSETTI MARINO - CROSSWIND	Ordine N° / P.O. No	1723001756 123A90A
Commessa / Mfr' work No.	23096	Disegno / Drawing	23096-01-EGA1
Progetto / Project	Crosswind Hollande Kust Noord Wind Park Project	N° Fabbrica / Serial No.	23096-01-SNA
Sigla / Item	V25001 A	P.C.Q. N°. / Q.C.P. No.	23096-01-QCPA step 75

Material Description: ALL PRESSURE RETAINING BUTT WELDS **AFTER PWHT**

Material P.N.1 max value 200 HB **Thk.** mm Various (see dwg)
Doc. di rif. / Doc. ref. 23096-TWB1 rev.3
Dis. N° / Dwg. No. 23096-01-EGA1

Specifica di riferimento / Reference specification	Strumento utilizzato / Equipment used
23096-QNDE rev.A (008 HB) Doc.N° 123A90-DDL-MAC-SP-50026	BAQ alphaDUR mini SN 1543 *calibration verified with reference Brinnel block Foundrax s.n. 20502/20AW*



Conforme alla specifica / Conform to specification	SI/YES ☑	NO/NO ☐	
Loc./Test place	Albignasego(PD)		
Accettato/Accepted ☑	Non Accettato/NotAccepted ☐	RNC N°/NCR No	
Eseguito da / Performed by	Verificato da QCM / Reviewed by QCM	Ispettore / Inspector	Ispettore / Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: / / Data/Date 05 Aug 24	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M.CALLI DATE: / / Data/Date 05 Aug 24	17. SET. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI DUREZZE
HARDNESS TEST REPORT

Document N°	23096-01-SNA-HB01
Pagina / Page	2 di / of 2

Cliente / Customer	ROSETTI MARINO - CROSSWIND	Ordine N° / P.O. No	1723001756 123A90A
Commessa / Mfr' work No.	23096	Disegno / Drawing	23096-01-EGA1
Progetto / Project	Crosswind Hollande Kust Noord Wind Park Project	N° Fabbrica / Serial No.	23096-01-SNA
Sigla / Item	V25001 A	P.C.Q. N°. / Q.C.P. No.	23096-01-QCPA step 75

Material Description: ALL PRESSURE RETAINING BUTT WELDS **AFTER PWHT**

Material P.N.1 max value 200 HB **Thk.** mm Various (see dwg)
Doc. di rif. / Doc. ref. 23096-TWB1 rev.3
Dis. N° / Dwg. No. 23096-01-EGA1

Specifica di riferimento / Reference specification	Strumento utilizzato / Equipment used
23096-QNDE rev.A (008 HB) Doc.N° 123A90-DDL-MAC-SP-50026	BAQ alphaDUR mini SN 1543 *calibration verified with reference Brinnel block Foundrax s.n. 20502/20AW*

POS	HARDNESS VALUE (HB)					POS	HARDNESS VALUE (HB)					POS	HARDNESS VALUE (HB)				
	1 B.M.	2 B.M.	1 H.A.Z.	2 H.A.Z.	W.M.		1 B.M.	2 B.M.	1 H.A.Z.	2 H.A.Z.	W.M.		1 B.M.	2 B.M.	1 H.A.Z.	2 H.A.Z.	W.M.
C1	152	165	197	197	189												
C2	156	159	193	193	187												
C3	151	162	194	196	188												
C4	159	152	196	192	184												
C5	162	152	193	196	183												
C6	154	161	192	196	189												
L1	157	165	195	192	187												
L2	164	157	194	192	188												
L3	158	150	195	197	182												
L4	160	152	192	196	184												
L5	158	148	193	197	188												
5N	163	165	196	196	185												
1N	149	155	192	196	184												
3N	162	165	194	196	183												
4N	162	164	195	195	187												
K1	165	162	195	194	186												
K2	161	158	194	194	186												
2N	163	154	195	196	183												
M1	166	166	194	195	186												
M2	156	159	193	193	185												

NOTE: test perfomed on internal side of vessel where accessible.

Conforme alla specifica / Conform to specification	SI/YES ☑	NO/NO ☐	
Loc./Test place	Albignasego(PD)		
Accettato/Accepted ☑	Non Accettato/NotAccepted ☐	RNC N°/NCR No	

Eseguito da / Performed by	Verificato da QCM / Reviewed by QCM	Ispettore / Inspector	Ispettore / Inspector
BREMBANA&ROLLE NICOLA TROLIO 2 LEVEL UNI EN ISO 9712 DATE : / / Data/Date 05 Aug 24	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M. GALLI DATE : / / Data/Date 05 Aug 24	17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO ULTRASONORO
ULTRASONIC EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA UT 1*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 23

Descrizione del materiale: Material Description: WELD OF NOZZLE **M1** ON LEFT HEAD

Materiale / Material P.N. 1 — **Sp.** / Thk. [mm] 44 — **Surface Conditions** AS WELDED

Time	PWHT		HYDROTEST	
	BEFORE ☑	AFTER ☐	BEFORE ☑	AFTER ☐

Dis. N° / Dwg. No. 23028-01-EGA1 — **WPS** SEE WELDING BOOK

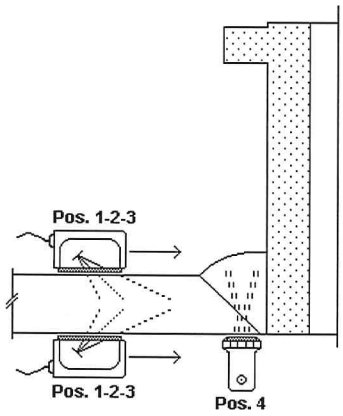
Procedura d'esame / Examination procedure	**Accettabilita' difetti** / Acceptance standard
23096-QNDE rev.03 - 004 UTD 21	ASME VIII/2 para. 7.5.4.2 2021 Ed.; ASME V - Art.4 2021 Ed.; Client's Spec. 123A90-DDL-MAC-SP-50026

Apparecchiatura utilizzata / Equipment used

Apparecchio / Equipment	GE USM GO+	**Costruttore** / Manufacturer	GE	**N° serie** / Serial no.	GOPLS15080123

Cavo / Cable (Type, Impedance, Lenght)	Coaxial / 50Ω / 2 mt	**Accoppiante** / Coupling agent	Methylcellulose paste
Blocco standard / Standard block	V1 Block	**Livello di riferimento** / Reference level	SDH at 80% of screen height
Blocco sensibilità / Sensitivity cal. block	N° 5 - thk. 50mm	**Livello di registrazione** / Recording	50% of ref. Lev.
Riflettore di riferimento / Reference	SDH ø 3 mm	**Livello di indagine** / Investigation level	20% of ref. Lev.
Controllo contaminanti accoppiante / Contaminand check of coupling		☐ **Richiesto** / Required	☑ **Non richiesto** / Not Required
Temperatura pezzo / Part	18°C	**Controllo materiale base adiacente alla saldatura** / Parent material test adjacent to	200 mm

Schema di controllo ultrasonoro / Ultrasonic scanning sketch



Sonde utilizzate / Probes used

Manufacturer	Model	Type	Angle(°)	Crystal	Tipe of wave	Dimens.(mm)	Freq.(MHz)	Serial Number	Pos
KRAUTKRAMER	SWB 45-2	Angle	45	Single	Shear	14 x 14	2	58414-51513	1
KRAUTKRAMER	SWB 60-2	Angle	60	Single	Shear	14 x 14	2	58415-01652	2
KRAUTKRAMER	SWB 70-2	Angle	70	Single	Shear	14 x 14	2	58416-01735	3
GE	SEB4-E	Straight-Foc.	0	Dual	Long	6 x 20	4	57469-9353	4

Dati di esplorazione / Scanning data	**Sensibilità per l'esplorazione** / Scanning sensitivity	DAC +	6	dB
	Perdite di trasferimento / Transfer correction	DAC +		dB

Risultato dell'esame / Examination results: No Recordable Indications.

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO PD - ITALY A.C.MANAGER M. GALLI DATE: / /	0094 LRQA 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17 SEP 2024
Data/Date 20/05/2024	**Data**/Date 20/05/2024		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO ULTRASONORO
ULTRASONIC EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA UT 2*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 30

Descrizione del materiale: Material Description: WELD OF NOZZLE **M2** ON RIGHT HEAD

Materiale / Material P.N. 1 — **Sp.** / Thk. [mm] 44 — **Surface Conditions** AS WELDED

Time	PWHT		HYDROTEST	
	BEFORE ☑	AFTER ☐	BEFORE ☑	AFTER ☐

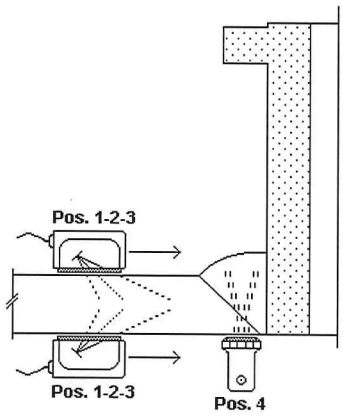
Dis. N° / Dwg. No. 23028-01-EGA1 — **WPS** SEE WELDING BOOK

Procedura d'esame / Examination procedure	**Accettabilita' difetti** / Acceptance standard
23096-QNDE rev.03 - 004 UTD 21	ASME VIII/2 para. 7.5.4.2 2021 Ed.; ASME V - Art.4 2021 Ed.; Client's Spec. 123A90-DDL-MAC-SP-50026

Apparecchiatura utilizzata / Equipment used

Apparecchio / Equipment	GE USM GO+	**Costruttore** / Manufacturer	GE	**N° serie** / Serial no.	GOPLS15080123
Cavo / Cable (Type, Impedance, Lenght)	Coaxial / 50Ω / 2 mt	**Accoppiante** / Coupling agent	Methylcellulose paste		
Blocco standard / Standard block	V1 Block	**Livello di riferimento** / Reference level	SDH at 80% of screen height		
Blocco sensibilità / Sensitivity cal. block	N° 5 - thk. 50mm	**Livello di registrazione** / Recording	50% of ref. Lev.		
Riflettore di riferimento / Reference	SDH ø 3 mm	**Livello di indagine** / Investigation level	20% of ref. Lev.		
Controllo contaminanti accoppiante / Contaminand check of coupling		☐ **Richiesto** / Required	☑ **Non richiesto** / Not Required		
Temperatura pezzo / Part	18°C	**Controllo materiale base adiacente alla saldatura** / Parent material test adjacent to	200 mm		

Schema di controllo ultrasonoro / Ultrasonic scanning sketch



Sonde utilizzate / Probes used

Manufacturer	Model	Type	Angle(°)	Crystal	Tipe of wave	Dimens.(mm)	Freq.(MHz)	Serial Number	Pos
KRAUTKRAMER	SWB 45-2	Angle	45	Single	Shear	14 x 14	2	58414-51513	1
KRAUTKRAMER	SWB 60-2	Angle	60	Single	Shear	14 x 14	2	58415-01652	2
KRAUTKRAMER	SWB 70-2	Angle	70	Single	Shear	14 x 14	2	58416-01735	3
GE	SEB4-E	Straight-Foc.	0	Dual	Long	6 x 20	4	57469-9353	4

Dati di esplorazione / Scanning data	**Sensibilità per l'esplorazione** / Scanning sensitivity	DAC +	6	dB
	Perdite di trasferimento / Transfer correction	DAC +		dB

Risultato dell'esame / Examination results: No Recordable Indications.

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY QC MANAGER M. GALLI DATE : / /	0086 LRQA 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed LRQA Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 24/05/2024	Data/Date 24/05/2024		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO ULTRASONORO
ULTRASONIC EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA UT 3*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 42

Descrizione del materiale: Material Description: WELDS OF NOZZLES **5N-1N-3N-4N-K1-K2-2N** ON SHELL COURSES

Materiale / Material P.N. 1 — **Sp.** / Thk. [mm] 44 — **Surface Conditions** AS WELDED

Time	PWHT		HYDROTEST	
	BEFORE ☑	AFTER ☐	BEFORE ☑	AFTER ☐

Dis. N° / Dwg. No. 23028-01-EGA1 — **WPS** SEE WELDING BOOK

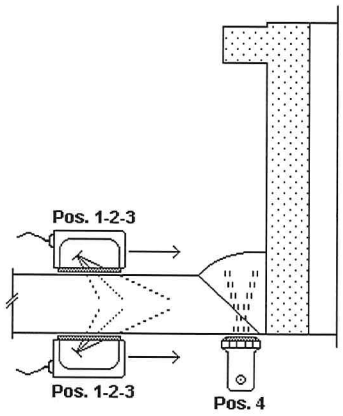
Procedura d'esame / Examination procedure	**Accettabilita' difetti** / Acceptance standard
23096-QNDE rev.03 - 004 UTD 21	ASME VIII/2 para. 7.5.4.2 2021 Ed.; ASME V - Art.4 2021 Ed.; Client's Spec. 123A90-DDL-MAC-SP-50026

Apparecchiatura utilizzata / Equipment used

Apparecchio / Equipment	GE USM GO+	**Costruttore** / Manufacturer	GE	**N° serie** / Serial no.	GOPLS15080123

Cavo / Cable (Type, Impedance, Lenght)	Coaxial / 50Ω / 2 mt	**Accoppiante** / Coupling agent	Methylcellulose paste
Blocco standard / Standard block	V1 Block	**Livello di riferimento** / Reference level	SDH at 80% of screen height
Blocco sensibilità / Sensitivity cal. block	N° 5 - thk. 50mm	**Livello di registrazione** / Recording	50% of ref. Lev.
Riflettore di riferimento / Reference	SDH ø 3 mm	**Livello di indagine** / Investigation level	20% of ref. Lev.
Controllo contaminanti accoppiante / Contaminand check of coupling		☐ **Richiesto** / Required	☑ **Non richiesto** / Not Required
Temperatura pezzo / Part	18°C	**Controllo materiale base adiacente alla saldatura** / Parent material test adjacent to	200 mm

Schema di controllo ultrasonoro / Ultrasonic scanning sketch



Sonde utilizzate / Probes used

Manufacturer	Model	Type	Angle(°)	Crystal	Tipe of wave	Dimens.(mm)	Freq.(MHz)	Serial Number	Pos
KRAUTKRAMER	SWB 45-2	Angle	45	Single	Shear	14 x 14	2	58414-51513	1
KRAUTKRAMER	SWB 60-2	Angle	60	Single	Shear	14 x 14	2	58415-01652	2
KRAUTKRAMER	SWB 70-2	Angle	70	Single	Shear	14 x 14	2	58416-01735	3
GE	SEB4-E	Straight-Foc.	0	Dual	Long	6 x 20	4	57469-9353	4

Dati di esplorazione / Scanning data	**Sensibilità per l'esplorazione** / Scanning sensitivity	DAC +	6	dB
	Perdite di trasferimento / Transfer correction	DAC +		dB

Risultato dell'esame / Examination results: No Recordable Indications.

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: Data/Date 25/06/24	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M. CALLI DATE: / / Data/Date 25/06/24	0084 RINA 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector, N.B. No. 17119 Milan Office 17. SEP. 2024

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO ULTRASONORO
ULTRASONIC EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA UT 4*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 63

Descrizione del materiale: Material Description: WELDS OF LIFTING LUGS ON SHELL

Materiale / Material P.N. 1 — **Sp.** / Thk. [mm] 30 — **Surface Conditions** AS WELDED

Time	PWHT	HYDROTEST
BEFORE	☑	☑
AFTER	☐	☐

Dis. N° / Dwg. No. 23028-01-EGA1 — **WPS** SEE WELDING BOOK

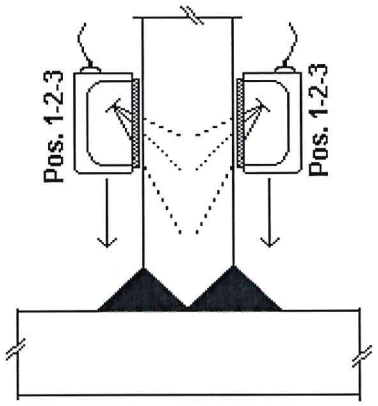
Procedura d'esame / Examination procedure	**Accettabilita' difetti** / Acceptance standard
23096-QNDE rev.03 - 004 UTD 21	ASME VIII/2 para. 7.5.4.2 2021 Ed.; ASME V - Art.4 2021 Ed.; Client's Spec. 123A90-DDL-MAC-SP-50026

Apparecchiatura utilizzata / Equipment used

Apparecchio / Equipment	GE USM GO+	**Costruttore** / Manufacturer	GE	**N° serie** / Serial no.	GOPLS15080123

Cavo / Cable (Type, Impedance, Lenght)	Coaxial / 50Ω / 2 mt	**Accoppiante** / Coupling agent	Methylcellulose paste
Blocco standard / Standard block	V2 Block	**Livello di riferimento** / Reference level	SDH at 80% of screen height
Blocco sensibilità / Sensitivity cal. block	N° 51 - thk. 38mm	**Livello di registrazione** / Recording	50% of ref. Lev.
Riflettore di riferimento / Reference	SDH ø 3 mm	**Livello di indagine** / Investigation level	20% of ref. Lev.
Controllo contaminanti accoppiante / Contaminand check of coupling		☐ **Richiesto** / Required	☑ **Non richiesto** / Not Required
Temperatura pezzo / Part	18°C	**Controllo materiale base adiacente alla saldatura** / Parent material test adjacent to	200 mm

Schema di controllo ultrasonoro / Ultrasonic scanning sketch



Sonde utilizzate / Probes used

Manufacturer	Model	Type	Angle(°)	Crystal	Tipe of wave	Dimens.(mm)	Freq.(MHz)	Serial Number	Pos
GE	MWB 45-4	Angle	45	Single	Shear	8 x 9	4	56927-58154	1
GE	MWB 60-4	Angle	60	Single	Shear	8 x 9	4	56928-57878	2
GE	MWB 70-4	Angle	70	Single	Shear	8 x 9	4	56929-70990	3

Dati di esplorazione / Scanning data	**Sensibilità per l'esplorazione** / Scanning sensitivity	DAC +	6	dB
	Perdite di trasferimento / Transfer correction	DAC +		dB

Risultato dell'esame / Examination results: No Recordable Indications.

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE MASSIMILIANO GALLI II LEV. SNT-TC-1A UT-MT-PT-RT-VT 2 LEVEL UNI EN ISO 9712 UT-MT-PT-RT-VT DATE:	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M. GALLI DATE:	0084 17. SEP. 2024	LRQA Verification Limited ☐ ~~Witnessed~~ ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 25/07/2024	Data/Date		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO ULTRASONORO
ULTRASONIC EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA-UTA-1*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 72

Descrizione del materiale: Material Description: WELDS OF NOZZLES **M1-M2-5N-1N-3N-4N-K1-K2-2N** ON SHELL AND HEADS

Materiale / Material P.N. 1 — **Sp.** / Thk. [mm] 44 — **Surface Conditions** AS WELDED

Time	PWHT		HYDROTEST	
	BEFORE ☐	AFTER ☑	BEFORE ☑	AFTER ☐

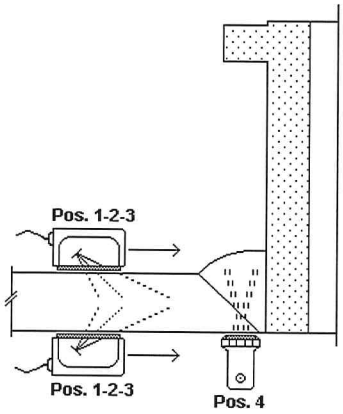
Dis. N° / Dwg. No. 23028-01-EGA1 — **WPS** SEE WELDING BOOK

Procedura d'esame / Examination procedure	**Accettabilita' difetti** / Acceptance standard
23096-QNDE rev.03 - 004 UTD 21	ASME VIII/2 para. 7.5.4.2 2021 Ed.; ASME V - Art.4 2021 Ed.; Client's Spec. 123A90-DDL-MAC-SP-50026

Apparecchiatura utilizzata / Equipment used

Apparecchio / Equipment	GE USM GO+	**Costruttore** / Manufacturer	GE	**N° serie** / Serial no.	GOPLS15080123
Cavo / Cable (Type, Impedance, Lenght)	Coaxial / 50Ω / 2 mt	**Accoppiante** / Coupling agent	Methylcellulose paste		
Blocco standard / Standard block	V1 Block	**Livello di riferimento** / Reference level	SDH at 80% of screen height		
Blocco sensibilità / Sensitivity cal. block	N° 5 - thk. 50mm	**Livello di registrazione** / Recording	50% of ref. Lev.		
Riflettore di riferimento / Reference	SDH ø 3 mm	**Livello di indagine** / Investigation level	20% of ref. Lev.		
Controllo contaminanti accoppiante / Contaminand check of coupling		☐ **Richiesto** / Required	☑ **Non richiesto** / Not Required		
Temperatura pezzo / Part	18°C	**Controllo materiale base adiacente alla saldatura** / Parent material test adjacent to	200 mm		

Schema di controllo ultrasonoro / Ultrasonic scanning sketch



Sonde utilizzate / Probes used

Manufacturer	Model	Type	Angle(°)	Crystal	Tipe of wave	Dimens.(mm)	Freq.(MHz)	Serial Number	Pos
KRAUTKRAMER	SWB 45-2	Angle	45	Single	Shear	14 x 14	2	58414-51513	1
KRAUTKRAMER	SWB 60-2	Angle	60	Single	Shear	14 x 14	2	58415-01652	2
KRAUTKRAMER	SWB 70-2	Angle	70	Single	Shear	14 x 14	2	58416-01735	3
GE	SEB4-E	Straight-Foc.	0	Dual	Long	6 x 20	4	57469-9353	4

Dati di esplorazione / Scanning data	**Sensibilità per l'esplorazione** / Scanning sensitivity	DAC +	6	dB
	Perdite di trasferimento / Transfer correction	DAC +		dB

Risultato dell'esame / Examination results: No Recordable Indications.

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : / / Data/Date 02/08/24	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C. MANAGER M. GALLI DATE : / / Data/Date 02/08/24	0084 17. SEP. 2024	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17 SEP 2024

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO ULTRASONORO
ULTRASONIC EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA-UTA-2*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO - CROSSWIND	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 73

Descrizione del materiale: Material Description: LONGITUDINAL AND CIRCUMFERENTIAL WELDS OF SHELL **L1÷L5 / C1÷C6**

Materiale / Material P.N. 1 — **Sp.** / Thk. [mm] 44 — **Surface Conditions** AS WELDED

Time	PWHT		HYDROTEST	
	BEFORE ☐	AFTER ☑	BEFORE ☑	AFTER ☐

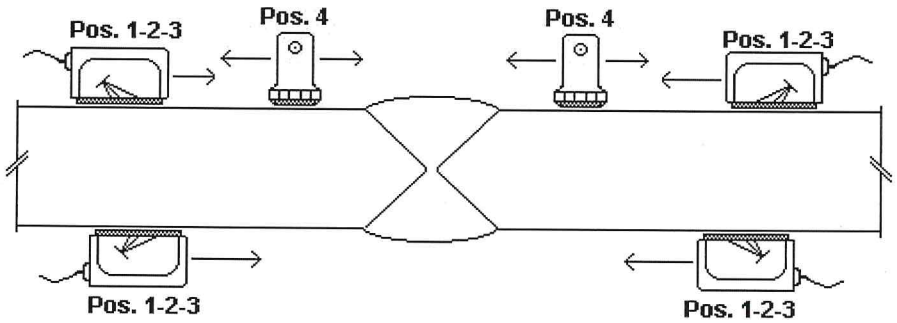
Dis. N° / Dwg. No. 23028-01-EGA1 — **WPS** SEE WELDING BOOK

Procedura d'esame / Examination procedure	**Accettabilita' difetti** / Acceptance standard
23096-QNDE rev.03 - 004 UTD 21	ASME VIII/2 para. 7.5.4.2 2021 Ed.; ASME V - Art.4 2021 Ed.; Client's Spec. 123A90-DDL-MAC-SP-50026

Apparecchiatura utilizzata / Equipment used

Apparecchio / Equipment	GE USM GO+	**Costruttore** / Manufacturer	GE	**N° serie** / Serial no.	GOPLS15080123
Cavo / Cable (Type, Impedance, Lenght)	Coaxial / 50Ω / 2 mt	**Accoppiante** / Coupling agent	Methylcellulose paste		
Blocco standard / Standard block	V1 Block	**Livello di riferimento** / Reference level	SDH at 80% of screen height		
Blocco sensibilità / Sensitivity cal. block	N° 5 - thk. 50mm	**Livello di registrazione** / Recording	50% of ref. Lev.		
Riflettore di riferimento / Reference	SDH ø 3 mm	**Livello di indagine** / Investigation level	20% of ref. Lev.		
Controllo contaminanti accoppiante / Contaminand check of coupling		☐ **Richiesto** / Required	☑ **Non richiesto** / Not Required		
Temperatura pezzo / Part	18°C	**Controllo materiale base adiacente alla saldatura** / Parent material test adjacent to	200 mm		

Schema di controllo ultrasonoro / Ultrasonic scanning sketch



Sonde utilizzate / Probes used

Manufacturer	Model	Type	Angle(°)	Crystal	Tipe of wave	Dimens.(mm)	Freq.(MHz)	Serial Number	Pos
KRAUTKRAMER	SWB 45-2	Angle	45	Single	Shear	14 x 14	2	58414-51513	1
KRAUTKRAMER	SWB 60-2	Angle	60	Single	Shear	14 x 14	2	58415-01652	2
KRAUTKRAMER	SWB 70-2	Angle	70	Single	Shear	14 x 14	2	58416-01735	3
GE	SEB4-E	Straight-Foc.	0	Dual	Long	6 x 20	4	57469-9353	4

Dati di esplorazione / Scanning data	**Sensibilità per l'esplorazione** / Scanning sensitivity	DAC +	6	dB
	Perdite di trasferimento / Transfer correction	DAC +		dB

Risultato dell'esame / Examination results: No Recordable Indications.

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA IROLIO DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY QC MANAGER M. GALLI DATE : 02 / 08 / 24	0094	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 02/08/24	**Data**/Date	17 SEP 2024	

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO ULTRASONORO
ULTRASONIC EXAMINATION REPORT

N°. Documento Document No.	*23096-01-SNA-UTA-3*
Pagina Page	1 di of 1

Cliente Customer	**ROSETTI MARINO - CROSSWIND**	**Ordine N°** P.O. No	**1723001756 123A90A**
Commessa Mfr' work No.	**23096**	**Disegno** Drawing	**23096-01-EGA1**
Progetto Project	**Crosswind Hollande Kust Noord Wind Park Project**	**N° Fabbrica** Serial No.	**23096-01-SNA**
Sigla Item	**V25001 A**	**P.C.Q. N°.** Q.C.P. No.	**23096-01-QCPA** step 74

Descrizione del materiale: Material Description: WELDS OF LIFTING LUGS ON SHELL

Materiale / Material P.N. 1 — **Sp.** / Thk. [mm] 30 — **Surface Conditions** AS WELDED

Time	PWHT	HYDROTEST
BEFORE	☐	☑
AFTER	☑	☐

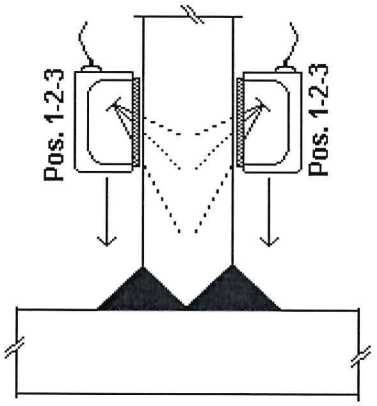
Dis. N° / Dwg. No. 23028-01-EGA1 — **WPS** SEE WELDING BOOK

Procedura d'esame / Examination procedure	**Accettabilita' difetti** / Acceptance standard
23096-QNDE rev.03 - 004 UTD 21	ASME VIII/2 para. 7.5.4.2 2021 Ed.; ASME V - Art.4 2021 Ed.; Client's Spec. 123A90-DDL-MAC-SP-50026

Apparecchiatura utilizzata / Equipment used

Apparecchio / Equipment	GE USM GO+	**Costruttore** / Manufacturer	GE	**N° serie** / Serial no.	GOPLS15080123
Cavo / Cable (Type, Impedance, Lenght)	Coaxial / 50Ω / 2 mt	**Accoppiante** / Coupling agent	Methylcellulose paste		
Blocco standard / Standard block	V2 Block	**Livello di riferimento** / Reference level	SDH at 80% of screen height		
Blocco sensibilità / Sensitivity cal. block	N° 51 - thk. 38mm	**Livello di registrazione** / Recording	50% of ref. Lev.		
Riflettore di riferimento / Reference	SDH ø 3 mm	**Livello di indagine** / Investigation level	20% of ref. Lev.		
Controllo contaminanti accoppiante / Contaminand check of coupling	☐ **Richiesto** / Required	☑ **Non richiesto** / Not Required			
Temperatura pezzo / Part	18°C	**Controllo materiale base adiacente alla saldatura** / Parent material test adjacent to	200 mm		

Schema di controllo ultrasonoro / Ultrasonic scanning sketch



Sonde utilizzate / Probes used

Manufacturer	Model	Type	Angle(°)	Crystal	Tipe of wave	Dimens.(mm)	Freq.(MHz)	Serial Number	Pos
GE	MWB 45-4	Angle	45	Single	Shear	8 x 9	4	56927-58154	1
GE	MWB 60-4	Angle	60	Single	Shear	8 x 9	4	56928-57878	2
GE	MWB 70-4	Angle	70	Single	Shear	8 x 9	4	56929-70990	3

Dati di esplorazione / Scanning data	**Sensibilità per l'esplorazione** / Scanning sensitivity	DAC +	6	dB
	Perdite di trasferimento / Transfer correction	DAC +		dB

Risultato dell'esame / Examination results: No Recordable Indications.

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA&ROLLE MASSIMILIANO GALLI III LEV. SNT-TC-1A UT-MT-PT-RT-VT 2 LEVEL UNI EN ISO 9712 UT-MT-PT-RT-VT DATE :	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M. GALLI DATE : / /	0094	LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 17. SEP. 2024
Data/Date 02/08/2024	Data/Date 02/08/2024	17. SEP. 2024	

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

N°. Documento Document No.	23096-01-SNA - RT 1
Pagina Page	1 di of 10

Cliente Customer	Rosetti Marino / Crosswind	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	Crosswind Hollande Kust Noord Wind Park Project	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 36-48-54

Descrizione del materiale: Material Description: LONGITUDINAL AND CIRCUMFERENTIAL WELDS OF SHELL

Materiale / Material CARBON STEEL P.N. 1

Time	PWHT		HYDROTEST	
	BEFORE ☑	AFTER ☐	BEFORE ☑	AFTER ☐

Dis. N° / Dwg. No.

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance specification
23096-QNDE rev.03 - 001 RT 21	ASME VIII/2 para. 7.5.3.2 / ASME V - Art.2 Client's doc. 123A90-DDL-MAC-SP-50026

Attrezzatura utilizzata Equipment used

Costruttore/Manufactur	**Costrutt.**/Manufacturer*	**Costrutt.**/Manufacturer*		
1 - COMET	2 - COMET	3 - Gamma-Ray (Rγ)	**Schermi piombo** / Lead screen	F = 0,05 ; B = 0,05mm
Tipo / Type	**Tipo** / Type	**Isotopo** / Isotope	**Sviluppo pellicole** / Film processing	Automatic
PXS EVO 300/3 D	PXS EVO 300/3 P	Iridium 192	**Verifica retrodiffusione** / Backscattered	Ok, verified
Macchia focale / Focal [mm] 1,41	**Macchia focale** / Focal [mm] 5,19	**Macchia focale** / Focal [mm] 3,160	**I procedimenti di saldatura possono essere visionati sul quaderno di saldatura.** The welding procedures could be verified on the Welding book.	

Descrizione / Description

Id. weld	Dimensions [mm]			Distance Source-object (D)	Distance weld-film (d)	Unsharpnes s (Ug)	Equip. Used*	Wall Exposure	Wall Viewing	Film type	Radiograph performed		Date of test
	ø ext.	Thk.	Lenght								No. of films	Film per holder	
L1	2888,0	44	3300	800	47	0,08	1	Single	Single	T200	11	1	21 Mar 24
L2	2888,0	44	3300	800	47	0,08	1	Single	Single	AA400	12	1	08 Jun 24
L3	2888,0	44	3300	800	47	0,08	1	Single	Single	T200	12	1	08 Jun 24
L4	2888,0	44	3300	800	47	0,08	1	Single	Single	AA400	12	1	05 May 24
L5	2888,0	44	3300	800	47	0,08	1	Single	Single	T200	11	1	18 Apr 24
C1	2888,0	44	9068	1400	47	0,17	2	Single	Single	AA400	31	1	05 Jul 24
C2	2888,0	44	9068	1400	47	0,17	2	Single	Single	AA400	31	1	25 Jun 24
C3	2888,0	44	9068	1400	47	0,17	2	Single	Single	AA400	31	1	03 Jul 24
C4	2888,0	44	9068	1400	47	0,17	2	Single	Single	AA400	31	1	18 May 24
C5	2888,0	44	9068	1400	47	0,17	2	Single	Single	AA400	31	1	20 Jul 24
C6	2888,0	44	9068	1400	47	0,17	2	Single	Single	AA400	31	1	20 Jul 24

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

LRQA Verification Limited ☐ Witnessed ☑ Reviewed LRQA Mattia Crivellari Authorized Inspector N.B. No. 17419 Milan Office 09/08/2024

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector
BREMBANA&ROLLE NICOLA TROLIO II LIV. SMT-TC-IA UT-TOFD-PAUT-MT-PT-RT-VT 2 LEVEL (DIN EN ISO 9712 UT-TOFD-PAUT-MT-PT-RT-VT-IT DATE : / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO (PD) - ITALY Q.C. MANAGER M. CALLI DATE : / /	LRQA verification ltd N 009 ☐ Witnessed ☐ Monitored ☑ Reviewed LRQA MATTIA CRIVELLARI Ref. No.. Office: Milan 09/08/2024
Data/Date 26 Jul 24	**Data**/Date 20 May 24	Ispettore Inspector

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

N°. Documento Document	23096-01-SNA - RT 1
Pagina Page	2 di of 10

Tabella visione lastre radiografiche / Radiograph Review form

Weld Id.	Film No.		Welder	Film size [cm]	Density	I.Q.I. Type	I.Q.I. Location	I.Q.I. Sensitivity	Ry Ci	Rx KV	Rx mA	Expos Time	Indications **	Result ***	Remarks
L4	1	2		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	2	3		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	3	4		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	4	5		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	5	6		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	6	7		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	7	8		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	8	9		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	9	10		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	10	11		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	11	12		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L4	12	13		15X40	2,3÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
C4	1	2		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	2	3		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	3	4		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	4	5		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	5	6		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'	12	1	
C4	6	7		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	7	8		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'	12	1	
C4	8	9		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'	12	1	
C4	9	10		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	10	11		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'	12	1	
C4	11	12		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	12	13		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	13	14		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	13	14		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	13	14		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	14	15		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	17	18		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	18	19		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	

Indicazioni / Indications **

100 Crack	203 Micro-shrinkage	5013 Shrinkage grooves	516 Root porosity
101 Longitudinal crack	2031 Interdendritic microshrinka	5014 Inter-pass undercut	517 Poor restart
102 Transverse crack	2032 Transgranular microshrinka	5015 Local intermittent undercut	520 Excessive distortion
103 Radiating cracks	300 Solid inclusion	502 Excess weld metal	521 Incorret weld dimensions
104 Crater crack	301 Slag inclusion	503 Excessive convexity	5211 Excessive weld thickness
105 Group of disconnected cracks	302 Flux inclusion	504 Excessive penetration	5212 Excessive weld width
106 Branching crack	303 Oxide iclusion	5041 Local excessive penetration	5213 Insufficient throat thickness
201 Gas cavity	3034 Puckering	5042 Continuos excessive penetratio	5214 Excessive throat thickness
2011 Gas pore	304 Metallic inclusion	5043 Excessive melt-through	600 Miscellaneous imperfections
2012 Uniformly distribuited porosity	3041 Tungsten inclusion	505 Incorrect weld toe	601 Arc strike
2013 Clustered (localized) porosity	3042 Copper inclusion	506 Overlap	602 Spatter
2014 Linear porosity	400 Lack of fusion and penetrat	507 Linear misalignment	6021 Tungsten spatter
2015 Elongated cavity	401 Lack of fusion	508 Angular misalignment	603 Torn surface
2016 Worm-hole	402 Lack of penetration	509 Sagging	604 Grinding mark
2017 Surface pore	4021 Incomplete root penetratic	510 Burn-through	605 Chipping mark
2018 Surface porosity	403 Spiking	511 Incompletely fillet groove	606 Underflushing
202 Shrinkage cavity	500 Imperfect shape	512 Excessive asymmetry of fillet w	608 Misalignment of opposite runs
2021 Interdendritic shrinkage	501 Undercut	513 Irregular width	613 Scaled surface
2024 Crater pipe	5011 Continuos undercut	514 Irregular surface	614 Flux residue
2025 End crater pipe	5012 Intermitted undercut	515 Root concavity	12 Film Defect

Risultato / Result ***

1 Accepted

2 To be repaired

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 09/08/2024

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ | **Non Accettato**/NotAccepted ☐ | **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: / /	BREMBANA & ROLLE S.p.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M.GALLI DATE: / /	☐ LRQA verification ltd ☐ Witnessed ☐ Monitored ☑ Reviewed MATTIA CRIVELLARI Ref. No. Office: Milan 09/08/2024	
Data/Date 26 Jul 24	Data/Date 26 Jul 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

N°. Documento / Document: 23096-01-SNA - RT -1

Pagina / Page: 3 di / of 10

Tabella visione lastre radiografiche / Radiograph Review form

Weld Id.	Film No.		Welder	Film size [cm]	Density	I.Q.I. Type	I.Q.I. Location	I.Q.I. Sensitivity	Ry Ci	Rx KV	Rx mA	Expos Time	Indications **	Result ***	Remarks
C4	19	20		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	20	21		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	21	22		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	22	23		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	23	24		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	24	25		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	25	26		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	26	27		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	27	28		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	28	29		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	29	30		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	30	31		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
C4	31	1		15X40	2,2÷3,0	ASTM 1B-11	Source	W8		300	2,5	45'		1	
L1	1	2		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L1	2	3		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L1	3	4		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L1	4	5		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L1	5	6		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L1	6	7		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L1	7	8		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L1	8	9		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L1	9	10		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L1	10	11		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L1	11	12		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'	2011	1	
L5	1	2		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L5	2	3		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L5	3	4		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L5	4	5		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L5	5	6		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L5	6	7		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	

Indicazioni / Indications **

100	Crack	203	Micro-shrinkage	5013	Shrinkage grooves	516	Root porosity
101	Longitudinal crack	2031	Interdendritic microshrinka	5014	Inter-pass undercut	517	Poor restart
102	Transverse crack	2032	Transgranular microshrinka	5015	Local intermittent undercut	520	Excessive distortion
103	Radiating cracks	300	Solid inclusion	502	Excess weld metal	521	Incorret weld dimensions
104	Crater crack	301	Slag inclusion	503	Excessive convexity	5211	Excessive weld thickness
105	Group of disconnected cracks	302	Flux inclusion	504	Excessive penetration	5212	Excessive weld width
106	Branching crack	303	Oxide iclusion	5041	Local excessive penetration	5213	Insufficient throat thickness
201	Gas cavity	3034	Puckering	5042	Continuos excessive penetratio	5214	Excessive throat thickness
2011	Gas pore	304	Metallic inclusion	5043	Excessive melt-through	600	Miscellaneous imperfections
2012	Uniformly distribuited porosity	3041	Tungsten inclusion	505	Incorrect weld toe	601	Arc strike
2013	Clustered (localized) porosity	3042	Copper inclusion	506	Overlap	602	Spatter
2014	Linear porosity	400	Lack of fusion and penetrat	507	Linear misalignment	6021	Tungsten spatter
2015	Elongated cavity	401	Lack of fusion	508	Angular misalignment	603	Torn surface
2016	Worm-hole	402	Lack of penetration	509	Sagging	604	Grinding mark
2017	Surface pore	4021	Incomplete root penetratic	510	Burn-through	605	Chipping mark
2018	Surface porosity	403	Spiking	511	Incompletely fillet groove	606	Underflushing
202	Shrinkage cavity	500	Imperfect shape	512	Excessive asymmetry of fillet w	608	Misalignment of opposite runs
2021	Interdendritic shrinkage	501	Undercut	513	Irregular width	613	Scaled surface
2024	Crater pipe	5011	Continuos undercut	514	Irregular surface	614	Flux residue
2025	End crater pipe	5012	Intermitted undercut	515	Root concavity	12	Film Defect

Risultato / Result ***

1 Accepted

2 To be repaired

LRQA Verification Limited ☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office
09/08/2024

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ | **Non Accettato**/NotAccepted ☐ | **RNC N°**/NCR Nº

Eseguito da / Performed by	Verificato da QCM / Reviewed by QCM	Ispettore / Inspector
BREMBANA&ROLLE NICOLA TROLIO II LEV. SNT-TC-IA UT-TRD-PHA-MT-PT-RT-VT 2 LEVEL UNI EN ISO 9712 ICT 106-PHA-MT-PT-RT-TT-LT DATE :	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M.GALLI DATE : / /	LRQA verification ltd ☑ Witnessed ☐ Monitored ☑ Reviewed MATTIA CRIVELLARI Ref. No.. Office: Milan 09/08/2024
Data/Date 26 Jul 24	Data/Date 26 Jul 24	Ispettore / Inspector

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

N°. Documento / Document	23096-01-SNA - RT 1
Pagina / Page	4 di / of 10

Tabella visione lastre radiografiche / Radiograph Review form

Weld Id.	Film No.		Welder	Film size [cm]	Density	I.Q.I. Type	I.Q.I. Location	I.Q.I. Sensitivity	Ry Ci	Rx KV	Rx mA	Expos Time	Indications **	Result ***	Remarks
L3	7	8		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L5	8	9		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L5	9	10		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L5	10	11		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L5	11	12		15X40	2,6÷3,5	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L3	1	2		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L3	2	3		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L3	3	4		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L3	4	5		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L3	5	6		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L3	6	7		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L3	7	8		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L3	8	9		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'	2011+12	1	
L3	9	10		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'	12	1	
L3	10	11		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L3	11	12		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'		1	
L3	12	13		15X40	2,1÷3,0	ASTM 1B-11	Source	W7		370	10,0	1'		1	
C1	1	2		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C1	2	3		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	3	4		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	2011	1	
C1	4	5		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	12+2011	1	
C1	5	6		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	2011	1	
C1	6	7		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	7	8		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	2013	1	
C1	8	9		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	9	10		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C1	10	11		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	2016	1	
C1	11	12		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	12	13		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	13	14		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	

Indicazioni / Indications **

100 Crack	203 Micro-shrinkage	5013 Shrinkage grooves	516 Root porosity
101 Longitudinal crack	2031 Interdendritic microshrinka	5014 Inter-pass undercut	517 Poor restart
102 Transverse crack	2032 Transgranular microshrinka	5015 Local intermittent undercut	520 Excessive distortion
103 Radiating cracks	300 Solid inclusion	502 Excess weld metal	521 Incorret weld dimensions
104 Crater crack	301 Slag inclusion	503 Excessive convexity	5211 Excessive weld thickness
105 Group of disconnected cracks	302 Flux inclusion	504 Excessive penetration	5212 Excessive weld width
106 Branching crack	303 Oxide iclusion	5041 Local excessive penetration	5213 Insufficient throat thickness
201 Gas cavity	3034 Puckering	5042 Continuos excessive penetratio	5214 Excessive throat thickness
2011 Gas pore	304 Metallic inclusion	5043 Excessive melt-through	600 Miscellaneous imperfections
2012 Uniformly distribuited porosity	3041 Tungsten inclusion	505 Incorrect weld toe	601 Arc strike
2013 Clustered (localized) porosity	3042 Copper inclusion	506 Overlap	602 Spatter
2014 Linear porosity	400 Lack of fusion and penetrat	507 Linear misalignment	6021 Tungsten spatter
2015 Elongated cavity	401 Lack of fusion	508 Angular misalignment	603 Torn surface
2016 Worm-hole	402 Lack of penetration	509 Sagging	604 Grinding mark
2017 Surface pore	4021 Incomplete root penetratic	510 Burn-through	605 Chipping mark
2018 Surface porosity	403 Spiking	511 Incompletely fillet groove	606 Underflushing
202 Shrinkage cavity	500 Imperfect shape	512 Excessive asymmetry of fillet w	608 Misalignment of opposite runs
2021 Interdendritic shrinkage	501 Undercut	513 Irregular width	613 Scaled surface
2024 Crater pipe	5011 Continuos undercut	514 Irregular surface	614 Flux residue
2025 End crater pipe	5012 Intermitted undercut	515 Root concavity	12 Film Defect

Risultato / Result ***

1 Accepted

2 To be repaired

LRQA Verification Limited ☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 09/08/2024

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da / Performed by	Verificato da QCM / Reviewed by QCM	Ispettore / Inspector	Ispettore / Inspector
BREMBANA&ROLLE NICOLA TROLIO II LEVEL SNT-TC-1A UT-TOFD-PHA-MT-PT-RT-VT 3 LEVEL UNI EN ISO 9712 UT-TOFD-PHA-MT-PT-RT-VT-LT DATE : 26 Jul 24	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M.GALLI DATE : / /	LRQA verification ltd ☐ Witnessed ☐ Monitored ☑ Reviewed MATTIA CRIVELLARI Ref. No.. Office: Milan 09/08/2024	
Data/Date 26 Jul 24	Data/Date 26 Jul 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

N°. Documento Document	23096-01-SNA - RT 1
Pagina Page	5 di of 10

Tabella visione lastre radiografiche / Radiograph Review form

Weld Id.	Film No.		Welder	Film size [cm]	Density	I.Q.I. Type	I.Q.I. Location	I.Q.I. Sensitivity	Ry Ci	Rx KV	Rx mA	Expos Time	Indications **	Result ***	Remarks
C1	14	15		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	15	16		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	16	17		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	17	18		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	301+2015	1	
C1	18	19		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	19	20		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	20	21		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	21	22		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	22	23		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	23	24		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	24	25		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	25	26		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	26	27		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	27	28		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	28	29		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	29	30		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C1	30	31		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	30-31	1	
C2	1	2		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	2015	1	
C2	2	3		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	3	4		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	4	5		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	5	6		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	6	7		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C2	7	8		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	8	9		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	9	10		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	10	11		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	11	12		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	12	13		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	13	14		15X40	2,0÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	

Indicazioni / Indications **

100 Crack	203 Micro-shrinkage	5013 Shrinkage grooves	516 Root porosity
101 Longitudinal crack	2031 Interdendritic microshrinka	5014 Inter-pass undercut	517 Poor restart
102 Transverse crack	2032 Transgranular microshrinka	5015 Local intermittent undercut	520 Excessive distortion
103 Radiating cracks	300 Solid inclusion	502 Excess weld metal	521 Incorret weld dimensions
104 Crater crack	301 Slag inclusion	503 Excessive convexity	5211 Excessive weld thickness
105 Group of disconnected cracks	302 Flux inclusion	504 Excessive penetration	5212 Excessive weld width
106 Branching crack	303 Oxide iclusion	5041 Local excessive penetration	5213 Insufficient throat thickness
201 Gas cavity	3034 Puckering	5042 Continuos excessive penetratio	5214 Excessive throat thickness
2011 Gas pore	304 Metallic inclusion	5043 Excessive melt-through	600 Miscellaneous imperfections
2012 Uniformly distribuited porosity	3041 Tungsten inclusion	505 Incorrect weld toe	601 Arc strike
2013 Clustered (localized) porosity	3042 Copper inclusion	506 Overlap	602 Spatter
2014 Linear porosity	400 Lack of fusion and penetrat	507 Linear misalignment	6021 Tungsten spatter
2015 Elongated cavity	401 Lack of fusion	508 Angular misalignment	603 Torn surface
2016 Worm-hole	402 Lack of penetration	509 Sagging	604 Grinding mark
2017 Surface pore	4021 Incomplete root penetratic	510 Burn-through	605 Chipping mark
2018 Surface porosity	403 Spiking	511 Incompletely fillet groove	606 Underflushing
202 Shrinkage cavity	500 Imperfect shape	512 Excessive asymmetry of fillet w	608 Misalignment of opposite runs
2021 Interdendritic shrinkage	501 Undercut	513 Irregular width	613 Scaled surface
2024 Crater pipe	5011 Continuos undercut	514 Irregular surface	614 Flux residue
2025 End crater pipe	5012 Intermitted undercut	515 Root concavity	12 Film Defect

Risultato / Result ***

1 Accepted

2 To be repaired

LRQA Verification Limited
Witnessed Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 1719
Milan Office 09/08/2024

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C. MANAGER M. GALLI DATE: / /	LRQA verification ltd Witnessed Reviewed MATTIA CRIVELLARI Ref No.. Office Milan 09/08/2024	
Data/Date 26 Jul 24	Data/Date 26 Jul 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

N°. Documento / Document: 23096-01-SNA - RT 1

Pagina / Page: 6 di / of 10

Tabella visione lastre radiografiche / Radiograph Review form

Weld Id.	Film No.		Welder	Film size [cm]	Density	I.Q.I. Type	I.Q.I. Location	I.Q.I. Sensitivity	Ry Ci	Rx KV	Rx mA	Expos Time	Indications **	Result ***	Remarks
C2	14	15		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C2	15	16		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	16	17		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	17	18		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	18	19		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	19	20		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	20	21		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	21	22		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	22	23		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	23	24		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C2	24	25		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	25	26		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	26	27		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	27	28		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	28	29		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	29	30		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	30	31		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C2	31	1		15X40	2,6÷3,0	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C3	1	2		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C3	2	3		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C3	3	4		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	4	5		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	5	6		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	6	7		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	7	8		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	8	9		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C3	9	10		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	10	11		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	11	12		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	12	13		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	

Indicazioni / Indications **

100 Crack	203 Micro-shrinkage	5013 Shrinkage grooves	516 Root porosity
101 Longitudinal crack	2031 Interdendritic microshrinka	5014 Inter-pass undercut	517 Poor restart
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2011 Gas pore	304 Metallic inclusion	5043 Excessive melt-through	600 Miscellaneous imperfections
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2017 Surface pore	4021 Incomplete root penetratic	510 Burn-through	605 Chipping mark
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2025 End crater pipe	5012 Intermitted undercut	515 Root concavity	12 Film Defect

Risultato / Result ***

1 Accepted

2 To be repaired

RQA Verification Limited ☐ Witnessed ☑ Reviewed LRQA
Mattia Crivellari
Authorized Inspector N.S. No. 17119
Milan Office 03/08/2024

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da / Performed by	Verificato da QCM / Reviewed by QCM	Ispettore / Inspector	Ispettore / Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C. MANAGER M. GALLI DATE: / /	☐ LRQA verification ltd ☐ Witnessed ☐ Monitored ☑ Reviewed LRQA MATTIA CRIVELLARI Ref. No.: Office: Milan 03/08/2024	
Data/Date 26 Jul 24	Data/Date 26 Jul 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

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Tabella visione lastre radiografiche / Radiograph Review form

Weld Id.	Film No.		Welder	Film size [cm]	Density	I.Q.I. Type	I.Q.I. Location	I.Q.I. Sensitivity	Ry Ci	Rx KV	Rx mA	Expos Time	Indications **	Result ***	Remarks
C3	12	13		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	13	14		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	14	15		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	15	16		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	16	17		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	17	18		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	18	19		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	19	20		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	20	21		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	21	22		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	22	23		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	23	24		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	24	25		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	25	26		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	26	27		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	27	28		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	28	29		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	29	30		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	30	31		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C3	31	1		15X40	2,4÷2,9	ASTM 1B-11	Source	W7		300	3,0	5'	2011	1	
C5	1	2		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	2	3		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	3	4		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	4	5		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	5	6		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	6	7		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'	2011	1	
C5	7	8		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	8	9		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	9	10		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	10	11		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	

Indicazioni / Indications **

100 Crack	203 Micro-shrinkage	5013 Shrinkage grooves	516 Root porosity
101 Longitudinal crack	2031 Interdendritic microshrinka	5014 Inter-pass undercut	517 Poor restart
102 Transverse crack	2032 Transgranular microshrinka	5015 Local intermittent undercut	520 Excessive distortion
103 Radiating cracks	300 Solid inclusion	502 Excess weld metal	521 Incorret weld dimensions
104 Crater crack	301 Slag inclusion	503 Excessive convexity	5211 Excessive weld thickness
105 Group of disconnected cracks	302 Flux inclusion	504 Excessive penetration	5212 Excessive weld width
106 Branching crack	303 Oxide iclusion	5041 Local excessive penetration	5213 Insufficient throat thickness
201 Gas cavity	3034 Puckering	5042 Continuos excessive penetratio	5214 Excessive throat thickness
2011 Gas pore	304 Metallic inclusion	5043 Excessive melt-through	600 Miscellaneous imperfections
2012 Uniformly distribuited porosity	3041 Tungsten inclusion	505 Incorrect weld toe	601 Arc strike
2013 Clustered (localized) porosity	3042 Copper inclusion	506 Overlap	602 Spatter
2014 Linear porosity	400 Lack of fusion and penetrat	507 Linear misalignment	6021 Tungsten spatter
2015 Elongated cavity	401 Lack of fusion	508 Angular misalignment	603 Torn surface
2016 Worm-hole	402 Lack of penetration	509 Sagging	604 Grinding mark
2017 Surface pore	4021 Incomplete root penetratic	510 Burn-through	605 Chipping mark
2018 Surface porosity	403 Spiking	511 Incompletely fillet groove	606 Underflushing
202 Shrinkage cavity	500 Imperfect shape	512 Excessive asymmetry of fillet w	608 Misalignment of opposite runs
2021 Interdendritic shrinkage	501 Undercut	513 Irregular width	613 Scaled surface
2024 Crater pipe	5011 Continuos undercut	514 Irregular surface	614 Flux residue
2025 End crater pipe	5012 Intermitted undercut	515 Root concavity	12 Film Defect

Risultato / Result ***

1 Accepted

2 To be repaired

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivelli
Authorized Inspector N.B. No. 1/119
Milan Office 09/08/2024

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ | **Non Accettato**/NotAccepted ☐ | **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : Data/Date 26 Jul 24	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C. MANAGER M.GALLI DATE : / / Data/Date 26 Jul 24	LRQA verification limited ☐ Witnessed ☐ Monitored ☑ Reviewed MATTIA CRIVELLI Ref. No.. Office: Milan 09/08/2024	

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

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Tabella visione lastre radiografiche / Radiograph Review form

Weld Id.	Film No.		Welder	Film size [cm]	Density	I.Q.I. Type	I.Q.I. Location	I.Q.I. Sensitivity	Ry Ci	Rx KV	Rx mA	Expos Time	Indications **	Result ***	Remarks
C5	11	12		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C5	12	13		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	13	14		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	14	15		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	15	16		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	16	17		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	17	18		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	18	19		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'	12+501	1	
C5	19	20		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	20	21		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	21	22		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C5	22	23		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	23	24		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	24	25		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	25	26		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	26	27		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C5	27	28		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	28	29		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	29	30		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C5	30	31		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'	12	1	
C5	31	1		15X40	2,3÷3,1	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	1	2		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	2	3		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	3	4		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	4	5		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	5	6		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	6	7		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	7	8		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	8	9		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	9	10		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	

Indicazioni / Indications **

100 Crack	203 Micro-shrinkage	5013 Shrinkage grooves	516 Root porosity
101 Longitudinal crack	2031 Interdendritic microshrinka	5014 Inter-pass undercut	517 Poor restart
102 Transverse crack	2032 Transgranular microshrinka	5015 Local intermittent undercut	520 Excessive distortion
103 Radiating cracks	300 Solid inclusion	502 Excess weld metal	521 Incorret weld dimensions
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105 Group of disconnected cracks	302 Flux inclusion	504 Excessive penetration	5212 Excessive weld width
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2015 Elongated cavity	401 Lack of fusion	508 Angular misalignment	603 Torn surface
2016 Worm-hole	402 Lack of penetration	509 Sagging	604 Grinding mark
2017 Surface pore	4021 Incomplete root penetratic	510 Burn-through	605 Chipping mark
2018 Surface porosity	403 Spiking	511 Incompletely fillet groove	606 Underflushing
202 Shrinkage cavity	500 Imperfect shape	512 Excessive asymmetry of fillet we	608 Misalignment of opposite runs
2021 Interdendritic shrinkage	501 Undercut	513 Irregular width	613 Scaled surface
2024 Crater pipe	5011 Continuos undercut	514 Irregular surface	614 Flux residue
2025 End crater pipe	5012 Intermitted undercut	515 Root concavity	12 Film Defect

Risultato / Result ***

1 Accepted

2 To be repaired

LRQA Verification Limited
Witnessed Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17419
Milan Office 09/08/2024

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE : Data/Date 26 Jul 24	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M. GALLI DATE : Data/Date 26 Jul 24	LRQA verification ltd Witnessed Monitored Reviewed LRQA MATTIA CRIVELLARI Ref. No.. Office: Milan 09/08/2024	

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

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Tabella visione lastre radiografiche / Radiograph Review form

Weld Id.	Film No.		Welder	Film size [cm]	Density	I.Q.I. Type	I.Q.I. Location	I.Q.I. Sensitivity	Ry Ci	Rx KV	Rx mA	Expos Time	Indications **	Result ***	Remarks
C6	10	11		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	11	12		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	12	13		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	13	14		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	14	15		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	15	16		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	16	17		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	17	18		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	18	19		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	19	20		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	20	21		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	21	22		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	2011	1	
C6	22	23		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	501	1	
C6	23	24		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	24	25		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	2013	1	
C6	25	26		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	26	27		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'	2013	1	
C6	27	28		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	28	29		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	29	30		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	30	31		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
C6	31	1		15X40	2,1÷3,2	ASTM 1B-11	Source	W7		300	3,0	5'		1	
L2	1	2		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L2	2	3		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L2	3	4		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L2	4	5		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L2	5	6		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'	12	1	
L2	6	7		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L2	7	8		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L2	8	9		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	

Indicazioni / Indications **

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103 Radiating cracks	300 Solid inclusion	502 Excess weld metal	521 Incorret weld dimensions
104 Crater crack	301 Slag inclusion	503 Excessive convexity	5211 Excessive weld thickness
105 Group of disconnected cracks	302 Flux inclusion	504 Excessive penetration	5212 Excessive weld width
106 Branching crack	303 Oxide iclusion	5041 Local excessive penetration	5213 Insufficient throat thickness
201 Gas cavity	3034 Puckering	5042 Continuos excessive penetratio	5214 Excessive throat thickness
2011 Gas pore	304 Metallic inclusion	5043 Excessive melt-through	600 Miscellaneous imperfections
2012 Uniformly distribuited porosity	3041 Tungsten inclusion	505 Incorrect weld toe	601 Arc strike
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2014 Linear porosity	400 Lack of fusion and penetrat	507 Linear misalignment	6021 Tungsten spatter
2015 Elongated cavity	401 Lack of fusion	508 Angular misalignment	603 Torn surface
2016 Worm-hole	402 Lack of penetration	509 Sagging	604 Grinding mark
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2021 Interdendritic shrinkage	501 Undercut	513 Irregular width	613 Scaled surface
2024 Crater pipe	5011 Continuos undercut	514 Irregular surface	614 Flux residue
2025 End crater pipe	5012 Intermitted undercut	515 Root concavity	12 Film Defect

Risultato / Result ***

1 Accepted

2 To be repaired

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 09/08/2024

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ | **Non Accettato**/NotAccepted ☐ | **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA&ROLLE NICOLA TROLIO DATE: Data/Date 26 Jul 24	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M. GALLI DATE: Data/Date 26 Jul 24	☐ LRQA verification ☐ Witnessed ☐ Monitored ☑ Reviewed MATTIA CRIVELLARI Ref. No.. Office: Milan 09/08/2024	

QUALITY CONTROL DEPARTMENT

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RADIOGRAPHIC EXAMINATION REPORT

N°. Documento Document	23096-01-SNA - RT 1
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Tabella visione lastre radiografiche / Radiograph Review form

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L2	9	10		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L2	10	11		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L2	11	12		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	
L2	12	13		15X40	2,0÷3,3	ASTM 1B-11	Source	W8		300	3,0	5'		1	

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2012 Uniformly distribuited porosity	3041 Tungsten inclusion	505 Incorrect weld toe	601 Arc strike
2013 Clustered (localized) porosity	3042 Copper inclusion	506 Overlap	602 Spatter
2014 Linear porosity	400 Lack of fusion and penetrat	507 Linear misalignment	6021 Tungsten spatter
2015 Elongated cavity	401 Lack of fusion	508 Angular misalignment	603 Torn surface
2016 Worm-hole	402 Lack of penetration	509 Sagging	604 Grinding mark
2017 Surface pore	4021 Incomplete root penetratic	510 Burn-through	605 Chipping mark
2018 Surface porosity	403 Spiking	511 Incompletely fillet groove	606 Underflushing
202 Shrinkage cavity	500 Imperfect shape	512 Excessive asymmetry of fillet w	608 Misalignment of opposite runs
2021 Interdendritic shrinkage	501 Undercut	513 Irregular width	613 Scaled surface
2024 Crater pipe	5011 Continuos undercut	514 Irregular surface	614 Flux residue
2025 End crater pipe	5012 Intermitted undercut	515 Root concavity	12 Film Defect

Risultato / Result ***

1 Accepted

2 To be repaired

LRQA Verification Limited ☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 09/08/2024

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

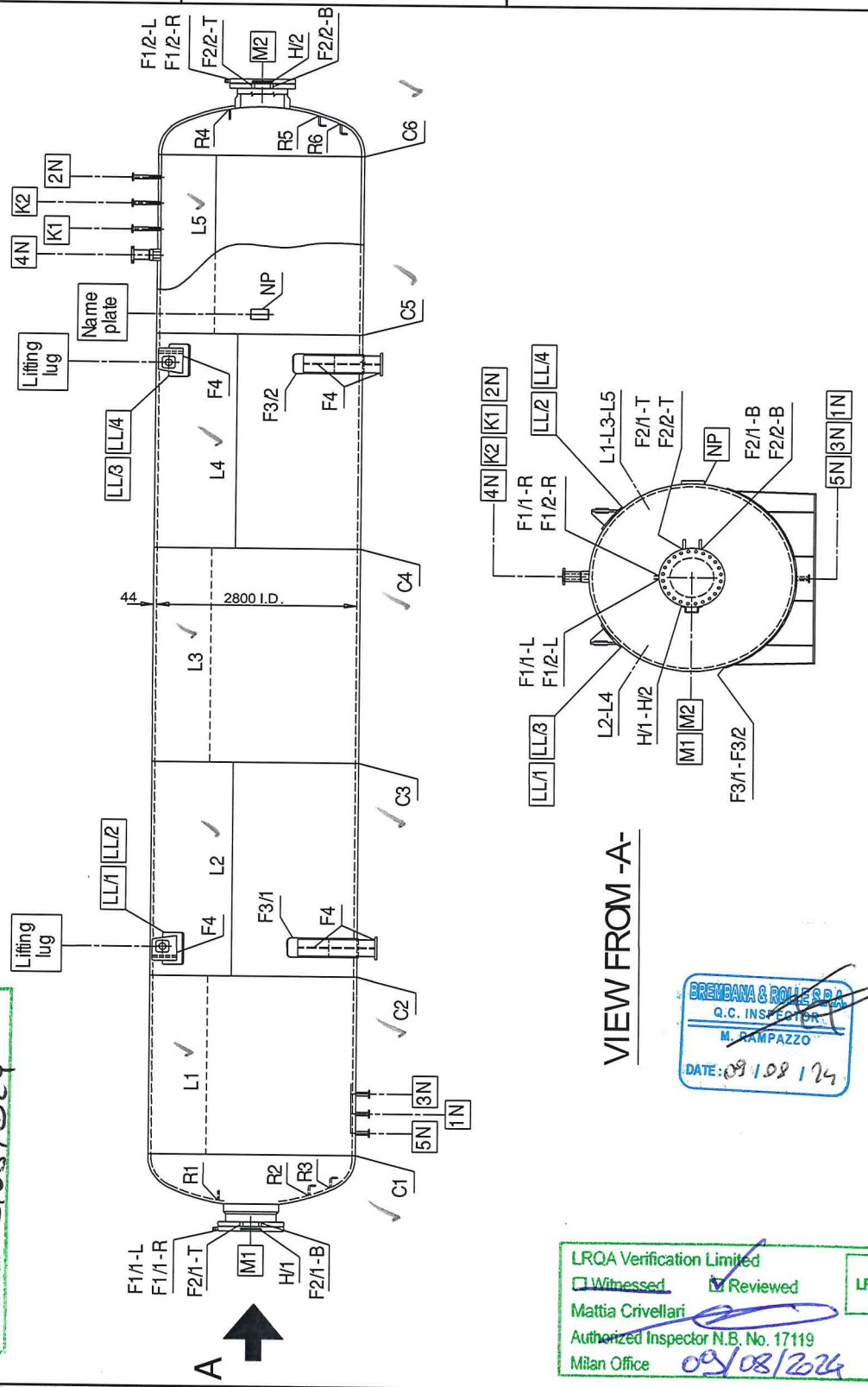
Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA&ROLLE NICOLA TROLIO 2 LEVEL - UNI EN ISO 9712 DATE : / / Data/Date 26 Jul 24	BREMBANA & ROLLE S.P.A. ALBIGNASEGO - PD - ITALY Q.C.MANAGER M.CALLI DATE : / / Data/Date 26 Jul 24	LRQA verification ltd Reviewed MATTIA CRIVELLARI Ref. No.. Office: Milan 09/08/2024	

WELDING MAP 1 of 1
Mappa delle Saldature 1 of 1

Purchaser:	Rosetti Marino
Item No.:	V25001 A/F
Serial No.:	23096-01÷06-SNA
B&R Job No.:	23096



BREMBANA & ROLLES S.P.A.
Q.C. INSPECTOR
M. PAMPAZZO
DATE: 09/08/24

LRQA verification ltd ☐ 6094 ☐
☐ Witnessed ☑ Monitored ☑ Reviewed
MATTIA CRIVELLARI
Ref. No.
Office: Milan 09/08/2024

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 09/08/2024

ISSUED BY - Preparato da:	APPROVED BY - Approvato da:	DATE - Data:	REV.-Rev.:
A. SANDONÀ	N. TOSTO	12.03.2024	2
A. SANDONÀ	N. TOSTO	08.03.2024	1
A. SANDONÀ	N. TOSTO	20.11.2023	0

Fabrication site: Albignasego – PD – ITALY

Section 14

PWHT Procedure / Certificate of Heat Treatment and Graphs

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**HEAT TREATMENT PROCEDURES (inc. PWHT) - H2 STORAGE VESSEL**	Sheet 1 of 8 Date: 24/07/2024 Rev: 2

Base Load Power Hub (BLPH)

HEAT TREATMENT PROCEDURES (inc. PWHT)

H2 STORAGE VESSEL

Document Number: 1723001756-QC-PRO-00011

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
D.CENACCHI	29/07/2024

Document Class: 2

Rev.	Date	Description	Prepared	Reviewed	Approved
2	24/07/2024	Accepted for contruction (AFC)	A. Sandonà	M. Carminati	N. Tosto
1	03/05/2024	Accepted for contruction (AFC)	A. Sandonà	M. Carminati	N. Tosto
0	21/11/2023	Issue for Review (IFR)	A. Sandonà	M. Carminati	N. Tosto

B&R BREMBANA&ROLLE

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**HEAT TREATMENT PROCEDURES (inc. PWHT) - H2 STORAGE VESSEL**	Sheet 2 of 8 Date: 24/07/2024 Rev: 2

Revision / Change Log

Rev.	Description
0	Issue for Information (IFI)
1	Accepted for contruction (AFC)
2	Accepted for contruction (AFC)

HOLDS LIST

No.	Description
1	
2	
3	
4	

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BREMBANA&ROLLE Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)	**PROCEDURE No.** **23096-01/TPWF**	8th Issue rev. 0 Sheet 1 of 5

POST WELD HEAT TREATMENT PROCEDURE

REFERENCE DOCUMENTS:

ASME BPV CODE Section VIII Div. 2 2021 Edition
Q.C. Manual
Project specification 123A90-DDL-MAC-SP-50026_0
Equipment datasheet 123A90-DDL-MAC-DS-50027_1

REVIEW FOR CONFORMANCE WITH REFERENCE CODE/DOCUMENTS REVISION:

Date:	Code Edition / Addenda:	Q.C.M.

Rev.	Date	Description	Issued by W.E.	Approved by Welding Dept. Manager	
2	24/07/2024	Revised as per comments	A. Sandonà	N. Tosto	
1	03/05/2024	Revised as per comments	A. Sandonà	N. Tosto	
0	21/11/2023	First issued for approval	A. Sandonà	N. Tosto	

CONTENTS:

1. Scope.
2. P.W.H.T. time.
3. Furnace.
4. Preparation.
5. Thermocouples.
6. P.W.H.T. temperatures.
7. Reports.

ABBREVIATIONS:

P.W.H.T. Post-Weld Heat Treatment
H.T. Heat Treatment
H.T.C.F. Heat Treatment Control Form
N.D.E. Non-Destructive Examination
P.T.P. Production Test Plate
TC Thermocouple

1. Scope

This procedure outlines the system used to perform **P.W.H.T.** of n°6 H2 Storage Vessel items V23001A÷F for Rosetti Marino/Crosswind Hollande Kust Noord Wind Park Project relevant to **B&R** job 23096.
P.W.H.T. shall be performed by B&R experienced personnel as per attached **H.T.C.F.**.

Following, list of Items to be treated for each furnace charge:

Item	Dwg. No.	Ref. HTCF Doc's	Components
V25001 A÷F	23096-01-EGA1	23096-01_HTCF	1) n°1 H2 Storage Vessel 2) n°2 Manhole flat cover 3) n°1 **P.T.P.**

2. P.W.H.T. time

P.W.H.T. shall be performed after final assembly and completion of welding for complete equipment and subjected to full visual, dimensional and N.D.E. required by Code and Spec.'s foreseen with satisfactory results.

3. Furnace

Furnace shall be permanently and closed type. Components shall be fully contained in the furnace.
Furnace heating shall be made by use of 18 gas burners, the construction details of the furnace is available in the "Appendix A" attached.

"Appendix A" and "Heat treatment control form" colors legend:

- Green → Mobile Carriage
- Red → Temporary Supports
- Brown → Burners

For the **P.W.H.T.** the equipment shall be placed on the furnace mobile carriege as indicated in relevant **H.T.C.F.** and then pushed into the furnace in the position indicated in relevant and "Appendix A".

4. Preparation

According to Technical Specification for CS Horizontal Pressure Vessels in H2 Service:

- The vessel or parts of the vessel shall be supported and protected so that deformation cannot occur.
  - Equipment shall be PWHTed on its own support saddles;
  - One (1) intermediate support shall be located at mid-length between the two saddles;
  - One support shall be located under each head knuckle.

  All the temporary supports shall be shaped to match equipment O.D.
- Machined surfaces, flange faces, etc., shall be protected from oxidation during heat treatment.

5. Thermocouples

Only calibrated thermocouples type K (Chrome-Alumel), typically red and yellow shielded wires, shall be used. Thermocouples shall be placed on the component according to a relevant **H.T.C.F.**.
Thermocouples shall be attached to the vessel by use of discharge capacitive welding machine, nut and bolt construction or other equivalent method. Temporary attachment for thermocouples shall be welded by BREMBANA&ROLLE.
Sub-supplier shall make available for review, all calibration certificates of thermocouples and recorders used in performing vessel **P.W.H.T.**.

After PWHT the locations of **TC**'s have to be ground and MT/PT-examined.

6. P.W.H.T. Temperatures

6.1 Temperature of the furnace shall room temperature at the time of the vessel is placed in it in order to permit the inspection step check of PWHT conditions and thermocouples placement. Above 800°F (425°C), the rate of heating shall be not more than 400°F/hr (222°C/h) divided by the maximum metal thickness of the shell or head plate in inches, but in no case more than 400°F/hr (222°C/h).

6.2 During the heating period there shall not be a greater variation in temperature throughout the portion of the vessel being heated than 250°F (140°C) within any 15 ft (4.6 m) interval.

6.3 Component shall be held at temperature and at holding time required by Code and Spec.'s.
During the holding period, there shall not be a greater difference than 180°F (100°C) between the highest and lowest temperature throughout the portion of the vessel being heated.

6.4 During the heating and holding periods, the furnace atmosphere shall be so controlled as to avoid excessive oxidation of the component surface. The furnace shall be such design as to prevent direct impingement of the flame on the vessel.
Burners shall always be equiped with a flame failure system that shuts off the fuel supply in any case of flame lapse thus preventing remainders of fuel entering the equipment.

6.5 Above 800°F (425°C), cooling shall be done in a closed furnace or cooling chamber at a rate not greater than 500°F/hr (280°C/h) divided by the maximum metal thickness of the shell or head plate in inches, but in no case more than 500°F/hr (280°C/h). At temperatures above 800°F (425°C), temperature variations within the heated portion during the cooling phase shall not be greater than 250°F (140°C) within any 15 ft (4.6 m) interval. From 800°F (425°C), the vessel may be cooled in still air.

6.6 When more stringent requirements have to be applied, then the data shown **H.T.C.F.** will prevail on general provision of points 6.1 to 6.5.

7. Report

A heat treatment record chart shall be issued showing time/temperature diagram according to the above mentioned prescription. The **H.T.** record chart shall be completed with heat treatment number, date, item involved and signed by sub-supplier.
H.T. record chart shall be delivered together with the vessel and shall be maintained in Quality Control department file.

BREMBANA&ROLLE

HEAT TREATMENT CONTROL FORM

Date: 24 July 2024
Rev. 2
Sheet 5 of 5

PURCHASER DATA		MANUFACTURER DATA	
PURCHASER	Rosetti Marino	**JOB No.**	23096
PLANT	Crosswind Hollande Kust Noord Wind Park Project	**DWG. No.**	23096-01-EGA1
P.O.	1723001756 123A90A	**SERIAL No.**	23096-01÷06-SNA
ITEM	V25001 A÷F H2 Storage Vessel	**DOC. No.**	23096-01/HTCF

APPLICABLE CODE:

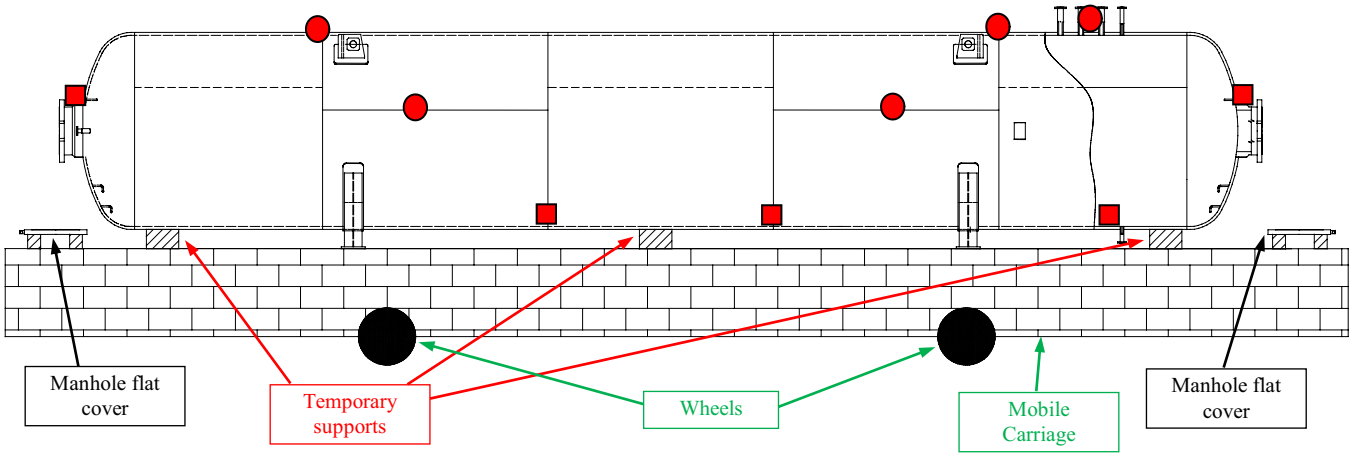
- ASME BPV CODE Sections VIII Div.2 2021 Edition

APPLICABLE STANDARD/SPECIFICATION:

- Customer Specifications 123A90-DDL-MAC-SP-50026_0

Sub-Supplier: _____	■ GAS FURNACE ☐ ELECTRICAL RESISTANCES
Part to be Heat Treated: See sketch below	**Heat Treatment Type:** Stress relieving
Material Spec's: SA 516 Gr.60 – SA 350 LF2	**Max. Thk. to be Heat Treated:** 44 mm

Thermocouples location: ● *EXTERNAL SIDE* ■ *INTERNAL SIDE*



NOTE: Thermocouples attached by capacitor discharge welding with max power output less than 125W-sec.
All areas where thermocouples has been removed shall be checked by visual inspection and PT or MT.

Thermocouples Type : K UNI 7938 G II E 230 st. | H.T. Record Type : Potentiometric

HEAT TREATMENT DATA

COMPONENT INSERTION [°C]	HEATING RATE [°C/h]	HEATING RATE Max. Δt [°C]	SOAKING TEMPERATURE [°C]	HOLDING TIME [h./min.]	COOLING RATE [°C/h]	COOLING RATE Max. Δt [°C]	COOLING IN STILL AIR FROM [°C]
Room Temperature	**≤60**	**120**	**610 ± 10**	**3h.**	**≤60**	**120**	**<300**

Brembana&Rolle T.P.	Bembana&Rolle ENG.	A.I. / Inspection Agency
N.Tosto – Tecnological Department Mgr.	D.Passerini – E.M.	

Comparison against Sub Supplier Heat Treatment Record Chart No. _____ DATED _____

RESULT: ❑ SATISFACTORY ❑ UNSATISFACTORY ❑ _____

Material is: ❑ ACCEPTED ❑ REJECTED ❑ _____

Brembana&Rolle Q.C.	A.I. / Inspection Agency
M.Galli – Q.C.M.	

BREMBANA&ROLLE
Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)

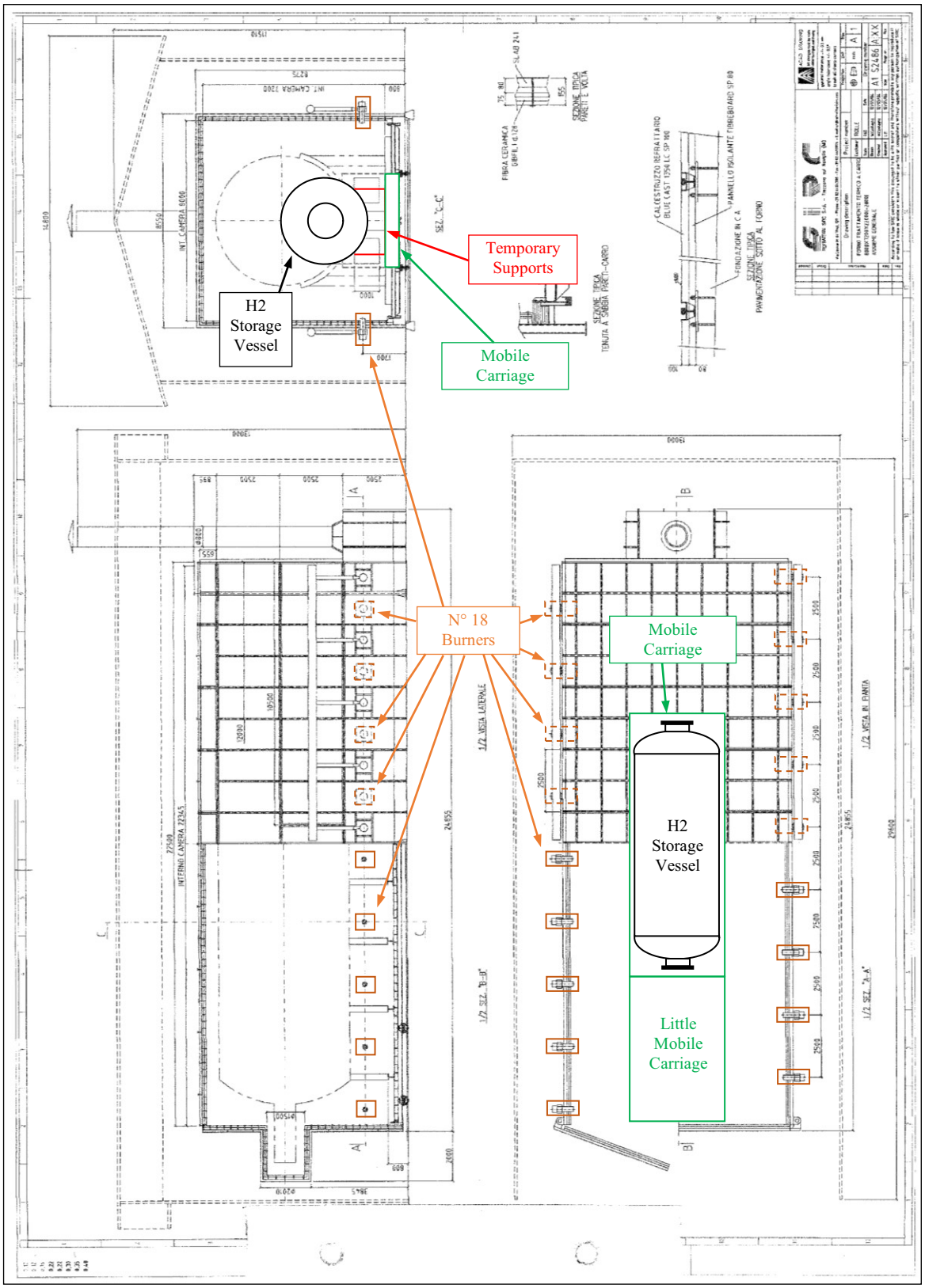
APPENDIX to PROCEDURE No. 23096/TPWF

DOC.	23096/TPWF	REV.	1
Sheet	1	Of	1
B&R Job	24018		
ITEM	R2 ÷ R5		

APPENDIX A

(PWHT furnace Construction drawing)

Albignasego site



BREMBANA&ROLLE

HEAT TREATMENT CONTROL FORM

Doc. 23096- PWHT-A

Sheet 1 of 1

PURCHASER DATA		MANUFACTURER DATA	
PURCHASER	Rosetti Marino	**JOB No.**	23096
PLANT	Crosswind Hollande Kust Noord Wind Park Project	**DWG. No.**	23096-01-EGA1
P.O.	1723001756 123A90A	**SERIAL No.**	23096-01÷06-SNA
ITEM	V25001 A÷F H2 Storage Vessel	**DOC. No.**	23096-01/HTCF

APPLICABLE CODE:

- ASME BPV CODE Sections VIII Div.2 2021 Edition

APPLICABLE STANDARD/SPECIFICATION:

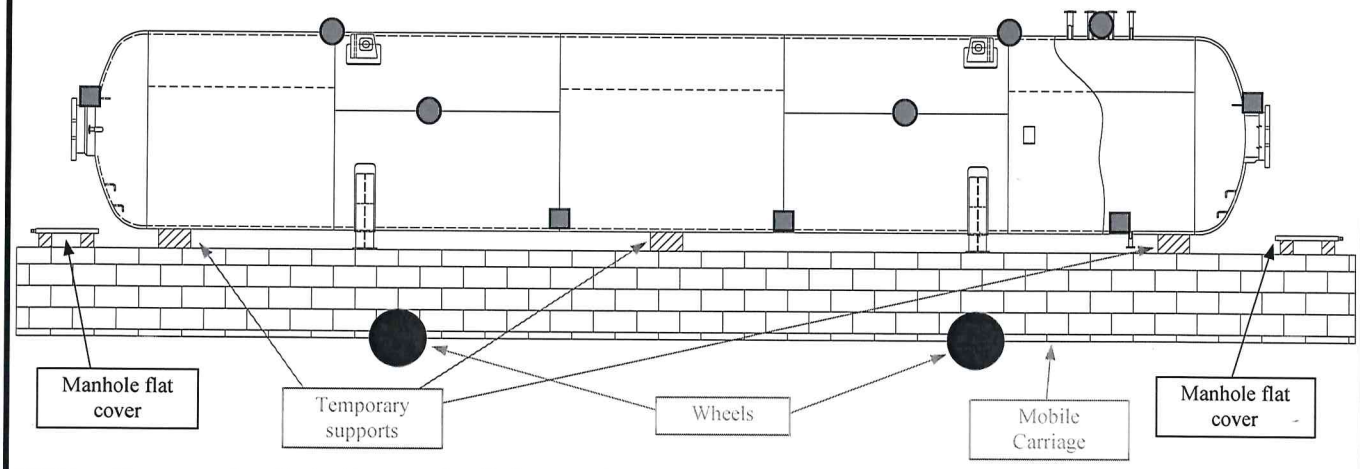
- Customer Specifications 123A90-DDL-MAC-SP-50026_0

Sub-Supplier: _____ ■ GAS FURNACE ☐ ELECTRICAL RESISTANCES

Part to be Heat Treated: See sketch below **Heat Treatment Type:** Stress relieving

Material Spec's: SA 516 Gr.60 – SA 350 LF2 **Max. Thk. to be Heat Treated:** 44 mm

Thermocouples location: ● *EXTERNAL SIDE* ■ *INTERNAL SIDE*



NOTE: Thermocouples attached by capacitor discharge welding with max power output less than 125W-sec.
All areas where thermocouples has been removed shall be checked by visual inspection and PT or MT.

Thermocouples Type : K UNI 7938 G II E 230 st. H.T. Record Type : Potentiometric

HEAT TREATMENT DATA

COMPONENT INSERTION [°C]	HEATING RATE [°C/h]	HEATING RATE Max. Δt [°C]	SOAKING TEMPERATURE [°C]	HOLDING TIME [h./min.]	COOLING RATE [°C/h]	COOLING RATE Max. Δt [°C]	COOLING IN STILL AIR FROM [°C]
Room Temperature	**≤60**	**120**	**610 ± 10**	**3h.**	**≤60**	**120**	**<300**

Brembana&Rolle T.P. 29.07.2024

Brembana&Rolle ENG. 0054 LRQA 29.07.2024

A.I. / Inspection Agency LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 03/08/2024

Comparison against Sub Supplier Heat Treatment Record Chart No. 23096-PWHT-A DATED 29/07/2024

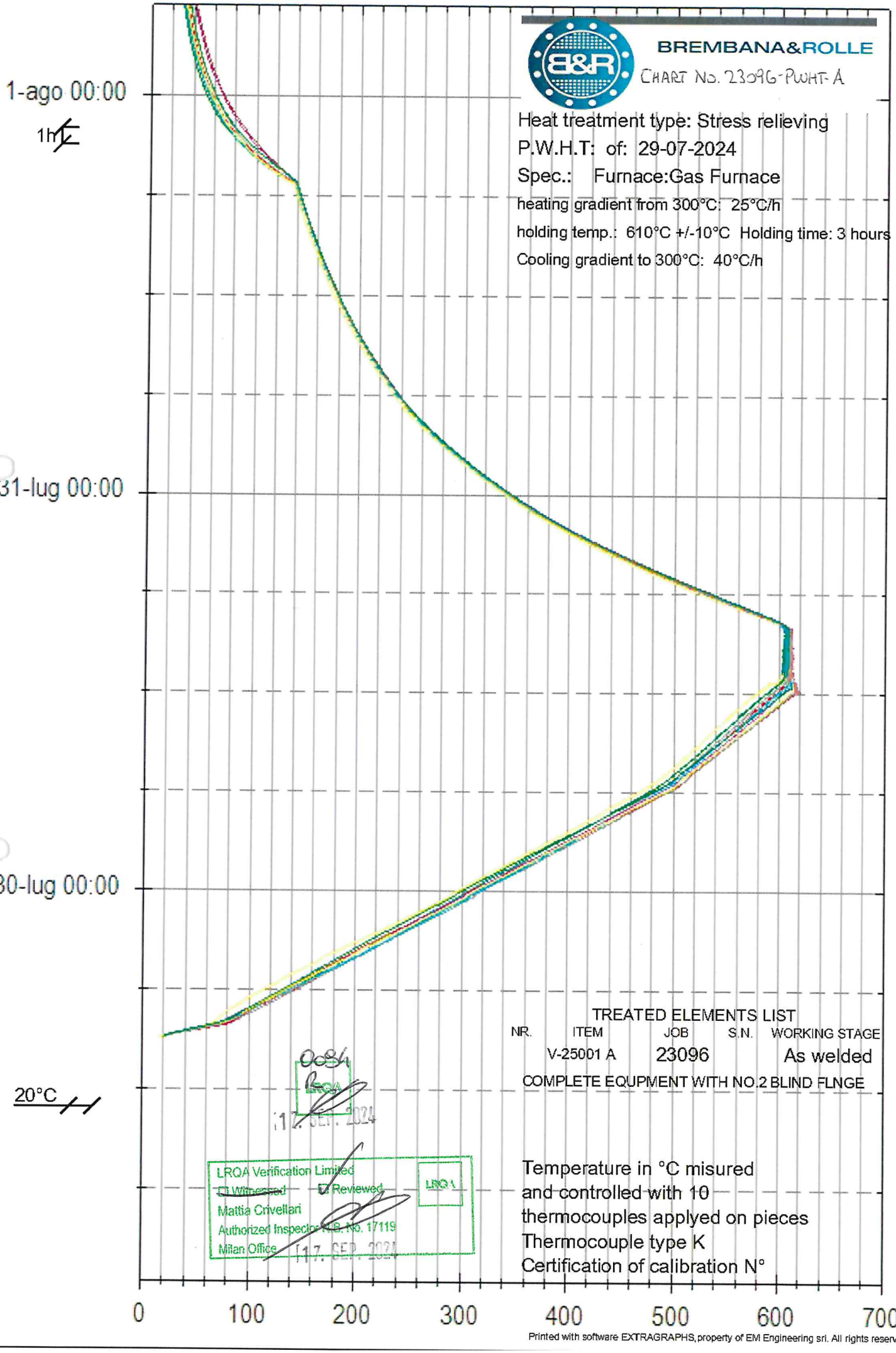
RESULT: ☒ SATISFACTORY ☐ UNSATISFACTORY ☐ _____

Material is: ☒ ACCEPTED ☐ REJECTED ☐ _____

Brembana&Rolle Q.C. BREMBANA & ROLLE S.p.A. Q.C. INSPECTOR M. RAMPAZZO DATE: 01/08/24

0054 LRQA 03/08/2024

A.I. / Inspection Agency LRQA Verification Limited ☐ Witnessed ☑ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 03/08/2024



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CCIAA BS 218279 TRIB BS REG 00926090176
Tel. 39030212151 - Fax 390302121536
www.siccet.com - e-mail info@siccet.com

TEST REPORT

No. ISTQL23-06811 of 28/11/2023

Print Date 05/12/2023

TEST REPORT No.: ISTQL23-06811

DATE: 28/11/2023

ITEM:	VHX0250KRT034XH.01 - CAVO KT 2x(1/0.80) DTEX-TW HT D.3.40 ANSI		
CUSTOMER:	1410BRE001 - BREMBANA & ROLLE S.P.A.		
YOUR ORDER:	ODA23-002543		
P.O. NUMBER:	ODV23-02772/10 20/09/2023		
ORDERED QTY:	4,008 KM		
ODP NO:	ODP23-044681	DATE:	10/11/2023

SPECIFICATION

	TEST		REQUESTED VALUE	MEASURED VALUE		RESULT
10	CONTIN -			OK		POSITIVE
20	R-ISOL -	MOhm x kM	>= 20	50		POSITIVE
30	DIAM -	mm		0.8		POSITIVE
40	NR-FILI -			1		POSITIVE
50	QTA-COND -			OK		POSITIVE
60	COD-COL -			OK		POSITIVE
70	SEQ-COL -			OK		POSITIVE
80	DIMENS -	mm		3.4		POSITIVE

NOTE

Quality Assurance

Luca Franchini

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
17 JAN 2024

IMPIANTI INDUSTRIALI

SOFTWARE GESTIONALE

li. 27/10/2023

Rif. Cliente: Brembana & Rolle – Forno a Gas per Trattamenti termici S/N 797 c/o il sito di Albignasego (PD)

Rif. Attività: Verifica canali acquisizione temperatura termocoppie a contatto

La verifica dei canali termocoppie è stata effettuata mediante l'utilizzo di un generatore di segnali AOIP modello TC6621 numero di serie 2702D con compensazione interna di giunto freddo collegato alle prese di connessione sul pannello bordo-forno. Il segnale generato è di tipo mV corrispondente alla temperatura segnalata.
I risultati della verifica di taratura sono elencati nella tabella seguente:

Segnale generato	150°C	300°C	450°C	600°C	750°C
TC3	149.3	299.7	450.2	600.3	749.7
TC4	149.5	299.9	450.4	600.6	750.3
TC5	149.3	299.7	450.2	600.4	750.0
TC6	149.8	300.2	450.7	600.7	749.9
TC7	149.3	299.7	450.1	600.2	749.8
TC8 N.F.					
TC9	149.5	299.8	450.3	600.4	749.9
TC10	149.6	300.2	450.6	600.6	750.1
TC11	149.8	300.1	450.5	600.5	749.9
TC12	149.3	299.9	450.3	600.3	749.8
TC13 N.F.					
TC14	149.6	300.1	450.4	600.3	749.9
TC15	149.4	299.8	450.3	600.4	749.8
TC16	149.5	299.7	450.2	600.2	749.9
TC17	149.4	299.8	450.3	600.3	749.8
TC18	149.2	299.9	450.4	600.3	749.7
TC19 N.P.					
TC20 N.P.					
TC21 N.P.					
TC22 N.P.					

I risultati della prova danno scostamenti inferiori ai limiti della normativa IEC 60584-2 classe B di riferimento che elenchiamo di seguito: -40°<T<333°C dT<+-2.5°C
333°<T<1200°C dT<+-0.0075*|t|

Il responsabile
Ing. Castagna Walter

Note: N.F.: non funzionante
N.P.: non presente

BRENTANA & ROLLE S.P.A.
ALBIGNASEGO - PD - ITALY
Q.C. MANAGER M. GALLI
DATE: 27 OCT 2023

EM Engineering S.r.L.
23851 GALBIATE (LC)
C.F. e P.iva 02953230139
e.mail wcastag@tin.it

EXPIRED ON 26 OCT. 2024

Fabrication site: Albignasego – PD – ITALY

Section 15

Hydrostatic procedure / Certificates of Hydrostatic, Pneumatic and Leakage Tests

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**HYDROSTATIC TEST PROCEDURES (FAT PROCEDURE) H2 STORAGE VESSEL**	Sheet 1 of 14 Date: 19/03/2024 Rev: 03

Base Load Power Hub (BLPH)

HYDROSTATIC TEST PROCEDURE (FAT PROCEDURE)
H2 STORAGE VESSEL

Document Number: 1723001756-QC-PRO-00012

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
	27-03-2024

Document Class: 2

03	19/03/2024	Accepted for contruction (AFC)	M.Rampazzo	P.Franzolin	M.Galli
02	30/01/2024	Accepted for contruction (AFC)	M.Rampazzo	P.Franzolin	M.Galli
01	10/01/2024	Accepted for contruction (AFC)	M.Rampazzo	P.Franzolin	M.Galli
00	24/11/2023	Issue for Information (IFR)	M.Rampazzo	P.Franzolin	M.Galli
Rev.	Date	Description	Prepared	Reviewed	Approved

B&R BREMBANA&ROLLE

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**HYDROSTATIC TEST PROCEDURES (FAT PROCEDURE) H2 STORAGE VESSEL**	Sheet 2 of 14 Date: 19/03/2024 Rev: 03

Revision / Change Log

Rev.	Description
00	Issue for Information (IFI)
01	Accepted for construction (AFC)
02	Accepted for construction (AFC)
03	Accepted for construction (AFC)

HOLDS LIST

No.	Description
1	
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3	
4	

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B&R GROUP PROCEDURE

23096-QHT1

QC PROCEDURE INDEX

Attach	Procedure Title	Proced.N°
▶	HYDROSTATIC PRESSURE TESTING PROCEDURE	100 HPT 21

B&R GROUP PROCEDURE

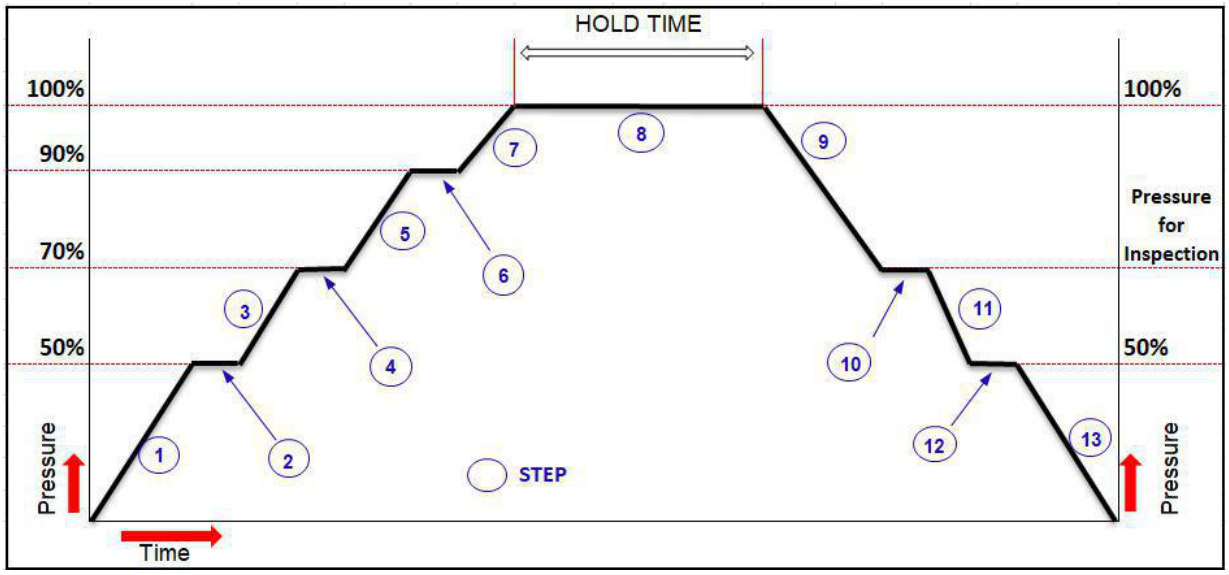
23096-QHT1

ADDITIONAL REQUIREMENTS

PRESSURE TESTING PROCEDURE - VALUE (1 1723001756-QC-PRO-00012_CRS CLOSE-OUT) 100 HPT 21

JOB 23096	V-25001A÷F			
Pressure test 50% (barg)	28.6			
Pressure test 70% (barg)	40.0			
Pressure test 90% (barg)	51.4			
Pressure test 100% (barg)	57.2			
Pressure for Inspection (barg)	45.7			
Hold time (Hour)	1			

PRESSURE TESTING PROCEDURE - CHART (1 1723001756-QC-PRO-00012_CRS CLOSE-OUT) 100 HPT 21



PRESSURE TESTING PROCEDURE - SEQUENCE (1 1723001756-QC-PRO-00012_CRS CLOSE-OUT) 100 HPT 21

STEP	SEQUENCE
1	Increasing pressure up to 50% of test pressure
2	Hold for 5 minutes
3	Gradually increasing pressure up to 70% of test pressure
4	Hold for 5 minutes
5	Gradually increasing pressure up to 90% of test pressure
6	Hold for 5 minutes
7	Gradually increasing pressure up to 100% of test pressure
8	Hold for (see above) hours and for the time need for visual inspection
9	Gradually decreasing pressure to Pressure for Inspection
10	Hold for 5 minutes and for the time need for visual inspection
11	Gradually decreasing pressure to 50% of test pressure
12	Hold for 5 minutes
13	Decreasing pressure to atmosphere pressure

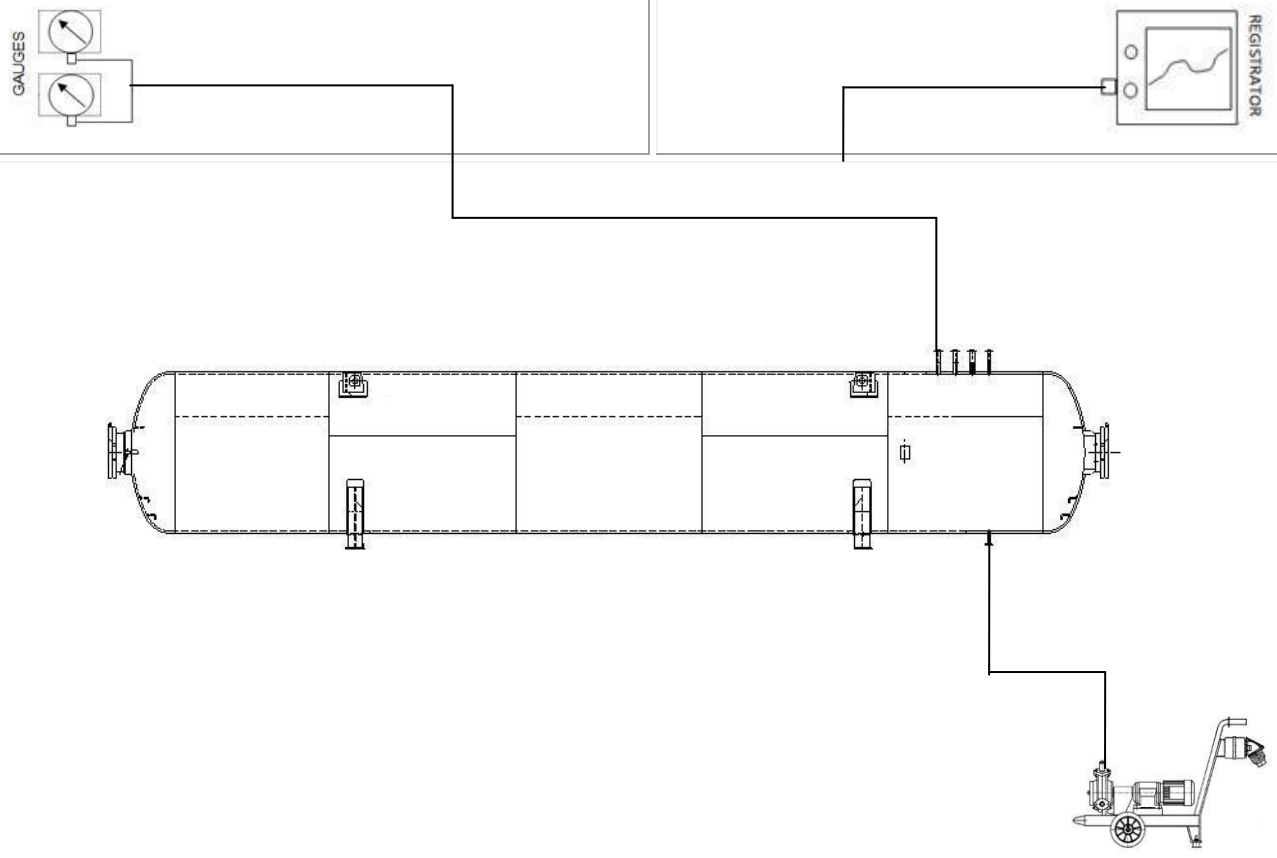
B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

ADDITIONAL REQUIREMENTS

V-25001A÷F



For the test pressure refer to Dwg n°.1723001756-MAC-DA-00004(B&R dwg.23096-01-EGA1)

(2 1723001756-QC-PRO-00012_CRS CLOSE-OUT)

BREMBANA&ROLLE	**INSTRUZIONE OPERATIVA No.** ***OPERATIVE INSTRUCTIONS No.*** **IHSE 8.1-15** **PROVE DI TENUTA IDRAULICA / *HYDRAULIC SEAL TESTS***	2nd Issue Rev.0 Sheet 1 of 2

(⚠3 1723001756-QC-PRO-00012_CRS CLOSE-OUT)

SCOPO ***PURPOSE***	Lo scopo di questa procedura è quello di stabilire le modalità di esecuzione delle prove idrauliche presso gli stabilimenti del gruppo B&R. *The purpose of this procedure is to establish the methods to carrying out the hydraulic tests at B&R group sites.*
CAMPO DI APPLICAZIONE ***SCOPE OF APPLICATION***	Questa Istruzione Operativa è applicabile quando vengono eseguite le prove idrauliche. *This Operative Instruction is applicable when the hydraulic tests are carried out.*

MODALITA' OPERATIVE / *OPERATIVE INSTRUCTONS*	
1	**PROVA IDRAULICA A PRESSIONE FINO A 400 bar** ***HYDRAULIC TESTS AT PRESSURE UP TO 400 Barg***
1.1	Questi test vengono effettuati in un'area produttiva temporaneamente dedicata al collaudo idraulico. *These tests are carried out in a production area temporarily dedicated to the Hydraulic test.*
1.2	L' Apparecchio a pressione dovrà essere posizionato in modo tale da garantire una distanza minima di fascia di rispetto di almeno 2 mt. *The Pressure Equipment shall be positioned in such a way as to guarantee a minimum distance of at least 2 (two) meters of free zone al around.*
1.3	Posizionato l'Apparecchio a pressione da collaudare dal personale incaricato, dovranno essere effettuati i collegamenti necessari per l'effettuazione della prova. *Once the Pressure Equipment is positioned for the test, the necessary connections shall be made to carry out the test.*
1.4	L'operatore incaricato delimita l'area con nastro bicolore (bianco rosso o giallo nero) ed opzionalmente con segnalatori ottici. *The worker in-charged delimits the area with a Hazard Tape (white-red or yellow-black) and additionally can be used optical indicators.*
1.5	**E' vietato sostare all'interno dell'area di prova durante la prova.** ***It's forbidden to be inside the test area during the test.***

2	**PROVA IDRAULICA A PRESSIONE SUPERIORE A 400 bar** ***HYDRAULIC TESTS AT PRESSURE ABOVE THAN 400 Barg***
2.1	Questi test vengono effettuati in un'area produttiva temporaneamente dedicata al collaudo Idraulico o in alternativa l'Attrezzatura a Pressione può essere posizionata all'interno del bunker se presente e se le dimensioni dell'Attrezzatura lo consentono. *These tests are carried out in a production area temporarily dedicated to the Hydraulic test or alternatively the Pressure Equipment can be positioned inside the bunker if any and if the Equipment dimensions allow it.*

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BREMBANA&ROLLE	**INSTRUZIONE OPERATIVA No.** ***OPERATIVE INSTRUCTIONS No.*** **IHSE 8.1-15** **PROVE DI TENUTA IDRAULICA / *HYDRAULIC SEAL TESTS***	2nd Issue Rev.0 Sheet 2 of 2

(⚠3 1723001756-QC-PRO-00012_CRS CLOSE-OUT)

2.2	L' Apparecchio a pressione dovrà essere posizionato in modo tale da garantire una distanza minima di fascia di rispetto di almeno 2 mt. *The Pressure Equipment shall be positioned in such a way as to guarantee a minimum distance of at least 5 (five) meters of free zone al around.*
2.3	Posizionato l'Apparecchio a pressione da collaudare dal personale incaricato, dovranno essere effettuati i collegamenti necessari per l'effettuazione della prova. *Once the Pressure Equipment is positioned for the test, the necessary connections shall be made to carry out the test.*
2.4	In caso di test nei reparti produttivi l'operatore incaricato delimita l'area con nastro bicolore (bianco rosso o giallo nero) ed opzionalmente con segnalatori ottici. *In case of test inside the work-shop, the worker in-charged delimits the area with a Hazard Tape (white-red or yellow-black) and additionally can be used optical indicators.*
2.5	Per i collaudi idraulici effettuati nel reparto produttivo sono disponibili come protezione dei pannelli metallici con sabbia all'interno. Questi hanno lo scopo di proteggere il personale dal pericolo derivante dalle connessioni (flange, ugelli) situate al di sotto dell'asse orizzontale dell'attrezzatura a pressione testata. Durante l'aumento della pressione di prova il personale B&R presta particolare attenzione alle perdite in prossimità dei tiranti, dei manometri e delle connessioni idrauliche. *For the hydraulic tests carried out in the production department, metal panels with sand inside are available as protection. They have the purpose to protect the personnel from the hazard arising from the connections (flanges, nozzles) located below the horizontal axis of the tested pressure equipment. During the increasing of test pressure the B&R employees pay particular attention to the leakage near the tie rods, pressure gauges and hydraulic connections.*
2.6	**È vietato sostare all'interno dell'area di prova durante la prova.** ***It's forbidden to be inside the test area during the test.***

Nota 1: Consulta la procedura di prova idraulica di ogni progetto emessa dal Controllo Qualità per quanto riguarda il posizionamento dei manometri e i metodi di posizionamento delle attrezzature a pressione da testare.

Note 1: *See the hydraulic test procedure of each project issued by the quality control dept. about positioning of pressure gauges and methods of positioning of Pressure equipment to be tested.*

Nota 2: In funzione della posizione dei manometri provvedere al loro accesso in sicurezza, mediante opere provvisionali (banchetti di prova idraulica, attrezzature per accesso in quota).

Note 2: *following the imposed position of the pressure gauges, provide temporary solution (like hydraulic test desks, equipment for access at heights etc) to ensure safe access to the gauges.*

0	29/01/2024	First Issue	D. Medolago	S.L. Rigobon	M. Rottoli
Rev.	**Date**	**Description**	**Issued by SPP**	**Verified by QA**	**Approved by CEO**

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B&R GROUP PROCEDURE

PRESSURE TESTING PROCEDURE

PR.N° 100 HPT 21 REV.0

REFERENCE DOCUMENTS:	
ASME BPV CODE SECTIONS I,VIII div.1,VIII div.2,	2021 Edition
ASME Power Piping B31.1	2020 Edition
TEMA Standard	10Th Edition 2019

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Gianluca Cestari
Authorized Inspector N.B. No. 16408
Milan Office 28/06/2022

A.I.

LRQA Verification Limited
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Alessandro Monastra
Authorized Inspector N.B. No. 13420
Milan Office 21 GIU. 2022

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Flavio Zanon
Authorized Inspector N.B. No. 13421
Milan Office 27-06-2022

A.I.

LRQA Verification Limited
☐ Witnessed ☑ Reviewed 26/1 Accepted
Luca Rivaroli
Authorized Inspector N.B. No. 13097
Milan Office 28/12/21

REVIEW FOR COMPLIANCE WITH REFERENCE CODE / DOCUMENT REVISION		
Date	Code Edition	TP

Rev.	Date	Description	Issued by	Approved by TP	Reviewed& Approved Lev.III
0	28-12-2021	Issued for approval	M. Fiammingo	N. Tosto	D. Botti

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B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 100 HPT 21

REV.0

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4.	PRESSURE TEST	4.	PROVA DI PRESSIONE
5.	PRESSURE TEST GAUGES	5.	MANOMETRI
6.	REPORTS	6.	REPORT

ABBREVIATIONS:

(Q.C.I.) Quality Control Inspector

(Q.C.M.) Quality Control Manager

(A.I.) Authorized Inspector

B&R GROUP PROCEDURE

Officine Meccaniche VILLA & BONALDI RICENGO - Italy

BREMBANA&ROLLE

PR.N° 100 HPT 21

REV.0

1. Scope

This procedure outline the system used in shop and field site to perform the pressure test of equipment manufactured by BREMBANA&ROLLE Group (Officine Meccaniche Villa&Bonaldi S.p.A., Brembana&Rolle S.p.A.).

1. Scopo

Questa procedura delinea il sistema utilizzato in officina e sul campo per eseguire la prova idraulica del recipiente a pressione prodotto dal Gruppo BREMBANA&ROLLE Group (Officine Meccaniche Villa&Bonaldi S.p.A., Brembana&Rolle S.p.A.).

2. Responsibility

2.1 The involved workers for pressure test, under the responsibility of the work-shop (field site) foreman, will prepare all necessary equipment and conduct the pressure test. The **Q.C.I.** and/or **Q.C.M.** shall carry out the final inspection, in order to verify no leakage are in the pressure vessel. After that, the vessel under pressure, shall be made available to the **A.I.** and User inspect (if any), for their inspection and acceptance.

2. Responsabilita'

2.1 I lavoratori incaricati per la prova di pressione, sotto la responsabilità del Preposto di officina, preparerà tutte le attrezzature necessarie ed eseguirà la prova di pressione. Il Q.C.I. e/o QCM deve effettuare l'ispezione finale, al fine di verificare che non vi siano perdite nel recipiente a pressione. Successivamente, l'apparecchio, è reso disponibile all'A.I. e all'ispettore dell'Utilizzatore (se presente), per la loro ispezione e accettazione.

3. Pressure test time

3.1 Pressure test shall be performed on all vessel after:

- All fabrication has been completed, included all heat treatments (if any), except for operation which could not be performed prior to the test such as weld end preparation, cosmetic grinding on base material which does not affect the required thickness.
- All examination and test have been performed, except those required after pressure test.
- Have been properly stocked, in order to avoid any visible permanent distortion or other damages, and at the same time to permit a complete visual inspection.
- Prior to final inspection and hydrostatic test, the vessel, inside and outside, shall be thoroughly cleaned and shall be free from all slag, scale, dirt, weld spatter, paint and pieces of loose metal.

3.2 Pressure test shall be performed before painting on welded joints

3. Tempo prova di pressione

3.1 La prova di pressione deve essere eseguita su tutto il serbatoio dopo:

- Tutta la fabbricazione è stata completata, inclusi tutti gli eventuali trattamenti termici, ad eccezione di operazioni che non potevano essere eseguite prima del test come la preparazione dell'estremità di saldatura, la molatura di rifinitura del materiale di base che non intacca lo spessore richiesto.
- L'esecuzione di tutti i controlli e le prove, ad eccezione di quelli richiesti dopo la prova di pressione.
- Sono stati adeguatamente stoccati, in modo da evitare qualsiasi visibile distorsione permanente o altri danni, e allo stesso tempo per consentire un'ispezione visiva completa.
- Prima dell'ispezione finale e della prova idrostatica, il recipiente, all'interno e all'esterno, deve essere accuratamente pulito e deve essere privo di scorie, incrostazioni, sporco, spruzzi di saldatura, vernice e pezzi sciolti di metallo.

3.2 La prova a pressione deve essere eseguita prima della verniciatura delle giunti saldati.

4. Pressure test

4.1 Hydrostatic test

a) All vessels designed for internal pressure shall be subjected to an hydrostatic test pressure in horizontal positions (small vessel can be tested in vertical position). The test pressure shall be calculated according to relevant Code or shall be based on a calculated pressure by agreement between User and the manufacturer.

b) Combination unit shall be tested by one of the following methods:

1) Pressure chamber of combination units that have been designed to operate independently shall be hydrostatically tested as separate vessels, that is each chamber shall be tested without pressure in the adjacent chamber.

2) When pressure chambers of combination units have their common element designed for the maximum differential pressure is less than the higher pressure in the adjacent chambers, the common elements shall be subjected to hydrostatic test pressure as per Code and User requirements.
Following the test of the common elements, the adjacent chamber shall be tested simultaneously.
Care shall be taken to limit the differential pressure between the chambers to the pressure used when testing the common elements.

c) Vent shall be provided at all high point of the vessel in the position in which it is to be tested to purge possible air pockets while the vessel is being filled.

d) The fluid media to be used in performing hydrostatic test pressure shall be normally fresh and clean water with a chloride content less than 30 p.p.m., except otherwise required.

e) The metal temperature during hydrostatic test pressure shall be:

1) Fluid temperature: 20°C (70°F) min.; 50°C (120°F) max. for ASME Code Section I and ASME B31.1 vessel.

2) Metal temperature: At least 17°C (30°F) above the minimum design metal temperature, 48°C (120°F) max. for ASME Code Section VIII Div. 1 and Div. 2.
The test pressure shall not be applied until the vessel and the pressuring medium shall be at about the same temperature.

f) During hydrostatic test pressure all tell tale hole shall be left open.

4. Prova di pressione

4.1 Prova idrostatica

a) Tutti i recipienti progettati per la pressione interna devono essere sottoposti a una pressione di prova idrostatica in posizione orizzontale (il recipiente piccolo può essere sottoposto a prova in posizione verticale). La pressione di prova deve essere calcolata in base al codice pertinente o deve essere basata su una pressione calcolata previo accordo tra l'utilizzatore e il produttore.

b) L'unità combinata deve essere sottoposta a prova con uno dei seguenti metodi:

1) La camera a pressione delle unità combinate che sono state progettate per funzionare indipendentemente deve essere sottoposta a prova idrostatica come recipienti separati, ovvero ciascuna camera deve essere provata senza pressione nella camera adiacente.

2) Quando le camere a pressione delle unità combinate hanno il loro elemento comune calcolato in modo che la pressione differenziale massima sia inferiore alla pressione maggiore nelle camere adiacenti, gli elementi comuni devono essere sottoposti a pressione di prova idrostatica come da Codice e requisiti dell' utilizzatore.
Dopo la prova degli elementi comuni, la camera adiacente deve essere provata simultaneamente.
Occorre prestare attenzione a non superare il limite della pressione differenziale tra le camere durante la prova degli elementi comuni.

c) Lo sfiato deve essere previsto in tutti i punti più alti del serbatoio,nella posizione in cui deve essere testato,per spurgare eventuali sacche d'aria mentre viene riempito.

d) Il fluido da utilizzare nell'esecuzione della pressione di prova idrostatica deve essere normalmente acqua dolce e pulita con un contenuto di cloruro inferiore a 30 ppm, salvo diversamente richiesto.

e) La temperatura del metallo durante la pressione di prova idrostatica deve essere:

1) Temperatura del fluido: 20°C (70°F) min.; 50°C (120°F) max. per codice ASME Sezione I e ASME B31.1.

2) Temperatura del metallo: almeno 17°C (30°F) al di sopra della temperatura minima del metallo di progetto, 48°C (120°F) max. per Codice ASME Sezione VIII Div. 1 e div. 2.

g) Following application of hydrostatic test pressure, examination for leakage shall be made of all joints and connections and of all regions of high stress such as knuckles, region around openings, and thickness transition section. The hydrostatic test pressure shall be held in any case not less than 1 (one) hour. Any leaks that are present shall be corrected in accordance with the rules, after which the vessel shall be re-tested in accordance with these requirements.	La pressione di prova non deve essere applicata fino a quando il recipiente e il fluido di pressione sono all'incirca alla stessa temperatura.
h) After hydrostatic pressure testing all water shall be drained, remaining water pockets shall be mopped dry or removed by blowing air.	f) Durante la prova idrostatica, tutti i fori rivelatori devono essere lasciati aperti.
	g) Dopo l'applicazione della pressione di prova idrostatica, l'ispezione deve essere effettuata su tutti i giunti e connessioni e su tutte le zone soggette a forti sollecitazioni come fondi, zone intorno alle aperture e sezione di transizione dello spessore. La pressione idrostatica di prova deve essere mantenuta in ogni caso non inferiore a 1 (una) ora. Eventuali perdite presenti devono essere corrette in conformità al codice, dopodiché il serbatoio deve essere nuovamente sottoposto a test in conformità con tali requisiti.
	h) Dopo la prova della pressione idrostatica, tutta l'acqua deve essere scaricata, le sacche d'acqua rimanenti devono essere asciugate con uno straccio o rimosse soffiando aria.

5. Pressure test gages	**5. Manometri**
5.1 Pressure test gages (at least two) used in testing vessel shall be indicating pressure gages and shall be connected to the vessel. If the indicating gages are not readily to the operator controlling the pressure applied, an additional indicating gage shall be provided where it will visible to the operator throughout the duration of the test. A recording gage shall be use, when required by relevant Code and/or Customer specification.	5.1 I manometri di prova della pressione (almeno due) utilizzati devono essere collegati al recipiente. Se i manometri non sono facilmente leggibili all'operatore che controlla la pressione applicata, deve essere fornito un ulteriore strumento di indicazione che sarà visibile all'operatore per tutta la durata della prova. Deve essere utilizzato uno strumento di registrazione, quando richiesto dal Codice pertinente e/o dalle specifiche del Cliente.
5.2 Dial indicating pressure gages used in testing shall be graduated over the range of about double the intended maximum test pressure, but in no case the range be less than 1½ nor more than 4 times that pressure. Digital reading pressure gages having a wider range of pressure could be used, provided the readings give the same or greater degree of accuracy as obtained with dial pressure gages.	5.2 I manometri con indicazione del quadrante utilizzati nelle prove devono essere graduati nell'intervallo di circa il doppio della pressione di prova massima prevista, ma in nessun caso l'intervallo deve essere inferiore a 1½ né superiore a 4 volte tale pressione. Possono essere utilizzati manometri a lettura digitale aventi un intervallo di pressione più ampio, a condizione che le letture forniscano un grado di precisione uguale o superiore a quello ottenuto con i manometri a quadrante.
5.3 All gages shall be calibrated against a calibrated master gage at least every 6 months or at any time there is reason to believe that they are in error.	5.3 Tutti i misuratori devono essere tarati rispetto ad un misuratore master tarato almeno ogni 6 mesi o in qualsiasi momento vi sia motivo di ritenere che siano in errore.

6. Report	6. Report
6.1 A pressure test report shall be full filled after each test and made available to the A.I. and User Inspector for their review and approval.	6.1 Dopo ogni test il rapporto di prova deve essere compilato e reso disponibile all'AI e dell'ispettore dell'Utilizzatore per revisione e approvazione.

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI PROVA IDRAULICA
HYDROSTATIC TEST REPORT

N°. Documento Document No.	*22112-01-SNA HPT 01*
Pagina Page	1 di of 1

Cliente Customer	SULZER	**Ordine N°** P.O. No	4500.04.4612
Commessa Mfr' work No.	22112	**Disegno** Drawing	22112--EGA
Progetto Project	HUITONG-China	**N° Fabbrica** Serial No.	22112-01-SNA
Sigla Item	Falling Film Crystallizer	**P.C.Q. N°.** Q.C.P. No.	22112-01-QCPA step

Specifica di riferimento
Reference Specification

Camera in pressione
Part under pression

Posizione di prova
Test position

Capacità
Capacity

Pressione di prova
Pressure test

Manometri utilizzati
Manometer S/N

Fluido utilizzato
Fluid employed

Temperatura
Temperature

Posizione
Location Wall Fluid

Mantenimento pressione
Pressure holding time

SAMPLE

Risultato della prova
Result of the test

Satisfactory - have not been found leakages neither permanent deformations.

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☑ **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
Data/Date	**Data**/Date		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI PROVA IDRAULICA
HYDROSTATIC TEST REPORT

N°. Documento Document No.	*23096-SNA HPT 01*
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	V-25001 A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 71

Specifica di riferimento Reference Specification: 23096-QHT Rev.03

Camera in pressione Part under pression: Shell

Posizione di prova Test position: Horizontal

Capacità Capacity: 101200 Liters

Pressione di prova Pressure test: 57,2 barg

Manometri utilizzati Manometer S/N: p285 - p287

Fluido utilizzato Fluid employed: potable water

Temperatura Temperature: 28°C

Posizione Location: Wall Fluid

Mantenimento pressione Pressure holding time: 1 hour

Risultato della prova Result of the test: Satisfactory - have not been found leakages neither permanent deformations.

☐ LRQA verification ltd ☑ 0094 ☐
☑ Witnessed ☐ Monitored ☐ Reviewed
MATTIA CRIVELLARI
Ref. No..
Office: Milan 09/08/2024

LRQA Verification Limited
☑ Witnessed ☐ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 09/08/2024

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA & ROLLE S.P.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / /	BREMBANA & ROLLE S.P.A. ALBIGNASEGO (PD) - ITALY Q.C. MANAGER M. GALLI DATE: / /	ROSETTI MARINO SPA NEGLI ESPOSTI R. 09/08/2024	CW L. D'ALESSANDRO 09/08/24
Data/Date 09 Aug 24	Data/Date 09 Aug 24		

BREMBANA&ROLLE
Via Villino, I 24030 Valbrembo(BG) Italy

CALIBRATION REPORT

N.	Date:
p287-2024-03-25	25/03/2024

Reference Procedure: 150-CPG

Expiration Date: 25/09/2024

Calibrating Equipment:	manometro	*S/N*	p287	*Range*	100,0	*Unit*	bar
Manufacturer:	Italmanometri						
Reference Equipment:	manometro	*S/N*	m004	*Range*	250,00	*Unit*	bar
Manufacturer:	Cube25						

Ambience Calibration Temperature	°C	20
Maximum Utilization Temperature	°C	30

(Ea) bar	*(Es) bar*	*(Ir) bar*	*(Et) bar/°C*	*(Ic) bar*
0,000	1,000	0,000	0,000	0.1

		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Reference Equipment Reading	bar	0	25	50	75	100	75	50	25	0			
Calibrating Equipment Reading	bar	0	25	50	75	100	75	50	25	0			
Error (Em)	bar	0	0	0	0	0	0	0	0	0			
Maximum Permissible Error	bar	2	2	2	2	2	2	2	2	2	2	2	2
Uncertaneity (Uce)	bar	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155			

Result (min/MAX) 1,155 / 1,155 CONFORM

Remarks

Operator: Fasolato G.

This document is produced by a protected database and valid without signature

LRQA Verification Limited
Witnessed Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 09/08/2024

ROSETI MARINO SPA
09/08/2024
REVIEWED

LRQA verification ltd 0094
Witnessed Monitored Reviewed
MATTIA CRIVELLARI
Ref. No..
Office: Milan 09/08/2024

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
25 MAR 2024

1723001756-QC-DB-00017_02 - V25001A

BREMBANA&ROLLE
Via Villino, I 24030 Valbrembo(BG) Italy

CALIBRATION REPORT

N.	Date:
p285-2024-03-25	25/03/2024

Reference Procedure: 150-CPG

Expiration Date: 25/09/2024

Calibrating Equipment:	manometro	*S/N*	p285	*Range*	100,0	*Unit*	bar
Manufacturer:	Italmanometri						
Reference Equipment:	manometro	*S/N*	m004	*Range*	250,00	*Unit*	bar
Manufacturer:	Cube25						

Ambience Calibration Temperature	°C	20
Maximum Utilization Temperature	°C	30

(Ea) bar	*(Es) bar*	*(Ir) bar*	*(Et) bar/°C*	*(Ic) bar*
0,000	1,000	0,000	0,000	0.1

		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Reference Equipment Reading	bar	0	25	50	75	100	75	50	25	0			
Calibrating Equipment Reading	bar	0	25	50	75	100	75	50	25	0			
Error (Em)	bar	0	0	0	0	0	0	0	0	0			
Maximum Permissible Error	bar	2	2	2	2	2	2	2	2	2	2	2	2
Uncertaneity (Uce)	bar	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155			

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 09/08/2024

Result (min/MAX) 1,155 / 1,155 CONFORM

Remarks

Operator: Fasolato G.

This document is produced by a protected database and valid without signature

ROSETI MARINO SpA
09/08/2024
REVIEWED

☐ LRQA verification ltd ☑ 009 ☐
☐ Witnessed ☑ Monitored ☑ Reviewed
MATTIA CRIVELLARI
Ref. No..
Office: Milan 09/08/2024

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
25 MAR 2024

1723001756-QC-DB-00017_02 - V25001A

Trescal

TRESCAL s.r.l.
Via dei Metalli, 1
25039 Travagliato (BS)
Tel. 030 6842501 - Fax 030 6842599
www.trescal.com - e-mail: it.info.bs@trescal.com

Centro di Taratura LAT 051
Calibration Centre
Laboratorio Accreditato di Taratura
Accredited Calibration Laboratory

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAT 051

Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC

Signatory of EA, IAF and ILAC Mutual Recognition Agreements

CERTIFICATO DI TARATURA LAT 051 C12229F8B0

Certificate of Calibration

- data di emissione *date of issue*	2022/10/28
- cliente *customer*	LABORATORIO METROLOGICO VENETO S.r.l. VIA SACRO CUORE, 15/B 35135 PADOVA (PD)
- destinatario *receiver*	BREMBANA E ROLLE SPA VIA VILLINO, 1 24030 VALBREMBO (BG)

Il presente certificato di taratura è emesso in base all'accreditamento LAT N° 051 rilasciato in accordo ai decreti attuativi della legge n. 273/1991 che ha istituito il Sistema Nazionale di Taratura (SNT). ACCREDIA attesta le capacità di misura e di taratura, le competenze metrologiche del Centro e la riferibilità delle tarature eseguite ai campioni nazionali e internazionali delle unità di misura del Sistema Internazionale delle Unità (SI).
Questo certificato non può essere riprodotto in modo parziale, salvo espressa autorizzazione scritta da parte del Centro.

This certificate of calibration is issued in compliance with the accreditation LAT N° 051 granted according to decrees connected with Italian law No. 273/1991 which has established the National Calibration System. ACCREDIA attests the calibration and measurement capability, the metrological competence of the Centre and the traceability of calibration results to the national and international standards of the International System of Units (SI).
This certificate may not be partially reproduced, except with the prior written permission of the issuing Centre.

Si riferisce a
referring to

- oggetto *item*	Manometro a quadrante
- costruttore *manufacturer*	//
- modello *model*	//
- matricola *serial number*	12G82102 (m004)
- data ricev. oggetto *date of receipt of item*	2022/10/19
- data delle misure *date of measurements*	2022/10/28
- registro di laboratorio *laboratory reference*	GS2M

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure citate alla pagina seguente, dove sono specificati anche i campioni o gli strumenti che garantiscono la catena di riferibilità del Centro e i rispettivi certificati di taratura in corso di validità. Essi si riferiscono esclusivamente all'oggetto in taratura e sono validi nel momento e nelle condizioni di taratura, salvo diversamente specificato.
The measurement results reported in this Certificate were obtained following the procedures given in the following page, where the reference standards or instruments are indicated which guarantee the traceability chain of the laboratory, and the related calibration certificates in their course of validity are indicated as well. They relate only to the calibrated item and they are valid for the time and conditions of calibration, unless otherwise specified.

Le incertezze di misura dichiarate in questo documento sono state determinate conformemente alla Guida ISO/IEC 98 e al documento EA-4/02. Solitamente sono espresse come incertezza estesa ottenuta moltiplicando l'incertezza tipo per il fattore di copertura *k* corrispondente ad livello di fiducia di circa il 95%. Normalmente tale fattore *k* vale 2.
The measurement uncertainties stated in this document have been determined according to the ISO/IEC 98 and to EA-4/02. Usually, they have been estimated as expanded uncertainty obtained multiplying the standard uncertainty by the coverage factor k corresponding to a confidence level of about 95%. Normally, this factor k is 2.

LRQA verification ltd ☒ 0094 ☐ ____
☐ ~~Witnessed~~ ☐ ~~Monitored~~ ☒ Reviewed
MATTIA CRIVELLARI
Ref. No..
Office: Milan 09/08/2024

Direzione tecnica
(Approving Officer)
Fenotti F.

BREMBANA & ROLLE S.P.A.
ALBIGNASEGO - PD - ITALY
Q.C. MANAGER M. GALLI
DATE: 28 OTT. 2022

LRQA Verification Limited
☐ ~~Witnessed~~ ☒ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 09/08/2024

Trescal

TRESCAL s.r.l.
Via dei Metalli, 1
25039 Travagliato (BS)
Tel. 030 6842501 - Fax 030 6842599
www.trescal.com - e-mail: it.info.bs@trescal.com

Centro di Taratura LAT 051
Calibration Centre
Laboratorio Accreditato di Taratura
Accredited Calibration Laboratory

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAT 051

Membro degli Accordi di Mutuo Riconoscimento
EA, IAF e ILAC

Signatory of EA, IAF and ILAC Mutual Recognition Agreements

CERTIFICATO DI TARATURA LAT 051 C12229F8B0

Certificate of Calibration

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure N.
The measurement results reported in this Certificate were obtained following procedures No.

MG/SIT/61 Rev. 04

La catena di riferibilità ha inizio dai campioni di riferimento N.
Traceability is through reference standards No.

J503	Accoppiamento pistone-cilindro
J194	Accoppiamento pistone-cilindro
2331	Accoppiamento pistone-cilindro
48120	Set di masse campione
TL-1351	Accoppiamento pistone-cilindro
47861	Set di masse campione
V-1335	Accoppiamento pistone-cilindro

muniti di certificati validi di taratura rispettivamente N.
validated by certificates of calibration No.

Certificato n.:	Emesso da
20-0511-02	I.N.Ri.M.
20-0511-01	I.N.Ri.M.
4220675	Fluke Calibration
LAT051 CT-MA-0845-2016	Trescal S.r.l.
19-0809-01	I.N.Ri.M.
LAT 051 CT-MA-0256-2022	Trescal S.r.l.
19-0809-02	I.N.Ri.M.

Condizioni ambientali
Environmental conditions

Temperatura: (20 ± 0,5) °C
Temperature

Umidità relativa: (50 ± 10) %UR
Relative Humidity

Pressione atmosferica: 101158 Pa
Atmospheric pressure

Luogo della taratura
Calibration site

Taratura eseguita presso il laboratorio permanente Trescal con sede a Travagliato (BS).
Calibration performed at Trescal permanent laboratory based in Travagliato (BS).

L'operatore
Clerici M.

Trescal CENTRO DI TARATURA
L'OPERATORE (MARCO CLERICI)

Trescal

TRESCAL s.r.l.
Via dei Metalli, 1
25039 Travagliato (BS)
Tel. 030 6842501 - Fax 030 6842599
www.trescal.com - e-mail: it.info.bs@trescal.com

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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAT 051

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EA, IAF e ILAC

Signatory of EA, IAF and ILAC
Mutual Recognition Agreements

CERTIFICATO DI TARATURA LAT 051 C12229F8B0

Certificate of Calibration

IMPOSTAZIONI

Campo di misura	0 / 250 bar	
Unità di formato	1	bar
Risoluzione	0.2	bar
Classe	0.25	

Fluido di taratura: Acqua
Livello di riferimento: piano del raccordo di connessione
Posizione: verticale
Pressione relativa alla pressione atmosferica

RISULTATI SPERIMENTALI

Pressione di riferimento P_{rif}	Pressione indicata (pressione crescente) P_{up}	Pressione indicata (pressione decrescente) P_{down}	Ripetibilità n. 1	Ripetibilità n. 2	Ripetibilità della pressione indicata
/ bar	/ bar	/ bar	/ bar	/ bar	/ bar
0.0	0.0	0.0			
25.0	25.0	25.0			
75.0	75.0	75.0			
125.0	125.0	125.0	125.0	125.0	0.0
200.0	200.4	200.4			
250.0	249.6	249.6			

Pressione di riferimento P_{rif}	Errore di indicazione pressione crescente E_{up}	Errore di indicazione pressione decrescente E_{down}	Incertezza estesa U	Incertezza estesa nel caso in cui non si effettuano correzioni U'_{up}	Incertezza estesa nel caso in cui non si effettuano correzioni U'_{down}
/ bar	/ bar	/ bar	/ bar	/ bar	/ bar
0.0	0.00	0.00	0.12	0.12	0.12
25.0	0.00	0.00	0.12	0.12	0.12
75.0	0.00	0.00	0.12	0.12	0.12
125.0	0.00	0.00	0.12	0.12	0.12
200.0	0.40	0.40	0.12	0.52	0.52
250.0	-0.40	-0.40	0.12	0.52	0.52

NOTE

Il manometro è stato picchiettato ad ogni punto di misura

L'operatore
Clerici M.

Trescal CENTRO DI TARATURA
L'OPERATORE (MARCO CLERICI)

BREMBANA&ROLLE
Via Villino, 1 24030 Valbrembo(BG) Italy

CALIBRATION REPORT

N.	Date:
13003751-21001336-2024-02-08	08/02/2024

Reference Procedure: 153-CTH

Expiration Date: 08/02/2025

Calibrating Equipment:	Termometro digitale + sonda tc "K"	*S/N*	13003751-21001336	*Range*	400,0	*Unit*	°C
Manufacturer:	Delta OHM						
Reference Equipment:	Pyrometer 1327K	*S/N*	200306847	*Range*	550,00	*Unit*	°C
Manufacturer:	RS PRO						

			(Ea) °C	(Es) °C	(Ir) °C	(Et) °C/°C	(Ic) °C
Ambience Calibration Temperature	°C	20	0,000	0.1	0,000	0,000	0.4
Maximum Utilization Temperature	°C	30					

		1	2	3	4	5	6	7	8	9	10	11	12
Reference Equipment Reading	°C	47,2	85,8	146,4	198,4	294,6	397,2						
Calibrating Equipment Reading	°C	46,8	84,2	144,8	196,6	293,5	395,1						
Error (Em)	°C	0,4	1,6	1,6	1,8	1,1	2,1						
Maximum Permissible Error	°C	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Uncertaneity (Uce)	°C	4,068	4,444	4,444	4,545	4,236	4,713						

Result (min/MAX) 4,068 / 4,713 CONFORM

Remarks

Operator: Fasolato G.

This document is produced by a protected database and valid without signature

ROSETTI MARINO SpA
08/08/2024
REVIEWED

☐ LRQA verification ltd UK 009 ☐
☐ Witnessed ☐ Monitored ☑ Reviewed
MATTIA CRIVELLARI
Ref. No..
Office: Milan
08/08/2024

BREMBANA & ROLLE S.p.A.
QCM - M. GALLI
REVIEWED / ACCEPTED
FEB 2024

1723001756-QC-DB-00017_02 - V25001A
PAGE 888/1016

Nemko

Laboratorio di Taratura Nemko

Nemko Calibration Laboratory

CERTIFICATO DI TARATURA N. ISO 05341/20
Certificate of Calibration No.

- Cliente *Customer*	*RS COMPONENTS SPA* *Via M.V. da Vizzi 93/95 - 20092 Cinisello Balsamo (MI)*	- Oggetto *Item*	Pirometro
- Destinatario *Addressee*	*Brembana & Rolle Spa* *----(-)*	- Marca *Manufacturer*	RS PRO
- Riferimento ordine *Order reference*	*NEx - 411491*	- Modello *Model*	1327K
- Registro di laboratorio *Laboratory register*	*05341*	- Matricola *Serial number*	200306847
- Data di ricevimento oggetto *Date of receipt of item*	*2020/12/02*	- Data di taratura *Date of calibration*	2020/12/03

Il laboratorio metrologico Nemko Spa, nei campi di misura ed entro le incertezze precisate nelle proprie procedure tecniche, garantisce:
- il mantenimento della riferibilità degli apparecchi usati dal Centro a campioni nazionali delle unità del Sistema Internazionale delle Unità (SI);
- la correttezza metrologica delle procedure di taratura adottate;
- la conformità alla norma ISO/IEC 17025.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure citate alla pagina seguente, dove sono specificati anche i campioni di prima linea da cui inizia la catena di riferibilità del Centro e i rispettivi certificati di taratura, in corso di validità. Essi si riferiscono esclusivamente alle grandezze in taratura e sono validi nel momento e nelle condizioni di taratura, salvo diversamente specificato.

Le incertezze di misura dichiarate in questo documento sono state determinate conformemente alla Guida ISO/IEC 98 e al documento EA-4/02. Solitamente sono espresse come incertezza estesa ottenuta moltiplicando l'incertezza tipo per il fattore di copertura k corrispondente ad un livello di fiducia di circa il 95 %. Normalmente tale fattore k vale 2.

Questo certificato non può essere riprodotto in modo parziale o completo, salvo espressa autorizzazione scritta da parte del Centro.

The metrology laboratory Nemko Spa, for the measurement ranges and the uncertainties stated in its technical procedures, guarantees:
- the maintenance of the traceability of the measuring equipment used by the Centre to national standards of the International System of Units (SI);
- the metrological correctness of the calibration procedures used;
- compliance to standard ISO/IEC 17025.

The measurement results reported in this Certificate were obtained following the procedures given in the following page, where the reference standards from which the traceability chain of the laboratory starts, and the relevant valid calibration certificates are also mentioned. The measurement results relate only to the calibrated quantities and they are valid for the time and conditions of calibration, unless otherwise specified.

The measurement uncertainties stated in this document have been determined according to the ISO/IEC Guide 98 and to EA-4/02. Usually, they have been estimated as expanded uncertainty obtained multiplying the standard uncertainty by the coverage factor k corresponding to a confidence level of about 95%. Normally, this factor k is 2.

This certificate may not be partially or completely reproduced, except with the prior written permission of the issuing Centre.

Data di emissione / *Date of issue*

2020/12/03

BREMBANA & ROLLE S.p.A.
P. FACHERIS
Q.C. CALIBRATION SUPERVISOR
18.05.2021
EXP. 18.05.2026

Approvato da / *Approved by*

P.I. Luca Terraneo

BREMBANA & ROLLE S.p.A.
VALBREMBO - BG ITALY
Q.C.MANAGER M.ESPOSITO
DATE 18 05 21

Nemko Italy
Nemko Spa a Socio Unico, Via del Carroccio 4, 20853 Biassono (MB)
TEL +39 039 220 12 01 FAX +39 039 220 12 21 EMAIL segreteria@nemko.com
COD.FISC./P.IVA IT02540280969 CAP.SOC. € 895.960,00 i.v. ISCR.R.I. MB 02540280969
Doc.: CDT Rev.: 7 Date: 2020-01-20

Nemko

Laboratorio di Taratura Nemko

Nemko Calibration Laboratory

CERTIFICATO DI TARATURA N. ISO 05341/20
Certificate of Calibration No.

1. MODALITA' DI TARATURA

1. CALIBRATION METHOD

1.1 Descrizione dell'oggetto in taratura

1.1 Description of the item to be calibrated

Lo strumento si presenta in buone condizioni e senza danni apparenti.
The instrument arrived in good conditions and without visible damages.

1.2 Descrizione della taratura

1.2 Calibration description

La taratura si esegue con il metodo del confronto con un termometro a resistenza (campione di lavoro) a sua volta tarato per confronto con un termometro a resistenza (campione di riferimento) tarato ai punti fissi della STI-90. Le apparecchiature utilizzate per la realizzazione della temperatura sono:
Calibration was performed though comparison method with a resistance thermometer (working standard) calibrated though comparison method with a resistance thermometer (reference standard) calibrated at ITS-90 fixed points. Instruments used for generating temperature are:

-80°C ÷ 50°C	bagno termostatico ad halocarbon (*halocarbon thermostatic bath*)
0°C	in vaso di dewar con ghiaccio fondente (*in dewar pot with melting ice*)
10°C ÷ 90°C	bagno termostatico ad acqua (*water thermostatic bath*)
50°C ÷ 200°C	bagno termostatico a olio (*oil thermostatic bath*)
200°C ÷ 550°C	bagno termostatico a sali fusi (*fused salts thermostatic bath*)
-20°C ÷ 550°C	fornetto a secco (dry well)

La taratura è stata eseguita con lo strumento in taratura alimentato internamente
Calibration was performed with instrument under calibration supplied internally

1.3 Valutazione di conformità

1.3 Conformity assessment

Si attesta che i valori riportati nel certificato in oggetto rispettano le specifiche dichiarate dal costruttore. Non è stata eseguita la messa in punto.
We state that the measured values, recorded in this certificate, comply with the instrument specifications declared by the manufacturer. No adjustment was made.

La verifica di conformità dello strumento viene eseguita assegnando ad ogni valore misurato uno dei seguenti esiti:
The conformity assessment of the instrument is performed by assigning each of the measured values one of the following results:

P (Pass) - I valori di taratura dello strumento rispettano i limiti della specifica nei punti misurati. Il rischio specifico di falsa accettazione raggiunge il 50 % quando i risultati di misura sono prossimi al limite.
P (Pass) - The calibration values of the instrument respect the specification limit at the points measured. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) – Uno o più valori di taratura dello strumento non rispettano i limiti della specifica nei punti misurati. Il rischio specifico di falso rigetto raggiunge il 50 % quando i risultati di misura sono prossimi al limite.
F (Fail) - One or more calibration values of the instrument do not respect the specification limit at the points measured. The specific risk of false reject is up to 50% when the measured result is close to the limit.

BREMBANA & BALLES.p.A.
R. FAORERIS
Q.C. CALIBRATION SUPERVISOR
18.05.2021
EXP. 18.05.2026

BREMBANA & BALLES.p.A.
VAL BREMBO - BG - ITALY
Q.C. MANAGER M.ESPOSITO
DATE 18/05/21

Nemko

Laboratorio di Taratura Nemko
Nemko Calibration Laboratory

CERTIFICATO DI TARATURA N. ISO 05341/20
Certificate of Calibration No.

2. PROCEDURE TECNICHE E CAMPIONI DI PRIMA LINEA
2. THECHNICAL PROCEDURES AND REFERENCE STANDARDS

2.1 I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure
2.1 The measurement results reported in this Certificate were obtained following procedures

WML0040rev5

2.2 La catena di riferibilità è costituita dai seguenti strumenti
2.2 Traceability is achieved through the following instruments

Descrizione *Description*	**Marca** *Manufacturer*	**Modello** *Model*	**Matricola** *Serial number*	**Certificato** *Certificate*	**Tarato il:** *Cal. date*	**Scade il:** *Due date*
Multimetro digitale	Hewlett Packard	3458A	2823A03147	INRIM 19-0803-01	12/2019	01/2021
Termometro a resistenza	Hart Scientific	5698	985007	INRIM 19-0868-01	10/2019	12/2020
Termometro a resistenza	Hart Scientific	5626	0807	ISO 02108/20	06/2020	12/2020
Termometro a resistenza	Isotech	909	1345	ISO 02109/20	06/2020	12/2020
Termometro a resistenza	Tinsley	5187 SA	250323	ISO 02110/20	06/2020	12/2020
Multimetro digitale	Hewlett Packard	3458A	2823A06345	ISO 00403/20	01/2020	01/2021
Termometro a resistenza di platino	Fluke	5626	4608	ISO 02107/20	06/2020	12/2020

3. LUOGO DI TARATURA
3. CALIBRATION PLACE

Nemko SpA
Via del Carroccio, 4
20853 Biassono (MB)

4. CONDIZIONI AMBIENTALI E DI TARATURA
4. CALIBRATION AND ENVIRONMENTAL CONDITIONS

Temperatura ambiente *Ambient Temperature*	(20±2)°C
Umidità Relativa *Relative Humidity*	(25-70)%
Tempo di riscaldamento prima di iniziare le misure *Turn on time before measurements*	NA

BREMBANA & BOLLER S.p.A.
P. FAGNERIS
Q.C. CALIBRATION SUPERVISOR
18.05.2021
EXP 18.05.2026
Doc.: CDT Rev.: 7 Date: 2020-01-20

BREMBANA & BOLLER S.p.A.
VALBREMBO - BG - ITALY
Q.C MANAGER M. ESPOSITO
DATE 18.05.21

Nemko

Laboratorio di Taratura Nemko

Nemko Calibration Laboratory

CERTIFICATO DI TARATURA N. ISO 05341/20
Certificate of Calibration No.

5. TARATO DA
5. CALIBRATED BY

P.I. Marco Rossi

6. RISULTATI DELLE MISURE, IMPOSTAZIONI DELLO STRUMENTO IN TARATURA E INCERTEZZA ESTESA
6. MEASUREMENTS RESULTS, INSTRUMENT UNDER SET UP AND EXPANDED UNCERTAINTY

Taratura di Termometro a Infrarossi *Infrared Thermometer Calibration*					Verifica delle Specifiche *Specification Check*		
Numero Punti *Points Number*	**Temperatura Riferimento** *Standard Temperature*	**Temperatura Indicata** *Indicated Temperature*	**Differenza** (t_{rif} - t_{ind}) *Difference* (t_{ref} - t_{ind})	**Incertezza** *Uncertainty*	**Specifica** *Specification*	**K_1=|E|/(S-U) K_2=|E|/(S+U)**	**Risultato** *Result*
1	0,0 °C	0,0 °C	0,0 °C	0,5 °C	1,00 °C	K1=0% - K2=0%	PASS
2	49,7 °C	50,1 °C	-0,4 °C	0,3 °C	1,05 °C	K1=54% - K2=30%	PASS
3	98,8 °C	98,9 °C	-0,1 °C	0,3 °C	1,10 °C	K1=13% - K2=7%	PASS
4	196,8 °C	196,0 °C	0,8 °C	0,3 °C	1,20 °C	K1=89% - K2=53%	PASS
					K1>100% - K2>100% FAIL K1>100% - K2<=100% NO DECISION K1<=100% - K2<100% PASS E = Errore (Error) S = Specifica (Specification) U = Incertezza (Uncertainty)		

BREMBANA & ROLLE S.p.A.
P. FARHERIS
Q.C. CALIBRATION SUPERVISOR
18.05.2021
EXP 18 05 2026

BREMBANA & ROLLE S.p.A.
VALBREMBO - BG - ITALY
Q.C. MANAGER M. ESPOSITO
DATE 18/05/21

HERAtech

Laboratorio – Gestione Operativa Processi Analitici Emilia Romagna
Via Setta, n. 4 – 40037 SASSO MARCONI (BO) C.F. :03578271201 P. Iva: 03819031208
e-mail: heratech@pec.gruppohera.it

CARATTERISTICHE DI QUALITA' MEDIE DELL'ACQUA DEI COMUNI DI:
AVERAGE QUALITY CHARACTERISTICS OF THE WATER OF THE MUNICIPALITIES OF:
PADOVA, ABANO TERME e ALBIGNASEGO
Mese di APRILE 2024
Month of APRIL 2024

Parametro *parameter*	***u.m.*** *u.o.m.*	***valore misurato (Nota n. 1)*** *Measured value (note no.1)*	***Valori dei parametri chimici e dei parametri indicatori*** *Values of chemical parameters and indicator parameters* ***(Nota n. 2)*** *(Note no. 2)*
Torbidità / *turbidity*	NTU	**< 0,2**	*(4)*
concentrazione ioni idrogeno / *hydrogen ion concentr.*	pH	**7,7**	*(6.5 ÷ 9.5)*
conduc. elettrica specifica a 20 °C / *electrical conducivity*	µS/cm	**457**	*(2500)*
durezza totale in gradi francesi / *total hardness in French grades*	°F	**27,4**	*(15 ÷ 50)*
residuo fisso a 180° C / *fixed residue at 180°C*	mg/l	**432**	*1500*
ossidabilità secondo Kübel / *oxidation according to Kübel*	mg/l	**0,9**	*(5,0)*
Calcio / *Calcium*	mg/l	**66,2**	--
Magnesio / *Magnesium*	mg/l	**26,0**	--
Sodio / *Sodium*	mg/l	**4,0**	*(200)*
Potassio / *Potassium*	mg/l	**< 1**	-
Cloruri / *Chloride*	mg/l	**8**	*(250)*
nitrato (come NO3) / *Nitrate (as NO3)*	mg/l	**14**	*50*
Solfati / *Sulphate*	mg/l	**16**	*(250)*
Bicarbonati / *Bicarbonates*	mg/l	**294**	--
Ammonio / *Ammonium*	mg/l	**< 0,05**	*(0,50)*
nitrito (come NO2) / *Nitrite (as NO2)*	mg/l	**< 0,05**	*0,10*
Fluoruri / *Fluoride*	mg/l	**0,08**	*1,50*
cianuri totali / *total cyanides*	µg/l	**< 5**	*50*
solventi clorurati totali (TCE+PCE) / *total chlorinated solvents*	µg/l	**4**	*10*
Trialometani / *trihalomethanes*	µg/l	**0,4**	*30*
antiparassitari totali / *total pesticides*	µg/l	**< 0,10**	*0,50*
Benzene / *Benzene*	µg/l	**< 0,1**	*1,0*
toluene, xileni, alchilbenzeni *(Nota n. 3)* / *toluene, xylenes, alkylbenzenes (Note No. 3)*	µg/l	**< 0,1**	--
diaminoclorotriazina (DACT) *(Nota n. 4)* / *diaminochlorotrazine (DACT) (Note No. 4)*	µg/l	**< 0,020**	*0,10*
Arsenico / *arsenic*	µg/l	**< 1**	*10*
Cadmio / *cadmium*	µg/l	**< 0,5**	*5,0*
cromo totale / *total chromium*	µg/l	**< 2**	*50*
ferro totale / *total iron*	µg/l	**< 10**	*(200)*
Manganese / *Manganese*	µg/l	**< 5**	*(50)*
Nichel / *Nickel*	µg/l	**< 2**	*20*
Piombo / *Lead*	µg/l	**< 1**	*10*
Rame / *Copper*	mg/l	**< 0,005**	*1,0*
Coliformi totali / *total coliforms*	in 100 ml	**0**	*10*
Escherichia coli / *Escherichia coli*	in 100 ml	**0**	*0*
Enterococchi / *Enterococci*	in 100 ml	**0**	*0*
Carica batterica a 37 °C / *Bacterial load at 37 °C*	In 1 ml	**2**	--
Carica batterica a 22 °C / *Bacterial load at 22 °C*	In 1 ml	**5**	--

BRENTANA & BOLLE S.p.A.
QC1 - LABORATORIO
REVIEWED / ACCEPTED
2024

NOTE / *NOTES*:

(1) Il valore riportato in colonna è il valore medio dei risultati ottenuti nel mese di prelievo indicato. In caso di presenza di valori sotto il limite di quantificazione, verrà considerato metà del valore assoluto della prova. In caso di assenza di risultati nel mese, verrà riportata la media del mese precedente.

(1) The value reported in the column is the average value of the results obtained in the indicated withdrawal month. In case of presence of values below the limit of quantification, half of the absolute value of the test will be considered. In case of no results in the month, the average of the previous month will be reported.

(2) I valori dei parametri chimici e i valori dei parametri indicatori (indicati tra parentesi) sono desunti dal D.Lgs. Governo 2 febbraio 2001, n. 31 e s.m.i. e dalla Delib. Giunta Reg. (Veneto) 22 dicembre 2004, n. 4080.

(2) The values of the chemical parameters and the values of the indicator parameters (indicated in brackets) are taken from the Government Legislative Decree 2 February 2001, n. 31 and subsequent amendments. and by the Resolution. Reg. Council (Veneto) 22 December 2004, n. 4080.

(3) Il valore del parametro Toluene, Xileni, Alchilbenzeni è ottenuto dalla media dei valori ottenuti per i parametri Toluene, m-Xilene, p- Xilene, o-Xilene, Alchilbenzeni.

(3) The value of the parameter Toluene, Xylenes, Alkylbenzenes is obtained from the average of the values obtained for the parameters Toluene, m-Xylene, p-Xylene, o-Xylene, Alkylbenzenes.

(4) Il valore del parametro diaminoclorotriazina (DACT) in µg/l è ottenuto dalla moltiplicazione del valore medio in ng/l per il fattore 0,001.

(4) The value of the diaminochlorotriazine parameter (DACT) in µg/l is obtained by multiplying the average value in ng/l by the factor 0.001.

Bologna, 21.05.2024

BREMBANA & TRO LE S.p.A.
QCM
REVIEWED / ACCEPTED
0 8 AUG 2024

Fabrication site: Albignasego – PD – ITALY

Section 16

Certificate of Visual and Dimensional Checking, thickness and tolerances

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI ESAME VISIVO
VISUAL EXAMINATION REPORT

N°. Documento Document No.	23096-SNA VT 01
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 16

Descrizione del materiale: Material Description: LEFT AND RIGHT HEADS INTERNAL/EXTERNAL VISUAL EXAMINATION

Materiale / Material SA 516 Gr.60 **Sp.** / Thk. 44 MAF **Surface** As rolled/formed

Time	PWHT		HYDROTEST	
	BEFORE ☑	AFTER ☐	BEFORE ☑	AFTER ☐

Dis. N° / Dwg. No. 23096-01-EGA1 Rev.05

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance specification
ASME VIII Div.2 2021 Ed. / ASME V – Art.9 2021 Ed. 23096-QNDE Rev.03	ASME VIII Div.2 2021 Ed. / 23096-QNDE Rev.03

Tecnica d'ispezione Inspection technique	**Condizioni di prova** Inspection condition	
Direct visual examination	**Stadio lavorazione** / Manufacturing	Material entry
General	**Superfici ispezionate** / Surfaces	100% Internal & external surfaces
Not Assisted	**Strumenti ausiliari** / Auxiliary	None

Illuminazione / Viewing conditions	**Tipo** / Type	**Intensità** / Intensity	**Note** / Remarks
	Ambient light	≥ 1076 lux	None

Risultato Result

Registrazione delle indicazioni / Recording of indications	No indication

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)
-	-	-	-	-	-
-	-	-	-	-	-

Note Remarks	None

Tipo di indicazioni / Type of indications

100 Crack	402 Lack of penetration	5043 Excessive melt-through	520 Excessive distortion	607 Tack weld imperfection
101 Longitudinal crack	4021 Incomplete root penetration	505 Incorrect weld toe	521 Incorret weld dimensions	608 Misalignment of opposite runs
102 Transverse crack	500 Imperfect shape	506 Overlap	5211 Excessive weld thickness	610 Temper colours
103 Radiating cracks	501 Undercut	507 Linear misalignment	5212 Excessive weld width	613 Scaled surface
104 Crater crack	5011 Continuos undercut	508 Angular misalignment	5213 Insufficient throat thickness	614 Flux residue
105 Group of disconnected crack	5012 Intermitted undercut	509 Sagging	5214 Excessive throat thickness	615 Slag residue
106 Branching crack	5013 Shrinkage grooves	510 Burn-through	600 Miscellaneous imperfections	617 Icorrect root gap for fillet welds
201 Gas cavity	5014 Inter-pass undercut	511 Incompletely fillet groove	601 Arc strike	993 Generic contamination
2017 Surface pore	5015 Local intermittent undercut	512 Excessive asymmetry of fillet welc	602 Spatter	994 Iron contamination
2018 Surface porosity	502 Excess weld metal	513 Irregular width	6021 Tungsten spatter	995 Localized corrosion
2024 Crater pipe	503 Excessive convexity	514 Irregular surface	603 Torn surface	996 Localized blister
2025 End crater pipe	504 Excessive penetration	515 Root concavity	604 Grinding mark	997 Localized pitting
400 Lack of fusion and penetratic	5041 Local excessive penetration	516 Root porosity	605 Chipping mark	998 Not-homogeneous paint
401 Lack of fusion	5042 Continuos excessive penetration	517 Poor restart	606 Underflushing	999 Insufficient paint

Conforme alla specifica / Conform to specification	**SI**/YES ☑	NO/NO ☐
Loc./Test place	Albignasego(PD)	
Accettato/Accepted ☑	**Non Accettato**/NotAccepted ☐	**RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA & ROLLE S.p.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / /	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED	0084 LRQA	LRQA Verification Limited ☑ Witnessed ☐ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 23/04/2024
Data/Date 23 Apr 24	**Data**/Date 23 Apr 24	23/04/2024	

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI ESAME VISIVO
VISUAL EXAMINATION REPORT

N°. Documento Document No.	23096-SNA VT 02
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 60

Descrizione del materiale: Material Description: VISUAL EXAMINATION INTERNAL/EXTERNAL BEFORE POST WELD HEAT TREATMENT OF COMPLETE EQUIPMENT

Materiale / Material SA 516 Gr.60 **Sp.** / Thk. 44 MAF **Surface** As rolled/formed

Time	PWHT BEFORE ☑	PWHT AFTER ☐	HYDROTEST BEFORE ☑	HYDROTEST AFTER ☐

Dis. N° / Dwg. No. 23096-01-EGA1 Rev.05

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance specification
ASME VIII Div.2 2021 Ed. / ASME V – Art.9 2021 Ed. 23096-QNDE Rev.03	ASME VIII Div.2 2021 Ed. / 23096-QNDE Rev.03
Tecnica d'ispezione Inspection technique	**Condizioni di prova** Inspection condition
Direct visual examination	**Stadio lavorazione** / Manufacturing: Material entry
General	**Superfici ispezionate** / Surfaces: 100% Internal & external surfaces
Not Assisted	**Strumenti ausiliari** / Auxiliary: None

Illuminazione / Viewing conditions	**Tipo** / Type	**Intensità** / Intensity	**Note** / Remarks
	Ambient light	≥ 1076 lux	None

Risultato Result

Registrazione delle indicazioni / Recording of indications: No indication

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)
-	-	-	-	-	-
-	-	-	-	-	-

Note Remarks: None

Tipo di indicazioni / Type of indications

100 Crack	402 Lack of penetration	5043 Excessive melt-through	520 Excessive distortion	607 Tack weld imperfection
101 Longitudinal crack	4021 Incomplete root penetration	505 Incorrect weld toe	521 Incorret weld dimensions	608 Misalignment of opposite runs
102 Transverse crack	500 Imperfect shape	506 Overlap	5211 Excessive weld thickness	610 Temper colours
103 Radiating cracks	501 Undercut	507 Linear misalignment	5212 Excessive weld width	613 Scaled surface
104 Crater crack	5011 Continuos undercut	508 Angular misalignment	5213 Insufficient throat thickness	614 Flux residue
105 Group of disconnected crack	5012 Intermitted undercut	509 Sagging	5214 Excessive throat thickness	615 Slag residue
106 Branching crack	5013 Shrinkage grooves	510 Burn-through	600 Miscellaneous imperfections	617 Icorrect root gap for fillet welds
201 Gas cavity	5014 Inter-pass undercut	511 Incompletely fillet groove	601 Arc strike	993 Generic contamination
2017 Surface pore	5015 Local intermittent undercut	512 Excessive asymmetry of fillet welc	602 Spatter	994 Iron contamination
2018 Surface porosity	502 Excess weld metal	513 Irregular width	6021 Tungsten spatter	995 Localized corrosion
2024 Crater pipe	503 Excessive convexity	514 Irregular surface	603 Torn surface	996 Localized blister
2025 End crater pipe	504 Excessive penetration	515 Root concavity	604 Grinding mark	997 Localized pitting
400 Lack of fusion and penetratic	5041 Local excessive penetration	516 Root porosity	605 Chipping mark	998 Not-homogeneous paint
401 Lack of fusion	5042 Continuos excessive penetration	517 Poor restart	606 Underflushing	999 Insufficient paint

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA & ROLLE S.P.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / /	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED	OBO CW L. DI ALESSANDRO	LRQA LRQA Verification Limited ☐ Witnessed ☐ Reviewed Flavio Zanon Authorized Inspector N.B. No. 13421 Milan Office 25-07-2024
Data/Date 25 Jul 24	Data/Date 25 Jul 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI ESAME VISIVO
VISUAL EXAMINATION REPORT

N°. Documento / Document No.	23096-SNA VT 03
Pagina / Page	1 di / of 1

Cliente / Customer	ROSETTI MARINO	**Ordine N°** / P.O. No	1723001756 123A90A
Commessa / Mfr' work No.	23096	**Disegno** / Drawing	23096-01-EGA1
Progetto / Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** / Serial No.	23096-01-SNA
Sigla / Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** / Q.C.P. No.	23096-01-QCPA step 67

Descrizione del materiale: / Material Description: VISUAL EXAMINATION INTERNAL/EXTERNAL AFTER POST WELD HEAT TREATMENT OF COMPLETE EQUIPMENT

Materiale / Material SA 516 Gr.60 **Sp.** / Thk. 44 MAF **Surface** AS WELDED

Time	PWHT		HYDROTEST	
	BEFORE ☐	AFTER ☑	BEFORE ☑	AFTER ☐

Dis. N° / Dwg. No. 23096-01-EGA1 Rev.05

Procedura d'esame / Examination procedure	**Accettabilita' difetti** / Acceptance specification
ASME VIII Div.2 2021 Ed. / ASME V – Art.9 2021 Ed. 23096-QNDE Rev.03	ASME VIII Div.2 2021 Ed. / 23096-QNDE Rev.03
Tecnica d'ispezione / Inspection technique	**Condizioni di prova** / Inspection condition
Direct visual examination	**Stadio lavorazione** / Manufacturing: Material entry
General	**Superfici ispezionate** / Surfaces: 100% Internal & external surfaces
Not Assisted	**Strumenti ausiliari** / Auxiliary: None

Illuminazione / Viewing conditions	**Tipo** / Type	**Intensità** / Intensity	**Note** / Remarks
	Ambient light	≥ 1076 lux	None

Risultato / Result

Registrazione delle indicazioni / Recording of indications: No indication

Pos. / Pos.	Tipo / Type	Descrizione / Description	Localizzazione / Location	Risultato / Result	Documentazione grafica (se necessaria) / Graphic documentation (if necessary)
-	-	-	-	-	-
-	-	-	-	-	-

Note / Remarks: None

Tipo di indicazioni / Type of indications

100 Crack	402 Lack of penetration	5043 Excessive melt-through	520 Excessive distortion	607 Tack weld imperfection
101 Longitudinal crack	4021 Incomplete root penetration	505 Incorrect weld toe	521 Incorret weld dimensions	608 Misalignment of opposite runs
102 Transverse crack	500 Imperfect shape	506 Overlap	5211 Excessive weld thickness	610 Temper colours
103 Radiating cracks	501 Undercut	507 Linear misalignment	5212 Excessive weld width	613 Scaled surface
104 Crater crack	5011 Continuos undercut	508 Angular misalignment	5213 Insufficient throat thickness	614 Flux residue
105 Group of disconnected crack	5012 Intermitted undercut	509 Sagging	5214 Excessive throat thickness	615 Slag residue
106 Branching crack	5013 Shrinkage grooves	510 Burn-through	600 Miscellaneous imperfections	617 Icorrect root gap for fillet welds
201 Gas cavity	5014 Inter-pass undercut	511 Incompletely fillet groove	601 Arc strike	993 Generic contamination
2017 Surface pore	5015 Local intermittent undercut	512 Excessive asymmetry of fillet weld	602 Spatter	994 Iron contamination
2018 Surface porosity	502 Excess weld metal	513 Irregular width	6021 Tungsten spatter	995 Localized corrosion
2024 Crater pipe	503 Excessive convexity	514 Irregular surface	603 Torn surface	996 Localized blister
2025 End crater pipe	504 Excessive penetration	515 Root concavity	604 Grinding mark	997 Localized pitting
400 Lack of fusion and penetratic	5041 Local excessive penetration	516 Root porosity	605 Chipping mark	998 Not-homogeneous paint
401 Lack of fusion	5042 Continuos excessive penetration	517 Poor restart	606 Underflushing	999 Insufficient paint

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepted ☐ **RNC N°**/NCR No

Eseguito da / Performed by	**Verificato da QCM** / Reviewed by QCM	**Ispettore** / Inspector	**Ispettore** / Inspector
BREMBANA & ROLLE S.P.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / /	BREMBANA & ROLLE S.P.A. QCM - M. GALLI REVIEWED / ACCEPTED	MATTEO VERSACI	LRQA Verification Limited ☑ Witnessed ☐ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 02/08/2024
Data/Date 02 Aug 24	Data/Date 02 Aug 24		

LRQA 02/08/2024

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI ESAME VISIVO
VISUAL EXAMINATION REPORT

N°. Documento Document No.	23096-SNA VT 04
Pagina Page	1 di of 1

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 79

Descrizione del materiale: Material Description: VISUAL EXAMINATION INTERNAL/EXTERNAL AFTER HYDROTEST OF COMPLETE EQUIPMENT

Materiale / Material SA 516 Gr.60 **Sp.** / Thk. 44 MAF **Surface** AS WELDED

Time	PWHT		HYDROTEST	
	BEFORE ☐	AFTER ☑	BEFORE ☐	AFTER ☑

Dis. N° / Dwg. No. 23096-01-EGA1 Rev.05

Procedura d'esame Examination procedure	**Accettabilita' difetti** Acceptance specification
ASME VIII Div.2 2021 Ed. / ASME V – Art.9 2021 Ed. 23096-QNDE Rev.03	ASME VIII Div.2 2021 Ed. / 23096-QNDE Rev.03
Tecnica d'ispezione Inspection technique	**Condizioni di prova** Inspection condition
Direct visual examination	**Stadio lavorazione** / Manufacturing: Material entry
General	**Superfici ispezionate** / Surfaces: 100% Internal & external surfaces
Not Assisted	**Strumenti ausiliari** / Auxiliary: None

Illuminazione / Viewing conditions	**Tipo** / Type	**Intensità** / Intensity	**Note** / Remarks
	Ambient light	≥ 1076 lux	None

Risultato Result

Registrazione delle indicazioni / Recording of indications: No indication

Pos. Pos.	Tipo Type	Descrizione Description	Localizzazione Location	Risultato Result	Documentazione grafica (se necessaria) Graphic documentation (if necessary)
-	-	-	-	-	-
-	-	-	-	-	-

Note Remarks: None

Tipo di indicazioni / Type of indications

100 Crack	402 Lack of penetration	5043 Excessive melt-through	520 Excessive distortion	607 Tack weld imperfection
101 Longitudinal crack	4021 Incomplete root penetration	505 Incorrect weld toe	521 Incorret weld dimensions	608 Misalignment of opposite runs
102 Transverse crack	500 Imperfect shape	506 Overlap	5211 Excessive weld thickness	610 Temper colours
103 Radiating cracks	501 Undercut	507 Linear misalignment	5212 Excessive weld width	613 Scaled surface
104 Crater crack	5011 Continuos undercut	508 Angular misalignment	5213 Insufficient throat thickness	614 Flux residue
105 Group of disconnected crack	5012 Intermitted undercut	509 Sagging	5214 Excessive throat thickness	615 Slag residue
106 Branching crack	5013 Shrinkage grooves	510 Burn-through	600 Miscellaneous imperfections	617 Icorrect root gap for fillet welds
201 Gas cavity	5014 Inter-pass undercut	511 Incompletely fillet groove	601 Arc strike	993 Generic contamination
2017 Surface pore	5015 Local intermittent undercut	512 Excessive asymmetry of fillet wel	602 Spatter	994 Iron contamination
2018 Surface porosity	502 Excess weld metal	513 Irregular width	6021 Tungsten spatter	995 Localized corrosion
2024 Crater pipe	503 Excessive convexity	514 Irregular surface	603 Torn surface	996 Localized blister
2025 End crater pipe	504 Excessive penetration	515 Root concavity	604 Grinding mark	997 Localized pitting
400 Lack of fusion and penetratic	5041 Local excessive penetration	516 Root porosity	605 Chipping mark	998 Not-homogeneous paint
401 Lack of fusion	5042 Continuos excessive penetration	517 Poor restart	606 Underflushing	999 Insufficient paint

Conforme alla specifica / Conform to specification: SI/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato/NotAccepted** ☐ **RNC N°/NCR No**

Eseguito da Performed by	Verificato da QCM Reviewed by QCM	Ispettore Inspector	Ispettore Inspector
BREMBANA & ROLLE S.P.A. Q.C. INSPECTOR M. RAMPANZO DATE: 9/8/24	BREMBANA & ROLLE S.p.A. QCM - M. CANCI REVIEWED / ACCEPTED	0094 LRQA 09/08/2024	LRQA Verification Limited ☑ Witnessed ☐ Reviewed Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 09/08/2024
Data/Date 09 Aug 24	Data/Date 09 Aug 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

N°. Documento / Document No.	23096-01-SNA DC 01
Pagina / Page	1 di / of 1

Cliente / Customer	ROSETTI MARINO	Ordine N° / P.O. No	3500056922
Commessa / Mfr' work No.	23096	Disegno / Drawing	23096-01-EGA1
Apparecchio / Equipment	HYDROGEN STORAGE VESSEL	N° Fabbrica / Serial No.	23096-01-SNA
Sigla / Item	V-25001A	P.C.Q. N°. / Q.C.P. No.	23096-01-QCPA step 17

Descrizione del materiale: / Material Description: DIMENSIONAL CHECK OF LEFT HEAD AFTER FORMING (POS 1)

Materiale / Material SA 516 Gr60 HIC — **Colata** / Heat 858209

Time	PWHT	HYDROTEST
	BEFORE ☑ AFTER ☐	BEFORE ☑ AFTER ☐

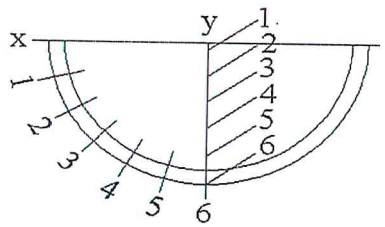
Dis. N° / Dwg. No. 23096-01-EGA1 Mk.1

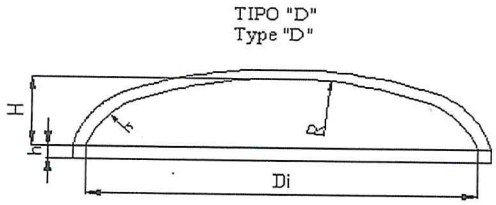
Tipo di Fondo, Head Type	Ell. Head 2:1 ☑ Hemis. Head ☐	**Stadio del controllo** / Test stage	Incoming good materials
Formatura, Forming	Hot ☑ Cold ☐	**Illuminazione** / Lighting	≥1076 lux
Heat treatment after forming	None		
Procedura di controllo, Codice Applicabile Examination procedure, Applicable Code	ASME VIII div. 2 ed.2021 par. 4.3.2.2		

Strumenti utilizzati
Instrument used

Tipo / Type	Range Dimen	Cod. / Code	Tipo / Type	Range Dimen	Cod. / Code	Tipo / Type	Range Dimen	Cod. / Code
Metro / Metre ☑	0÷5000	198	**Corda metrica** / Metric tape ☐			**Spessimetro** / UT thk.Gau ☑	EZ878	
Calibro / Caliper ☐			**Sagoma** / Template ☑			**Laser** / Laser ☐		
Micrometro / Micrometre ☐			**Tampone** / go-no go gauge ☐			**Altro** / Other ☐		

Calculation limit deviation	Only internal pressure		Internal and external pressure	
	Inner surface	- 0,625%*D	Fig. UG-80.1 as per maximum plus-or-minus deviation	Using L/Do=0,5
		+1,25%*D	Fig. UG-29.2 as per minimun arc length template	





DESCRIPTION	Di (INSIDE DIAMETER)		C (CIRCUMFERENCE)	O (OUT OF ROUNDNESS)	Hi (H+h) (INTERNAL HEIGHT)	
UNIT OF MEAS.	[mm]		[mm]	[%]	[mm]	
LIMIT DEVIATIONS	~~-0/+3~~		/	≤ 1%	-0/+3	
REQUIRED	2800		9098	/	750	
ACTUAL	2801	2806	9108	0,18	750	750

* en 44 MIN su tratto h

POSITION	U.M.	LIMIT DEV.	x1 *	x2	x3	x4	x5	x6	y1 *	y2	y3	y4	y5	y6
en (THICKNESS)	[mm]	MIN. 40/44 *	47,16	45,92	45,42	44,60	44,30	44,35	46,80	45,90	45,60	44,90	44,35	44,35
DEVIATION FROM TEMPLATE	[mm]	Concavity 35,0	4	0	0	4	1	0	0	1	2	0	3	8
		Convexity 17,5	0	3	2	0	0	1	2	0	0	1	1	0

23/04/2024

Note

Remarks **MARKING:** voestalpine - CE/05710/10/10 - SA 516 Gr60 HIC - 858209 - 230890/1 - UTA 578-C+S1 - MT LTV

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place Schio (VI)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — RNC N°/NCR No

Eseguito da / Performed by	Verificato da QCM / Reviewed by QCM	Ispettore / Inspector	Ispettore / Inspector
Data/Date 09 Apr 24	BREMBANA & ROLLE S.p.A. QCM M. GALLI REVIEWED / ACCEPTED Data/Date 09 Apr 24	17. SEP. 2024	LRQA verification ltd 0094 ☐ Witnessed ☐ Monitored ☐ Reviewed MATTIA CRIVELLARI Ref. No. Office: Milan 22 APR 2024

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

N°. Documento / Document No.	23096-01-SNA DC 02
Pagina / Page	1 di / of 1

Cliente / Customer	ROSETTI MARINO	Ordine N° / P.O. No	3500056922
Commessa / Mfr' work No.	23096	Disegno / Drawing	23096-01-EGA1
Apparecchio / Equipment	HYDROGEN STORAGE VESSEL	N° Fabbrica / Serial No.	23096-01-SNA
Sigla / Item	V-25001A	P.C.Q. N°. / Q.C.P. No.	23096-01-QCPA step 17

Descrizione del materiale: / Material Description: DIMENSIONAL CHECK OF RIGHT HEAD AFTER FORMING (POS 2)

Materiale / Material SA 516 Gr60 HIC **Colata** / Heat 858209

Time	PWHT		HYDROTEST	
	BEFORE ☑	AFTER ☐	BEFORE ☑	AFTER ☐

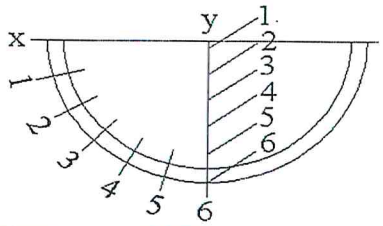
Dis. N° / Dwg. No. 23096-01-EGA1 Mk.2

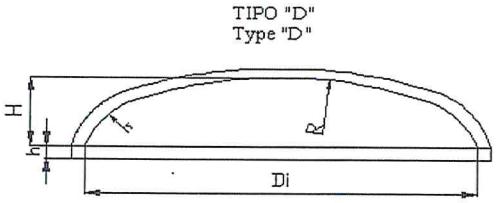
Tipo di Fondo, Head Type	Ell. Head 2:1 ☑ Hemis. Head ☐	**Stadio del controllo** / Test stage	Incoming good materials
Formatura, Forming	Hot ☑ Cold ☐	**Illuminazione** / Lighting	≥1076 lux
Heat treatment after forming	None		
Procedura di controllo, Codice Applicabile Examination procedure, Applicable Code	ASME VIII div.2 ed.2021 par. 4.3.2.2		

Strumenti utilizzati
Instrument used

Tipo / Type	Range Dimen	Cod. / Code	Tipo / Type	Range Dimen	Cod. / Code	Tipo / Type	Range Dimen	Cod. / Code
Metro / Metre ☑	0÷5000	198	Corda metrica / Metric tape ☐			Spessimetro / UT thk.Gau ☑	EZ878	
Calibro / Caliper ☐			Sagoma / Template ☑			Laser / Laser ☐		
Micrometro / Micrometre ☐			Tampone / go-no go gauge ☐			Altro / Other ☐		

Calculation limit deviation	Only internal pressure		Internal and external pressure	
	Inner surface	- 0,625%*D	Fig. UG-80.1 as per maximum plus-or-minus deviation	Using L/Do=0,5
		+1,25%*D	Fig. UG-29.2 as per minimun arc length template	





DESCRIPTION	Di (INSIDE DIAMETER)		C (CIRCUMFERENCE)	O (OUT OF ROUNDNESS)	Hi (H+h) (INTERNAL HEIGHT)	
UNIT OF MEAS.	[mm]		[mm]	[%]	[mm]	
LIMIT DEVIATIONS	-0/+3		/	≤ 1%	-0/+3	
REQUIRED	2800		9098	/	750	
ACTUAL	2798	2802	9097	0,14	750	750

* en 44 MIN su tratto h

POSITION	U.M.	LIMIT DEV.	x1 *	x2	x3	x4	x5	x6	y1 *	y2	y3	y4	y5	y6
en (THICKNESS)	[mm]	MIN. 40/44 *	48,06	45,72	45,25	44,65	44,30	44,04	47,38	46,32	45,48	45,27	44,57	43,83
DEVIATION FROM TEMPLATE	[mm]	Concavity 35,0	8	0	4	5	1	0	10	5	0	2	1	0
		Convexity 17,5	0	2	6	1	2	4	0	7	2	0	0	1

23/04/2024

Note

Remarks **MARKING:** voestalpine - CE/05710/10/9 - SA 516 Gr60 HIC - 858209 - 230890/1 - UTA 578-C+S1 - MT LTV

Conforme alla specifica / Conform to specification SI/YES ☑ NO/NO ☐

Loc./Test place Schio (VI)

Accettato/Accepted ☑ Non Accettato/NotAccepted ☐ RNC N°/NCR No

Eseguito da / Performed by	Verificato da QCM / Reviewed by QCM	Ispettore / Inspector	Ispettore / Inspector
Data/Date 09 Apr 24	BREMBANA & ROLLE S.p.A. QCM M.GALLI REVIEWED / ACCEPTED Data/Date 09 Apr 24		17. SEP. 2024

☐ QA verification ltd ☐ 0094 ☐ ☐ Witnessed ☐ Monitored ☐ Reviewed LRQA
MATTIA CRIVELLARI A17113
Ref. No.
Office: Milan 29 AGO 2024

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

Documento Document No.	*23096-SNA DC 03*
Pagina Page	1 di of 2

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 14

Descrizione del materiale: Material Description: CONTROLLO DIMENSIONALE SELLE PRIMA DI FIT-UP ITEM V-25001A

Materiale / Material PN1

Time	PWHT	HYDROTEST / PROVA IDRAULICA
	PRIMA ☑ DOPO ☐	PRIMA ☑ DOPO ☐

Dis. N° / Dwg. No. 23096-01-EGA1 Rev.05 / 23096-01-ED01 Rev.02

Procedura di controllo Examination procedure	**Stadio del controllo** / Test stage Final Dimensional check
23096-QNDE Rev.03	**Illuminazione** / Lighting >1076 lux

Strumenti utilizzati
Instrument used

Tipo / Type	Range Dimen	Cod. / Code	Tipo / Type	Range Dimen	Cod. / Code	Tipo / Type	Range Dimen	Cod. / Code
Metro / Meter ☑	0÷5000	198	**Corda metrica** / Metric tape ☐			**Spessimetro** / UT thk.Gauge ☐	DTG-	
Metro / Meter ☑	0÷3000	197	**Sagoma** / Template ☐			**Laser** / Laser ☐		
Calibro / Caliper ☐	0÷150	795	**Tampone** / go-no go gauge ☐			**Altro** / Other ☐		

TUTTE LE DIMENSIONI SONO STATE CONTROLLATE, VEDERE SKETCH REPORT ALLEGATI.
ALL DIMENSIONS HAVE BEEN CHECKED, SEE ATTACHED SKETCH REPORT.

Note Remarks: ACCEPTABLE, NO RELEVANT DEFORMATION DETECTED.

Conforme alla specifica / Conform to specification: **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑	**Non Accettato**/NotAccept ☐	**RNC N°**/NCR No

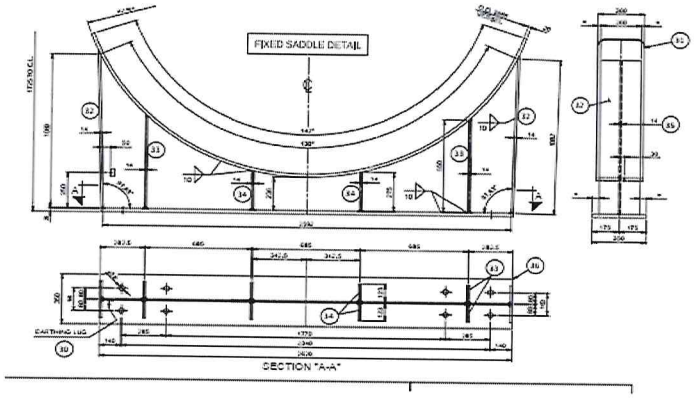
Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA & ROLLES S.P.A. Q.C. INSPECTOR M. RAMPAZZO DATE	BREMBANA & ROLLES S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED		RINA 17. SEP. 2024
Data/Date 21 Jun 24	**Data**/Date 21 Jun 24		

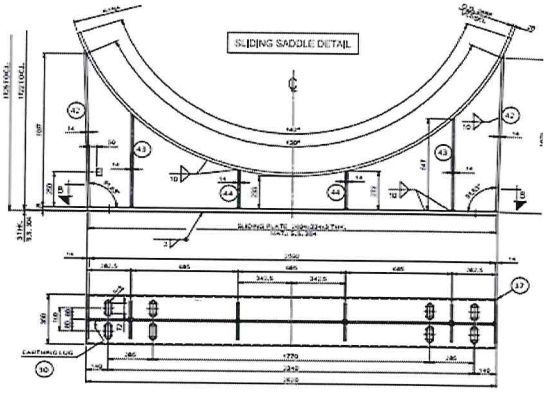
QUALITY CONTROL DEPARTMENT

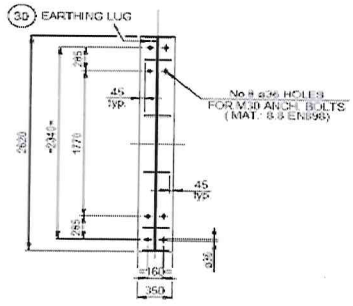
CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

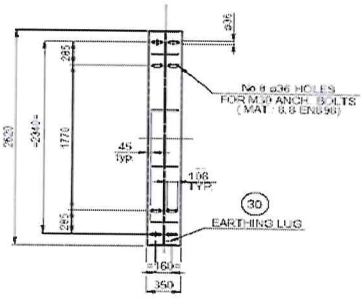
Documento Document No.	*23096-SNA DC 03*
Pagina Page	2 di of 2

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 14









Conforme alla specifica / Conform to specification	**SI**/YES ☑ NO/NO ☐		
Loc./Test place	Albignasego(PD)		
Accettato/Accepted ☑	**Non Accettato**/NotAccepted ☐	**RNC N°**/NCR No	
Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA & ROLLE S.p.A. Q.C. INSPECTOR Data/Date 21 Jun 24	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED Data/Date 21 Jun 24		17 SEP. 2024

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

Documento Document No.	*23096-SNA DC 04*
Pagina Page	1 di of 6

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 61

Descrizione del materiale: Material Description: DIMENSIONAL CHECK BEFORE PWHT - complete equipment

Materiale / Material complete

Time	PWHT		HYDROTEST / PROVA IDRAULICA	
	before ☑	after ☐	before ☑	after ☐

Dis. N° / Dwg. No. 23096-01-EGA1 Rev.5

Procedura di controllo Examination procedure	**Stadio del controllo** / Test stage Final Dimensional check
23096-QNDE Rev.03	**Illuminazione** / Lighting >1076 lux

Strumenti utilizzati
Instrument used

Tipo / Type	**Range Dimen**	**Cod.** / Code	**Tipo** / Type	**Range Dimen**	**Cod.** / Code	**Tipo** / Type	**Range Dimen**	**Cod.** / Code
Metro / Meter ☑	0÷5000	198	**Corda metrica** / Metric tape ☐			**Spessimetro** / UT thk.Gauge ☐	DTG-	
Metro / Meter ☑	0÷3000	197	**Sagoma** / Template ☐			**Laser** / Laser ☐		
Calibro / Caliper ☑	0÷150	795	**Tampone** / go-no go gauge ☐			**Altro** / Other ☐		

TUTTE LE DIMENSIONI SONO STATE CONTROLLATE, VEDERE SKETCH REPORT ALLEGATI.
ALL DIMENSIONS HAVE BEEN CHECKED, SEE ATTACHED SKETCH REPORT.

Note Remarks

Conforme alla specifica / Conform to specification **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ **Non Accettato**/NotAccepte ☐ **RNC N°**/NCR No

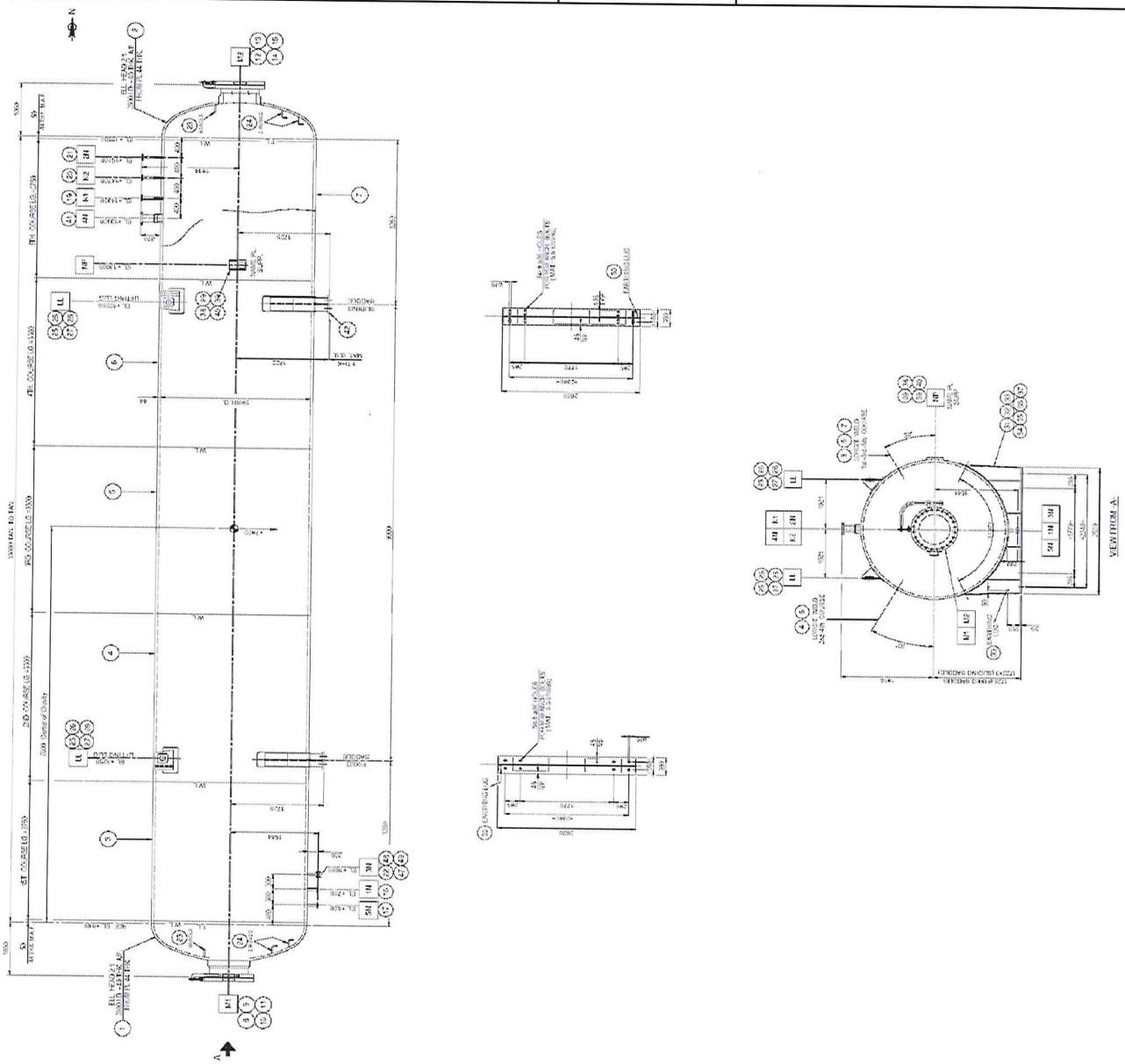
Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA & ROLLE S.P.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / /	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED	0080 CW L. D'ALESSANDRO	0084 LRQA LRQA Verification Limited ☐ Witnessed ☐ Reviewed Flavio Zanon Authorized Inspector N.B. No. 13421 Milan Office
Data/Date 24 Jul 24	**Data**/Date 24 Jul 24		25-07-2024

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

Documento Document No.	*23096-SNA DC 04*
Pagina Page	2 di of 6

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 61



Conforme alla specifica / Conform to specification	**SI**/YES ☑	NO/NO ☐	
Loc./Test place	Albignasego(PD)		
Accettato/Accepted ☑	**Non Accettato**/NotAccepted ☐	**RNC N°**/NCR No	
Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA & ROLLE S.p.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / /	BREMBANA & ROLLE S.p.A. QCM - M. CARLO REVIEWED / ACCEPTED	OBO CW L. DI ALESSANDRO	LRQA Verification Limited ☐ Witnessed ☐ Reviewed Flavio Zanon Authorized Inspector N.B. No. 13421 Milan Office 25-07-2024
Data/Date 24 Jul 24	**Data**/Date 24 Jul 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

Documento Document No.	*23096-SNA DC 04*
Pagina Page	3 di of 6

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 61

NOZZLES ELEVATION From fixed saddle	**NOMINAL (mm)**	**REAL (mm)**
Nozzle 1N	-2550	-2549 (-1)
Nozzle 2N	11850	11849 (-1)
Nozzle 3N	-2250	-2249 (-1)
Nozzle 4N	10650	10652 (+2)
Nozzle 5N	-2850	-2848 (-2)
Nozzle K1	11050	11048 (-2)
Nozzle K2	11450	11449 (-1)
Nozzle 1M	-4300	-4298 (-2)
Nozzle 2M	13300	13298 (-2)
NOZZLES PROJECTION From vessel wall	**NOMINAL (mm)**	**REAL (mm)**
Nozzle 1N	200	201 (+1)
Nozzle 2N	370	369 (-1)
Nozzle 3N	200	201 (+1)
Nozzle 4N	370	370
Nozzle 5N	200	201 (+1)
Nozzle K1	370	371 (+1)
Nozzle K2	370	369 (-1)
Nozzle 1M from vessel center line	center line axis	center line axis
Nozzle 2M from vessel center line	center line axis	center line axis

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA & ROLLE S.P.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / /	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED	OBO CWI L. D'ALESSANDRO	0084 LRQA LRQA Verification Limited ☑ Witnessed ☐ Reviewed Flavio Zanon Authorized Inspector N.B. No. 13421 Milan Office 25-07-2024
Data/Date 24 Jul 24	**Data**/Date 24 Jul 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

Documento Document No.	*23096-SNA DC 04*
Pagina Page	4 di of 6

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 61

NOZZLES ORIENTATION	NOMINAL	REAL
Nozzle 1N	180°	180°
Nozzle 2N	0°	0°
Nozzle 3N	180°	180°
Nozzle 4N	0°	0°
Nozzle 5N	180°	180°
Nozzle K1	0°	0°
Nozzle K2	0°	0°
NAME PLATE	90°	90°

NOZZLES TILT	NOMINAL (mm)	REAL (mm)
Nozzle 1N	0	0
Nozzle 2N	0	0
Nozzle 3N	0	0
Nozzle 4N	0	0
Nozzle 5N	0	0
Nozzle K1	0	0
Nozzle K2	0	0
Nozzle 1M	0	0
Nozzle 2M	0	0

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA & ROLLE S.P.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / /	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED	OBO CRV L. DIAVOLETTO	0094 LRQA LRQA Verification Limited ☐ Witnessed ☐ Reviewed Flavio Zanon Authorized Inspector N.B. No. 13421 Milan Office 25-07-2024
Data/Date 24 Jul 24	**Data**/Date 24 Jul 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

Documento Document No.	*23096-SNA DC 04*
Pagina Page	5 di of 6

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 61

MISCELLANEOUS	NOMINALE	REALE
Disatance from fixed saddle to sliding saddle	9000	9000
Projection from fixed saddle base to vessel shell	281	283 (+2)
Projection from sliding saddle base to vessel shell	281	281
Davit support orientation on nozzle 1M from DWG A view	90°	90°
Davit support orientation on nozzle 2M from DWG A view	270°	270°
Elevation of +3250 LL right side DWG A view from fixed saddle	0	-3
Elevation of +3250 LL left side DWG A view from fixed saddle	0	-3
Elevation of +12250 LL right side DWG A view from fixed saddle	9000	9006 (+6)
Elevation of +12250 LL left side DWG A view from fixed saddle	9000	9006 (+6)
Projection of +3250 LL right side DWG A view from 0-180° axis	1021	1023 (+2)
Projection of +3250 LL left side DWG A view from 0-180° axis	1021	1023 (+2)
Projection of +12250 LL right side DWG A view from 0-180° axis	1021	1022 (+1)
Projection of +12250 LL left side DWG A view from 0-180° axis	1021	1022 (+1)
Distance from fixed saddle to left TL	3250	3247 (-3)

SHELL THICKNESS	NOMINALE (mm)	REALE (mm)
COURSE 1 Mk 3	44	45,23 - 45,30
COURSE 2 Mk 4	44	45,22 - 45,34
COURSE 3 Mk 5	44	45,36 - 45,31
COURSE 4 Mk 6	44	45,11 - 45,12
COURSE 5 Mk 7	44	45,37 - 45,30

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place Albignasego(PD)

Accettato/Accepted ☑ — **Non Accettato**/NotAccepted ☐ — **RNC N°**/NCR No

Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA & ROLLE S.P.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / /	BREMBANA & ROLLE S.P.A. QCM - M. GALLI REVIEWED / ACCEPTED	OBO ew L'ALESSANDRO	LRQA Verification Limited ☐ Witnessed ☐ Reviewed Flavio Zanon Authorized Inspector N.B. No. 13421 Milan Office 25-07-2024
Data/Date 24 Jul 24	**Data**/Date 24 Jul 24		

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

Documento Document No.	*23096-SNA DC 04*
Pagina Page	6 di of 6

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 61

POSITION	DIA NOM	0°-180°	45°-225°	90°-270°	135°-315°	DIA MAX-MIN	TOLLERANCE
COURSE 1 Mk 3	2800	2798	2797	2798	2803	6	28mm
COURSE 2 Mk 4	2800	2794	2796	2800	2800	6	28mm
COURSE 3 Mk 5	2800	2794	2799	2799	2801	7	28mm
COURSE 4 Mk 6	2800	2795	2800	2799	2801	6	28mm
COURSE 5 Mk 7	2800	2798	2796	2804	2802	8	28mm

Total vessel lenght from FF 1M to FF 2M : 17597 mm (-3)

Conforme alla specifica / Conform to specification — **SI**/YES ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑	**Non Accettato**/NotAccepted ☐	**RNC N°**/NCR No	
Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector	**Ispettore** Inspector
BREMBANA & ROLLE S.p.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / / **Data**/Date 24 Jul 24	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED **Data**/Date 24 Jul 24	OBO CW A. D'ALESSANDRO	LRQA Verification Limited ☑ Witnessed ☐ Reviewed Flavio Zanon Authorized Inspector N.B. No. 13421 Milan Office 25-07-2024

QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

Documento Document No.	*23096-SNA DC 05*
Pagina Page	1 di of 2

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 68

Descrizione del materiale: Material Description: CONTROLLO DIMENSIONALE ITEM V25001A DOPO TRATTAMENTO TERMICO

Materiale / Material COMPLETO

Time	PWHT		HYDROTEST / PROVA IDRAULICA	
	PRIMA ☐	DOPO ☑	PRIMA ☑	DOPO ☐

Dis. N° / Dwg. No. 23096-01-EGA1 Rev.05

Procedura di controllo Examination procedure	**Stadio del controllo** / Test stage Final Dimensional check
23096-QNDE Rev.03	**Illuminazione** / Lighting >1076 lux

Strumenti utilizzati
Instrument used

Tipo / Type	Range Dimen	Cod. / Code	Tipo / Type	Range Dimen	Cod. / Code	Tipo / Type	Range Dimen	Cod. / Code
Metro / Meter ☑	0÷5000	198	**Corda metrica** / Metric tape ☐			**Spessimetro** / UT thk.Gauge ☐	DTG-	
Metro / Meter ☑	0÷3000	197	**Sagoma** / Template ☐			**Laser** / Laser ☐		
Calibro / Caliper ☐	0÷150	795	**Tampone** / go-no go gauge ☐			**Altro** / Other ☐		

TUTTE LE DIMENSIONI SONO STATE CONTROLLATE, VEDERE SKETCH REPORT ALLEGATI.
ALL DIMENSIONS HAVE BEEN CHECKED, SEE ATTACHED SKETCH REPORT.

Note Remarks: **ACCEPTABLE, NO RELEVANT DEFORMATION DETECTED.**

Conforme alla specifica / Conform to specification: **SI/YES** ☑ NO/NO ☐

Loc./Test place: Albignasego(PD)

Accettato/Accepted ☑	**Non Accettato**/NotAccept ☐	**RNC N°**/NCR No
Eseguito da Performed by: BREMBANA & ROLLE S.p.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / / Data/Date 02 Aug 24	**Verificato da QCM** Reviewed by QCM: BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED Data/Date 02 Aug 24	**Ispettore** Inspector: MATTEO VERSARI

LRQA Verification Inspector ☑ Witnessed ☐ Reviewed — **Ispettore** Inspector: Mattia Crivellari, Authorized Inspector N.B. No. 17119, Milan Office 02/08/2024 — LRQA

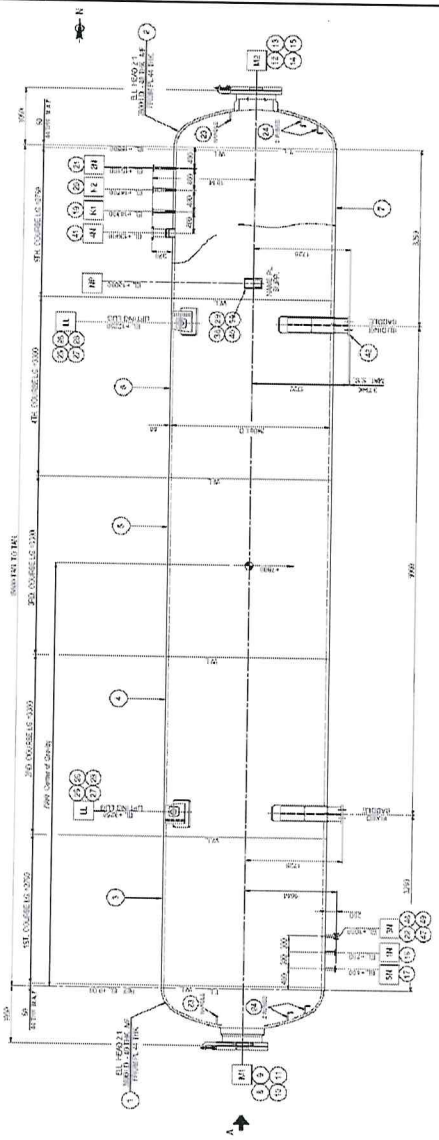
0084 LRQA 02/08/2024

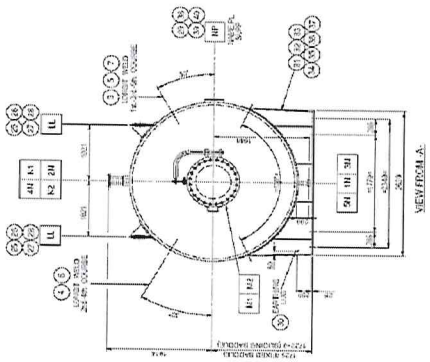
QUALITY CONTROL DEPARTMENT

CERTIFICATO DI CONTROLLO DIMENSIONALE
DIMENSIONAL CHECK REPORT

Documento Document No.	*23096-SNA DC 05*
Pagina Page	2 di of 2

Cliente Customer	ROSETTI MARINO	**Ordine N°** P.O. No	1723001756 123A90A
Commessa Mfr' work No.	23096	**Disegno** Drawing	23096-01-EGA1
Progetto Project	CROSSWIND HOLLANDE KUST NOORD WIND PARK	**N° Fabbrica** Serial No.	23096-01-SNA
Sigla Item	HYDROGEN STORAGE VESSEL ITEM V-25001A	**P.C.Q. N°.** Q.C.P. No.	23096-01-QCPA step 68





Conforme alla specifica / Conform to specification	**SI**/YES ☑ NO/NO ☐	
Loc./Test place Albignasego(PD)		
Accettato/Accepted ☑	**Non Accettato**/NotAccepted ☐	**RNC N°**/NCR No
Eseguito da Performed by	**Verificato da QCM** Reviewed by QCM	**Ispettore** Inspector
BREMBANA & ROLLE S.p.A. Q.C. INSPECTOR M. RAMPAZZO DATE: Data/Date 02 Aug 24	BREMBANA & ROLLE S.p.A. QCM - M. GALLI REVIEWED / ACCEPTED Data/Date 02 Aug 24	MATTEO VERGARI
		LRQA Verification Limited ☑ Witnessed ☐ Inspector Mattia Crivellari Authorized Inspector N.B. No. 17119 Milan Office 02/08/2024

0034 LRQA 02/08/2024

BREMBANA&ROLLE
Via Delle Industrie 35, 35020 Albignasego Padova - Italy

DIMENSIONAL CHECK TEST REPORT
Bolt thightening

REPORT No. 23096-01-SNA/BT
Page 1 of 2

PURCHASER DATA		MANUFACTURER DATA	
PURCHASER	ROSETTI MARINO	ORDER	1723001756 123A90A
JOB No.	23096	DWG. No.	23096-01-EGA1
PLANT	NETHERLANDS, 18.5KM OFF THE COAST, NEAR THE TOWN OF EGMOND AAN ZEE.	SERIAL No.	23096-01-SNA1
ITEM	V-25001A	Q.C.P. No.	23096-01-QCPA step N.A.

APPLICABLE CODE:
ASME VIII Div.2 – 2021 Ed.;
APPLICABLE STANDARD/SPECIFICATION:
ASME PCC-1 2019 ed. "Guidelines for Pressure Boundary Bolted Flange Joint Assembly"

Bolt material SA 193 Gr.B7

Nozzle **M1** 1 1/2" BOLT n°	Elongation [mm]			
	at Minimum Jack Load 250332 N (refer to 2003 Nm)		at Maximum Jack Load 312915 N (refer to 2754 Nm)	
	Actual	Min Required	Actual	Max Required
1	0,20	0,20	0,23	0,24
2	0,20	0,20	0,23	0,24
3	0,20	0,20	0,24	0,24
4	0,20	0,20	0,22	0,24
5	0,18	0,20	0,24	0,24
6	0,20	0,20	0,22	0,24
7	0,20	0,20	0,24	0,24
8	0,20	0,20	0,22	0,24
9	0,18	0,20	0,24	0,24
10	0,18	0,20	0,22	0,24
11	0,18	0,20	0,23	0,24
12	0,20	0,20	0,23	0,24
13	0,19	0,20	0,22	0,24
14	0,18	0,20	0,22	0,24
15	0,19	0,20	0,23	0,24
16	0,21	0,20	0,24	0,24
17	0,18	0,20	0,24	0,24
18	0,21	0,20	0,23	0,24
19	0,18	0,20	0,22	0,24
20	0,19	0,20	0,22	0,24
21	0,19	0,20	0,24	0,24
22	0,21	0,20	0,22	0,24
23	0,21	0,20	0,22	0,24
24	0,18	0,20	0,22	0,24

Bolting sequence as per 23096-01-EIM1 Rev.1.
ACTUAL JACK LOAD ELONGATION HAS BEEN FOUND WITHIN REQUIRED VALUES.

BREMBANA&ROLLE S.p.A.

BREMBANA & ROLLE S.P.A.
Q.C. INSPECTOR
M. RAMPAZZO
DATE: 08 / 08 / 24

INSPECTION AGENCY

BREMBANA&ROLLE
Via Delle Industrie 35, 35020 Albignasego Padova - Italy

DIMENSIONAL CHECK TEST REPORT
Bolt thightening

REPORT No. 23096-01-SNA/BT
Page 2 of 2

PURCHASER DATA		MANUFACTURER DATA	
PURCHASER	ROSETTI MARINO	ORDER	1723001756 123A90A
JOB No.	23096	DWG. No.	23096-01-EGA1
PLANT	NETHERLANDS, 18.5KM OFF THE COAST, NEAR THE TOWN OF EGMOND AAN ZEE.	SERIAL No.	23096-01-SNA1
ITEM	V-25001A	Q.C.P. No.	23096-01-QCPA step N.A.

APPLICABLE CODE:
ASME VIII Div.2 – 2021 Ed.;
APPLICABLE STANDARD/SPECIFICATION:
ASME PCC-1 2019 ed. "Guidelines for Pressure Boundary Bolted Flange Joint Assembly"

Bolt material SA 193 Gr.B7

Nozzle **M2** 1 1/2" BOLT n°	Elongation [mm]			
	at Minimum Jack Load 250332 N (refer to 2003 Nm)		at Maximum Jack Load 312915 N (refer to 2754 Nm)	
	Actual	Min Required	Actual	Max Required
1	0,21	0,20	0,24	0,24
2	0,21	0,20	0,24	0,24
3	0,20	0,20	0,22	0,24
4	0,19	0,20	0,23	0,24
5	0,19	0,20	0,23	0,24
6	0,20	0,20	0,24	0,24
7	0,21	0,20	0,23	0,24
8	0,21	0,20	0,22	0,24
9	0,18	0,20	0,23	0,24
10	0,18	0,20	0,24	0,24
11	0,18	0,20	0,24	0,24
12	0,20	0,20	0,22	0,24
13	0,21	0,20	0,24	0,24
14	0,19	0,20	0,23	0,24
15	0,18	0,20	0,22	0,24
16	0,21	0,20	0,23	0,24
17	0,19	0,20	0,24	0,24
18	0,20	0,20	0,24	0,24
19	0,18	0,20	0,22	0,24
20	0,20	0,20	0,22	0,24
21	0,18	0,20	0,22	0,24
22	0,18	0,20	0,22	0,24
23	0,19	0,20	0,22	0,24
24	0,19	0,20	0,24	0,24

Bolting sequence as per 23096-01-EIM1 Rev.1.
ACTUAL JACK LOAD ELONGATION HAS BEEN FOUND WITHIN REQUIRED VALUES.

BREMBANA&ROLLE S.p.A.

BREMBANA & ROLLE S.P.A.
Q.C. INSPECTOR
M. RAMPAZZO
DATE: 08/08/24

INSPECTION AGENCY

Fabrication site: Albignasego – PD – ITALY

Section 17

Panting procedure / Certificate of cleanness, protection and painting

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**SURFACE PREPARATION AND PAINTING PROCEDURE H2 STORAGE VESSEL**	Sheet 1 of 33 Date: 25/06/2024 Rev: 02

Base Load Power Hub (BLPH)

PAINTING PROCEDURE (including surface preparation)
H2 STORAGE VESSEL

Document Number: 1723001756-MAT-PRO-00008

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
Michele Sacchi	04/07/2024

Document Class: 2

Rev.	Date	Description	Prepared	Reviewed	Approved
02	25/06/2024	Accepted for Construction (AFC)	M.Rampazzo	P.Franzolin	M.Galli
01	23/05/2024	Issue for Review (IFR)	M.Rampazzo	P.Franzolin	M.Galli
00	03/04/2024	Issue for Review (IFR)	M.Rampazzo	P.Franzolin	M.Galli

BREMBANA&ROLLE

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CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**SURFACE PREPARATION AND PAINTING PROCEDURE H2 STORAGE VESSEL**	Sheet 2 of 33 Date: 25/06/2024 Rev: 02

Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
01	Issue for Review (IFR)
02	Accepted for Construction (AFC)

HOLDS LIST

No.	Description
1	
2	
3	
4	

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BREMBANA&ROLLE Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)	PROCEDURE No. **23096-01-QSP**	2nd Issue rev. 1 Sheet 1 of 14

SURFACE PREPARATION AND PAINTING PROCEDURE

REFERENCE DOCUMENTS:

Project Spec. 123A90-DDL-MAT-SP-60006 Rev.02 Date 12/03/2024
B&R Dwg. 23096-01-ESP01 Rev.0 Date 08/02/2024
Norsok M-501 Edition 6, February 2012
SSPC SP1 Last Edition
ISO 8501 - 1 Last Edition
ISO 8501 - 3 Last Edition
ISO 8502 - 3 Last Edition
ISO 8502 - 6&9 Last Edition
ISO 8503 Last Edition
ISO 8504 - 2 Last Edition
ISO 4624 Last Edition
ISO 29601 Last Edition
ASTM D4228 Last Edition
ASTM D4285 Last Edition
ASTM D4414 Last Edition

REVIEW FOR CONFORMANCE WITH REFERENCE CODE/DOCUMENTS REVISION:

Date:	Code Edition / Addenda:	Q.C.M.

Rev.	Date	Description	Issued by Q.C.I.	Approved by Q.C. Manager
0	03/04/2024	Issued for approval	R.B.	M. Galli
1	20/05/2024	Issued for approval	L. Buzoianu	M. Galli

Brembana & Rolle S.p.A.

B&R Job No: **23096**

Project: **CROSSWIND HOLLANDE KUST NOORD WIND PARK**

Contract No: **1723001756 123A90A**

Client: **ROSETTI MARINO – Ravenna (Italy)**

Index

1. SCOPE
2. REFERENCE DOCUMENTS
3. QUALIFICATIONS OF OPERATORS AND INSPECTION PERSONNEL
4. SAFETY
5. ENVIRONMENTAL CONDITIONS
6. UN-PAINTED SURFACES
7. PRE-BLASTING PREPARATION
8. ABRASIVE BLAST CLEANING
9. PAINT APPLICATION
10. COATING SYSTEMS
11. INSPECTION AND TESTING
12. COATING REPAIRS
13. HANDLING OF COATED ITEMS
14. ATTACHMENTS

1 – SCOPE

1.1. This document details the "Working procedure" for surface preparation, paint application, inspections and eventually repairs external surface of equipment, manufactured by Brembana & Rolle S.p.A., listed below:

H2 Storage Vessel V25001 A/B/C/D/E/F MFR'S SERIAL No. 223096-01-SNA/B/C/D/E/F

1.2. This procedure shall be read in conjunction with project specification, the instruction and recommendations written by the paint manufacturer in the Product Data Sheet and all the B&R's reference drawings.

2 – REFERENCE DOCUMENTS

- General painting Specification Doc. No. 123A90-DDL-MAT-SP-60006 Rev.02 Date 12.03.24
- Painting Plan Drawing Hydrogen Storage Vessel B&R Dwg. 23096-01-ESP01 Rev.0 Date 08/02/2024
- Surface preparation and protective coating Norsok Standard M-501 Edition 6, February 2012
- SSPC SP1 Last Edition, Surface Preparation Standard No. 1 Solvent Cleaning
- ISO 8501-1 Last Edition, Preparation of steel substrates before application of paints and related products, Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings. Informative supplement to part 1: Representative photographic examples of the change of appearance imparted to steel when blast-cleaned with different abrasives (ISO 8501-1:1988/Suppl:1994)
- ISO 8501-3 Last Edition, Preparation of steel substrates before application of paints and related products Visual assessment of surface cleanliness – Part 3: Preparation grades of welds, edges and other areas with surface imperfections
- ISO 8502-3 Last Edition, Preparation of steel substrates before application of paints and related products Test for the assessment of surface cleanliness – Part 3: Assessment of dust on steel surfaces prepared for painting (pressure sensitive tape method)
- ISO 8502-6 Last Edition, Preparation of steel substrates before application of paints and related products Test for the assessment of surface cleanliness - Part 6: Extraction of soluble contaminants for analysis - The Bresle method ISO 8502-9, Preparation of steel substrates before application of paints and related products - Test for the assessment of surface cleanliness - Part 9: Field method for the conductometric determination of water-soluble salts

- ISO 8503 Last Edition, Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast cleaned substrates
- ISO 8504-2 Last Edition, Preparation of steel substrates before application of paints and related products Surface preparation methods – Part 2: Abrasive blast cleaning
- ISO 4624 Last Edition, Paints and varnishes – Pull-off test for adhesion
- ISO 29601 Paints and varnishes Last Edition, Corrosion protection by protective paint systems - Assessment of porosity in a dry film
- ASTM D4228 Last Edition, Standard Practice for Qualification of Coating Applicators for Application of Coatings to Steel Surfaces
- ASTM D4285 Last Edition, Standard Test Method for Indicating Oil or Water in Compressed Air
- ASTM D4414 Last Edition, Standard Practice for Measurement of Wet Film Thickness by Notch Gages

3 – QUALIFICATION OF OPERATORS AND INSPECTION PERSONNEL

3.1. Subcontractor operators employed in abrasive blast cleaning and coating operations (qualified in according to ASTM D 4228) shall be aware of the requirements of project specifications and B&R's procedure as well as the recommendations contained in the documents issued by the paint manufacturer.

3.2. The coating Contractor shall demonstrate their experience in the execution of similar coating work in terms of surface preparation as well as coating application for the coating systems described in NORSOK M-501 Annex A.

3.3. Personnel carrying out inspection or verification shall be qualified in accordance with NS 476, Inspector level II, Certified NACE Coating Inspector Level II or equivalent.

4 – SAFETY

4.1. Any blast-cleaning and coating activities shall be carried out and any paint, thinner, abrasive, material or equipment shall be used in accordance to all applicable local, national and international safety regulations.

4.2. Material Safety Data Sheets shall be available for review at shops during all the sandblasting and coating activities.

4.3. All operators shall be equipped with suitable Personal Protective Equipment.

4.4. Used solvents, paint, waste materials and cleaning materials shall be strictly handled in accordance with PDS & MSDS requirements.

5 – ENVIRONMENTAL CONDITION

5.1. Blast-cleaning shall not be executed when:
- Relative Humidity is above 85%, unless paint manufacturer specifies otherwise;
- Surface temperature is less than 3°C above the dew point;

5.2. Coating shall not be applied under the following conditions:
- Substrate is damp, wet or contaminated in any way;
- Substrate temperature is less than 10 °C or anyway outside the range recommended by the paint manufacturer;
- Surface temperature is less than 3°C above the dew point;
- When the relative humidity of the air is greater than the paint manufacturer recommendations or 85%, whichever is lower;

5.3. The solvent based inorganic zinc shell be only applied when Relative Humidity is above 50%.

6 – UNPAINTED SURFACES

6.1. Unless otherwise specified, the following surfaces shall not be coated:
- Un-Insulated Stainless Steel and Duplex Surfaces;
- All galvanized structural bolting;
- Bolts, Nuts and Washers;
- Name plates;
- Sealing surface of flanges;

6.2. All openings in the equipment and piping shall be plugged or blinded to protect internal surfaces from abrasive blasting and to prevent entry to used abrasive, and other debris generated during surface preparation and coating application.

7 – PRE-BLASTING PREPARATION

7.1. Before blasting all the components shall be thoroughly inspected to assure that sharp edges, fillets, corners, indentation, protrusion and welds have been adequately ground to smooth out the contour.
All flame and plasma cut surfaces shall be ground smooth before blasting.

7.2. Special attention shall be given to all weld areas for removal of welding flux, slags, welding spatters and other foreign materials.
Spot and discontinue welds shall not be allowed.

7.3. Any surfaces defects, particularly surface laminations or undercuts, likely to be detrimental to protective coating systems, shall be smoothened by grinding.

7.4. All surfaces shall be finished in accordance with ISO 8501-3 and preparation grade P3.

7.5. Prior to surface preparation, the surface shall be inspected for contaminants such as oil and grease deposits. If any, the deposit shall be solvent cleaned as per SSPC-SP 1.

8 – ABRASIVE BLAST CLEANING

8.1. Prior to blast cleaning, surface area difficult to be sandblasted shall be hand/power tool cleaned up to a result of ISO St 3 according to ISO 8501-1.

8.2. The compressed air used for blast-cleaning, blowing and spray application, shall be free from water and oil. The air compression system shall be equipped with adequate separators and traps and these shall be emptied regularly of water and oil to guarantee their efficiency.
Control of the compressed air cleanliness shall be done according to Standard ASTM D 4285.

8.3. The abrasive shall be dry, clean and free from oil, grease and other contaminants that could be detrimental to long term coating performance.
The blasting media shall comply with the requirements of SSPC AB 1 Class A (less than 1% crystalline silica) for mineral sands and slags and SSPC AB 3 for steel abrasive.

8.4. Abrasive blast-cleaning activities shall be in accordance with ISO 8504-2, or equivalent, to a grade of finish of Sa 2 ½ as per ISO 8501-1. The surface roughness shall be to grade medium G according ISO 8501-3.

8.5. The maximum content of soluble impurities on the blasted surface as sampled using ISO 8502-6 and distilled water, shall not exceed a conductivity measured in accordance with ISO 8502-9 corresponding to a NaCl content of 20 mg/m2.

8.6. Roughness measurement shall be carried out in accordance with ISO 8503-5 using Replica Tape method.

8.7. Any grinding performed after blast cleaning, must be re-blasted to required roughness.

8.8. After preparation of the surfaces any grit, dust, etc. shall be removed by blowing with clean and dry compressed air.

8.9. The test panels supplied by B&R for each paint system and item, shall receive the same surface preparation of the items.

BREMBANA&ROLLE Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)	**PROCEDURE No.** **23096-01-QSP**	2nd Issue rev. 1 Sheet 9 of 14

9 – PAINT APPLICATION

9.1. Paint containers shall remain unopened until required for use.
No paint shall be used whose shelf life ("pot life") has expired.

9.2. Coating System no. 1 according to Norsok M-501 Edition 6 shall be pre-qualified.
Pre- qualification of paints shall be done adopting the ageing resistance method, according to ISO 20340, procedure A.

9.3. The maximum time allowed between blasting and coating application is 4 hours. If the blasting performed if not coated within 4 hours the surfaces have to be re-blasted and retested.
Prior coating, the blast-cleaned surface shall be vacuum cleaned or blown free of dust and other loose contaminants. All application data shall be in accordance with the PDS of the Paint Manufacturer.

9.4. No thinners are allowed, except where it is specified by the paint manufacturer.

9.5. Airless spray method shall be used.
Brushing or rolling is allowed only for stripe coating, touch-ups, and areas difficult to reach with spray. Stripe-coating will be done for each coat layer, to obtain the specified film thickness and to avoid holidays.

9.6. In the timeframe between coating and curing, the freshly applied paint shall not come into contact with handling equipment or any other items that may impact coating quality. Coated items shall be held in a covered area protected from dust, wind and rain.
Over-coating time shall be recommended by the Paint Manufacturer in the PDS.

9.7. The blast-cleaned test panels shall be painted contemporaneously with the same coating system and method as per the represented items.

10 – COATING SYSTEM

B&R DWG. 23096-01-ESP rev. 0 Position 01 – Max Operating Temperature 20°C NOT Insulated

Norsok M-501 Edition 6 – System 1 – PRE-QUALIFICATION REQUIRED

Surface Preparation	Primer	Intermediate Coat	Top Coat
ISO 8501-1 **Sa 2 ½** (SSPC SP10) Profile: **grade medium G per ISO 8501-3** Remove residual dust by dry compressed air jetting.	Two component polyamide cured zinc rich epoxy **Barrier 80 by Jotun** **MDFT 60 µm**	Two component polyamine cured pure epoxy **Penguard Universal by Jotun** **MDFT 160 µm**	Two components chemically curing aliphatic acrylic polyurethane **Hardtop AX by Jotun** **MDFT 60 µm** Colour: **Light Grey RAL 7035**

11 – INSPECTION AND TESTING

TEST TYPE	METHOD & REFERENCE STANDARD	TESTING FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (IF ANY)
Environment conditions	ISO 8502-4 Thermo hygrometer	Before and during Blasting and Painting operations Before start of each shift + minimum twice per shift.	Air Temperature: min. 10°C – max. 40°C. The paint manufacturer shall specify the maximum and minimum application and curing temperature and other relevant limitations regarding application and curing conditions for each product. RH: 85% max. (for inorganic zinc RH 50% min.) Steel Temperature: min 10°C – max. 40°C, and 3°C min. above the Dew Point Temperature.	Unless these parameters are met the operations shall not proceed.
Blotter Test	ASTM D 4285	Before start of each shift	A piece of clean white absorbent paper shall be positioned direcly in front of the air nozze outlet. After about 1 min. there shall be no trace/residue of water and oil on the paper.	Any accumulated moisture and oil in the traps, separators and filters shall be emptied. The air supply shall then be checked once again until conformity is achieved.
Abrasives Quality	SSPC	All supplied material	**Mineral**: AB1(Class A) **Steel**: AB 3	New products to be provided
Pre-cleaning of surfaces	SSPC-SP 1	All surfaces	Surface contaminants such as oil and grease shall be solvent cleaned as per SSPC-SP 1.	If oil, grease and any exogenous compound is still visible on the surface with Black light UV Lamp, the operations shall be repeated until conformity is achieved.
Surface Preparation Cleanliness	ISO 8501-1	All surfaces.	The required visual standard of blast cleaning shall correspond to ISO 8501-1 Sa 2 ½ (SSPC SP 10)	Re-blasting and re-testing until acceptable.
Water Soluble Salts	Bresle-kit ISO 8502-6 ISO 8502-9	N°1 for every 100 m2	The salt concentration (chlorides) tested on the blast-cleaned surfaces shall not exceed 20 mg/m2.	Washing with water and retesting until acceptable.
Blasted Surface Profile	Replica tape ISO 8503-5	N°2 for each Item	See Para. 10 – Coating Systems	Re-blasting.
Blasted Surface Dust Cleanliness	Transparent adhesive tape ISO 8502-3	N° 1 for each item	The residual particle quantity and particle size shall be class 2, rating 2 using a spring-loaded roller for dust test measurement	Recleaning and retesting until acceptable.

TEST TYPE	METHOD & REFERENCE STANDARD	TESTING FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (IF ANY)
Paint Material	Visual Examination Paint Datasheet	All paint materials	Paint within the Shelf Life. Paint not presenting to a large degree: Gel, skinning, high viscosity, sedimentation	Replace paint material
Wet Film Thickness	ASTM D 4414	Always during application	As indicate in PDS.	Additional coat.
Visual Inspection of Coating	Visual	During all phases of coating application.	The coating shall be smooth, of uniform color, free of runs, sags, visible holidays, blisters, orange peel, scratches, dust inclusions, solvent retention or any other irregularities.	Repair and retesting.
Dry Film Thickness	Electromagnetic thickness gauge in accordance with ISO 19840	On dry film before application of any other coats	20 Measurement shall be taken. The average DFT shall be higher than the NDFT. 5% of measurements may be below the NDFT by ≤20%. *DFT shall not exceed*: - 140 µm for zinc dust primer; - 200% of NDFT for oper. temp. ≤200°C - 125% of NDFT for oper. temp. >200°C	Repair, additional coats or recoating as appropriate.
Adhesion Test	ISO 4624 Hydraulic "pull-off" testing devices shall be used.	On test panel as pre-production qualify-cation (CPT) and one test panel during production	Min 5 MPa (725 psi) 50 % reduction of average adhesion value from the CPT is acceptable as minimum adhesion during production coating. Different values shall be reviewed case by case or according with coating manufacturer PDS.	Prepare a detailed repair procedure for Owner review/approval.
Holiday Detection	ISO 29601	100% of the surfaces	No holidays	Repair and retesting

12 – COATING REPAIR

12.1. Damaged spots and holidays in the primer and/or areas which do not comply with the specified quality requirements shall be treated as follows:
- Further inspections shall be performed as requested to define the limits of the defective areas;
- The defective areas shall be repaired in accordance with the specified coating systems and this procedure;
- Repaired areas shall be 100% inspected.

12.2. Areas requiring to be re-primed shall be re-blasted or prepared by hand/power tool before to be repainted.

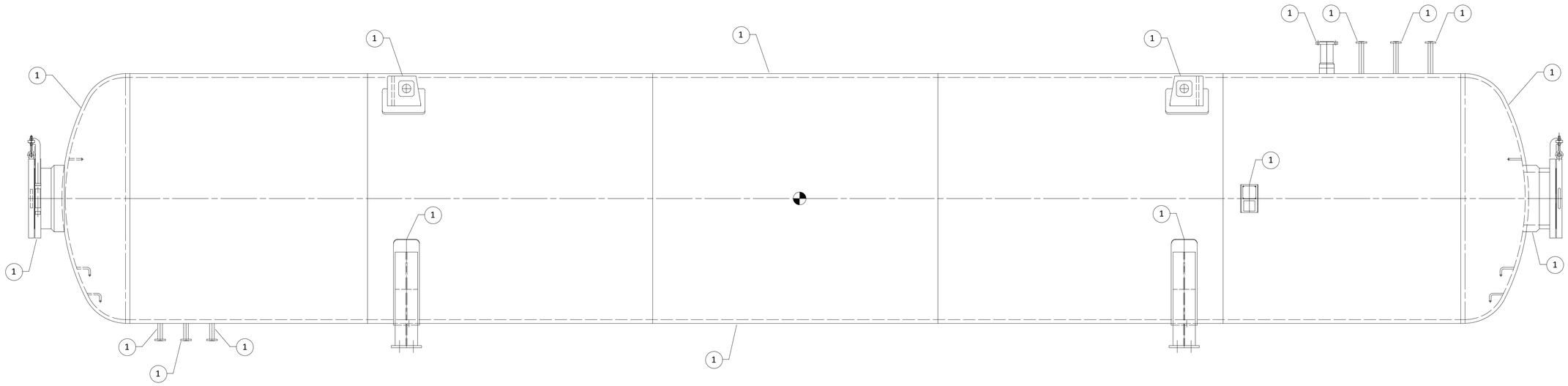
12.3. Re-priming shall be done with the same primer as originally applied. Where this is not feasible, the primer used shall be compatible and be suitable for the operating temperature.

13 – HANDLING OF COATED ITEMS

13.1. All shop-coated equipment shall be handled using nylon or rubber slings, or other approved lifting methods.
Coated items shall be handled and/or stored in a manner to protect the coating from damage, they shall not be dropped or impact against other objects.

14 – ATTACHMENTS

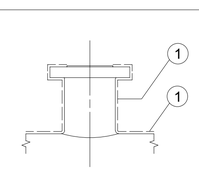
- **DWG 23096-01-ESP1 Rev.0**
- **Coating report draft**
- **Paint Material PDS's**



POS.	m²	SURFACE PREPARATION	PAINTING TYPE	N°. OF COATS	THK. FOR COAT	COLOUR	THK. TOT.	T.OPERATING	INSUL.	FIREPROOF.
1	~175	SANDBLASTING SA 2-1/2 (According to ISO 8501-1) Medium roughness G ISO 8503-1	TWO COMPONENT POLYAMIDE CURED ZINC RICH EPOXY COATING	1	60 µm	--	280 µm	20 °C	NO	NO
			TWO COMPONENT POLYAMINE CURED PURE EPOXY COATING	1	160 µm	--				
			TWO COMP. CHEMICALLY CURING ALIPH. ACRYLIC POLYUR. COATING	1	60 µm	Light Grey RAL 7035				

NOTES:

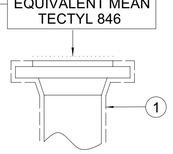
1) FOR EQUIPMENT ASSEMBLY, BILL OF MATERIAL & GENERAL NOTES SEE DRAWINGS: No. 23096-01-EGA1 & DWG. No.23096-01-EBM1.
2) PAINTING ACCORDING TO SPEC.: 123A90-DDL-MAT-SP-60006
3) BOLT THREADS OF OUTSIDE FLANGE CONNECTIONS TO BE COATED WITH ANTI-SEIZE PRODUCT TYPE "MOLYKOTE 1000 SOLID LUBRICANT PASTE".
4) BOLT HOLES OF FLANGES SHALL ALSO BE PAINTED.
5) THE GAP BETWEEN THE FACES OF COUPLES FLANGES SHALL NEITHER BE GRITBLASTED NOR PAINTED.
6) ALL INDICATED THKS. ARE MINIMUM DRY FILM THK (M.D.F.T.)
7) ALL EQUIPMENT THAT HAS RECEIVED POST WELD HEAT TREATMENTFOR WHATEVER REASON SHALL HAVE PAINTED ON ITS SIDE IN WHITE LETTERING THE FOLLOWING INSTRUCTION:
"STRESS RELIEVED ITEM NO WELDING PERMITTED"
(The lettering to be 100 mm high and the message written in english language.)



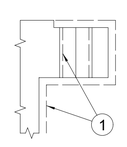
NOZZLES

TO BE PROTECTED WITH:
PROTETTO CON :

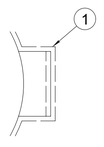
GREASE OR EQUIVALENT MEAN TECTYL 846



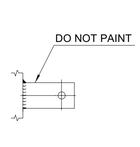
TYP. DETAIL FOR NOT BLINDED FLANGES



BOLT HOLES



SUPPORT. NAMEPLATE



EARTHING LUG

BREMBANA&ROLLE

VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.	PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK
PURCHASE ORDER No.: 1723001756 123A90A	LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.
B&R CAD FILE No: 23096-01-ESP1.dwg — MFR'S S.N. 23096-01-SNA/F	B&R DRAWING No. 23096-01-ESP1

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
0	08/02/2024	AF	MT	DP	ISSUE FOR REVIEW (IFR)

CROSSWIND

ROSETTI MARINO

PAINTING PLAN DRAWING
HYDROGEN STORAGE VESSEL ITEM : V-25001A/F

CONTRACT NO. CW-I-WP4-2023-05 / H2 STORAGE				SCALE 1:25	
DRAWN A.FRANCO	CHECKED M.TONIOLO	APPROVED D.PASSERINI	DATE 08/02/24		
A1	DRAWING NO. 23096-01-ESP1		SHEET 1	REV. 0	

File Name : 23096-01-ESP1.DWG

BREMBANA&ROLLE Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)	**PROCEDURE No.** **23096-01-QSP**	2nd Issue rev. 1

Paint report

Front page

PAINT REPORT	
Date:	
PO No:	Paint system:
Manufactory Company:	Manufactures contact person:
Manufactures internal order no:	
Paint shop:	Paint shops contact person:
Paint shops internal order no:	
Paint inspectors name:	Paint inspectors signature:
Certification organization:	Certificate level and no:

Painted objects

No off	Object	Size	Material	Tag no

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Inspection results pages

Paint cycle		
First coat:	Nom. thickness, µm:	Thinner:
Second coat:	Nom. thickness, µm:	Thinner:
Third coat:	Nom. thickness, µm:	Thinner:
Fourth coat:	Nom. thickness, µm:	Thinner:
Comments:		

Visual receive control			
Date of receive control:		Steel preparation according ISO 8501-3	
Edges rounded:	Major surface defects:	Weld splatters, slivers:	All signs off:
Continually welds:	All welds dressed:	Bolts and nuts protected:	End caps on:
Rust grade:			
Comments:			

Cleaning			
Date of cleaning:		Oil, grease, corrosion inhibitors and salt removed:	
Method of cleaning:		Type of detergent:	
If machined surfaces; strength of detergent:		Cleaned with freshwater after use of detergent:	
Comments:			

Abrasive blasting			
Blasting machine:		Open blasting:	
Abrasive type:		Abrasive size:	
Start blasting, Date:	Time:	End blasting, Date:	Time:
Air temp, °C:	Surface temp., °C:	Humidity, %:	Dew point, °C:
Comments:			

Surface cleanliness and roughness	
Requirements to cleanliness and roughness	
Requirements to cleanliness:	Requirements to roughness:
Type of material to be blasted:	Abrasive quality:
Tested cleanliness and roughness	
Date of test of cleanliness and roughness:	
Test equipment for cleanliness:	Tested cleanliness:
Test equipment for roughness:	Tested roughness:
Comments:	

Salt test	
Requirements to salt concentration	
Requirements to max salt concentration: 20 mg/m² NaCl	
Tested salt concentration	
Date of test of salt concentration:	
Salt test equipment:	Tested salt concentration:
Comments:	

Visual inspection after blasting		
Date of visual inspection:		
All parts blasted without holidays:	Rust grade:	Edges:
Weld spatters and pores in welds:	Major surface defects:	Pores/holes in casting:
Comments:		

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Each coat			
Product name:		Colour, RAL Code:	
Batch no.:		Exp. date:	
Start application, date:	Time:	End application, date:	Time:
Application method:		Stripe coat applied:	
Max. thinner allowed, %:		Actual thinner added, %:	
Environmental control instrument:			Blotter test:
Air temp., °C:	Surface temp., °C:	Humidity, %:	Dew point, °C:
Comments:			
Paint thickness, each coat			
Requirement to thickness according to CSDS:			
Average DFT, µm:	Min. DFT, µm:	Max. DFT, µm:	
Measured thickness of each coat:			
Date of test of paint thickness control:			
Film thickness control instrument:		No. of measures:	
Average DFT, µm:	Min. DFT, µm:	Max. DFT, µm:	
Visual inspection after coating			
Date of visual inspection:			
Contaminations:	Solvent retention:	Pinholes/popping:	
Sagging:	Wrinkling:	Surface defects:	
Comments:			
Adhesion			
Requirements to adhesion test			
Adhesion test according to:	ISO 4624		
Absolute minimum adhesion based on NORSOK M-501, MPa		Absolute minimum adhesion based on Coating Procedure Test (CPT), MPa	
Assumed temperature during curing, °C:		Calculated necessary curing time (h):	
Adhesion test results			
Date of gluing dollies to the test plate:		Date of pull-off:	Temp. during curing, °C:
Adhesion test instrument:		Film thickness on tested surface, µm:	
Is the test performed on the object or on a test plate?:			
If test plate, has the test plate been treated as the object?:			
Diameter of dolly, mm:	Expiry date of glue:	Type of glue:	
Adhesion value (MPa):	Failure description (% adhesive/ cohesive/glue):		
Comments:			
Verification of curing (i.e. MEK-test or curing of phenolic epoxy)			
Requirement to curing			
Measured film thickness, µm:		Allowed range of air humidity, % RH:	
Assumed temperature during curing, °C:		Calculated necessary curing time (h):	
Curing log			
Start curing, date:	Time:	End curing, date:	Time:
Mean temp. during curing, °C:		Actual curing time, hrs.:	
Measured air humidity, % RH:		Curing control method:	
Comments:			
Holiday test			
Requirement to holiday test			
Requirement to holiday test: No holidays			
Holiday test result			
Date of holiday test:		Test instrument:	
Result of holiday test:			
Comments:			

BREMBANA&ROLLE Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)	PROCEDURE No. 23096-01-QSP	2nd Issue rev. 1

Technical Data Sheet

JOTUN

Barrier 80

Product description

This is a two component polyamide cured zinc rich epoxy coating. It is a high solids, high zinc dust containing product. It conforms to the compositional requirements of SSPC paint 20, level 2 and ISO 12944-5. It provides very good corrosion protection as part of a complete coating system. To be used as primer in atmospheric environments. Suitable for carbon steel, repair of inorganic zinc silicate coating and damaged galvanised steel substrates. This product complies with ASTM D520 type II zinc dust.

Typical use

Protective:
Suitable for structural steel and piping exposed in corrosivity categories up to C5 (ISO 12944-2). Recommended for offshore environments, refineries, power plants, bridges, buildings, mining equipment and general structural steel. Specially designed as a primer for coating systems where extended durability is required.

Approvals and certificates

Tested in accordance with ISO 12944-6, high expected durability in corrosivity category C5-I

Additional certificates and approvals may be available on request.

Colours

grey

Product data

Property	Test/Standard	Description
Solids by volume	ISO 3233	61 ± 2 %
Gloss level (GU 60 °)	ISO 2813	matt (0-35)
Flash point	ISO 3679 Method 1	27 °C
Density	calculated	2.5 kg/l
VOC-US/Hong Kong	US EPA method 24 (tested) (CARB(SCM)2007, SCAQMD rule 1113, Hong Kong)	380 g/l
VOC-EU	IED (2010/75/EU) (theoretical)	366 g/l
VOC-China	GB/T 23985-2009 (tested)	371 g/l
VOC-Korea	Korea Clean Air Conservation Act (tested) (Max. thinning ratio included)	435 g/l

The provided data is typical for factory produced products, subject to slight variation depending on colour.
All data is valid for mixed paint.
Gloss description: According to Jotun Performance Coatings' definition.

BREMBANA&ROLLE Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)	PROCEDURE No. 23096-01-QSP	2nd Issue rev. 1

Technical Data Sheet
Barrier 80

JOTUN

Film thickness per coat

Typical recommended specification range

Dry film thickness	40 - 80	µm
Wet film thickness	65 - 130	µm
Theoretical spreading rate	15.3 - 6.8	m²/l

Surface preparation

To secure lasting adhesion to the subsequent product all surfaces shall be clean, dry and free from any contamination.

Surface preparation summary table

Substrate	Surface preparation	
	Minimum	Recommended
Carbon steel	St 3 (ISO 8501-1)	Sa 2½ (ISO 8501-1)
Shop primed steel	Clean, dry and undamaged approved shop primer (ISO 12944-4 5.4)	Sweep blasted or alternatively blasted to Sa 2 (ISO 8501-1) of at least 70 % of the surface.

Optimum performance, including adhesion, corrosion protection, heat resistance and chemical resistance is achieved with recommended surface preparation.

Application

Application methods

The product can be applied by

Spray:	Use airless spray.
Brush:	Recommended for stripe coating and small areas. Care must be taken to achieve the specified dry film thickness.

Product mixing ratio (by volume)

Barrier 80 Comp A	3 part(s)
Barrier 80 Comp B	1 part(s)

Technical Data Sheet
Barrier 80

JOTUN

Thinner/Cleaning solvent

Thinner: Jotun Thinner No. 17

Guiding data for airless spray

Nozzle tip (inch/1000): 15-21
Pressure at nozzle (minimum): 150 bar/2100 psi

Drying and Curing time

Substrate temperature	5 °C	10 °C	23 °C	40 °C
Surface (touch) dry	50 min	30 min	10 min	4 min
Walk-on-dry	3 h	2 h	1.5 h	40 min
Dry to over coat, minimum	3 h	2 h	1.5 h	40 min
Dried/cured for service	10 d	7 d	5 d	2 d

For maximum overcoating intervals, refer to the Application Guide (AG) for this product.

Drying and curing times are determined under controlled temperatures and relative humidity below 85 %, and at average of the DFT range for the product.

Surface (touch) dry: The state of drying when slight pressure with a finger does not leave an imprint or reveal tackiness.

Walk-on-dry: Minimum time before the coating can tolerate normal foot traffic without permanent marks, imprints or other physical damage.

Dry to over coat, minimum: The recommended shortest time before the next coat can be applied.

Dried/cured for service: Minimum time before the coating can be permanently exposed to the intended environment/medium.

Induction time and Pot life

Paint temperature	23 °C
Induction time	30 min
Pot life	12 h

Heat resistance

	Temperature	
	Continuous	Peak
Dry, atmospheric	120 °C	140 °C

Peak temperature duration max. 1 hour.

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Technical Data Sheet
Barrier 80

The temperatures listed relate to retention of protective properties. Aesthetic properties may suffer at these temperatures.

Product compatibility

Depending on the actual exposure of the coating system, various primers and topcoats can be used in combination with this product. Some examples are shown below. Contact Jotun for specific system recommendation.

Previous coat:	inorganic zinc shop primer
Subsequent coat:	epoxy, epoxy mastic, polyurethane

Packaging (typical)

	Volume (litres)	Size of containers (litres)
Barrier 80 Comp A	3 / 6.75	5 / 10
Barrier 80 Comp B	1 / 2.25	1 / 3

The volume stated is for factory made colours. Note that local variants in pack size and filled volumes can vary due to local regulations.

Storage

The product must be stored in accordance with national regulations. Keep the containers in a dry, cool, well ventilated space and away from sources of heat and ignition. Containers must be kept tightly closed. Handle with care.

Shelf life at 23 °C

Barrier 80 Comp A	24 month(s)
Barrier 80 Comp B	24 month(s)

In some markets commercial shelf life can be dictated shorter by local legislation. The above is minimum shelf life, thereafter the paint quality is subject to re-inspection.

Caution

This product is for professional use only. The applicators and operators shall be trained, experienced and have the capability and equipment to mix/stir and apply the coatings correctly and according to Jotun's technical documentation. Applicators and operators shall use appropriate personal protection equipment when using this product. This guideline is given based on the current knowledge of the product. Any suggested deviation to suit the site conditions shall be forwarded to the responsible Jotun representative for approval before commencing the work.

Health and safety

Please observe the precautionary notices displayed on the container. Use under well ventilated conditions. Do not inhale spray mist. Avoid skin contact. Spillage on the skin should immediately be removed with suitable cleanser, soap and water. Eyes should be well flushed with water and medical attention sought immediately.

Technical Data Sheet
Barrier 80

JOTUN

Colour variation

When applicable, products primarily meant for use as primers or antifoulings may have slight colour variations from batch to batch. Such products may fade and chalk when exposed to sunlight and weathering.

Colour and gloss retention on topcoats/finish coats may vary depending on type of colour, exposure environment such as temperature, UV intensity etc., and application quality. Contact your local Jotun office for further information.

Disclaimer

The information in this document is given to the best of Jotun's knowledge, based on laboratory testing and practical experience. Jotun's products are considered as semi-finished goods and as such, products are often used under conditions beyond Jotun's control. Jotun cannot guarantee anything but the quality of the product itself. Minor product variations may be implemented in order to comply with local requirements. Jotun reserves the right to change the given data without further notice.

Users should always consult Jotun for specific guidance on the general suitability of this product for their needs and specific application practices.

If there is any inconsistency between different language issues of this document, the English (United Kingdom) version will prevail.

BREMBANA&ROLLE Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)	**PROCEDURE No.** **23096-01-QSP**	2nd Issue rev. 1

Technical Data Sheet

JOTUN

Penguard Universal

Product description

This is a two component polyamine cured pure epoxy coating. It is a fast drying, abrasion resistant, high solids, high build product. It provides excellent corrosion protection as part of a complete coating system. Can be used as primer, mid coat, finish coat or as single coat system in atmospheric and immersed environments. Suitable for properly prepared carbon steel, galvanized steel, shop primed steel, stainless steel, aluminium and concrete substrates. Suitable as maintenance coating on a wide range of aged coating surfaces. It can be applied at sub zero surface temperatures.

Typical use

Recommended for offshore environments, including splash zones, refineries, power plants, bridges, buildings, mining equipment and general structural steel. Approved for PSPC cross over testing with a wide range of shop primers.

Approvals and certificates

Certified in accordance with IMO Res.215(82) – PSPC Water Ballast Tanks
Certified in accordance with IMO Res.288(87) – PSPC Crude Oil Tanks

Pre-qualified in accordance with NORSOK M-501, Edition 6, System 1
Pre-qualified in accordance with NORSOK M-501, Edition 6, System 7.

When used as part of an approved scheme, this material has the following certification:
- Low Flame Spread in accordance with EU Directive for Marine Equipment. Approved in accordance with parts 5 and 2 of Annex 1 of IMO 2010 FTP Code, or Parts 5 and 2 of Annex 1 of IMO FTPC when in compliance with IMO 2010 FTP Code Ch. 8

Consult your Jotun representative for details.

Additional certificates and approvals may be available on request.

Colours

aluminium, grey and selected range of colours

Product data

Property	Test/Standard	Description
Solids by volume	ISO 3233	72 ± 2 %
Gloss level (GU 60 °)	ISO 2813	matt (0-35)
Flash point	ISO 3679 Method 1	30 °C
Density	calculated	1.4 kg/l
VOC-US/Hong Kong	US EPA method 24 (tested) (CARB(SCM)2007, SCAQMD rule 1113, Hong Kong)	245 g/l
VOC-EU	DED (2010/75/EU) (theoretical)	281 g/l
VOC-China	GB/T 23985-2009 (tested)	212 g/l
VOC-Korea	Korea Clean Air Conservation Act (tested) (Max. thinning ratio included)	309 g/l

Date of issue: 15 June 2021 Page: 1/5

This Technical Data Sheet supersedes those previously issued.
This Technical Data Sheet (TDS) is recommended to be read in conjunction with the Safety Data Sheet (SDS) and the Application Guide (AG) for this product. For your nearest local Jotun office, please visit our website at www.jotun.com

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Technical Data Sheet
Penguard Universal

JOTUN

The provided data is typical for factory produced products, subject to slight variation depending on colour.

Gloss description: According to Jotun Performance Coatings' definition.

Gloss level may vary slightly with colour, application method, film thickness and with environmental conditions during application and drying/curing.

Film thickness per coat

Typical recommended specification range

Dry film thickness	75	- 300	µm
Wet film thickness	105	- 415	µm
Theoretical spreading rate	9.6	- 2.4	m²/l

Surface preparation

Surface preparation summary table

Substrate	Surface preparation	
	Minimum	Recommended
Carbon steel	St 2 (ISO 8501-1)	Sa 2½ (ISO 8501-1)
Aluminium	The surface shall be hand or machine abraded with non-metallic abrasives or bonded fibre machine or hand abrasive pads to impart a scratch pattern to the surface.	Abrasive blast cleaning to achieve a surface profile using non-metallic abrasive media which is suitable to achieve a sharp and angular surface profile.
Galvanised steel	The surface shall be clean, dry and appear with a rough and dull profile.	Sweep blast-cleaning using non-metallic abrasive leaving a clean, rough and even pattern.
Stainless steel	The surface shall be hand or machine abraded with non-metallic abrasives or bonded fibre machine or hand abrasive pads to impart a scratch pattern to the surface.	Abrasive blast cleaning to achieve a surface profile using non-metallic abrasive media which is suitable to achieve a sharp and angular surface profile.
Shop primed steel	Dry, clean and intact shop primer.	Sweep blasted or alternatively blasted to Sa 2 (ISO 8501-1) of at least 70 % of the surface.
Coated surfaces	Clean, dry and undamaged compatible coating.	F Sa 2½ (ISO 8501-2)
Concrete	Minimum 4 weeks curing. Moisture content maximum 5 %. Mechanically prepare the existing concrete surface by scabbing, needle gun, mechanical disc grinding.	Minimum 4 weeks curing. Moisture content maximum 5 %. Prepare the surface by means of enclosed blast shot or diamond grinding and other appropriate means to abrade the surrounding concrete and to remove laitance.

BREMBANA&ROLLE Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)	**PROCEDURE No.** **23096-01-QSP**	2nd Issue rev. 1

Technical Data Sheet
Penguard Universal

JOTUN

Optimum performance, including adhesion, corrosion protection, heat resistance and chemical resistance is achieved with recommended surface preparation.

Application

Application methods

The product can be applied by

Spray:	Use airless spray.
Brush:	Recommended for stripe coating and small areas, care must be taken to achieve the specified dry film thickness.
Roller:	May be used for small areas but is not recommended for first primer coat. However, when using roller application care must be taken to apply sufficient material in order to achieve the specified dry film thickness.

Product mixing ratio (by volume)

Penguard Universal Comp A	3 part(s)
Penguard Universal Comp B	1 part(s)

Thinner/Cleaning solvent

Thinner: Jotun Thinner No. 17

Guiding data for airless spray

Nozzle tip (inch/1000): 17-31

Pressure at nozzle (minimum): 150 bar / 2100 psi

Drying and Curing time

Substrate temperature	-10 °C	-5 °C	0 °C	5 °C	10 °C	23 °C	40 °C
Surface (touch) dry	27 h	15 h	11 h	7 h	5 h	2 h	1 h
Walk-on-dry	73 h	35 h	24 h	14 h	10 h	5 h	2 h
Dry to over coat, minimum	36 h	35 h	16 h	10 h	7 h	4 h	2 h
Dried/cured for service			21 d	14 d	11 d	7 d	4 d

For maximum overcoating intervals, refer to the Application Guide (AG) for this product.

Drying and curing times are determined under controlled temperatures and relative humidity below 85 %, and at average of the DFT range for the product.

Surface (touch) dry: The state of drying when slight pressure with a finger does not leave an imprint or reveal tackiness.

Walk-on-dry: Minimum time before the coating can tolerate normal foot traffic without permanent marks, imprints or other physical damage.

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Dry to over coat, minimum: The recommended shortest time before the next coat can be applied.

Dried/cured for service: Minimum time before the coating can be permanently exposed to the intended environment/medium.

Induction time and Pot life

Paint temperature	23 °C
Induction time	10 min
Pot life	2 h

Heat resistance

	Temperature	
	Continuous	Peak
Dry, atmospheric	120 °C	140 °C
Immersed, sea water	60 °C	70 °C
Immersed, crude oil	80 °C	90 °C

Peak temperature duration max. 1 hour.

The temperatures listed relate to retention of protective properties. Aesthetic properties may suffer at these temperatures.

Note that the coating will be resistant to various immersion temperatures depending on the specific chemical and whether immersion is constant or intermittent. Heat resistance is influenced by the total coating system. If used as part of a system, ensure all coatings in the system have similar heat resistance.

Product compatibility

Depending on the actual exposure of the coating system, various primers and topcoats can be used in combination with this product. Some examples are shown below. Contact Jotun for specific system recommendation.

Previous coat:	inorganic zinc silicate shop primer, epoxy, epoxy mastic, zinc epoxy, zinc silicate
subsequent coat:	acrylic, alkyd, epoxy, polyurethane, polysiloxane, epoxy mastic, vinyl epoxy

Packaging (typical)

	Volume (litres)	Size of containers (litres)
Penguard Universal Comp A	15	20
Penguard Universal Comp B	5	5

The volume stated is for factory made colours. Note that local variants in pack size and filled volumes can vary due to local regulations.

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Technical Data Sheet
Penguard Universal

JOTUN
Jotun Pinturas Property

Storage

The product must be stored in accordance with national regulations. Keep the containers in a dry, cool, well ventilated space and away from sources of heat and ignition. Containers must be kept tightly closed. Handle with care.

Shelf life at 23 °C

Penguard Universal Comp A	48 month(s)
Penguard Universal Comp B	48 month(s)

In some markets commercial shelf life can be dictated shorter by local legislation. The above is minimum shelf life, thereafter the paint quality is subject to re-inspection.

Caution

This product is for professional use only. The applicators and operators shall be trained, experienced and have the capability and equipment to mix/stir and apply the coatings correctly and according to Jotun's technical documentation. Applicators and operators shall use appropriate personal protection equipment when using this product. This guideline is given based on the current knowledge of the product. Any suggested deviation to suit the site conditions shall be forwarded to the responsible Jotun representative for approval before commencing the work.

Health and safety

Please observe the precautionary notices displayed on the container. Use under well ventilated conditions. Do not inhale spray mist. Avoid skin contact. Spillage on the skin should immediately be removed with suitable cleanser, soap and water. Eyes should be well flushed with water and medical attention sought immediately.

Colour variation

When applicable, products primarily meant for use as primers or antifoulings may have slight colour variations from batch to batch. Such products and epoxy based products used as a finish coat may chalk when exposed to sunlight and weathering.

Colour and gloss retention on topcoats/finish coats may vary depending on type of colour, exposure environment such as temperature, UV intensity etc., application quality and generic type of paint. Contact your local Jotun office for further information.

Disclaimer

The information in this document is given to the best of Jotun's knowledge, based on laboratory testing and practical experience. Jotun's products are considered as semi-finished goods and as such, products are often used under conditions beyond Jotun's control. Jotun cannot guarantee anything but the quality of the product itself. Minor product variations may be implemented in order to comply with local requirements. Jotun reserves the right to change the given data without further notice.

Users should always consult Jotun for specific guidance on the general suitability of this product for their needs and specific application practices.

If there is any inconsistency between different language issues of this document, the English (United Kingdom) version will prevail.

Date of issue: 15 June 2023 Page: 5/5

This Technical Data Sheet supersedes those previously issued.

The Technical Data Sheet (TDS) is recommended to be read in conjunction with the Safety Data Sheet (SDS) and the Application Guide (AG) for this product. For your nearest local Jotun office, please visit our website at www.jotun.com

BREMBANA&ROLLE Via Villino 1 - 24030 Valbrembo, Bergamo (Italy)	PROCEDURE No. 23096-01-QSP	2nd Issue rev. 1

Technical Data Sheet

JOTUN

Hardtop AX

Product description

This is a two component chemically curing aliphatic acrylic polyurethane coating. It has a high gloss finish with very good gloss retention. It has good chemical resistance. It is a high solids product. This product contains no solvents on the Hazardous Air Pollutants (HAPs) list. Minor amounts of such solvents may come in through tinting of some colours. To be used as topcoat in atmospheric environments.

Typical use

Marine:
Recommended for topside, deck and superstructure.

Protective:
Recommended for offshore environments, refineries, power plants, bridges and buildings. Suitable for a wide range of industrial structures. Used as a topcoat in pre-qualified NORSOK systems.

Approvals and certificates

This product contributes to the Green Buildings Standard credits. Please see section Green Building Standards.

APAS approved to specification 2011

When used as part of an approved scheme, this material has the following certification:
- Low Flame Spread in accordance with EU Directive for Marine Equipment. Approved in accordance with parts 5 and 2 of Annex 1 of IMO 2010 FTP Code, or Parts 5 and 2 of Annex 1 of IMO FTPC when in compliance with IMO 2010 FTP Code Ch. 8

Consult your Jotun representative for details.
Additional certificates and approvals may be available on request.

Colours

selected colours over Multicolour tinting system (MCI)

Product data

Property	Test/Standard	Description
Solids by volume	ISO 3233	63 ± 2 %
Gloss level (GU 60 °)	ISO 2813	gloss (70-85)
Flash point	ISO 3679 Method 1	38 °C
Density	calculated	1.4 kg/l
VOC-US/Hong Kong	US EPA method 24 (tested) (CARB(SCM)2007, SCAQMD rule 1113, Hong Kong)	325 g/l
VOC-EU	IED (2010/75/EU) (theoretical)	330 g/l
VOC-China	GB/T 23985-2009 (tested)	321 g/l
VOC-Korea	Korea Clean Air Conservation Act (tested) (Max. thinning ratio included)	355 g/l

The provided data is typical for factory produced products, subject to slight variation depending on colour.
All data is valid for mixed paint.

Date of issue: 22 March 2021 Page: 1/5

This Technical Data Sheet supersedes those previously issued.
The Technical Data Sheet (TDS) is recommended to be read in conjunction with the Safety Data Sheet (SDS) and the Application Guide (AG) for this product. For your nearest local Jotun office, please visit our website at www.jotun.com

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Hardtop AX

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Gloss description: According to Jotun Performance Coatings' definition.

The VOC values refer to white colour.

Film thickness per coat

Typical recommended specification range

Dry film thickness	50	- 100	µm
Wet film thickness	80	- 160	µm
Theoretical spreading rate	13	- 6.3	m²/l

Bright colours may need film thickness in the high end of the recommended specification range to achieve opacity.

Surface preparation

To secure lasting adhesion to the subsequent product all surfaces shall be clean, dry and free from any contamination.

Surface preparation summary table

Substrate	Surface preparation	
	Minimum	Recommended
Coated surfaces	Clean, dry and undamaged compatible coating	Clean, dry and undamaged compatible coating

Application

Application methods

The product can be applied by

Spray:	Use air spray or airless spray.
Brush:	Recommended for stripe coating and small areas, care must be taken to achieve the specified dry film thickness.
Roller:	May be used. However when using roller application care must be taken to apply sufficient material in order to achieve the specified dry film thickness.

Product mixing ratio (by volume)

Hardtop AX Comp A	4 part(s)
Hardtop AX Comp B	1 part(s)

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Thinner/Cleaning solvent

Thinner: Jotun Thinner No. 26 / Jotun Thinner No. 10

Jotun Thinner No. 10 can be used where aromatic solvents are accepted.

Thinning is not normally required. Consult the local representative for advice during application in extreme conditions. Do not thin more than allowed by local environmental legislation.

Guiding data for airless spray

Nozzle tip (inch/1000): 13–19

Pressure at nozzle (minimum): 150 bar/2100 psi

Guiding data for air spray

Nozzle tip: Gravity gun: 1.6–1.8 (mm) / Pressure pot: 1.4–1.8 (mm)

Pressure at nozzle (minimum): Gravity gun: 3.2 bar / Pressure pot: 3.2 bar

Pressure at pressure pot: 1.6 bar

Drying and Curing time

Substrate temperature	0 °C	5 °C	10 °C	23 °C	40 °C
Surface (touch) dry	4 h	3 h	2 h	1 h	1 h
Walk-on-dry	40 h	24 h	16 h	8 h	4 h
Dry to over coat, minimum	24 h	18 h	10 h	5 h	3 h
Dried/cured for service	20 d	14 d	10 d	5 d	3 d

For maximum overcoating intervals, refer to the Application Guide (AG) for this product.

Drying and curing times are determined under controlled temperatures and relative humidity below 85 %, and at average of the DFT range for the product.

Surface (touch) dry: The state of drying when slight pressure with a finger does not leave an imprint or reveal tackiness.

Walk-on-dry: Minimum time before the coating can tolerate normal foot traffic without permanent marks, imprints or other physical damage.

Dry to over coat, minimum: The recommended shortest time before the next coat can be applied.

Dried/cured for service: Minimum time before the coating can be permanently exposed to the intended environment/medium.

Induction time and Pot life

Paint temperature	23 °C
Pot life	2 h

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Heat resistance

	Temperature	
	Continuous	Peak
Dry, atmospheric	120 °C	140 °C

Resistant to spills of most oils, aliphatic petroleum products and non aggressive chemicals.

Peak temperature duration max. 1 hour.

The temperatures listed relate to retention of protective properties. Aesthetic properties may suffer at these temperatures.

Product compatibility

Depending on the actual exposure of the coating system, various primers and topcoats can be used in combination with this product. Some examples are shown below. Contact Jotun for specific system recommendation.

Previous coat: epoxy, zinc epoxy, epoxy mastic, polyurethane

subsequent coat: polyurethane

Packaging (typical)

	Volume (litres)	Size of containers (litres)
Hardtop AX Comp A	4 / 16	5 / 20
Hardtop AX Comp B	1 / 4	1 / 5

The volume stated is for factory made colours. Note that local variants in pack size and filled volumes can vary due to local regulations.

Storage

The product must be stored in accordance with national regulations. Keep the containers in a dry, cool, well ventilated space and away from sources of heat and ignition. Containers must be kept tightly closed. Handle with care.

Shelf life at 23 °C

Hardtop AX Comp A	48 month(s)
Hardtop AX Comp B	48 month(s)

In some markets commercial shelf life can be dictated shorter by local legislation. The above is minimum shelf life, thereafter the paint quality is subject to re-inspection.

Green Building Standards

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This product contributes to Green Building Standard credits by meeting the following specific requirements:

BREEAM® NOR (2016)
- Hea 02: VOC content for Two-pack performance Coatings SB (500 g/l) (EU Directive 2004/42/CE) and emission demands (ISO 16000-series).
- Mat 01: The product Safety Data Sheet confirms that the product does not contain any substances on the Norwegian A20 list.

BREEAM® NOR (2012)
- Hea 9: VOC content for Two-pack performance Coatings SB (500 g/l) (EU Directive 2004/42/CE) and emission demands (ISO 16000-series).
- Mat 1.5: This product Safety Data Sheet confirms that the product does not contain any substances on the Norwegian A20 list.

Caution

This product is for professional use only. The applicators and operators shall be trained, experienced and have the capability and equipment to mix/stir and apply the coatings correctly and according to Jotun's technical documentation. Applicators and operators shall use appropriate personal protection equipment when using this product. This guideline is given based on the current knowledge of the product. Any suggested deviation to suit the site conditions shall be forwarded to the responsible Jotun representative for approval before commencing the work.

Health and safety

Please observe the precautionary notices displayed on the container. Use under well ventilated conditions. Do not inhale spray mist. Avoid skin contact. Spillage on the skin should immediately be removed with suitable cleanser, soap and water. Eyes should be well flushed with water and medical attention sought immediately.

Colour variation

When applicable, products primarily meant for use as primers or antifoulings may have slight colour variations from batch to batch. Such products and epoxy based products used as a finish coat may chalk when exposed to sunlight and weathering.

Colour and gloss retention on topcoats/finish coats may vary depending on type of colour, exposure environment such as temperature, UV intensity etc., application quality and generic type of paint. Contact your local Jotun office for further information.

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E.M.M.A. S.R.L.

PAINTING REPORT

PAINTING REPORT No. 24-112	PAGE: 1 di 1	DATE: 06/09/2024

IDENTIFICATION DATA

CUSTOMER / CLIENTE: *BREMBANA & ROLLE S.P.A.*	PLANT / IMPIANTO: -
JOB NO. / COMMESSA: *23096*	*CLIENT*: *ROSETTI MARINO*
MATERIAL DESCRIPTION / DESCRIZIONE MATERIALE: ITEM V25001A DWG 23096-01-ESP1	

WEATHER CONDITIONS, STEEL and SURFACE PREPARATION

DATE – TIME: *BLASTING 22/08/2024– ORE 10.00 AM*	STEEL PREPARATION - ISO 8501-3: P3
BLOTTER TEST- ASTM D 4417 - CONFORMING	ABRASIVE TYPE and SIZE - ISO - ISO 11124-3: Steel Grit
AIR TEMPERATURE – ISO 8502-4: 32.1°	BLAST PROFILE – ISO 8503 -5: 76 micr.
STEEL TEMPERATURE – *ISO 8502-4: 32.9°*	ABRASIVE CONDUCTIVITY - ISO 11126-10 N.R.
RELATIVE UMIDITY – ISO 8502-4: 48.2%	SURFACE SOLUBLE SALTS - ISO 8502-6/9: 4 mg/m2
DEW POINT – ISO 8502-4: 19.8°	SURFACE CLEANLINESS - ISO 8502-3: Class Rating 1 SIZE: 1
DEGREE OF CLEANLINESS: SSPC-SP1: SOLVENT CLEANING ISO 8501-1 SA 2.5	Note: N.A.

APPLICATION

REF. SPECIFICATION: *123A90-DDL-MAT-SP-60006 Rev.02*			COATING SYSTEM: *Norsok M-501 Edition 6 – System 1*		
TYPE of COATS	PRIMER	INTERMEDIATE	INTERMEDIATE	TOP COAT	TYPE of INSTRUMENTS
Ambient Conditions	Date 22/08/2024 Hour 01.00 PM Air °T: 34° Surface °T: 33° RH% 49 % Dew Point 21.76°	Date 23/08/2024 Hour 08.00 AM Air °T: 31° Surface °T: 30° RH% 52% Dew Point 19.98°		Date 26/08/2024 Hour 08.00 AM Air °T: 31 ° Surface °T: 30° RH% 47% Dew Point 18.36°	POSITECTOR 6000
STRIPE COAT by brush/roller	YES	YES		YES	
APPLICATION METHOD	BRUSH – ROLLER AIRLESS	BRUSH – ROLLER AIRLESS		BRUSH – ROLLER AIRLESS	
PRODUCTS TYPE BRAND NAME	BARRIER 80	PENGUARD UNIVERSAL		HARDTOP AX	
BATCH NUMBER A B	3583470-1-*-1:2 3589589-1-*-1:2-1	3365663-1-*-1:3-1 3540834-1-*-1:2-1		3590159-1-*-1:2 3613863-1-*-1:2	
COLOUR *COLORE*	GREY	GREY		7035	
DFT. REQUIRED µ	60 MICR	160 MICR		60 MICR	
WFT APPLIED. µm	83 MICR	208 MICR		84 MICR	
ISO 19840 DFT µ	62 MICR	225 MICR		286 MICR	POSITECTOR 6000
VISUAL CHECK	NO DEFECTS	NO DEFECTS		NO DEFECTS	
MEK TEST ASTM D 4752 for inorganic zinc only	N.A.	N.A.		N.A.	
NOTE:					

Q.C. SIGNATURE *FIRMA CONTROLLO QUALITA'*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*
E.M.M.A. S.R.L. Sede legale: Viale Tunisia, 25 - 20124 Milano PIVA e C.F. 12112700963 Codice SDI: M5UXCR1 PEC: e.m.m.asrl@pec.it	BREMBANA & ROLLE S.P.A. Q.C. INSPECTOR M. RAMPAZZO DATE: 06 09 2024	ROSETTI MARINO S.p.A. Milano e Sesto Q.C. Dept. REVIEW	
DATE: 06.09.2024	DATE:	DATE: 06-09-2024	DATE:

E.M.M.A. S.R.L.

PROVA ADESIONE IN ACCORDO ALLO STANDARD ASTM D4541 (SU CAMPIONE)
ADHESION TEST ACCORDING TO ASTM D4541 (ON PLATE)

DATE: 20.09.2024	Attached to the certificate N. 24-112 Job 23096 ITEM V25001A
PERFORMED BY / *ESEGUITO DA:* HERMAN COSTEL	
WITNESSED BY / *CONTROLLATO DA:* LOZZA ANTONY	
INSTRUMENT INVOLVED: *STRUMENTO UTILIZZATO*: POSITEST AT-M; Matr. AT 12236	HYDRAULIC ADHESION TESTER-POSITEST AT-M SERIAL N.AT-12236 GLUE TYPE: 2PACK EPOXY

READING GROUP *GRUPPO LETTURA*	SPOT MEAS.	AVERAGE OF READINGS *MEDIA LETTURE* (1+2+3): 3	TOP COAT APPLICATION DATE
SYSTEM 1	1	285	26/08/2024
SYSTEM 1	2	283	26/08/2024
SYSTEM 1	3	286	26/08/2024

RESULT - *RISULTATO*

POINTS *PUNTI*	1	2	3
VALUES *VALORI*	11,44	8,83	11,60
	100%D	50%Y 50%D	100%D

AVERAGE min required MPa: 5 MPa
MEDIA min richiesta

NOTES / *NOTE:*
Z:DOLLY/ Y:GLUE / A:TOP COAT / B: INTERMEDIATE / C: PRIMER / D: BLASTED SURFACES

Q.C. SIGNATURE *FIRMA CONTROLLO QUALITA'*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*
E.M.M.A. S.R.L. Sede legale: Viale Tunisia, 25 - 20124 Milano P.IVA e C.F. 12112700963 Codice SDI: M5UXCR1 PEC: e.m.m.asrl@pec.it	BREMBANA & ROLLE S.P.A. Q.C. INSPECTOR M. RAMAZZO DATE:	ROSETTI MARINO SpA Michele Sacchi Quality Control Dept. NACE # 35744	
DATE: *DATA: 20.09.2024*	DATE: *DATA:* 20 SEP 2024	DATE: *DATA:* 20-09-2024	DATE: *DATA:*

EMMA S.R.L.

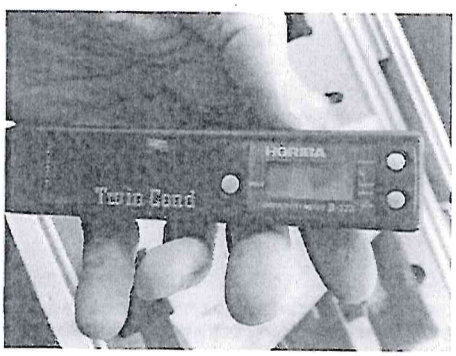
CALIBRATION CERTIFICATE

Product Name: **HORIBA CONDUCTIVITY METER B-771**
Serial N°: **102037**

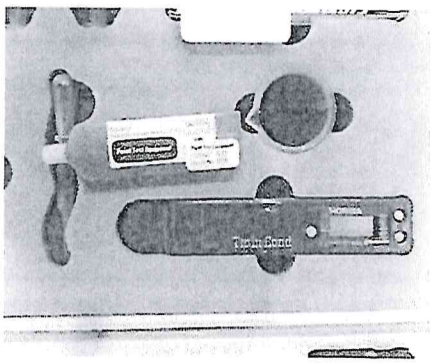
Calibration Solution:	**Serial N° 1785**	**Cert. N° 7869**
Standard Solution:	**Model Y071L**	**1,41 mS/cm**
Manufacturing Date:	**September 2023**	
Use best before:	**September 2024**	

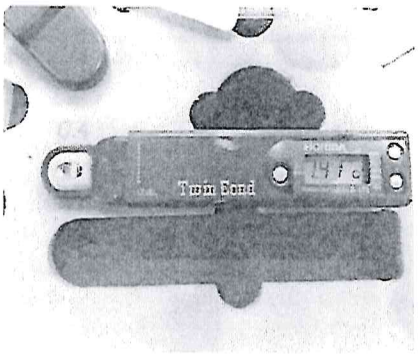
Instrument Calibration Date: **October 5, 2023**
Instrument Expire Calibration Date: **October 5, 2024**

Calibration test Performed By:
Mr. Paolo Caprioli NACE Certified Coating Inspector Levell III #6476









NACE INTERNATIONAL
Paolo Caprioli
NACE - Coating Inspector
Level III - Certified #6476

TQC

Vision on quality
www.tqc.eu

Laboratorio Metrologico / Metrology Laboratory

CERTIFICATO DI TARATURA
CERTIFICATE
N° 10170/23

Destinatario: TQC ITALIA srl
Customer

Oggetto della taratura: Termoigrometro per ambiente
Description: thermohygrometer
Metodo: verifica per comparazione con campioni e/o strumenti primari
Method: verify by comparison with master samples / instruments
Utilizzo: misuratore di umidità relativa e temperatura
Use: temperature and humidity indicator

Modello / *Model:* DPM
Matricola / *s/n:* 284557
Visualizzatore tipo / *viewer:* PosiTector ADV
Matricola / *s/n:* 793034
Sonda tipo / *Probe:* /
Matricola / *s/n:* /

Procedura utilizzata per la verifica: CP06 – CP03
Procedure

Data: 05-10-23
Date

Intervallo di verifica: 12 mesi
Checking every: 12 months

Procedura di verifica
La procedura utilizzata per effettuare la verifica prevede l'impiego di strumenti e/o campioni primari certificati da centri Accredia o equivalenti riconosciuti a livello internazionale (ove disponibili). La verifica vengono effettuate per confronto diretto o indiretto tra lo strumento/campione in lavoro e lo strumento/campione di riferimento primario con l'utilizzo della attrezzatura di supporto. Si predispone l'oggetto della verifica e gli strumenti/campioni di confronto pronti ad effettuare misurazioni isolandoli per circa due ore nella camera di prova a temperatura ed umidità controllate. Si effettuano una serie di misure significative annotandole sulla scheda tecnica interna. Si calcola la media aritmetica degli scostamenti rilevati. Si verifica poi la ripetibilità di lettura. Si determina quindi l'incertezza di misura derivante dagli scostamenti rilevati, dalla ripetibilità di lettura, dall'incertezza degli strumenti e/o campioni utilizzati per la prova, da deriva termica, rumore, ove applicabili. Si determina poi l'esito della verifica e la conformità alla normativa di riferimento, se previsti. Alla fine della compilazione della scheda tecnica interna, può essere redatto il documento di verifica. Si appone infine sullo strumento/campione l'etichetta di avvenuta certificazione.

Procedure of verify.
The procedure used for the verify provides the use of master samples / instruments certificated by Accredia centres or equivalent recognized at international level (where available).
The verifies are effected by direct or in direct comparison between the sample / instrument to cobbiato and the master sample / instrument using support equipments.
The object of the verify and the master samples / instruments are arranged to be ready to take measures, they stay in the test room about two hours at controlled temperature and humidity. Some significant measures are taken, and they are annotated on the internal technical-report. The arithmetical mean of the errors, which have been taken, is calculated. Then the reading repeatability is verified. So the uncertainty of measure is determined, it comes from the: errors, reading repeatability, uncertainty of the samples / instruments used for the test, thermic deviation, noise, where applicable. Then the result of the verify or the conformity with the tolerance standard is determined, if they are provided. At the end of the compilation of the internal technical-report, the verify document can be compiled. Finally the label of occured calibration is affixed on the sample / instrument.

Il responsabile di laboratorio: C. Alborghetti firma
Head of laboratory *signature*

Registro di laboratorio CERT06 *Laboratory registration*	Documento N° 41/7 del 21-07-98 *Document nr. 41/7 dated 21-07-98*	Rev. 1.01

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TQC ITALIA S.R.L.
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Branch SEREGNO (MB)
IBAN IT 42 I 03069 33041 100000001659
C.F. 09031040960
P.IVA. 09031040968
Numero REA MB - 1886907
www.tqcitaly.it/www.tqc.eu
info@tqcitaly.it

Certificato n° 10170/23
Certificate

SCHEDA TECNICA (1)
TECHNICAL REPORT

Verifica termoigrometro per comparazione con campioni primari
Verify of thermohygrometer by comparison with master samples / instruments

Procedura / *Procedure:* CP06

Modello / *Model:* DPM Matricola / *s/n:* 284557
Visualizzatore tipo / *viewer:* PosiTector ADV Matricola / *s/n:* 793034
Metodo di rilevazione umidità / *Method:* sensore capacitivo / *capacity sensor*
Campo di misura / *Range:* 0...100%RH -40 +80°C Precisione/*Accuracy:* ±3%RH. ± 1°C
Risoluzione/*resolution:* 0.1%RH 0.1°C

La catena di riferibilità ha inizio con i seguenti campioni primari *Master samples / instruments:*
Igrometro HD4901T matricola 11005609 corredato di certificato ACCREDIA 0069 19 UR
Hygrometer HD4901T s/n 11005609 with ACCREDIA certificate 0069 19 UR
Termometro digitale HD9219 matricola 003ASC+03000092 corredato di certificato ACCREDIA C1181D6000
Digital thermometer HD9219 s/n 003ASC+03000092 with ACCREDIA certificate C1181D6000

Strumentazione ausiliaria *auxiliary equipment:*
Camera termoigrometrica M60-TB matricola 38 (M10110593) *Thermohygrometer room M60-TB sn38 (M10110593)*
Unità criogenica 9705 matricola 34 (811955) *Criogenic unit 9705 sn 34 (811955)*

Norma di riferimento IEC 584 con espressione della temperatura secondo STI 90
Reference standard IEC 584 with temperature representation conform to STI 90

UMIDITA' / *HUMIDITY*

Punto *Step*	valore nominale *Nominal value* (%RH)	valore letto *Reading value* (%RH)	scostamento dal valore nominale *Error* (%RH)
1	35,0	36,9	1,9
2	50,0	52,3	2,3
3	80,0	82,5	2,5
Scostamento medio dal valore nominale / *Mean error from nominal value:* 2,23 (% RH)			
Incertezza di misura / *Uncertainty of readings:* < ± 2,01 (% RH)			

TEMPERATURA / *TEMPERATURE*

Punto *Step*	valore nominale *Nominal value* (°C)	valore letto *Reading value* (°C)	scostamento dal valore nominale *Error* (°C)
1	-10,8	-10,0	0,8
2	20,6	20,0	-0,6
3	81,4	80,0	-1,4
Scostamento medio dal valore nominale / *Mean error from nominal value:* -0,40 (°C)			
Incertezza di misura / *Uncertainty of readings:* < ± 0,36 (°C)			

Le incertezze di misura dichiarate in questo documento, associate alle letture effettuate, sono espresse come due volte lo scarto tipo corrispondente, nel caso di distribuzione normale, ad un livello di confidenza di circa 95%.
The uncertainties stated in this document are estimated at the level of twice the standard deviation, corresponding, in case of normal distribution, to a confidence level of about 95%.

Le misure sono state effettuate nelle seguenti condizioni ambientali *Room test conditions:*
Temperatura / *Temperature:* 23°C ± 1°C Umidità / *Humidity:* 50% u.r. ± 10% u.r.

Data delle prove *Test date* 05-10-23 Tecnico di laboratorio *Technician of laboratory*

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Certificato n° 10170/23
Certificate

SCHEDA TECNICA (2)
TECHNICAL REPORT

Verifica rilevazioni termometro digitale tipo / *Verify of digital thermometer model:* DPM, per superfici
Matricola / *s/n:* 284567
Visualizzatore tipo / *viewer:* PosiTector ADV Matricola / *s/n:* 793034
Campo di misura / *Range:* -40 +190°C
Procedura / *Procedure:* CP03

La catena di riferibilità ha inizio con i seguenti campioni primari :
Master samples / Instruments:
- Termometro digitale HD9219 matricola 003ASC+03000092 corredato di certificato ACCREDIA C1181D6000
Digital thermometer HD9219 s/n 003ASC+03000092 with ACCREDIA certificate C1181D6000
- Calibratore multifunzione Fluke 5500A matricola 6330020 corredato di certificato ACCREDIA 356433
Multifunction calibrator Fluke 5500A sn 6330020 with Accredia certificate 356433

Norma di riferimento CEI EN 60584-1 e CEI EN 60751 con espressione della temperatura secondo STI 90
Reference standard CEI EN 60584-1 e CEI EN 60751 with temperature representation conform to STI 90

Strumentazione ausiliaria *auxiliary equipment*
Strumento calibratore Thermostatic calibrator Pyros matricola F087 00 *Thermostatic calibrator Pyros sn F08700*
Strumento calibratore Thermostatic calibrator Pyros matricola C152 95 *Thermostatic calibrator Pyros sn C15295*
Unità criogenica 9705 matricola 34 (811955) *Criogenic unit 9705 sn 34 (811955)*

Risultati della verifica con sonda matricola 284567
Results of the verify with probe s/n 284567

Punto *Step*	valore nominale *Nominal value* (°C)	valore letto *Reading value* (°C)	scostamento dal valore nominale *Error* (°C)	Incertezza di misura *Uncertainty of reading* (< +°C)
1	20,0	20,4	0,4	0,35
2	50,0	50,8	0,8	0,70
3	80,0	81,1	1,1	0,97
4	100,0	101,4	1,4	1,23
5	150,0	151,6	1,6	1,41
Scostamento medio dal valore nominale: *mean error from nominal value:*			1,06 (°C)	

Considerazioni / *Considerations:* /

Le incertezze di misura dichiarate in questo documento, associate alle letture effettuate, sono espresse come due volte lo scarto tipo corrispondente, nel caso di distribuzione normale, ad un livello di confidenza di circa 95%.
The uncertainties stated in this document are estimated at the level of twice the standard deviation, corresponding, in case of normal distribution, to a confidence level of about 95%.

Le misure sono state effettuate nelle seguenti condizioni ambientali:
Room test conditions:
Temperatura / *Temperature:* 23°C ± 1°C
Umidità / *Humidity:* 50% u.r. ± 10% u.r.

Data delle prove *Test date* 05-10-23 Tecnico di laboratorio *Technician of laboratory*

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CERTIFICATE OF CONFORMANCE

Issue by: Paint Test Equipment

Date of Issue: 2024-07-26 Certificate No: 122766

Paint Test Equipment

3-4 The Courtyard,
Greenfield Farm Estate,
Congleton, Cheshire,
CW12 4TR, England

www.paint-test-equipment.com

tel: +44 (0)1260 275614

Email: sales@paint-test-equipment.com

Approved Signatory



S. McCloskey

CUSTOMER:	EMMA Srl
PART NO:	R1002
PRODUCT:	Testex Tape X Coarse
SERIAL NO:	08898
STANDARDS:	ISO 8503-5, ASTM D4417 and NACE SP0287
INFORMATION:	Do not expose the Testex Replica Tape to any extremes of temperature or daylight. We would recommend that the Testex Replica Tape is used within a 12-month period from date of purchase.

The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of a approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. This is certify that the above equipment has been calibrated and found to comply with Paint Test Equipment specifications. This Certificate is issued in accordance with ISO 10012:2003(E). It provides traceability of measurements to recognised National Standards UKAS and BAM. It is recommended that the Certificate is reissued on a 12-monthly basis.

CERTIFICATE OF CONFORMANCE

Issue by: Paint Test Equipment
Date of Issue: 2024-07-26 **Certificate No:** 122767

Paint Test Equipment
3-4 The Courtyard,
Greenfield Farm Estate,
Congleton, Cheshire,
CW12 4TR, England

www.paint-test-equipment.com
tel: +44 (0)1260 275614
Email: sales@paint-test-equipment.com

Approved Signatory



S. McCloskey

CUSTOMER:	EMMA Srl
PART NO:	R1002
PRODUCT:	Testex Tape X Coarse
SERIAL NO:	08899
STANDARDS:	ISO 8503-5, ASTM D4417 and NACE SP0287
INFORMATION:	Do not expose the Testex Replica Tape to any extremes of temperature or daylight. We would recommend that the Testex Replica Tape is used within a 12-month period from date of purchase.

The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of a approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. This is certify that the above equipment has been calibrated and found to comply with Paint Test Equipment specifications. This Certificate is issued in accordance with ISO 10012:2003(E). It provides traceability of measurements to recognised National Standards UKAS and BAM. It is recommended that the Certificate is reissued on a 12-monthly basis.

JOTUN
Jotun Protects Property

Trieste, 23/09/2024

Certificate of Batch Analysis and Conformity

We hereby certify that the product(s) supplied detailed hereon have been inspected and tested according to the following standards*:

- Viscosity: ISO 2884 / ASTM D 562
- Density: ISO 2811
- Grindness: ISO 1524
- Application properties and SAG index: n/a
- Colour strength: DIN 53234
- Specular gloss: ISO 2813

* where applicable, according to the product's type

The test results were compliant with the provisions of the QC plan(s) and the product(s) fully comply with what is described in the Technical Data Sheets.

Customer:
E.M.M.A. SRL

Sales Part Description	Lot/Batch No	Production Date	Best Before Date
PENGUARD UNI GREY A 15L	3550855-1-*-1:3-2	12/07/2024	11/07/2028
PENGUARD UNI, COMP B 5L	3546405-1-*-1:2-2	12/07/2024	11/07/2028
BARRIER 80 S, EU COMP B 1.25L	3589589-1-*-1:2-1	24/07/2024	24/07/2026
BARRIER 80 S GREY A 7.5L	3565748-1-*-1:2-3	06/07/2024	06/07/2026
HARDTOP AX, COMP B 4L	3583861-1-*-1:2	19/07/2024	18/07/2028

Jotun Italia Srl
Soggetta all'attività di direzione e coordinamento da parte della Jotun AS - Norvegia
Via O. Petronio, 8
34015 Muggia (Trieste) ITALY
P.I. 00804150324 - C.F. 10163910150

Jotun Italia Srl
Via O. Petronio, 8
34015 – Muggia (TS)
Italy

Soggetta all'attività di direzione e coordinamento da parte della Jotun AS - Norvegia.

JOTUN
Jotun Protects Property

Trieste, 23/09/2024

Certificate of Batch Analysis and Conformity

We hereby certify that the product(s) supplied detailed hereon have been inspected and tested according to the following standards*:

- Viscosity: ISO 2884 / ASTM D 562
- Density: ISO 2811
- Grindness: ISO 1524
- Application properties and SAG index: n/a
- Colour strength: DIN 53234
- Specular gloss: ISO 2813

* where applicable, according to the product's type

The test results were compliant with the provisions of the QC plan(s) and the product(s) fully comply with what is described in the Technical Data Sheets.

Customer:
E.M.M.A. SRL

Sales Part Description		Lot/Batch No	Production Date	Best Before Date
HARDTOP AX RAL 7035	14,48L	3594117-1-*-1:2	30/08/2024	29/08/2028

Jotun Italia Srl
Soggetta all'attività di direzione e coordinamento da parte della Jotun AS - Norvegia
Via O. Petronio, 8
34015 Muggia (Trieste) ITALY
P.I. 00804150324 - C.F. 10163910159

Jotun Italia Srl
Via O. Petronio, 8
34015 – Muggia (TS)
Italy

Soggetta all'attività di direzione e coordinamento da parte della Jotun AS - Norvegia.

E.M.M.A. S.R.L.

RAPPORTO DI TARATURA *Calibration Report*
Nr. 0315

STRUMENTO TIPO: **Instrument type:**	TESTEX GAUGE PAINT TEST EQUIPMENT S/N AA661113

Si certifica che lo strumento è stato da noi controllato e tarato, secondo le specifiche di costruzione, servendoci di fogli di taratura
Matricola Nr. 280409NRK/221008TAM/290199OFJ con certificato di taratura
SIT Nr. 1003525DSI + Nr. 1005010DSI + Nr. 1005009DSI.

We certify that the instrument has been controlled by us and calibrate according to the costruction specification, using calibration sheet serial Number no. 280409NRK /221008TAM/290199OFJ with calibration certificate No. 1003525DSI + No.1005010DSI + No. 1005009DSI

INCERTEZZA DI MISURA : **uncertainty of measure:**	± 5 %
Valore campione: ***Example value:*** **73.2 µm** **289 µm** **687 µm**	**Valori riscontrati:** ***Value measured:*** **74 – 74 – 73 µm** **289 – 290 – 290 µm** **687 – 688 – 686 µm**

Data di controllo / *Date of control :*	03/07/2024
Intervallo di verifica / *Verify E.M.M.A. srl :*	12 mesi / *12 month*
Responsabile / Responsable :	Lozza Antony

E.M.M.A. S.R.L.

PAINTING REPORT

PAINTING REPORT No. 24-112	PAGE: 1 di 1	DATE: 06/09/2024

IDENTIFICATION DATA

CUSTOMER / CLIENTE: *BREMBANA & ROLLE S.P.A.*	PLANT / IMPIANTO: -
JOB NO. / COMMESSA: *23096*	*CLIENT*: *ROSETTI MARINO*
MATERIAL DESCRIPTION / DESCRIZIONE MATERIALE: ITEM V25001A DWG 23096-01-ESP1	

WEATHER CONDITIONS, STEEL and SURFACE PREPARATION

DATE – TIME: *BLASTING 22/08/2024– ORE 10.00 AM*	STEEL PREPARATION - ISO 8501-3: P3
BLOTTER TEST- ASTM D 4417 - CONFORMING	ABRASIVE TYPE and SIZE - ISO - ISO 11124-3: Steel Grit
AIR TEMPERATURE – ISO 8502-4: 32.1°	BLAST PROFILE – ISO 8503 -5: 76 micr.
STEEL TEMPERATURE – *ISO 8502-4: 32.9°*	ABRASIVE CONDUCTIVITY - ISO 11126-10 N.R.
RELATIVE UMIDITY – ISO 8502-4: 48.2%	SURFACE SOLUBLE SALTS - ISO 8502-6/9: 4 mg/m2
DEW POINT – ISO 8502-4: 19.8°	SURFACE CLEANLINESS - ISO 8502-3: Class Rating 1 SIZE: 1
DEGREE OF CLEANLINESS: SSPC-SP1: SOLVENT CLEANING ISO 8501-1 SA 2.5	Note: N.A.

APPLICATION

REF. SPECIFICATION: *123A90-DDL-MAT-SP-60006 Rev.02*			COATING SYSTEM: *Norsok M-501 Edition 6 – System 1*		
TYPE of COATS	PRIMER	INTERMEDIATE	INTERMEDIATE	TOP COAT	TYPE of INSTRUMENTS
Ambient Conditions	Date 22/08/2024 Hour 01.00 PM Air °T: 34° Surface °T: 33° RH% 49 % Dew Point 21.76°	Date 23/08/2024 Hour 08.00 AM Air °T: 31° Surface °T: 30° RH% 52% Dew Point 19.98°		Date 26/08/2024 Hour 08.00 AM Air °T: 31 ° Surface °T: 30° RH% 47% Dew Point 18.36°	POSITECTOR 6000
STRIPE COAT by brush/roller	YES	YES		YES	
APPLICATION METHOD	BRUSH – ROLLER AIRLESS	BRUSH – ROLLER AIRLESS		BRUSH – ROLLER AIRLESS	
PRODUCTS TYPE BRAND NAME	BARRIER 80	PENGUARD UNIVERSAL		HARDTOP AX	
BATCH NUMBER A B	3583470-1-*-1:2 3589589-1-*-1:2-1	3365663-1-*-1:3-1 3540834-1-*-1:2-1		3590159-1-*-1:2 3613863-1-*-1:2	
COLOUR *COLORE*	GREY	GREY		7035	
DFT. REQUIRED µ	60 MICR	160 MICR		60 MICR	
WFT APPLIED. µm	83 MICR	208 MICR		84 MICR	
ISO 19840 DFT µ	62 MICR	225 MICR		286 MICR	POSITECTOR 6000
VISUAL CHECK	NO DEFECTS	NO DEFECTS		NO DEFECTS	
MEK TEST ASTM D 4752 for inorganic zinc only	N.A.	N.A.		N.A.	
NOTE:					

Q.C. SIGNATURE *FIRMA CONTROLLO QUALITA'*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*
E.M.M.A. S.R.L. Sede legale: Viale Tunisia, 25 - 20124 Milano P.IVA e C.F. 12112700963 Codice SDI: M5UXCR1 PEC: e.m.m.asrl@pec.it	BREMBANA & ROLLE S.p.A. Q.C. INSPECTOR M. RAMPAZZO DATE: 06/09/2024	ROSETTI MARINO S.p.A. Milano (Sa) REVIEW	Angelo Susani AMPP No. N-46232 Jotun Italy S.r.l.
DATE: 06.09.2024	DATE:	DATE: 06-09-2024	DATE:

E.M.M.A. S.R.L.

PROVA ADESIONE IN ACCORDO ALLO STANDARD ASTM D4541 (SU CAMPIONE)
ADHESION TEST ACCORDING TO ASTM D4541 (ON PLATE)

DATE: 20.09.2024	Attached to the certificate N. 24-112 Job 23096 ITEM V25001A
PERFORMED BY / *ESEGUITO DA:* HERMAN COSTEL	
WITNESSED BY / *CONTROLLATO DA:* LOZZA ANTONY	
INSTRUMENT INVOLVED: *STRUMENTO UTILIZZATO*: POSITEST AT-M; Matr. AT 12236	HYDRAULIC ADHESION TESTER-POSITEST AT-M SERIAL N.AT-12236 GLUE TYPE: 2PACK EPOXY

READING GROUP *GRUPPO LETTURA*	SPOT MEAS.	AVERAGE OF READINGS *MEDIA LETTURE* (1+2+3): 3	TOP COAT APPLICATION DATE
SYSTEM 1	1	285	26/08/2024
SYSTEM 1	2	283	26/08/2024
SYSTEM 1	3	286	26/08/2024

RESULT - *RISULTATO*

POINTS *PUNTI*	1	2	3
VALUES *VALORI*	11,44	8,83	11,60
	100%D	50%Y 50%D	100%D

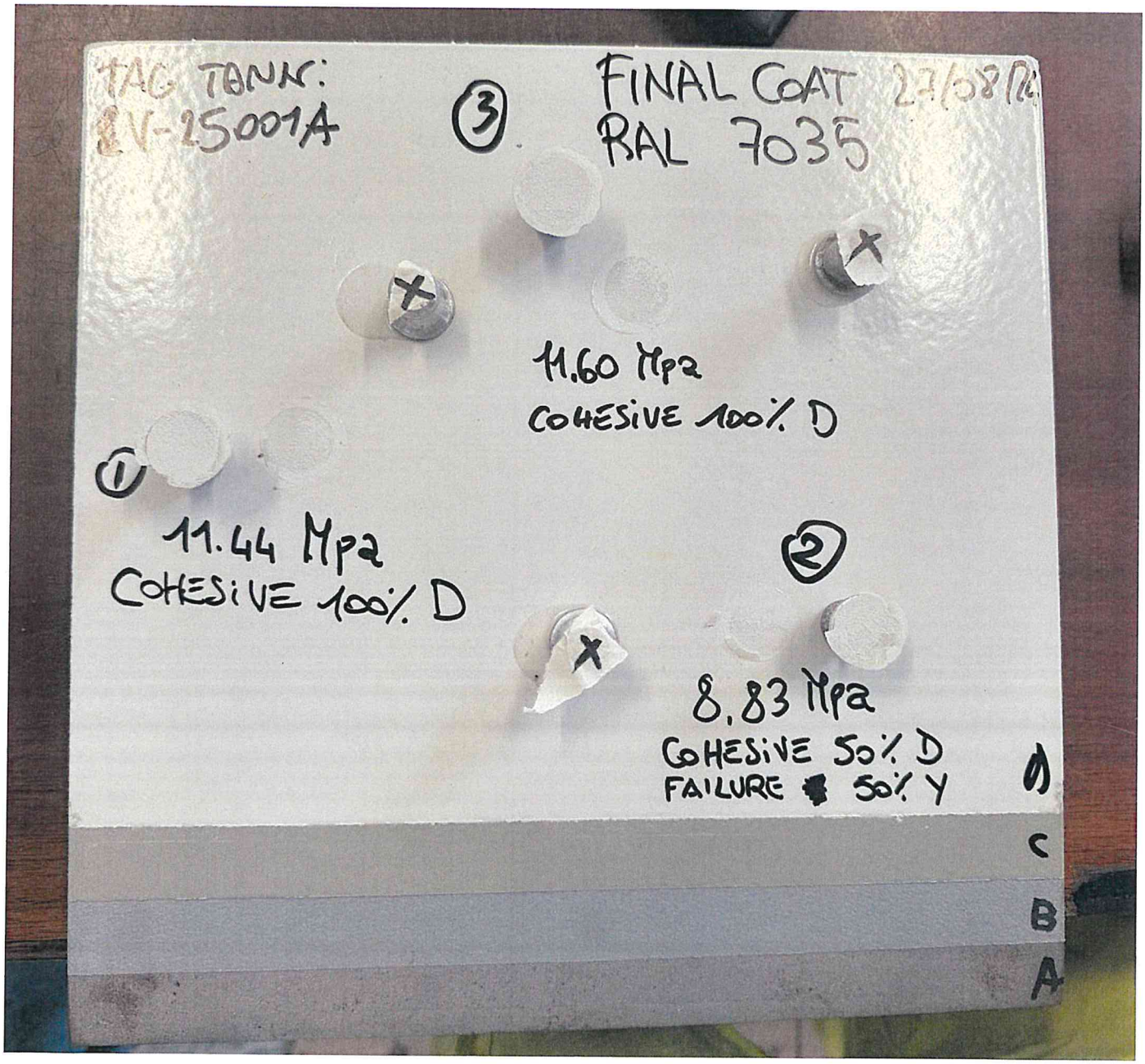
AVERAGE min required MPa: 5 MPa
MEDIA min richiesta

NOTES / *NOTE:*
Z:DOLLY/ Y:GLUE / A:TOP COAT / B: INTERMEDIATE / C: PRIMER / D: BLASTED SURFACES

Q.C. SIGNATURE *FIRMA CONTROLLO QUALITA'*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*	INSPECTOR SIGNATURE *FIRMA ISPETTORE*
E.M.M.A. S.R.L. Sede legale: Viale Tunisia, 25 - 20124 Milano P.IVA e C.F. 12112700963 Codice SDI: M5UXCR1 PEC: e.m.m.asrl@pec.it	BREMBANA & ROLLE S.p.A. Q.C. INSPECTOR M. RAMPAZZO DATE: / /	ROSETTI MARINO SpA Michele Sacchi Quality Control Dept. NACE # 35744	Angelo Susani AMPP No. N-46232 Jotun Italy S.r.l.
DATE: *DATA: 20.09.2024*	DATE: *DATA:* 20 SEP 2024	DATE: *DATA:* 20-09-2024	DATE: *DATA:*

ATTACHMENT TO PAINTING REPORT NO. 24-112

16-10-2024



ANTONY COZZA

20 SEP 2024

BRENBANA & ROLLE S.P.A.
Q.C. INSPECTOR
M. RAMPAZZO
DATE: 20 SEP 2024

ROSETTI MARINO SpA
Michele Sacchi
Quality Control Dept.
NACE #35 FA4

Angelo Susani
AMPP No. N-46232
Jotun Italy S.r.l.

SOLUBLE SALT TEST acc. ISO 8502-6 and 9

Company: ..... Name: ..... Date / Time: ..../..../.....

TQC SHEEN DUST TEST KIT REPORT FORM

acc. ISO 8502-3

Company: BREMBANA PADOVA Name: 23096 - A Date / Time: 22/08/2024

A

SALI 1 SALI 2

ACQUA 2 ACQUA 2

TEST 3 (1X4) - TEST 4 (2X4)

B

Testex® PRESS-O-FILM® HT X-Coarse
www.testextape.com
1.5 to 4.5 mil
38 to 115 µm
Made in USA
22/08/2024 1
20 C 38 (C + XC) / 2 64 XC 115 µm
0.8 1.5 2.5 4.5 mil

54 NW

Testex® PRESS-O-FILM® HT X-Coarse
www.testextape.com
1.5 to 4.5 mil
38 to 115 µm
Made in USA
22/08/2024 2
20 C 38 (C + XC) / 2 64 XC 115 µm
0.8 1.5 2.5 4.5 mil

70 NW

C

Testex® PRESS-O-FILM® HT X-Coarse
www.testextape.com
1.5 to 4.5 mil
38 to 115 µm
Made in USA
22/08/2024 3
20 C 38 (C + XC) / 2 64 XC 115 µm
0.8 1.5 2.5 4.5 mil

76 NW

D

E

1	2	3	4	5

Test Sample	A	B	C	D	E	Mean
Dust Quantity Rating						
Dust Particle Size*						

* See Display Board for classification

Site / Location: ..... Surface type: ..... Nature of tested surface: .....

Adhesive tape type used: ☐ TQC SP3209 ☐ Other: .....

Background used: ☐ TQC SP3220 ☐ Other: .....

BREMBANA & ROLLE S.P.A.
Q.C. INSPECTOR
M. RAMPAZZO
DATE: 15/10/24

Fabrication site: Albignasego – PD – ITALY

Section 18

Weighing Procedure & report

NOT APPLICABLE

Fabrication site: Albignasego – PD – ITALY

Section 19

Name Plate (copy or facsimile)

BREMBANA & ROLLE S.p.a.

		B&R JOB No.	23096
ITEM	V-25001A	CUST. ORDER	1723001756 123A90A
SERVICE/TYPE	HYDROGEN STORAGE VESSEL		
BUILT FOR	ROSETTI MARINO S.p.A.		
YEAR BUILT	2024	MFRS' SERIAL No	23096-01-SNA
SURFACE AREA	165 m²	SIZE	17600 x 2888

DESIGN TEMPERATURE (TS)	-29 / 80 °C
DESIGN PRESSURE (PS)	FV / 40 barg
FIELD TEST PRESSURE (PT)	57.2 barg
CORROSION ALLOWANCE	0
RADIOGRAPHED	FULL
STRESS RELIEVED	YES
CAPACITY (V)	101200 L
MIN. DES. METAL TEMP.	-29 °C
FLUID GR./TYPE/CAT. (PED)	1 / G / IV

CE 0094

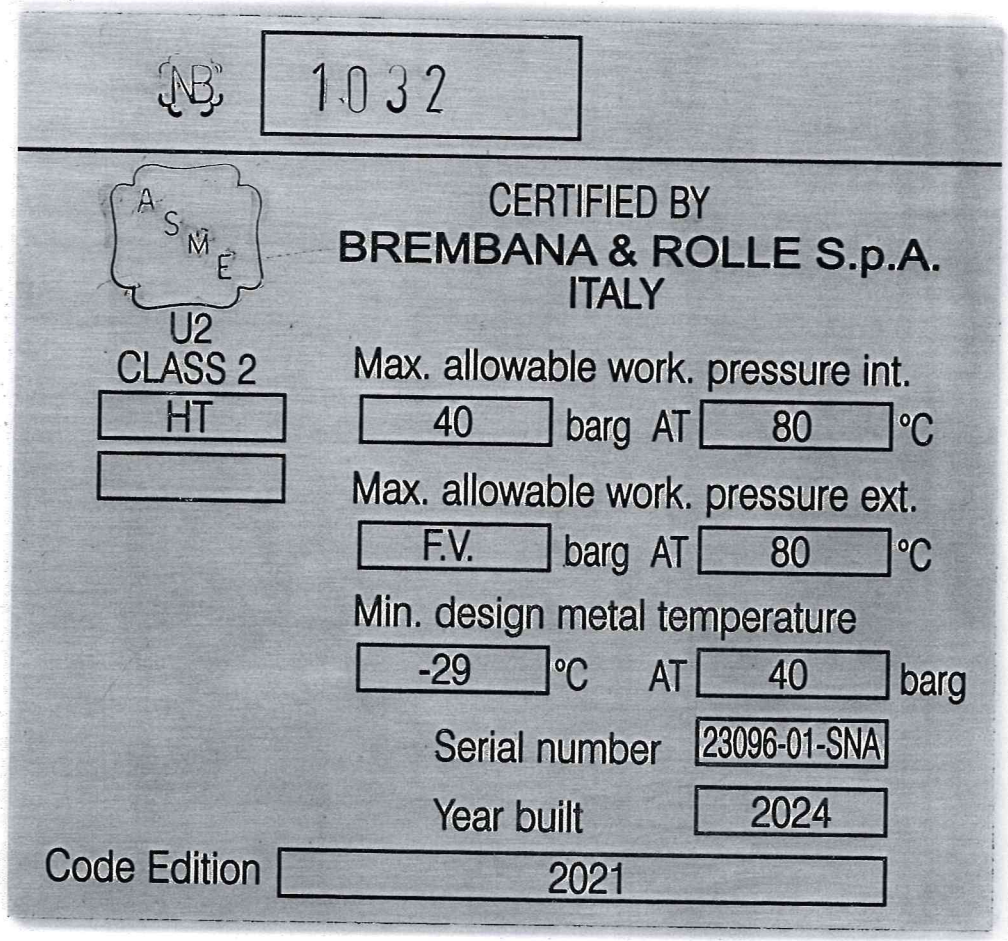
USER CLASSIFICATION OF INSTALLATION AREA

ZONE 1 IIB T1+H2

CODE	ASME VIII Div.2 CL.2 2021 ED.+ PED 2014/68/EU		
WEIGHT FULL WATER	160400 Kg	DATE OF TEST	09AUG2024
WEIGHT EMPTY	58700 Kg	THIRD PARTY INSP.	N.A.

BREMBANA & ROLLE S.P.A.
Q.C. INSPECTOR
M. RAMPAZZO
DATE 17 SEP 2024

0094
R
LRQA
17. SEP. 2024



BREMBANA & ROLLE S.p.A.
Q.C. INSPECTOR
M. RAMPAZZO
DATE 12 SEP 2024

LRQA Verification Limited
☐ Witnessed ☑ Reviewed
Mattia Crivellari
Authorized Inspector N.B. No. 17119
Milan Office 17 SEP 2024

Fabrication site: Albignasego – PD – ITALY

Section 20

Instruction Operating Manual

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**INSTRUCTION OPERATING MANUAL – H2 STORAGE VESSEL V-25001 A÷F**	Sheet 1 of 17 Date: 14/06/2024 Rev: 1

Base Load Power Hub (BLPH)

INSTRUCTION OPERATING MANUAL
H2 STORAGE VESSEL
V-25001 A÷F

Document Number: 1723001756-MAC-MAN-00019

Document Class: 3

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
	10-07-2024

1	25/06/2024	Issue for Information (IFI)	M. Toniolo	D. Passerini	D. Passerini
0	26/04/2024	Issue for Information (IFI)	M. Toniolo	D. Passerini	D. Passerini
Rev.	Date	Description	Prepared	Reviewed	Approved

B&R BREMBANA&ROLLE

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**INSTRUCTION OPERATING MANUAL – H2 STORAGE VESSEL**	Sheet 2 of 17 Date: 14/06/2024 Rev: 0

Revision / Change Log

Rev.	Description
0	Issue for Information (IFI)
1	Issue for Information (IFI)

HOLD LIST

No.	Description
1	
2	
3	
4	

BREMBANA&ROLLE	INSTRUCTION OPERATING MANUAL	DOC.	23096-01-EIM1	REV.	1
		Sheet	3 of 17		
		JOB	23096		
		ITEM	V-25001 A÷F		

CLIENT:	**ROSETTI MARINO**
PURCHASE ORDER No.:	**1723001756 123A90A**
END USER:	**CROSSWIND**
ENGINEERING	**ROSETTI MARINO**
PROJECT:	**BLPH PLATFORM**
SITE:	**HOLLANDSE KUST NOORD SITE V**
ITEM:	**V-25001 A÷F**
EQUIPMENT TYPE:	**HORIZONTAL EQUIPMENT**
SERVICE:	**H2 STORAGE VESSEL**
MANUFACTURER	**BREMBANA & ROLLE S.p.A.**
JOB NOMBER:	**23096**
SERIAL NUMBER	**23096-01-SNA÷SNF**

REV.	DESCRIPTION	DATE	ORIGINATOR [Project Eng.]	CHECK [Project Eng.]	APPROVAL [Engineering Mgr.]
1	Issued for APPROVAL	14/06/2024	M. Toniolo	M. Toniolo	D. PASSERINI
0	Issued for APPROVAL	15/04/2024	M. Toniolo	M. Toniolo	D. PASSERINI

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FOREWORD

SCOPE

This manual covers the minimum requirements for handling, installation, operation and maintenance of pressure equipment manufactured by Brembana&Rolle.

This manual is divided in two sections: the first section deals with the general instructions for all types of equipment, the second section gives guidelines for specific type of pressure equipment, manufactured by Brembana&Rolle listed here below:

- Horizontal Equipment

In some cases, it is not possible to identify the equipment in only one of the above mentioned category; in this case User/Contractor shall take into consideration instruction of all the categories that characterise the equipment.

REFERENCE DOCUMENTS

All activities and operations in the scope of this manual shall be done strictly in accordance, with the following documents:

- General Arrangement drawings:
  B&R ref.: 23096-01-EGA1 (Client Doc. no. 1723001756-MAC-DA-00004)
- Shipping drawings:
  B&R ref. 23096-01-ESH1 (Client Doc. no. 1723001756-TI-DD-00021)
- Mechanical calculations and nozzle loading calculations:
  B&R ref. 23096-01-EMC1 (Client Doc. no. 1723001756-MAC-CAL-00003)
- Bolt tightening procedure: PART OF THIS DOCUMENT
- TECHNICAL SPECIFICATION 123A90-DDL-MAC-SP-50026_01

Any conflict discovered among the above mentioned documents shall be brought to the attention of B&R and solved before proceeding with the works. Other specific documents may be issued by B&R whenever required by special applications of the pressure equipment; they will be pointed out to the attention of the involved personnel by means of notes on the General Arrangement drawings.

SECTION 1

GENERAL INSTRUCTIONS

The employed personnel shall be of proved experience and skill about activities of pressure equipment operation, handling and movement. Works shall be executed according to the documents mentioned in the foreword.

Tools and materials used during field operation are not supplied by B&R excluding those indicated on the General Arrangement drawing and its attachments or those specifically requested by the Contractor during the negotiation and the design phase (thus are excluded all the tools necessary to undress the equipment of the ancillaries and appurtenances used during the transport and stocking time till the start-up of the equipment).

The equipment shall be installed and put in service in accordance with applicable requirements of the State or the Local Authorities, and with applicable regulations.

The equipment are designed for the combination of the maximum pressure and the maximum temperature indicated on the nameplate as design data. In any case this combination shall not be exceeded, except for special services (e.g. steam-out, dry-out) agreed between Manufacturer and Contractor and that are indicated on the design data of the GA drawing.

Design pressure for which equipment have been designed is considered to be the maximum allowed. Contractor and User shall include in this value all possible contribute of pressure.

The tags of the equipment covered by this procedure are the following:

ITEM	SERVICE
V25001 A÷F ①	HYDROGEN STORAGE VESSEL

1 PROTECTION FOR TRANSPORT, STORAGE, HANDLING

1.1 PREPARATION OF ITEMS FOR SHIPPING

The items shall be internally and externally cleaned, in manner to remove weld spatters, scales, rust, cuts, filings and any other foreign material. For SS, clad, alloy lined steels, stainless steel brushes shall be used on alloy. Solvents shall be free of chlorides.

After hydrostatic test the water shall be completely drained from the item and then the pressure vessel shall be wiped and blown dry. For stainless steel units, air temperature is limited to 50 °C.
The item shall be externally coated, following surface preparation and coating cycles in full adherence to the applicable painting data-sheets and specification.

The machined surfaces that do not require painting (such as gasket contact surface of flanges not closed with process blind flanges) shall be cleaned and coated with a rust preventive such as grease or peeling product (i.e. Tectyl 846 or similar/equivalent product approved), before closing. All openings shall be made watertight against external atmosphere.

All flanged connections which are not furnished with permanent blinds shall be covered with rubber gaskets 3 mm thick and 6 mm minimum thick, full diameter, steel plate covers. The covers shall be installed with at least 4 bolts (except for the items with nitrogen blanket which require all the openings are closed with full bolting covers and marked with appropriate tag). Flanges drilled for bolting larger than 3/4" diameter may be secured with 3/4" diameter bolts and suitable cut washers. Flanged openings shall be covered with taped heavy plastic sheet. Tape containing chlorides shall not be used on stainless steel.
Bolts thread of pressure retaining bolts, if not otherwise protected, shall be coated with molybdenum disulphide based anti-seizing lubricant.

The items included in the supply shall be conditioned for shipping in accordance with the table below.

ITEM	NITROGEN internal overpressure ≥ 0.3 bar g	SILICA GEL
V25001 A÷F ①	☒	☐

Threaded vent holes shall be protected by a suitable plugging, at least by silicone application or heavy grease.
Pieces or parts used for protection or reinforcement purposes must not be welded to the equipment.
Surface areas of the item which may come in contact with the slings shall be covered with rubber strips or similar to prevent any type of damages during lifting operation.
All internals shall be shipped installed securely in place.

1.2 SPARE PARTS

Spare parts like gaskets, stud bolt, special tools shall be separately boxed for each mean item. The spares shall be labelled with the equipment item number and cross reference to the relevant drawing.

The box for spare shall be wrapped in waxed paper, the internal protection of box shall be water-proof lined paper and suitable for handling by forks.

1.3 INSPECTION BEFORE SHIPPING

All items shall be inspected before shipping, to verify draining, drying, cleaning, blasting and coating quality.

All spare parts boxes shall be inspected for quantity, quality and suitability of package.

Only after satisfactory result of all packing and marking requirements set forth in this procedure, the items shall be released for shipping.

1.4 CERTIFICATION BEFORE SHIPPING

At least, the sandblasting and coating inspection certificates shall be inserted in the Data Book.

1.5 INSPECTION AFTER SHIPPING

The equipment must be submitted to a scheduled visual inspection to check the integrity of the surface coating and to insure that nitrogen pressure (if any) does not decrease below the minimum requirement. Specifically, the pressure target value of 0.3 barg shall be checked and restored anytime the internal pressure is found lower; a touch-up of surface coating only is requested in case of local defect are observed.

The timing of this visual check must be as much frequent as possible at the beginning of the shipping and storage period and can be progressively reduced based on the positive result of the inspection; namely from 7 days up to once a month.

With continuing positive inspection results, sudden failure will not be expected. This justifies for enlarged timing between two subsequent visual checks. Nevertheless, care shall be paid to the accessibility at the equipment by unauthorized people, as this may be cause for voluntary or not damaging actions. (i.e. recovery of blind flanges, studs and nuts, etc. is not uncommon in an extended site area where different Companies are operating).

1.6 TRANSPORT AND STORAGE

It is assumed that the storage of the equipment at site will take place in a covered area, since weather conditions are expected to be the most probable cause of degradation of the protection foreseen on outer surfaces.

The equipment are protected for the transport and storage prior to erection as necessary against physical damage and/or corrosion which may occur due to the method and conditions of transport and the time which may elapse before erection, up to maximum of three months. For longer storage periods, protection shall be restored by the User at site, with particular attention to the protection of machined surfaces and the compatibility (e.g. against corrosion) of any material used for physical protection.

In case the items are covered with tarpaulin, insure that there is no direct contact between the equipment surface and the covering sheets and, better, a sufficient light is granted in order to let air circulate freely around the equipment.
This, especially in the high humidity areas (sea, tropical, etc.), where the change of air saturated conditions during the 24 day hours easily drive to the formation of water condense on surfaces where no air refreshing is granted, will prevent the condense to form and persist between the equipment and the tarpaulin, promoting a quicker paint degradation.

1.7 HANDLING

Handling must be executed by means of proper devices. Before lifting the equipment, centre of gravity and weight shall be checked on the name plate or on the reference documentation to select the proper lifting tools to be adopted (e.g. chains, slings, shackles).

During loading and unloading operations lifting points (trunnions, lugs, painted lifting points on apparatus) shall be used in order to avoid the possibility of distortion of the equipment and any of its parts. It is strictly forbidden to lift or to move the equipment by fastening others braces like nozzles or supports without written permission of the manufacturer. Any damage must be immediately notified to Brembana&Rolle.

Manoeuvring of horizontal equipment, supported by two saddles, shall be carried out by means of lifting bands surrounding the vessel body and straddling the centre of gravity. Where different lifting point are not indicated on the reference documentation, lifting band shall be located closer as possible outward the saddle position to avoid any sliding between band and the equipment.

2 INSTALLATION

All the ancillaries, as listed below, used during the transport operation and the storage period shall be removed from the equipment; where possible after the apparatus has been put in the proper location for service:

- Wooden saddles or supports
- Any external protection such as polyethylene sheets
- Shipping blind flanges, gaskets and bolts
- Internal protection by use of silica gel bags or nitrogen filling with annexed bottle
- Special paint for protection of face and external edge of flanges

Integrity of the nameplate must be checked and all the information must be well readable. The good condition of the equipment shall be checked and particular attention shall be paid to ensure that no damages occurred during transport and handling.

Operating position of the equipment is indicated on the reference document. Equipment must always be installed by the supports forecast on the vessels and it is not allowed to support / hang equipment by means of external piping.

A visual examination shall be executed according to the same procedure as per maintenance activities as detailed in 1.4. Special care must be paid to avoid to leave tools inside the equipment.

Before the equipment is installed and connected to the piping, an internal inspection of the equipment is mandatory, to establish whether or not a general flushing and/or suitable chemical cleaning is required, wherever not already scheduled prior to plant start-up. Special care must be paid to avoid tools are left inside the apparatus.

2.1 FOUNDATION

Supports shall be set upon the foundation and secured down with bolts where the bases are properly drilled. Foundations shall be adequate to support the equipment and its maximum capacity. Only the type of equipment support (saddles, brackets, lugs, legs, etc.) shown in the general arrangement drawing must be used to transmit loads to foundations. Each hole in the base plates must have its own foundation bolt. If not indicated on the drawing, the material for anchorage bolts shall be at least Class 8.8, and bolt diameter shall be not smaller than the hole diameter minus 3 (three) mm.

2.2 INSULATION

Insulation shall be applied as per Contractor requirements: in case not even insulation for personnel protection is foreseen, but operating temperature might make the contact or closeness harmful to health, clear warnings shall be put close to the apparatus location to workers.

2.3 ACCESS, OPENINGS AND CLEARANCE

The equipment shall be installed with sufficient clearance from associated structures and other apparatuses to provide safe (for dangerous service to human health and environment equipment shall be located in isolated site), efficient working by operators and to provide ready access for cleaning, inspections and maintenance.

Equipment having covers that permit inspection of the interior shall be installed so that these openings are easily accessible.

All fast-openings shall be equipped with adequate instrumentation to avoid that accidentally they can be opened even-if a differential pressure exists between inside of the vessel and room condition.
Where necessary, ladders and platforms shall be installed to give access to valves and other control device.

Safety devices, and important equipment fittings, shall be located and installed so that they are readily accessible for operation, inspection, maintenance and removal.

Process piping shall be connected to the equipment with proper gaskets. Piping development shall be designed to avoid any nozzle loading other than specified in the reference documents.

2.4 REMOVABLE PARTS

Removable parts such as demister, trays, stairs, platform, etc… shall be securely fixed. To avoid that during service they can accidentally move a tack weld between nuts and screw shall be performed. If it is not possible to weld an unscrew device shall be used.

2.5 PRESSURE RELIEVING DEVICES, PRESSURE AND TEMPERATURE GAUGES

Before the equipment is put in service adequate devices to ensure that design parameters are not exceeded shall be installed, directly on the equipment connected to the service nozzles, where requested by the Contractor, or on the connecting pipe-line. These devices (e.g. pressure and temperature gauges, chemical cleaning nozzles, pressure relieving devices: valves, bursting disk) even they are or not part of the scope of supply of the manufacturer shall be selected by the Contractor.

2.6 FIRE PROOFING AND EXTINGUISHER

Where indicated by the Contractor fire proofing shall be installed to prevent the structures and an excessive overheating of the fluid up to the flash point at the operating pressure. In any case is responsibility of the User to define which devices and facilities shall be installed in the plant to prevent fire.

2.7 EARTHING LUG

Equipment earthing lug shall be connected to the ground with electric cable or strip with adequate size according to User instructions.

2.8 FIRE IGNITION SOURCE

The User will provide devices and facilities in order to avoid fire ignition source as settled in the Risk Analysis.

3 OPERATION

As a statement all general instructions shall be observed. The equipment shall not be put in service for conditions other than for which it has been designed.

Any change of the operating condition (not limited to pressure and temperature) will involve a redesign of the equipment: Contractor shall check if the stated corrosion allowance and used material are still compatible with eventual new fluid and the expected life, taking into account the possible corrosion rate already consumed. A new mechanical design will be performed by the manufacturer upon Contractor's request, otherwise Manufacturer is not responsible anymore for all consequences due to change of the design condition.

It is strictly forbidden to open any closure, joints or other parts during operating. During operation only authorised personnel can stand near the equipment and only after having followed all the safety procedure instruction of the plant under the User's responsibility.

3.1 START-UP & SHUT-DOWN

Start-up of the equipment shall be executed gradually. At least at half of the operating pressure a step-check shall confirm the evidence of no deformation or damage and no leaking from connection. Particular care shall be taken for all components that have no possibility to deform freely. Pressure, temperature and eventual noises shall be checked.

4 MAINTENANCE & INSPECTION

As a general statement Contractor and User shall define an inspection schedule taking into account:

- field activities
- experience about the used material
- experience about the media in conjunction with the corrosion allowance that has been asked the manufacturer to take into account in the design
- environment around the field

For missing information due to process, Contractor and User shall acknowledge themselves referring to technical literature or standard. In any case the inspection schedule shall observe, as a minimum, all the requirements of the legislation in force in the Country where the equipment is put in service.

If the inspection schedule is not defined and inspection activities are not carried out and adequately recorded, the Manufacturer's responsibility is broken off. Inspection shall be carried out at least once a year. Not scheduled inspections shall be executed for reduced performance or odd noises.

Inspection may be external or internal and can be executed by mean of several non-destructive examination methods. The inspection method may be performed when the equipment is operating on-stream or depressurised, but shall provide the necessary information that the essential sections of the equipment are of a condition to continue to operate for the expected time interval. On-stream inspection, included while under pressure, may be used to satisfy inspection requirements provided the accuracy of the method can be demonstrated, and in any case shall be executed under User's responsibility.

Inspection of environment in which the equipment operates includes:
external painting or coating in order to establish if there is any possibility further ambient corrosion
good condition of instruments and safety equipment
tight of foundation bolts

All inspection activities shall be executed with care about the safety of the involved personnel and the environment under the User of delegate society's responsibility.

4.1 EXTERNAL INSPECTION

The purpose of an external inspection is to provide information regarding the overall condition of the pressure vessel. In particular:

Insulation or other covering
If it is found that external coverings such as insulation and corrosion resistant linings are in good condition and there is no reason to suspect any unsafe condition behind them, it is not necessary to remove them for inspection of the equipment. However, it may be advisable to remove small portions of the coverings in order to investigate their condition and the condition of the metal wall.

Evidence of leakage
Any leakage of gas, vapour or liquid shall be investigated. Leakage coming from behind insulation coverings, supports or evidence of past leakage shall be thoroughly investigated by removing any covering necessary until the source is established.

Structural attachments
The pressure equipment location shall be checked for adequate allowance for expansion and contraction, such as provided by slotted bolt holes or unobstructed saddle. Attachments such saddles or other supports shall be examined for distortion or cracks at welds.

Connections
Reinforcing plates (if any), nozzles or other connections should be examined for cracks, deformation or other defects. Bolts and nuts should be checked for corrosion or defects. Tell-tale holes in reinforcing plates shall remain open to provide visual evidence of leakage as well as to prevent pressure build up between the equipment and the reinforcing plate. Accessible flange faces shall be examined for distortion and to determine the condition of gasket-seating surfaces.

Cuts or Gouges
Cuts or gouges can cause high stress concentrations and decrease the wall thickness. Depending upon the extent of the defect, it may be necessary to repair the area by welding or patching. If these activities are be performed without Brembana&Rolle approval guarantee will be no longer in force.

Surface inspection
The surfaces of shell and heads shall be examined for possible cracks, blisters, bulges, and other evidence of deterioration, giving particular attention to support attachment and knuckle regions of the heads.

Welded joints
Welded joints and the adjacent heat affected zones shall be examined for cracks or other defects. Superficial NDE is recommended.

4.2 INTERNAL INSPECTION

The following activities shall be performed to support the inspection:
inspection plugs and covers shall be removed;
equipment shall be sufficiently cleaned to allow for visual inspection of internal and external surfaces;
equipment shall be reclaimed and internal atmosphere shall be tested to check the presence of dangerous and lethal gases.

A general visual inspection is the first step in making an internal inspection. All parts of the vessel shall be inspected for corrosion, erosion, blistering, deformation, cracking and laminations. In particular:

Connections
Threaded connections shall be inspected to ensure that an adequate number of threads are engaged. All openings leading to any external fittings or controls shall be examined as thoroughly as possible to ensure they are free from obstructions.

Closures
Any closures, which are used frequently in the operation of an equipment, shall be checked by the Inspector for adequacy and wear. A check shall also be made for cracks at areas of high stress concentration.

Corrosion
The type of corrosion (pitted or uniform), its location and any obvious data shall be established. Data collected for equipment in similar service will aid in locating and analysing corrosion in the equipment being inspected. The liquid level lines, the bottom and the shell area adjacent to and opposite inlet nozzles are often locations of most severe corrosion. Welded seams and nozzles and areas adjacent to welds are often subjected to accelerated corrosion.
Sacrificial anodes, where installed, shall be weighed/measured to evaluate the corrosion rate. If it is necessary, upon Contractor's instructions, they shall be substituted.

The above indicated inspections are not limiting to any eventual further control that the qualified personnel could by themselves carried out in order to establish the remaining life of the equipment.

4.3 INSPECTION INTERVALS FOR CORROSIVE SERVICE

New pressure equipment are placed in service to operate under their conditions for a period of time determined by the service conditions and corrosion rate. If the pressure equipment shall remain in operation over the expected time, the allowable conditions of service and length of time before the next inspection shall be based on the condition of the equipment as determined by the inspection.

5 RETIRING

All removable internal parts shall be removed to avoid that during handling they can move or fall outside of the pressure equipment during handling.
Before retiring, all chambers of the pressure equipment shall be washed, neutralised and drained. Washing water shall be treated before pouring in the pit to prevent any pollution to the environment.
Special care shall be paid to lifting points before removing the equipment, to ensure that they are not damaged. If lifting devices have been cut after the installation, the equipment shall be hoisted straddling the centre of gravity and in any case a design evaluation shall be performed to verify if the lifting points are sufficient strong.

S E C T I O N II

1 HORIZONTAL EQUIPMENT

Horizontal Equipment shall be lifted using their own lifting devices installed. Unless otherwise noted they must be kept in the operating position during handling activities.
A spreader-beam may ① be used to maintain vertical the direction of the slings connected.
① Refer to shipping drawing of the equipment.

S E C T I O N III

BOLT UP (FLANGE TIGHTENING SPECIFICATION)

1 TOOLS

None restriction is given for the use of tools from different trade mark other than the ones used in the manufacturer's shop. It is responsibility of the Owner to select different tools than those proposed in the following procedure. The Owner shall ensure that tools are used within the calibration expiring date.
Plant Operation manual shall include the tools to be used.

2 PRELIMINARY INSPECTION

The flange, the gaskets and the bolting (including nuts and washers) shall be inspected before to proceed

2.1 FLANGE

Main flange dimensions shall be checked acc.to the Manufacturer's drawings, i.e. internal and external diameters, bolt circle diameter, gasket seating diameter, number and size of the bolt holes. In case of blind threaded holes, inner threading shall be free of any defects, diameter and pitch shall be acc.to the drawings.
Gasket seating surface shall have the finish indicated in the Manufacturer's drawings.
The seating surface shall be free of scratches, dirt, scale and rust; in case of previous welding activities close to the bolted joint, the seating surface shall be free of any weld spatter. In case the joint is assembled after a previous operating period all traces of old gasket material shall be removed.
In case of defects in flange facing finish for raised face and large male and female flanges permissible imperfections can be evaluated acc.to TEMA Fig.F-4.
Depending upon the Purchaser's requirements and/or experience in shop/field flatness tolerance shall be checked on gasket seating surface acc.to API-660 §.9.8.
Flange holes shall be free of any defect and clean. Nut bearing surface shall be free of scores and burrs.

2.2 BOLTING

Bolting, nuts and washers materials shall be checked against the manufacturer's drawing. Care shall be taken if coated bolts or nuts are specified on the manufacturer's drawing: in this case shall be checked on the delivery note of the Bolts manufacturer that applied coating is the same than specified within manufacturer's drawings.
Bolting shall be checked to ensure that all dimensions are acc.to the Manufacturer's drawing: diameter, pitch and length. In case of necked down bolts, the unthreaded portion of the bolt shall have an evenly diameter shown in the Manufacturer's drawing, the length of threaded and unthreaded portion shall respect the construction drawing. In case of drilled bolts the inner bolt shall be checked too.
External surface of the bolts and nuts shall not be damaged and free of any rust and corrosion
If not otherwise forbidden (e.g. coated bolts) bolt threading shall be adequately lubricated. Molycote 1000 (e.g. or equivalent) is suggested if not otherwise stated (see notes on construction drawing prior to proceed); prior to apply the paste, maximum allowable temperature acc.to technical data sheet for the given grade shall be checked against the design pressure marked on the construction drawings.

2.3 GASKET

Gasket type and material shall be checked against the manufacturer's drawing.
Inner, outer sealing diameters and inner/outer stop devices stop devices diameters of the gasket shall comply with the dimensions shown on manufacturer's drawing.

2.4 TOOLS

Tools shall be inspected before to proceed, particular care for hoses of hydraulic and pneumatic devices to ensure the safety of the personnel.

3 INSTALLATION

With reference to the Manufacturer's drawing, check if centring devices, such as centring dowels or peripheral centring plates shall be installed.
If centring devices are not foreseen insert at least four bolts in the rest flange to facilitate the centring during the assembly of the joint. In case it is not possible assembly the joint after the insertion of the bolts (for instance hinged closure, without translation movement), bolts shall be installed later on.
In case of bolts equipped with collar bolts all the bolts shall be installed at this stage.
Place the gasket on the rest flange, if the plane gasket is in vertical position spray adhesive can be used to temporarily keep the gasket in position.
Close the flanged joint, taking care that male, female, recess and raising surface match each other's to avoid damage of edges.
As joint has been closed complete the insertion of the bolts, and tight slightly by hand all the bolts.
Depending upon the size of the bolts and Purchaser's requirements bolt can be tightened by torque the nuts or by tensioning the bolt. Purchaser requires that bolts up-to Ø50 mm shall be tightened by torque, bolts greater than Ø50 mm are recommended to be tightened by tensioning. Hydraulic bolt tensioner type used is Tentec or SPS (Hydraulic Tensioning Technology Ltd., Plymouth House, Guns Lane, West Bromwich, West Midlands B70 9HS, England).

4 TIGHTENING

Both for bolt torque or tensioning, tightening shall be performed with a rotating cross pattern sequence. Bolts position shall be marked on the flange rim with a crayon, the second bolt to be tightened shall be in diametric opposite position, i.e. given position 0° at the first bolt, and the second one shall be at 180°. The third bolt to be tightened shall be at 270°, the fourth bolt shall be at 90°. After completion of the this first sequence, tightening proceeds with groups of four bolts each time, and by starting with the bolt adjacent to the first bolt of the previous round moving in clockwise direction.
After final torque/tension is reached, tighten in rotational order in clockwise direction followed by a round in the counterclockwise direction.
If time permits, repeat rotational clockwise / counterclockwise rotations after a minimum dwell time of four hours.

4.1 BOLT TORQUING

For small size bolts hand wrench can be adopted. The wrench shall be set for the proper torque to be transferred to the bolts.
For greater sizes pneumatic or hydraulic wrench shall be used, in this case diagram provided by the tool suppler shall be read to establish the pump pressure correlated to the requested torque moment.
For detailed information and safety the reader is requested to refer to the user manual of the tools.
In any case is forbidden to use hammer wrenches.
Tightening may proceed with the general instruction provided below.

4.2 BOLT TENSIONING.

In order to use bolt tensioner faces of the nuts shall be provided with holes to engage the tommy bar necessary to rotate the nut. If nuts are not provided with holes, nut rotating socket shall be installed.
Bolt tensioning is requested for bolts equal or greater than Ø 50 mm.
The operator shall ensure that enough protrusion of the bolt is available beyond the nut face on the side to be tensioned. Particular attention shall be paid to bolts with collar: in this case first the bolts shall be tightened on the side of the flange facing the collar by hand and being sure that collar is in contact with the end of the socket, further tensioning will be performed on the opposite side, i.e. form the flange that does not face the of the collar.

The operator shall perform the tensioning of more than one bolt each time, as requested on the data sheet at the end of the procedure.
Bridge shall be installed on the bolt/s to be tensioned, paying attention that the bridge window is radially facing out from the center of the circular flanged joint. Load cells shall be fitted above the bridges, and screw the threaded insert on the end of the nut. Fully screw the insert in order to go to stop on the cells, make all the connection with hoses to the pump taking care that the allowable pressure is greater than the one requested to tension the bolts. This pressure shall be read on the diagram supplied by the tools supplier versus the requested maximum load as given in data sheet.
System shall be pressurized and by use of the tommy bar back down the nuts toward the joint face.
Check of bolts elongation shall be performed if requested by the Purchaser.

4.3 TIGHTENING DATA SHEET

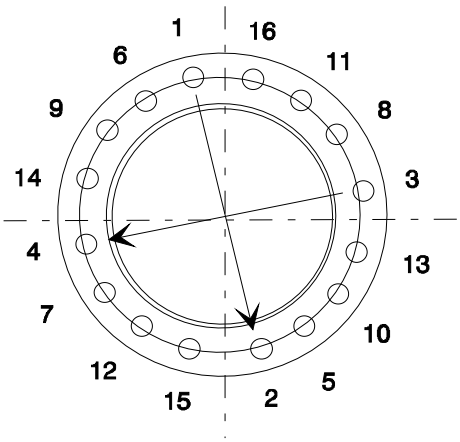
TIGHTENING DATA SHEET

EQUIPMENT	PRESSURES		FLANGED JOINT		BOLT/NUTS				
ITEM TAG	DES. [barg]	TEST [barg]	TAG	SIZE	SIZE	MATERIALS	QT.	TORQUE VALUE	JACK LOAD
V25001 A÷F ①	40	57.2	M1/M1	24" 300# Manway	1 ½"	SA-193 B7 SA-194 2H	24	Max 2754 Nm	--
V25001 A÷F ①	40	57.2	3N	1" 300# Inspection	5/8"	SA-193 B7 SA-194 2H	4	Max 158 Nm	--

NOTES

1) Load values shall be achieved by cycles: 50%, 75% and 100% of the target value.
2) At least four bolts for each step shall be tensioned simultaneously.
3) Minimum Target values of tension load equal to test load plus 20% margin, if not already defined in the mechanical calculation .
4) Torque = k*D*F/1000 == > Nut factor k = 0.23.

TYPICAL BOLT SEQUENCE



BREMBANA&ROLLE

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ISSUED BY

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ESSENTIAL SAFETY

CLIENT:	**ROSETTI MARINO**
PURCHASE ORDER No.:	**1723001756 123A90A**
END USER:	**CROSSWIND**
ENGINEERING	**ROSETTI MARINO**
PROJECT:	**BLPH PLATFORM**
SITE:	**HOLLANDSE KUST NOORD SITE V**
ITEM:	**V-25001 A÷F**
EQUIPMENT TYPE:	**HORIZONTAL EQUIPMENT**
SERVICE:	**H2 STORAGE VESSEL**
MANUFACTURER	**BREMBANA & ROLLE S.p.A.**
JOB NOMBER:	**23096**
SERIAL NUMBER	**23096-01-SNA/B/C/D/E/F**

LIST OF REVISION

0	First issue

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0 REFERENCES **4**

1 ESSENTIAL SAFETY REQUIREMENTS - ANNEX I **5**

0 References

- B&R Drawings: 23096-01-EGA1
- ASME VIII Div. 2 Cl.2 Ed. 2021
- PED 2014/68/EU

1 Essential Safety Requirements - Annex I

The Manufacturer has adopted all mandatory provisions of Code:

☐ STOOMWEZEN (edition and addenda specified in the drawing)
☐ ASME Section VIII Div. 1 (edition and addenda specified in the drawing)
☒ ASME Section VIII Div. 2 (edition and addenda specified in the drawing)
☐ ISPESL VSR / S / M (edition and addenda specified in the drawing)
☐ Harmonized Code EN 13445 (edition and addenda specified in the drawing)
☐ PD 5500 (edition and addenda specified in the drawing)
☐ ASME ANSI B31.3 (edition and addenda specified in the drawing)

Where PED requirements are not specifically addressed by a. m. Code, the Manufacturer has taken additional considerations shown on the last column of the tables of this document.

Item No	Requirement	Compliance: Yes;No; N/A	Comments/Standards used
1	**General**		
1.1	Pressure equipment must be designed, manufactured and checked, and if applicable equipped and installed, in such a way as to ensure its safety when put in service in accordance with manufacture's instruction.	YES	The Manufacturer has prepared Operating Instructions for the Purchaser / User containing the necessary safety information in accordance with par. 3.4 of Annex I. The Manufacturer has also considered the following aspects: ☒ inform Purchaser / User of residual hazards ☒ prevent dangers from foreseeable misuse ☒ take into account foreseeable degradation mechanisms ☒ ensure safety throughout the intended life of the pressure equipment. *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*
1.2	Manufacture to apply the following principles - Eliminate or reduce hazards as far as is reasonably practicable. - Apply appropriate protection measures against hazards which cannot be eliminated. - Inform users of residual hazards	YES	The Manufacturer has: ☒ eliminated or reduced hazards as far as it is reasonably practical ☒ applied appropriate protection measures against hazards which cannot be eliminated ☒ informed Purchaser / User of any residual hazards and any additional measures to be taken to reduce risks during installation and / or use. *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*
1.3	Where potential misuse is known, the pressure equipment must be designed so as to prevent danger. If that is not possible: adequate warning must be provided.	YES	☒ The Manufacturer has provided the necessary safeguards where there is potential for measure of the pressure equipment. ☒ The Manufacturer has provided appropriate warnings in Operating Instructions regarding improper use of the equipment (see par. 3.4 of Annex I). *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*

2	**Design**		
2.1	**General** Pressure equipment must be properly designed taking all relevant factors into account in order to ensure that the equipment will be safe throughout its intended life. The design must include appropriate safety coefficients using comprehensive methods which are known to incorporate adequate safety margins against all relevant failure modes in a consistent manner.	**YES**	The Manufacturer has considered the following factors in the design of the equipment: ☒ take into account foreseeable degradation mechanisms ☒ ensure safety throughout the intended life of the pressure equipment.
2.2	**Design for adequate strength**		
2.2.1	The pressure equipment must be designed for loadings appropriate to its intended use, such as - Internal/external pressure - Ambient and operating temperatures - Static pressure and mass contents in operating and test conditions - Traffic, wind, earthquake loading - Reaction forces and moments which result from the supports, attachments, piping, etc. - Corrosion and erosion, fatigue, etc. - Decomposition of unstable fluids. - Others	**YES**	See list of loads applicable to this job, attached to calculation report. *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EMC1*
2.2.2	**Design for adequate strength must be based on:** - as a general rule: a calculation method as per 2.2.3 and supplemented if necessary by an experimental design method as per 2.2.4 - an experimental design method without calculation as per 2.2.4. when the PS*V is < 6000 bar*L, or PS*DN is < 3000 bar.	**YES**	Pressure Equipment has been designed in accordance with a CALCULATION METHOD stated on Design Code adopted. *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EMC1*
2.2.3	**Calculation method** **(2)** Calculation method to provide sufficient safety margins (where applicable) with the requirements of Section 7. (a) Calculation method may be carried out via: design by formula design by analysis design by fracture mechanics	**YES**	The Manufacturer has adopted design by: ☒ formulas ☐ stress analysis ☐ fracture mechanics. *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EMC1*
	(b) Resistance of the pressure equipment must be established via: calculation pressure must not be less than PS, taking into account static and dynamic fluid pressures and the decomposition of unstable fluids. Calculation temperatures must allow for appropriate safety margin, taking account of all possible combinations of temperature and pressure	**YES**	☐ The design has taken in account PED requirement about decomposition of unstable fluids ☒ Decomposition of unstable fluid not applicable to this job.
	The maximum stresses and peak stresses concentrations must be kept within safe limits, utilising appropriate values of material properties, such as yield strength, 0.2% proof stress, 1% proof stress, UTS, creep strength, plastic strain limit, impact strength, fracture toughness.	**YES**	☐ The design has take in account the PED requirement about the amount of plastic strain ☒ Plastic strain not applicable to this job. ☐ Creep resistant materials has been used.
	Appropriate joint factors applied to material properties depending on NDT, material joined & envisaged operating conditions, taking into account of all reasonably foreseeable degradation mechanisms (corrosion allowance, creep – design hours at specified temperatures, fatigue – design number of cycles at specified stress level)	**YES**	☒ No creep, No fatigue foreseen joint factors applied according to Code and Client requirements. *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EGA1 (G.A. DWG)*
	(c) Stability aspects: Where the calculated thickness does not allow for adequate structural stability, necessary measures (taking into account handling and transportation) to be introduced.	**N/A**	☐ The design calculation has taken in account structural stability, including transport and handling of vessels and assemblies. *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EMC1*

2.2.4	**Experimental design method** Test programme must be clearly defined and approved prior to testing. Test programme to include: (a) A pressure strength test (b) Where creep or fatigue exist, appropriate tests must be determined on the basis of service conditions (c) Where necessary, additional test to be conducted concerning other factors such as corrosion, external damage, etc.	**N/A**	The Manufacturer has ☐ adopted an experimental design method, as described in par. 2.2.4 of Annex I. The experimental program has included additional tests for ☐ fatigue, ☐ creep, ☐ corrosion rates. The program has imposed additional limitations consistent with those in the PED (Annex I par. 2.2.2). The program has taken in account leakage and deterioration mechanisms, where appropriate. ☒ not adopted an experimental design method, as described in par. 2.2.4 of Annex I.
2.3.	**Provisions for safe handling and operation** Specified operation must preclude any reasonably foreseeable risks. Attention must be paid to: - closure & openings - dangerous discharges of pressure relief blow-off - devices to prevent physical access while pressure or vacuum exists - surface temperature taking into account consideration of the intended use - decomposition of unstable fluids Access door must be equipped with an automatic or manual device enabling the user to ascertain that the opening will not present any hazard.	**YES**	The Manufacturer has considered the following aspects to insure safe handling and preclude risk during operation: ☒ Closures and openings, ☐ Dangerous discharge of pressure relief blow off, as safety / relief valve is part of supply, ☒ Access while pressure or vacuum exists in the pressure equipment, ☒ Surface temperature, taking into account the intended use of the equipment, Decomposition of unstable fluids is ☐ applicable ☒ NOT applicable to this job. Pressure equipment is ☐fitted ☒NOT fitted with physical access door: ☐ hand hole / ☐manhole. ☐ If this physical access is a quick opening closure, has been equipped with ☐ automatic or ☒ manual devices to enable the Purchaser / User to ascertain that the opening does not present any hazard. *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*
2.4.	**Means of examination** (a) Pressure equipment must be design and constructed so that all necessary examinations to ensure safety can be carried out. (b) Means of determining the internal condition of the equipment must be available to ensure continued safety of the equipment (c) Other means of ensuring the safe conditions may be applied: - where it is too small for physical internal access - where opening the pressure equipment would adversely affect the inside - where the substance contained has been shown not to be harmful to the material of construction.	**YES**	Provisions for safe conditions inside the vessel: ☒ have been included in Operating Instructions. ☐ are not applicable. *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*
2.5	**Means of draining and ventilating** Adequate means must be provided for the draining and venting of pressure equipment where necessary: - To avoid harmful effects such as water hammer, vacuum collapse, corrosion and uncontrolled chemical reactions. - To permit cleaning, inspection and maintenance in a safe manner.	**YES**	☒ The vessel Manufacturer has provided adequate means for venting and draining for all stages of operation and testing, where necessary. ☒ The Manufacturer has avoided harmful effects. *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1* *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EGA1 (G.A. DWG)*

2.6.	**Corrosion or other chemical attack** Where necessary, adequate allowance or protection against corrosion or other chemical attack must be provided, taking into account the intended and reasonably foreseeable use.	**YES**	☒ The Manufacturer has given considerations for corrosion and other forms of chemical attack, where appropriate, as required by PED Annex I, par. 2.6. *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EMC1*

2.7.	**Wear** Where sever conditions of erosion or abrasion may arise, adequate measures must be taken to: - minimise the effect by appropriate design, e.g. additional material thickness, or by the use of liners or cleaning materials. - Permit replacement of parts which are most affected. - draw attention, in the instruction referred to in 3.4, to measures necessary for continued safe use.	**YES**	☐ Erosion and abrasion have been considered in the design. ☒ Erosion and abrasion are not applicable to this job. ☐ The Manufacturer has included consideration for wear in the Operating Instructions for the Purchaser / User of the pressure equipment. ☒ Wear is not applicable to this job. *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EMC1*
2.8.	**Assemblies** Assemblies must be so designed that - the components to be assembled together are suitable and reliable for their duty. - All the components are properly integrated and assembled in an appropriate manner.	**YES**	Equipment supplied by the Manufacturer is ☐ an assembly designed to comply with the applicable PED requirements. (Assembly: several pieces of pressure equipment assembled by a manufacturer to constitute an integrated and functional whole). ☒ not an assembly as defined in PED Art. 1 par. 2.1.5.
2.9.	**Provisions for filling and discharge** Where appropriate, pressure equipment must be so designed and provided with accessories, or made for their fitting, as to ensure safe filling and discharge. (a) on filling: - overfilling or over pressurisation having regard in particular to the filling ratio and vapour pressure at reference temperature. - Instability of the pressure equipment. (b) on discharge: the uncontrolled release of the pressurised fluid. (c) On filling or discharge: unsafe connection and disconnection.	**YES**	The necessary accessories in accordance with the requirements of PED, to assure safe filling and discharge, prevent uncontrolled release of pressurised fluid, and prevent unsafe connection and disconnection ☐ are part of the supply ☒ are not part of the supply, but the Manufacturer has prepared Operating Instructions for the Purchaser / User containing the necessary information. *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*
2.10.	**Protection against exceeding the allowable limits of pressure equipment** The pressure equipment must be fitted with, or provision made for the fitting of, suitable protective devices, unless the equipment is intended to be protected by other protective devices within an assembly. Suitable protective devices comprise: - safety accessories - where appropriate, monitoring devices.	**YES**	The necessary indicators and alarms to comply with the requirements of PED, Annex I, par. 2.10, ☐ are part of the supply ☒ are not part of the supply, but the Manufacturer has prepared Operating Instructions for the Purchaser / User containing the necessary information to: • design, provide and install the indicators and alarms • forbid to pressurise the equipment in lacking of above, • warn the Purchaser / User of the danger of using the equipment in lacking of above. *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*
2.11.	**Safety accessorier**		
2.11.1	**Safety accessories must:** - Be designed and constructed to be reliable and suitable for their intended use and take into account the maintenance and testing requirements. - Be independent of other functions, unless their safety function cannot be affected by such other functions. - Comply with appropriate design principles in order to obtain suitable and reliable protection. These principles include, in particular, fail-safe modes, redundancy, diversity and self diagnosis.	**YES**	☐ The design and construction of safety accessories, if supplied by vessel manufacturer, has complied with the requirements of PED, Annex I, par. 2.11. ☒ The design and construction of safety accessories, supplied by other, has to comply with the appropriate design principles in the PED and shall be assessed as part of the assembly assessment (out of responsibility of the vessel manufacturer). *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*
2.11.2	**Pressure limiting devices** These devices must be so designed that the pressure will not permanently exceed the maximum allowable pressure OS; however a short duration pressure surge in keeping with specification laid down in 7.3 is allowable, where appropriate.	**YES**	Pressure relief devices are ☐ supplied / ☒ not supplied by the equipment Manufacturer. ☒ In the design, max permissible pressure excess above the MAWP is limited to 10% (Annex I, par. 7.3) or less, even if the Code adopted would allow a greater tolerance. ☒ It is responsibility of the Purchaser / User to ensure that the

			required pressure relief devices properly installed prior to initial operation. These devices are installed ☐ directly ☒ not directly on a connection of the equipment designed for this purpose. *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*
2.11.3	**Temperature monitoring devices** These devices must have an adequate response time on safety grounds, consistent with the measurement function.	**YES**	The temperature monitoring devices are ☐ part of the supply ☒ **not part of the supply** *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*
2.12.	**External fire** Where necessary, pressure equipment must be so designed and, where appropriate, fitted with suitable accessories, or provision made for their fitting, to meet damage limitation requirements in the event of external fire, having particular regard to internal use.	**YES**	**These devices are** ☐ **part of the supply** ☒ **not part of the supply** *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*

3	**Manufacturing**		
3.1.	**Manufacturing procedures** The manufacturer must ensure the competent execution of the provision set out at the design stage by applying the appropriate techniques and relevant procedures.	YES	
3.1.1	**Preparation of the component parts** Preparation of the component parts (e.g. forming and chamfering) must not give rise to defects or cracks or changes in the mechanical characteristics likely to be detrimental to the safety of the pressure equipment.	YES	
3.1.2.	**Permanent joining** Permanent joints and adjacent zones must be free of any surface or internal defects detrimental to the safety of the equipment. The properties of the permanent joints must meet the minimum properties specified for the materials to be joined unless other relevant property values are specifically taken into account in the design calculations. Permanent joints of pressure parts must be carried out by suitably qualified personnel according to suitable operating procedures. For categories II, III and IV, operating procedures and personnel must be approved by a competent third party or NB.	YES	Approvals of welding procedures, welders and welding operators qualifications according to: ☐EN 288-3; EN 287-1; EN 1418 ; ☒ ASME IX integrated by supplemental tests required a.m. EN specification(a); are: ☒ issued by notified body ☐ issued by third party organisation ☐ not required for category I ☐ not applicable to this job (seamless). Range of approval of welding variables is according to Construction Code and: ☒ ASME IX (if Construction Code is ASME VIII); ☐ EN 288-3; EN 287-1; EN 1418 (if Construction Code is European or is Harmonized Code). Welded joints (weld metal and heat affected zone): ☒ have met the same specified minimum mechanical properties as the base metal ☐ not applicable to this job. ☐ Remark (only for ASME Code): Supplementary essential variables of ASME IX par. QW-250 are not applicable if impact test is required by dispositions other than requirements of ASME VIII). *SEE BREMBANA&ROLLE Doc. No.: 23096-01-TWB1*
3.1.3	**Non-destructive tests** NDT of permanent joints must be carried out by suitably qualified personnel. For categories III and IV the personnel must be approved by a third party organisation.	YES	Approvals of NDE personnel according to ☒ SNT-TC-1A / ☒ EN 473 are: ☒ issued by third party organisation ☐ not required for category I and II ☐ not applicable to this job (joint coefficients not larger than 0,7). *SEE BREMBANA&ROLLE Doc. No.: 23096-01-QCPA*
3.1.4	**Heat treatment** Where there is a risk that the manufacturing process will change the material properties to an extent which would impair the safety of the pressure equipment, suitable heat treatment must be applied at the appropriate stage of manufacture.	YES	*SEE BREMBANA&ROLLE Doc. No.: 23096-TPWF*
3.1.5	**Traceability** Suitable procedures must be established and maintained for identifying the material making up the components of the equipment which contribute to pressure resistance by suitable means from receipt through production, up to the final test of the manufactured pressure equipment.	YES	PMI in accordance with the Client Specification: *SEE BREMBANA&ROLLE Doc. No. PR.N° 009PMX (included in B&R Doc. 23096-QNDE)*

3.2	**Final assessment**		
3.2.1	**Final inspection** Pressure equipment must undergo a final inspection to assess visually and by examination of the accompanying documents compliance with the requirements of PED. Tests carried out during manufacture may be taken into account. As far as is necessary, internal and external examination must be carried out.	**YES**	The Manufacturer has provided documentation to demonstrate compliance with PED. This has included: ☒ Qualifications of the NDE personnel, ☒ Qualifications of welders and welding operators ☒ Welding procedure qualifications; ☒ Heat treatment data; ☒ Forming and special processes data; ☒ Material certification and inspection documents for base metal and welding consumables; ☒ Sketch for insuring material traceability; ☒ NDT reports; ☒ Production weld control test plates; ☒ Radiographic films; ☒ Reports of intermediate and final tests other than NDT; ☒ Other technical documentation in accordance with the appropriate conformity assessment module and the Construction Code adopted.
3.2.2	**Proof test** Final assessment of pressure equipment must include a test for the pressure containment aspect, which will normally take the form of a hydrostatic pressure test. For category I series-produced pressure equipment, pressure test may be performed on a statistical basis. Where the hydrostatic pressure test is harmful or impractical, other tests of a recognised value may be carried out.	**YES**	The Manufacturer has adopted ☒ hydrostatic test the test pressure not less than values specified in par. 7.4 of Annex I and value specified in construction code, whichever is larger. ☐ pneumatic test pressure not less than value specified in construction code. *SEE BREMBANA&ROLLE Doc. No.: 100 HPT 21 (included in B&R Doc. 23096-QHT1)*
3.2.3	**Inspection of safety devices** For assemblies, the final assessment must also include a check of the safety devices intended to check full compliance with the requirements referred to in 2.10.	**YES**	☐ Safety devices are part of supply. The assessment has included a check of monitoring devices, such as indicators and / or alarms for safety accessories to prevent exceeding the allowable pressure and temperature limits (see Annex I, par. 2.10(b)). ☒ Safety devices are not part of supply.
3.3.	**Marking and labelling** (a) for all pressure equipment - the name and address or other means of identification of the manufacturer and, where appropriate, of his authorised representative within the EEA. - The year of manufacture - Identification of the pressure equipment according to its nature, such as type, series or batch identification and serial number. - Essential maximum/minimum allowable limit.	**YES**	☒ In addition to the CE marking, the Manufacturer has provided the additional information required by PED, Annex I, par 3.3(a) and par. 3.3(b), if appropriate (see copy of nameplate). *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EGA1 (G.A. DWG)*
	(b) depending on the type of the pressure equipment, further information necessary for safe installation, operation or use and, where applicable, maintenance and periodic inspection such as: - the volume V in L - the nominal size for piping DN - the test pressure PT in bar, and date of test - safety devices set pressure in bar - output of the pressure equipment in kW - supply voltage in V (volts) - intended use - filling ratio kg/L - maximum filling mass in kg - tare mass in kg - the product group	**YES**	*SEE BREMBANA&ROLLE Doc. No.: 23096-01-EGA1 (G.A. DWG)*
	(c) where necessary, warning fixed to the pressure equipment drawing attention to misuse which experience has shown might occur.	**YES**	☒ When applicable, the Manufacturer attached to the pressure equipment warning labels: ☐ equipment heat treated, do not weld ☐ equipment delivered filled with nitrogen at low pressure (0,5 barg)

			☐ do not pressurize before installing safety devices ☒ ..... *SEE BREMBANA&ROLLE Doc. No.: 23096-01-ESH1 (Transport. DWG)*
3.4	**Operating instructions** (a) when pressure equipment is placed on market, it must be accompanied, as far as relevant, with instructions for the user, containing all the necessary safety information relating to: - mounting including assembling of different pieces of pressure equipment - putting into service - use - maintenance including checks by the user. (b) instruction must cover information affixed to the pressure equipment in accordance with 3.3., with the exception of serial identification and must be accompanied, where appropriate, by the technical documents, drawings, diagrams necessary for full understanding of these instructions. If appropriate, these instructions must also refer to hazards arising from misuse in accordance with 1.3. and particular features of the design in accordance with 2.2.3.	**YES**	*SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1* *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EMC1*

4	**Materials**		
4.1.	**Materials for pressurised parts must:** (a) have appropriate properties for all operating conditions which are reasonably foreseeable and for all test conditions, and in particular, they should be ductile and tough (see 7.5) (b) be sufficiently chemically resistant to the fluid contained in the pressure equipment. (c) not be significantly affected by ageing. (d) be suitable for the intended processing (e) be selected in order to avoid significant undesirable effects when the various materials are put together.	**YES**	☒ The Manufacturer holds responsibility for material selection for the intended service.
4.2.	(a) the pressure equipment manufacturer must define in an appropriate manner the values necessary for the design calculations referred in 2.2.3 and the essential characteristics of the materials and their treatment referred to in 4.1.	**YES**	☒ The Manufacturer has used materials meeting the requirements of Annex I, par. 4.1(a) through par. 4.1(e). ☒ The Manufacturer has used steels meeting the requirements of elongation of Annex I par. 7.5. *SEE BREMBANA&ROLLE Doc. No.: all PMA for the job*
	(b) the manufacturer must provide in his technical documentation elements relating to compliance with the materials specifications of the Directive in one of the following forms: - by using materials which comply with harmonised standards. - By using materials covered by a European approval of pressure equipment materials - By a particular material appraisal. (c) the pressure equipment in categories III and IV, particular appraisal must be performed by NB.	**YES**	Selected materials conform to one of the following: ☐ materials that are covered by a European harmonised product standard (HS) ☐ materials that are covered by a European approval of pressure equipment materials (EAM) ☐ materials that are issued with a Particular Material Appraisal (PMA) ☒ materials that are issued with a Particular Material Appraisal (PMA) carried out by the Notified Body, for categories III and IV *SEE BREMBANA&ROLLE Doc. No.: all PMA for the job*
4.3.	The equipment manufacturer must take appropriate measures to ensure that the material used conforms with the required specification. In particular, documentation prepared by the material manufacturer affirming compliance with a specification must be obtained for all materials. For the main pressure bearing parts in categories II, III and IV, this must take the form of a certificate of specific product control. Where a material manufacturer has an appropriate quality assurance system, certified by a competent body established within the community and having undergone a specific assessment of materials, certificates issued by the manufacturer are presumed to certify conformity with the relevant requirements.	**YES**	The Manufacturer provide materials conform to the appropriate specifications and supported by appropriate certification: ☒ for main pressure parts in categories II / III / IV: test certificates .EN 10204 types 3.1A, 3.1C, or 3.2 of mechanical tests; or: 3.1B, 2.3 with accredited certification EN ISO 9001 or 9002 or equivalent to the material manufacturer from a Body established within the EC; ☒ for main pressure parts in category I, for attachments to pressure parts in any category, for pressure parts other than main: test certificates .EN 10204 types above specified or 2.2. ☐ for weld filler materials in any category: AWS SFA-5.01 Level F / ☒ EN 10204 type 2.2 ….. Main pressure parts definition: see Guideline 7/6. ☒ If required by the material specification, material certificates include impact test results. irrespective of code exemption.

5	**Specific requirements: Fired or otherwise heated pressure equipment with a risk of overheating** This pressure equipment includes: - steam and hot-water generators, such as fired steam and hot water boilers, superheaters and reheaters, waste-heat boilers, waste incineration boilers, electrode or immersion-type electrically heated boilers, pressure cookers, together with their accessories and where applicable their systems for treatment of feedwater and fuel supply, and - process-heating vessels for other than steam and hot water generation, such as heaters for chemical and other similar processes and	**YES**	*SEE BREMBANA&ROLLE Doc. No.: 22143-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 22143-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 22143-EIM3* *SEE BREMBANA&ROLLE Doc. No.: 22143-EHA1*

	pressurised food-processing equipment. This equipment must be calculated, designed and constructed so as to minimise risks of a significant loss of containment from overheating. (a) Appropriate means of protection are provided to restrict operating parameters such as heat input, heat take-off and where applicable, fluid level so as to avoid any risk of local and general overheating. (b) Sampling points are provided where required to allow evaluation of the properties of the fluid so as to avoid risks related to deposits and or corrosion. (c) Adequate provisions are made to eliminate risks of damage from deposits, (d) Means of safe removal of residual heat after shutdown are provided. (e) Steps are taken to avoid a dangerous accumulation of ignitable mixtures of combustible substances and air, or flame blowback.		

6	**Specific requirements: Piping** Design and construction must ensure: (a) that the risk of overstressing from inadmissible free movement or excessive forces being produced, e.g. on flanges, connections, bellows or hoses, is adequately controlled by means such as support, constraint, anchoring, alignment and pre-tension. (b) That where there is a possibility of condensation occurring inside pipes for gaseous fluids, means are provided for drainage and removal of deposits from low areas to avoid damage from water hammer or corrosion. (c) That due consideration is given to the potential from turbulence and formation of vortices; the relevant parts of 2.7 are applicable. (d) That due consideration is given to the risk of fatigue due to vibration in pipes. (e) That, where fluids of Group 1 are contained in the piping, appropriate means are provided to isolate "take-off" pipes the size of which represents a significant risk. (f) That the risk of inadvertent discharge is minimised; the take-off points must be clearly marked on the permanent side, indicating the fluid contained; (g) That the position and route of underground piping is at least recorded in the technical documentation to facilitate safe maintenance, inspection or repair.	**YES**	*SEE BREMBANA&ROLLE Doc. No.: 22143-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 22143-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 22143-EIM3* *SEE BREMBANA&ROLLE Doc. No.: 22143-EHA1*

7	**Specific quantitative requirements for certain pressure equipment** Note: These provisions apply as a **"general rule".** Where they are not applied, the manufacturer must demonstrate that appropriate measures have been taken to achieve an "equivalent overall level of safety".	**N/A**	The Manufacturer has applied the general rules of Annex I, par. 7
7.1	**Allowable stresses**		☒ See Particular Material Approval sheets.
7.1.1	**Symbols** Re/t , yield limit, indicates the value at the calculation temperature of:	**YES**	*SEE BREMBANA&ROLLE Doc. No.: 23096-EIM1* *SEE BREMBANA&ROLLE Doc. No.: 23096-EIM2* *SEE BREMBANA&ROLLE Doc. No.: 23096-EHA1*

	- the upper flow limit for a material presenting upper and lower flow limits. - The 1% proof strength for austenitic steel and non-alloyed aluminium - The 0.2% proof strength on other cases. Rm/20 indicates the minimum value of the ultimate strength at ambient temperature. Rm/t designates the ultimate strength at the calculation temperature.		
7.1.2	The permissible general membrane stress (f) for predominantly static loads and for temperature outside the range in which creep is significant, must not exceed the smaller of the following values, according to material used: - for ferritic steel., including normalised (normalised rolled) steel, [but excluding fine grained steel (especially heat treated steel] f= min[2/3 Re/t, 5/12 Rm/20] - for austenitic steel f= 2/3 Re/t if elongation after rupture >30% f= min[5/6 Re/t, 1/3 Rm/t] if elongation > 35% - for non-ally or low alloy cast steel f= min[10/19 Re/t, 1/3 Rm/20] - for aluminium f= 2/3 Re/t - for aluminium alloy [excluding precipitation hardening alloys] f= min[2/3 Re/t, 5/12 Rm/20]	**YES**	*SEE BREMBANA&ROLLE Doc. No.: 23096-01-EMC1* *SEE BREMBANA&ROLLE Doc. No.: all PMA for the job*
7.2.	**Joint coefficients** For welded joints, the joint coefficient must not exceed the following values - for equipment subjected to destructive and NDT which confirm that the whole series of joints show no significant defect: 1 - for equipment subject to random NDT: 0.85 - for equipment not subject to NDT other than visual inspection: 0.7	**YES**	For the joint coefficients, the Manufacturer has adopted the values indicated in the drawing and in the calculation report. *SEE BREMBANA&ROLLE Doc. No.: 23096-01-EMC1*
7.3.	**Pressure limiting devices, particularly for pressure vessels** The momentary pressure surge referred to in 2.11.2 must be kept to 10% of the maximum allowable pressure.	**N/A**	
7.4.	**Hydrostatic test pressure** For pressure vessels, the hydrostatic test pressure referred to in 3.2.2 must not be less than - that corresponding to the maximum loading to which the pressure equipment may be subject in service taking into account its maximum allowable pressure and its maximum allowable temperature, multiplied by the coefficient 1.25,	**YES**	*SEE BREMBANA&ROLLE Doc. No.: 23096-01-EMC1*

	or - the maximum allowable pressure multiplied by the coefficient 1.43, which ever is greater.		
7.5	**Material characteristics** Unless other values are required in accordance with other criteria that must be taken into account, a steel is considered as sufficiently ductile to satisfy 4.1 (a) if, in a tensile test carried out by a standard procedure, its elongation after rupture is no less than 14% and its bending rupture energy measured on ISO V test piece is no less than 27 J, at a temperature not greater than 20 degree C but not higher than the lowest scheduled operating temperature.	**YES**	Steels used for pressure parts are tested at temperature TKV specified in Annex I par. 7.5 (or in harmonized code) and impact test energy corresponding to standard size specimens results not lesser than 27 J. ALTERNATIVELY: If so permitted by PMAs, steels used for pressure parts were not tested for impact energy if exempted by Construction Code and if this omission is allowed by criteria of guideline 7/17. (i. e. overall safety equivalent to PED Annex I par. 7.5 recommendations). *SEE BREMBANA&ROLLE Doc. No.: all PMA for the job*

BREMBANA&ROLLE

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VAT No. IT07348970158 - C.F. 00226780161
Subscribed and Paid-up Capital € 14.560.000

23096-EHA1

RISK ANALYSIS

CLIENT:	**ROSETTI MARINO**
PURCHASE ORDER No.:	**1723001756 123A90A**
END USER:	**CROSSWIND**
ENGINEERING	**ROSETTI MARINO**
PROJECT:	**BLPH PLATFORM**
SITE:	**HOLLANDSE KUST NOORD SITE V**
ITEM:	**V-25001 A÷F**
EQUIPMENT TYPE:	**HORIZONTAL EQUIPMENT**
SERVICE:	**H2 STORAGE VESSEL**
MANUFACTURER	**BREMBANA & ROLLE S.p.A.**
JOB NOMBER:	**23096**
SERIAL NUMBER	**23096-01-SNA/B/C/D/E/F**

0	Emesso per Approvazione	11/04/2024	M. TONIOLO	D. PASSERINI	D. PASSERINI
REV.	**DESCRIPTION**	**DATE**	**ORIGINATOR** [Project Eng.]	**CHECK** [Project Tech.Mng.]	**APPROVAL** [Engineering Mgr.]

Ref.	Hazardous Events	Causes	Consequence	Control Measures *Action required*		
				ACTION	BY	DONE (*)
/	Leakage or structural failure of pressure equipment	Design fault	Catastrophic failure Potential loss of life and damage to adjacent equipment	Equipments designed according to ASME VIII Div.1 2021 Ed.,. a recognized pressure vessel Codes. / Independent check of design.	B&R NO.BO.	YES
/	Leakage or structural failure of pressure equipment	Defective materials	Catastrophic failure Potential loss of life and damage to adjacent equipment	Use certified pressure vessel material that is traceable to its source (EN 10204 Type 3.1, 3.2). Only use material that is approved for pressure purpose and ensure that manufacturer has a suitable material traceability system.	B&R	YES
/	Leakage or structural failure of pressure equipment	Defective welds	Catastrophic failure Potential loss of life and damage to adjacent equipment	Use approved welders working to approved and qualified procedures. Use NDT examination of welds. NDT operators qualified, working to approved procedures and undergo annual eye tests.	B&R	YES
/	Leakage or structural failure of pressure equipment	Inappropriate stress relieving of equipment	Catastrophic failure Potential loss of life and damage to adjacent equipment	Review post weld heat treatment procedure, use calibrated probes. Check heat treatment chart for correct soaking time and cooling rate to pressure vessel code for the applicable material and design.	B&R	YES
/	Leakage or structural failure of pressure equipment	Incorrect selection of material, not compatible with contents	Catastrophic failure Potential loss of life and damage to adjacent equipment	Check the compatibility of the contents with the selected material, ensure no risk of chemical attack. Ensure from end user that all potential contents for the equipment are known.	B&R Contractor	YES
/	Leakage or structural failure of pressure equipment	Installation of material not in compliance with material selection.	Catastrophic failure Potential loss of life and damage to adjacent equipment	Manufacturer has implemented a Quality System that ensure the material traceability and installation of material in compliance with the drawing. Check of MTR is done too.	B&R	YES
/	Leakage or structural failure of pressure equipment	Incorrect forming of pressure vessel retaining parts	Catastrophic failure Potential loss of life and damage to adjacent equipment	Check forming procedure as per vessel code. Check out of roundness and deviation from nominal shape.	B&R	YES
/	Leakage or structural failure of pressure equipment	Inadequate pressure testing	Catastrophic failure Potential loss of life and damage to adjacent equipment	Test to pressure specified in the Code according to a hydraulic pressure test procedure . Use calibrated pressure gauges.	B&R NO.BO.	YES
/	Leakage or structural failure of pressure equipment	Damage to equipment during transit	Catastrophic failure Potential loss of life and damage to adjacent equipment or reduced service life	Equipments are delivered on supports and steel/wooden saddles for shipping purpose.	B&R	YES
/	Leakage or structural failure of pressure equipment	Damage during erection or during commissioning	Catastrophic failure Potential loss of life and damage to adjacent equipment or reduced service life	Provide adequate operating procedure.	B&R	YES

Ref.	Hazardous Events	Causes	Consequence	Control Measures *Action required*		
				ACTION	BY	DONE (*)
/	Leakage or structural failure of pressure equipment	Brittle fracture	Catastrophic failure Potential loss of life and damage to adjacent equipment	Material selected according to requirements of the applicable pressure vessel Code	B&R Contractor	YES
/	Leakage or structural failure of pressure equipment	Creep	Catastrophic failure Potential loss of life and damage to adjacent equipment and reduced service life	The equipment not intended to work in creep range temperature.	B&R	YES
/	Leakage or structural failure of pressure equipment	Fatigue	Catastrophic failure Potential loss of life and damage to adjacent equipment and reduced service life	Fatigue screening check performed according to ASME VIII div. 2 Code. No need of fatigue analysis required	B&R	YES
/	Leakage or structural failure of pressure equipment	Over pressurization	Catastrophic failure Potential loss of life and damage to adjacent equipment	Safety devices shall be provided by the End User, directly connected to the equipment or as a branch connection on the connected pipes	End User	(3)
/	Leakage or structural failure of pressure equipment	Over heating	Catastrophic failure Potential loss of life and damage to adjacent equipment	Connection system to be provided with several Temperature instruments which will trip the plant in case the Operating Temperature will be too high	End User	(3)
/	Leakage or structural failure of pressure equipment	External loading	Catastrophic failure Potential loss of life and damage to adjacent equipment	Equipment is designed to include effect of external loading	B&R	YES
/	Leakage or structural failure of pressure equipment	External fire	Catastrophic failure Potential loss of life and damage to adjacent equipment	Fireproofing is not included in the supply of the equipment. Safety Valve on the system shall be sized for (among others) fire case	End User	(3)
/	Leakage or structural failure of pressure equipment	Leaking joint	Catastrophic failure Potential loss of life damage to vessel or damage to adjacent equipment or risk of inhalation of toxic fumes or gas	Carry out hydraulic test and check tightness of each joint.	B&R	YES
/	Leakage or structural failure of pressure equipment	Inadequate safety valve sizing	Catastrophic failure Potential loss of life and damage to adjacent equipment or over pressurization of the vessel	Ensure suitable rated safety valve approved for design conditions No Safety valves are in B&R scope of supply. It is responsibility of the End USER to provide for it, wherever needed	End User	(3)
/	Leakage or structural failure of pressure equipment	Failure of safety or pressure accessories	Catastrophic failure Potential loss of life and damage to adjacent equipment or over pressurization of the vessel	Use tested / approved devices; End User to fix in-service inspection/examination program	End User	(3)
/	Leakage or structural failure of pressure equipment	Decomposition of unstable fluids, exothermic thermal reaction.	Catastrophic failure Potential loss of life and damage to adjacent equipment	Design condition has been established by the Contractor, taking into account load pressure and heat delivered from the media.	Contractor/ End User	YES (2)

Ref.	Hazardous Events	Causes	Consequence	Control Measures *Action required*		
				ACTION	BY	DONE (*)
/	Injury to operator	Quick release door-residual pressure	Injury to operator	Not applicable	/	/
/	Injury to operator	Hot surface	Injury to operator	Equipment is not insulated. wherever indicated: insulation / personal protection are not included in B&R scope of the supply	(1)	(2)
/	Injury to operator	Discharge from safety valves	Injury to operator	Discharge far away from personnel transit shall be taken into account by the End User during plant design	End User	(3)
ATEX Directive 2014/34/EU – **Not applicable**						
	(*) YES means: action already done within the delivery date. (1) Insulation (if any) and/or warning signals to be installed by the Contractor (2) Action already done to establish the design pressure, monitoring at site during operation at charge of the End User. (3) Action at End User charge once the equipment is at site					

Fabrication site: Albignasego – PD – ITALY

Section 21

Commissioning Spare Parts

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**SPARE PART INDEX REGISTER (COMMISIONING, OPERATION) H2 STORAGE VESSEL**	Sheet 1 of 5 Date: 14/06/2024 Rev: 0

Base Load Power Hub (BLPH)

SPARE PART INDEX REGISTER (COMMISIONING, OPERATION) H2 STORAGE VESSEL

Document Number: 1723001756-COM-LIS-00018

Document Class: 3

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED

NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.

Sign	Date
	20-06-2024

Rev.	Date	Description	Prepared	Reviewed	Approved
1	14/06/2024	Issue for Information (IFI)	M. Toniolo	D. Passerini	D. Passerini
0	03/05/2024	Issue for Information (IFI)	M. Toniolo	D. Passerini	D. Passerini

B&R BREMBANA&ROLLE

CROSSWIND	HOLLANDSE KUST NOORD WIND PARK Project **Contract No. CW-I-WP4-2023-05**	ROSETTI MARINO
Document Title:	**SPARE PART INDEX REGISTER (COMMISIONING, OPERATION) H2 STORAGE VESSEL**	Sheet 2 of 5 Date: 14/06/2024 Rev: 0

Revision / Change Log

Rev.	Description
0	Issue for Information (IFI)
1	Issue for Information (IFI)

HOLD LIST

No.	Description
1	
2	
3	
4	

BREMBANA&ROLLE	COMMISIONING & START-UP SPARE PARTS LIST	DOC.	23096-LSP1	REV.	1
		Sheet	3	of	4
		JOB	23096		
		ITEM	V-25001 A÷F		

CLIENT:	**ROSETTI MARINO**
PURCHASE ORDER No.:	**1723001756 123A90A**
END USER:	**CROSSWIND**
ENGINEERING	**ROSETTI MARINO**
PROJECT:	**BLPH PLATFORM**
SITE:	**HOLLANDSE KUST NOORD SITE V**
ITEM:	**V-25001 A÷F**
EQUIPMENT TYPE:	**HORIZONTAL EQUIPMENT**
SERVICE:	**H2 STORAGE VESSEL**
MANUFACTURER	**BREMBANA & ROLLE S.p.A.**
JOB NOMBER:	**23096**
SERIAL NUMBER	**23096-01-SNA÷SNF**

1	Issued for APPROVAL	14/06/2024	M. TONIOLO	D.PASSERINI	D.PASSERINI
0	Issued for APPROVAL	03/05/2024	M. TONIOLO	D.PASSERINI	D.PASSERINI
REV.	**DESCRIPTION**	**DATE**	**ORIGINATOR** [Project Eng.]	**CHECK** [Project Tech.Mng.]	**APPROVAL** [Engineering Mgr.]

BREMBANA&ROLLE	2 YEARS OPERATION SPARE PARTS LIST	DOC.	23096-LSP2	REV.	1
		Sheet	4	of	4
		JOB	23096		
		ITEM	V-25001 A÷F		

CLIENT:	**ROSETTI MARINO**
PURCHASE ORDER No.:	**1723001756 123A90A**
END USER:	**CROSSWIND**
ENGINEERING	**ROSETTI MARINO**
PROJECT:	**BLPH PLATFORM**
SITE:	**HOLLANDSE KUST NOORD SITE V**
ITEM:	**V-25001 A÷F**
EQUIPMENT TYPE:	**HORIZONTAL EQUIPMENT**
SERVICE:	**H2 STORAGE VESSEL**
MANUFACTURER	**BREMBANA & ROLLE S.p.A.**
JOB NOMBER:	**23096**
SERIAL NUMBER	**23096-01-SNA÷SNF**

1	Issued for APPROVAL	14/06/2024	M. TONIOLO	D.PASSERINI	D.PASSERINI
0	Issued for APPROVAL	03/05/2024	M. TONIOLO	D.PASSERINI	D.PASSERINI
REV.	**DESCRIPTION**	**DATE**	**ORIGINATOR** [Project Eng.]	**CHECK** [Project Tech.Mng.]	**APPROVAL** [Engineering Mgr.]

ROSETTI MARINO

SPARE PARTS LIST

CROSSWIND

Document Title	Commissioning and 2 years spare parts list					
The document relates to	HOLLANDSE KUST NOORD WIND PARK Project - Base Load Power Hub (BLPH)					Contract: CW-I-WP4-2023-05
Project ID	123A90	Doc. n°	123A90-XXX-XX-XX-0000	Rev.: Issued for review	Rev. Date: 02-May-24	Status: IFR / Class: 2

The equipment consists of the following units/components

1 Tag no.: V25001 A/F

2 Tag description: H2 Storage Vessel

3 Manufacturer model/type no.:

4 Manufacturer serial no.: 22046-01-SN/F

5 No. of units: 6

Supplier: BREMBANA & ROLLE S.p.A.

PO Number: 1723001756 123A90A

PO description: H2 Storage Vessels

Contact name: Mrs. Nadia Roncalli / Floriana Riganello

Address: Via Villino, 1 - 24030 Valbrembo (BG) - Italy

Supplier telephone no: +39-35-4510682

Contact mobile no:

E-mail: nroncalli@brembaeurotile.com; floriana@brembaeurotile.com

WEBSITE: www.brembaeurotile.com

General Information:

6 Quantity of parts FITTED / INSTALLED per unit/component

MATERIALS DATA

Item Number	Total number of identical spares installed	Description of recommended spare parts	Parts/drawing ref.			Material	Certificate Type (if applicable)	Certificate Reference (if applicable)	Shelf life (years)	Weight (net)	Weight (gross)	Volume	HS Code	ECCN Code	% US Content	Country of origin	Supplier part no.	Manufacturer part no.	Manufacturername	Commissioning spares: Quantity ordered	2 Years spares: Quantity ordered	Remarks
			Project Datasheet no.	Project Detail dwg. no.	Item ref.																	
7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	144	STUD BOLTS 1-1/2"-8UN B1.1 Lg. 260 mm + 2 NUTS (M1)	12390-DDL-MAC-DS-S0027	1723001756-MAC-DD-00024	10	SA 193 Gr.B7 + SA 194 Gr.2H	3.1	EN-10204: 2004	>5	3.5	3.5	n.a.	7318	1548		Italy	10	n.a.	PRESSBOLT S.R.L.	15	15	BREMBANA & ROLLE GENERAL ASSEMBLY DWG: 1723001756-MAC-DD-00024
2	6	SW GASKET 24" 300# c/w S.S. INNER/ C.S OUTER RING (M1)	12390-DDL-MAC-DS-S0027	1723001756-MAC-DD-00024	11	316 S.S. + EPOXY COATED C.S.	2.2	EN-10204: 2004	>3	4	4	n.a.	8484	1000		Italy	11	n.a.	ABO S.R.L.	18	18	BREMBANA & ROLLE GENERAL ASSEMBLY DWG: 1723001756-MAC-DD-00024
3	144	STUD BOLTS 1-1/2"-8UN B1.1 Lg. 260 mm + 2 NUTS (M2)	12390-DDL-MAC-DS-S0027	1723001756-MAC-DD-00024	14	SA 193 Gr.B7 + SA 194 Gr.2H	3.1	EN-10204: 2004	>5	3.5	3.5	n.a.	7318	1548		Italy	14	n.a.	PRESSBOLT S.R.L.	15	15	BREMBANA & ROLLE GENERAL ASSEMBLY DWG: 1723001756-MAC-DD-00024
4	6	SW GASKET 24" 300# c/w S.S. INNER/ C.S OUTER RING (M2)	12390-DDL-MAC-DS-S0027	1723001756-MAC-DD-00024	15	316 S.S. + EPOXY COATED C.S.	2.2	EN-10204: 2004	>3	4	4	n.a.	8484	1000		Italy	15	n.a.	ABO S.R.L.	18	18	BREMBANA & ROLLE GENERAL ASSEMBLY DWG: 1723001756-MAC-DD-00024
5	24	STUD BOLTS 5/8" UNC-B1.1 Lg 85 + 2 NUTS (3N)	12390-DDL-MAC-DS-S0027	1723001756-MAC-DD-00024	48	SA 193 Gr.B7 + SA 194 Gr.2H	3.1	EN-10204: 2004	>5	0.25	0.25	n.a.	7318	1548		Italy	48	n.a.	PRESSBOLT S.R.L.	12	12	BREMBANA & ROLLE GENERAL ASSEMBLY DWG: 1723001756-MAC-DD-00024
6	6	SW GASKET 1" 300# c/w S.S. INNER/ C.S OUTER RING (3N)	12390-DDL-MAC-DS-S0027	1723001756-MAC-DD-00024	49	316 S.S. + EPOXY COATED C.S.	2.2	EN-10204: 2004	>3	0.08	0.08	n.a.	8484	1000		Italy	49	n.a.	ABO S.R.L.	18	18	BREMBANA & ROLLE GENERAL ASSEMBLY DWG: 1723001756-MAC-DD-00024
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1723001756-QC-DB-00017_02 - V25001A

PAGE 1013/1016

Fabrication site: Albignasego – PD – ITALY

Section 22

Packing list and shipping drawing

BREMBANA&ROLLE

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Stabilimento: Via Delle Industrie, 35 – 35020 Albignasego, Padova (Italy)
CF 00226780161 – P.IVA IT07348970158
www.brembanarolle.com – E-mail: info@brembanarolle.com

PACKING LIST n° 23096-01-SNA

03/09/2024

CLIENT:

ROSETTI MARINO SPA

P.O. NO: 1723001756 123A90A **B&R JOB:** 23096

FINAL DESTINATION

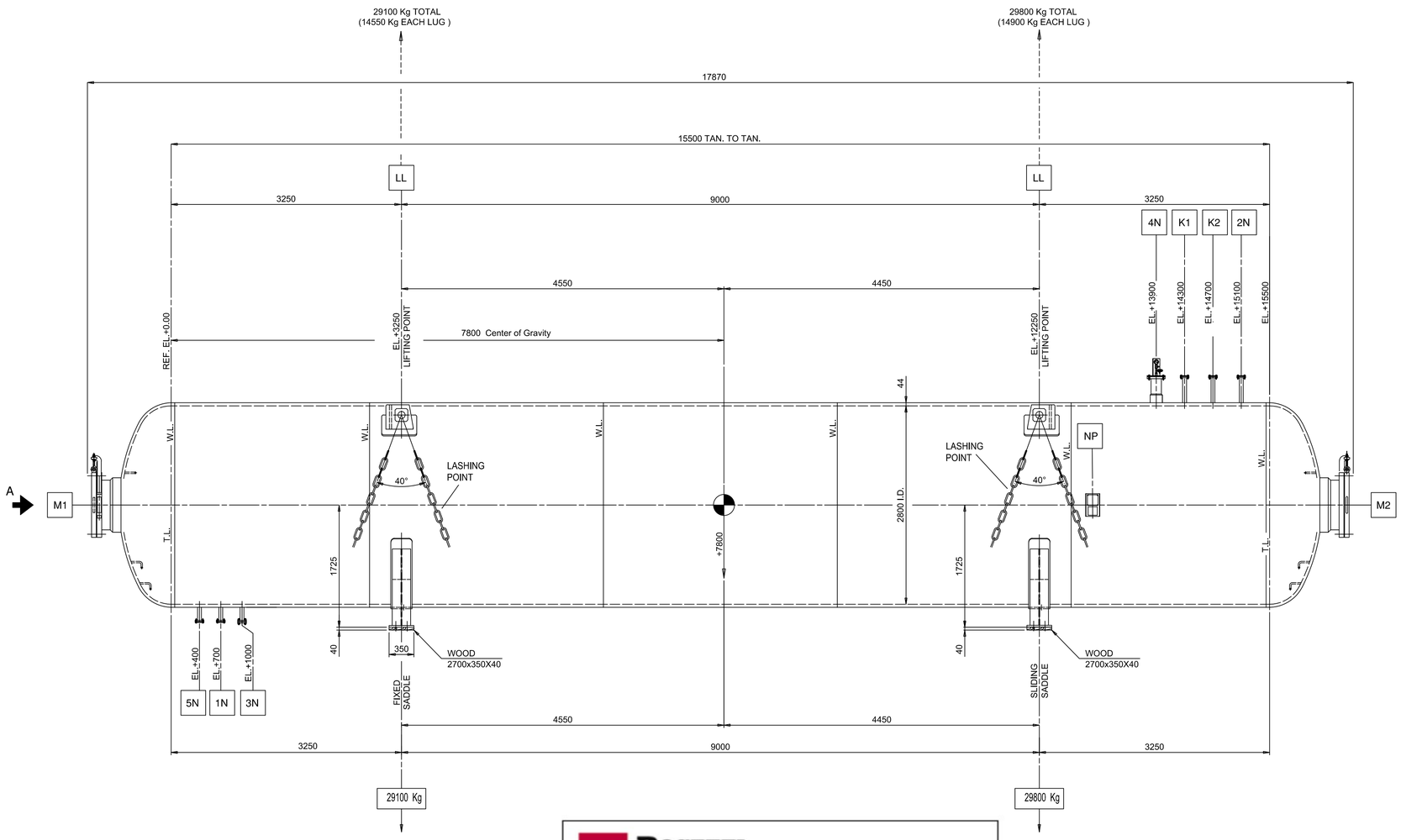
NETHERLANDS, 18,5KM OFF THE COAST,
NEAR THE TOWN OF EGMOND AAN ZEE

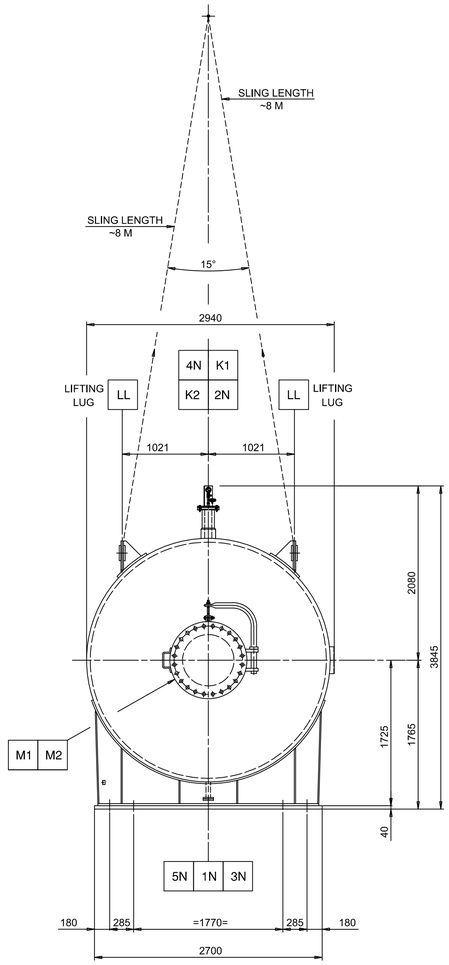
Shipping Marks

CLIENT: ROSETTI MARINO SPA
PURCHASE ORDER NO.: 1723001756 123A90A
PROJECT: CROSSWIND HOLLANDSE KUST NOORD WIND PARK
TAG NO.: V-25001 A
GROSS/NET WEIGHT KG: 58900 / 58700
DIMENSIONS: see below
PACKAGE NO.: see below
COUNTRY OF ORIGIN: ITALY

N.° Package	Q.ty	Description	Type of Package	Type of Stocage	Item	Dimension in CMS (L. x W. x H.)	Net Weight (Kg)	Gross Weight (Kg)	Shipping Volume (m^3)
1 OF 1	1	HYDROGEN STORAGE VESSEL ITEM V-25001 A - MFR'S S.N. 26096-01-SNA - B&R DWG 23096-01-EGA1	saddle	A	V-25001A	1787 x 294 x 384,5	58700	58900	202,00

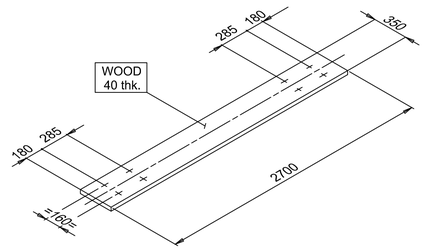
SAFE WORKING LOAD (SWL) FOR EACH LUG
30000 Kg (WITH SAFETY FACTOR 1.5)





VIEW FROM -A-

ROSETTI MARINO	
1	NO COMMENTS - APPROVED - WORK MAY PROCEED
2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
3	MAJOR COMMENTS – REJECTED – DO NOT PROCEED
4	APPROVAL NOT REQUIRED
NOTE: Approval doesn't relieve the supplier from mandatory compliance with contractual documents and specifications. Comments made do not imply acceptance of any cost or delivery impact.	
Sign	Date
	10-10-2024



No. 2 PIECES

NOTES:

1) FOR EQUIPMENT ASSEMBLY, BILL OF MATERIAL & GENERAL NOTES SEE DRAWINGS: N. 23096-01-EGA1 & DWG. N. 23096-01-EBM1 .
2) LIFTING OF THE EQUIPMENT TO BE PERFORMED BY MEANS OF DEVICES WITH ADEQUATE LOADING CAPACITY (OUT OF B&R SCOPE OF SUPPLY).
3) LIFTING POINTS AND C.O.G. SHALL BE MARKED BY PAINTING ON THE OPPOSITE SIDES OF SHELL.
4) LOOSE PARTS AND SPARE PARTS SHIPPED IN A SEPARATE WOODEN BOX WITH A SEPARATE PACKING LIST.
5) LASHING POINTS SHALL BE PROTECTED WITH A POLYETHYLENE SHEET TO PREVENT PAINT FROM BEING DAMAGED. TRUE POSITION, PROTECTION AND LASHING OUTFIT SHALL BE DEFINED AND EQUIPPED BY THE CARRIER.
6) ALL WOODS MUST BE HEAT TREATED AND CERTIFIED ACCORDING TO ISPM 15.
7) TRANSPORTATION FROM ALBIGNASEGO TO RAVENNA SITE
8) PADEYES DESIGN IN SUITABLE FOR TWO SLINGS ARRANGEMENTS WITHOUT SPREADER BARS
9) PRESSURIZE VESSEL WITH NITROGEN TO POSITIVE INTERNAL PRESSURE OF 0,3÷0,5 Bar. ⚠4

QUANTITY :		1
EMPTY WEIGHT :	(KGS)	58700
GROSS WEIGHT :	(KGS)	58900
OVERALL LENGTH :	(mm)	(L)=17870
OVERALL WIDTH :	(mm)	(W)=2940
OVERALL HEIGHT :	(mm)	(H)=3845

BREMBANA&ROLLE — VILLA & BONALDI

CLIENT : Rosetti Marino S.p.A.
PURCHASE ORDER No.: 1723001756 123A90A
PROJECT: CROSSWIND HOLLANDE KUST NOORD WIND PARK
LOCATION : NETHERLANDS, 18.5KM OFF THE COAST , NEAR THE TOWN OF EGMOND AAN ZEE.

B&R CAD FILE No.: 23096-01-EGA1.DWG | MFR'S S.N. 23096-01-SNA/F | B&R DRAWING No. 23096-01-ESH1

REV.	DATE	DRN	CHKD	APPD	DESCRIPTION
4	03/10/2024	AD	MT	DR	ISSUE FOR INFORMATION (IFI)
3	19/08/2024	AD	MT	DR	ISSUE FOR INFORMATION (IFI)
2	12/07/2024	E.G	MT	DR	ISSUE FOR INFORMATION (IFI)
1	13/05/2024	AD	MT	DR	ISSUE FOR INFORMATION (IFI)
0	30/04/2024	AD	MT	DR	ISSUE FOR REVIEW (IFR)

CROSSWIND — ROSETTI MARINO

SHIPPING DRAWING
HYDROGEN STORAGE VESSEL ITEM : V-25001A/F

CONTRACT NO. CW-I-WP4-2023-05 / H2 STORAGE | SCALE 1:35

DRAWN A.FRANCO | CHECKED M.TONIOLO | APPROVED D.PASSERINI | DATE 03/10/24

A1 | DRAWING NO. 1723001756-TI-DD-00021 | SHEET 1 | REV. 4

File Name : - 1723001756-TI-DD-00021