Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

EQUIPMENT MANUFACTURER RECORD BOOK (FINAL DOSSIER)

Document Number: 1724001317-QC-DB-00014

Document Class: 2

00	16/01/2026	Issue for Review (IFR)	N.Collins	N.Collins	Niall Townsend
Rev.	Date	Description	Prepared	Reviewed	Approved

BakerHughes

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Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

EQUIPMENT MANUFACTURER RECORD BOOK (FINAL DOSSIER) - INDEX - ULTRASONIC FLOWMETER

Document Number: 1724001317-QC-LIS-00013

Document Class: 2

ROSETTI MARINO

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Sign	Date
ROSETTI MARINO SpA Stefano Liguti Quality Control Dept.	02/10/2025

Rev.	Date	Description	Prepared	Reviewed	Approved
01	11/09/2025	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
00	14/10/2024	Issue for Review (IFR)	BH DC	Tom Griffin	Niall Townsend

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PRROJECT NAME: **HOLLANDSE KUST NOORD WIND PARK Project Contract No. CW-I-WP4-2023-05**

PO & JOB No: **1724001317_123A90A**

Internal Order No: **1706864**

Equipment Manufacturer Record Book (Final Dossier)-INDEX -ULTRASONIC FLOWMETER

Section	Document title	Document No.
1. Engineering and Procedures		
1.1	SMIR - SUPPLIER MASTER INFORMATION REGISTER	1724001317-MD-LIS-00001
1.2	INSPECTION AND TEST PLAN - ULTRASONIC FLOWMETER	1724001317-QC-ITP-00002
1.3	GENERAL ARRANGEMENT DRAWINGS - ULTRASONIC FLOWMETER	1724001317-IN-DA-00003
1.4	WIRING DIAGRAMS - ULTRASONIC FLOWMETER	1724001317-IN-DG-00004
1.5	ULTRASONIC FLOWMETER SIZING CALCULATION - ULTRASONIC FLOWMETER	1724001317-IN-CA-00005
1.6	DATA SHEET - ULTRASONIC FLOWMETER	1724001317-IN-DS-00006
1.7	PAINTING PROCEDURE - ULTRASONIC FLOWMETER	1724001317-MAT-PRO-00007
1.8	NON DESTRUCTIVE EXAMINATION PROCEDURES and NDE OPERATORS LIST and QUALIFICATIONS - ULTRASONIC FLOWMETER	1724001317-NDT-PRO-00008
1.9	WELDING PROCEDURE SPECIFICATION (WPS) AND QUALIFICATIONS (PQR) RECORDS and WELD OPERATORS LIST and WELDER QUALIFICATIONS RECORDS (WPQ) - ULTRASONIC FLOWMETER	1724001317-WEL-PRO-00009
1.10	FAT (FINAL ACCEPTANCE TEST) PROCEDURES - ULTRASONIC FLOWMETER	1724001317-QC-PRO-00010
1.11	COMMISSIONING PROCEDURES - ULTRASONIC FLOWMETER	1724001317-COM-PRO-00011
1.12	ATEX REGISTER - ULTRASONIC FLOWMETER	1724001317-IN-LIS-00015
1.13	SPARE PART INDEX REGISTER	1724001317-COM-LIS-00016

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	(COMMISSIONING and 2 YEAR OPERATION) - ULTRASONIC FLOWMETER	
1.14	INSTALLATION, OPERATING AND MAINTENANCE MANUAL - ULTRASONIC FLOWMETER	1724001317-IN-MAN-00017
1.15	SHIPPING, HANDLING, STORAGE and PRESERVATION PROCEDURES - ULTRASONIC FLOWMETER	1724001317-QC-PRO-00018
2. Test, Records, Reports		
2.1	PRESSURE TEST REPORT	-
2.2	PMI REPORT	-
2.3	FUNCTION TEST REPORT	-
2.4	INSPECTION RELEASE NOTE	-
2.5	SHIPPING RELEASE NOTE	-
2.6	PACKING LIST	-
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2.9	Material Traceability Records	-
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SECTION 1.

ENGINEERING & PROCEDURES

SECTION 1.1
SMIR - SUPPLIER MASTER INFORMATION REGISTER - ULTRASONIC FLOWMETER 1724001317-MD-LIS-00001

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

SUPPLIER MASTER INFORMATION REGISTER

Document Number: 1724001317-MD-LIS-00001

Document Class: 3

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Sign	Date
V. Barratta	21-08-2025

Rev.	Date	Description	Prepared	Reviewed	Approved
02	05-08-2025	Issue for Information (IFI)	BH DC	Tom Griffin	Niall Townsend
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File: 1724001317-MD-LIS-00001_01 (1).xlsx

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4	References	X	X	X					
5	SMIR	X	X	X					

Revision / Change Log

Rev.	Description
00	Issue for Information (IFI)
01	Issue for Information (IFI)
02	Issue for Information (IFI)

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SMIR - REGISTRO DOCUMENTI / *SMIR - SUPPLIER MASTER INFORMATION REGISTER*

	Ordine n°/*order nr.*	1724001317		Fornitore/*Supplier* :	BAKER HUGHES EMEA UNLIMITED							
	data / *dated:*	13-11-2024		Codice F./ *S. Code:*								
	Commessa / *Job:*	123A90		Indirizzo/ *address* :								
	Descrizione / *Description*	ULTRASONIC FLOWMETER		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)	SMIR -SUPPLIER MASTER INFORMATION REGISTER DRILLERS CRANE 95-L-03 (4)	Disciplina / *Discipline* (5)	Blocco Classe / *Class Block (6)*	Docum. Format (7)	first issue date (8)	KEY Document Ingegneria	Document Approval (I/A)
					CONTROL DOCUMENTS								
1	1724001317-MD-LIS-00001	00	1724001317-MD-LIS-00001	00	VDRL-1706864	00	SMIR - SUPPLIER MASTER INFORMATION REGISTER	INS		A3	21-08-2024		I
					QUALITY DOCUMENTS								
2	1724001317-QC-ITP-00002	00	1724001317-QC-ITP-00002	00	QP-1706864	00	INSPECTION AND TEST PLAN - ULTRASONIC FLOWMETER	QUA		A4	21-08-2024		A
					ENGINEERING DOCUMENTS								
3	1724001317-IN-DA-00003	00	1724001317-IN-DA-00003	00	GADWG1706864	00	GENERAL ARRANGEMENT DRAWINGS -ULTRASONIC FLOWMETER	INS		A1	21-08-2024		A
4	1724001317-IN-DG-00004	00	1724001317-IN-DG-00004	00	WDWG-1706864	00	WIRING DIAGRAMS-ULTRASONIC FLOWMETER	INS			21-08-2024		A
5	1724001317-IN-CA-00005	00	1724001317-IN-CA-00005	00	FSC-1706864	00	ULTRASONIC FLOWMETER SIZING CALCULATION-ULTRASONIC FLOWMETER	INS			21-08-2024		A
6	1724001317-IN-DS-00006	00	1724001317-IN-CA-00005	00	CDWG-1706864	00	DATA SHEET-ULTRASONIC FLOWMETER	INS		A4	30-08-2024		I
7	1724001317-MAT-PRO-00007	00	1724001317-MAT-PRO-00007	00	SPST-1706864	00	PAINTING PROCEDURE-ULTRASONIC FLOWMETER	QUA		A4	10-09-2024		A
8	1724001317-NDT-PRO-00008	00	1724001317-NDT-PRO-00008	00	NDER-1706864	00	NON DESTRUCTIVE EXAMINATION PROCEDURES and NDE OPERATORS LIST and QUALIFICATIONS-ULTRASONIC FLOWMETER	QUA		A4	10-09-2024		A
9	1724001317-WEL-PRO-00009	00	1724001317-WEL-PRO-00009	00	WPSPQR-1706864	00	WELDING PROCEDURE SPECIFICATION (WPS) AND QUALIFICATIONS (PQR) RECORDS and WELD OPERATORS LIST and WELDER QUALIFICATIONS RECORDS (WPQ)-ULTRASONIC FLOWMETER	WEL		A4	10-09-2024		A
10	1724001317-QC-PRO-00010	00	1724001317-QC-PRO-00010	00	FATP-1706864	00	FAT (FINAL ACCEPTANCE TEST) PROCEDURES-ULTRASONIC FLOWMETER	INS		A4	30-09-2024		A
11	1724001317-COM-PRO-00011	00	1724001317-COM-PRO-00011	00	PCP-1706864	00	COMMISSIONING PROCEDURES -ULTRASONIC FLOWMETER	COM		A4	30-09-2024		A
12	1724001317-COM-PRO-00012	00	1724001317-COM-PRO-00012	00	ACRE-1706864	00	ASSET REGISTER - ULTRASONIC FLOWMETER	QUA		A4	21-07-2025		A
					CERTIFICATION								
13	1724001317-QC-LIS-00013	00	1724001317-QC-LIS-00013	00	MRBI-1706864	00	EQUIPMENT MANUFACTURER RECORD BOOK (FINAL DOSSIER) - INDEX-ULTRASONIC FLOWMETER	QUA		A4	20-09-2024		A
14	1724001317-QC-DB-00014	00	1724001317-QC-DB-00014	00	MRB-1706864	00	EQUIPMENT MANUFACTURER RECORD BOOK (FINAL DOSSIER) -ULTRASONIC FLOWMETER	CERT		A4	30-01-2025		A
15	1724001317-IN-LIS-00015	00	1724001317-IN-LIS-00015	00	HAZC-1706864	00	ATEX REGISTER-ULTRASONIC FLOWMETER	QUA		A3	20-11-2024		A
					SPARES & MAINTENANCE DATA								
16	1724001317-COM-LIS-00016	00	1724001317-COM-LIS-00016	00	SPLCOM-1706864	00	SPARE PART INDEX REGISTER (COMMISSIONING and 2 YEAR OPERATION)-ULTRASONIC FLOWMETER	COM		A3	20-10-2024		A
17	1724001317-IN-MAN-00017	00	1724001317-IN-MAN-00017	00	IOM1706864	00	INSTALLATION, OPERATING AND MAINTENANCE MANUAL -ULTRASONIC FLOWMETER	INS		A4	30-11-2025		A
					HANDLING, SHIPPING & SITE INSTALLATION								
18	1724001317-QC-PRO-00018	00	1724001317-QC-PRO-00018	00	PMR1706864	00	SHIPPING, HANDLING, STORAGE and PRESERVATION PROCEDURES-ULTRASONIC FLOWMETER	EXP		A4	30-11-2025		I

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Document number assigned by final Client
(2) Numero documento interno
Document number internal
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Document number assigned by Supplier
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(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)

SECTION 1.2
INSPECTION AND TEST PLAN
ULTRASONIC FLOWMETER
1724001317-QC-ITP-00002

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

INSPECTION AND TEST PLAN

TAG NO: 43-FT-001

Document Number: 1724001317-QC-ITP-00002

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Sign	Date
ROSETTI MARINO SpA Stefano Lingri Quality Control Dept.	20/12/2024

Document Class: 2

Rev.	Date	Description	Prepared	Reviewed	Approved
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INSPECTION AND TEST PLAN : FLOWMETER MANUFACTURE

Customer :	ROSETTI MARINO SPA	Supplier : Baker Hughes Company		Doc. No : ITP- 1706864	Rev. : B	Baker Hughes
P.O. No. :	1724001317 123A90A	Supplier Order No. :	0	Date Of Issue : 20/11/2024		

Para	Sr.No.	Description of Activity	Procedure / Acceptance Criteria	Verifying Document	Sub-Vendor	Baker Hughes	Customer	Third Party Inspector	Crosswind
BH Sensing Internal Tests [1]	1.1	Hydrostatic pressure test the T5/IMA assembly.	PS-219 Hydrostatic Testing of IMA and Transducers, 412.5PSIG hold for 10minutes	Pressure Test Report	-	W	R	R	W
	1.2	Positive Material Identification (PMI)	PS-613 PMI Procedure	PMI Report	-	W	R	R	R
	1.3	Function test the flowmeter and transducers on in-house flowloop.	PS-885 Factory Acceptance Test Procedure (1724001317-QC-PRO-00010)	Function Test Report	-	W	R	R	W
Final Inspection3	3.1	Final Inspection Inspection scope includes: - Visual Inspection - Function Test Report Review - Material Certification Review - Hydrotest Report (IMA71) - Sub-Supplier Manufacturing Test Reports - Cert of Conformance	As per PO requirements / Approved ITP (ITP-1706864)	Inspection Release Note	-	R	W	R	W
	3.2	Final Customer Visual inspection & Documentation Review (at single location)	As per PO requirements	Shipping Release Note	-	R	W	R	W
Final Documentation	4.1	Quality Control Manufacturing Dossier check	Approved Manufacturing Record Databook Index	Manufacturing Record Databook	-	R	R	R	R
Delivery	5.1	Pack goods for final delivery.	552-102 Packaging Specification (1724001317-QC-PRO-00018)	Packing List	-	P	R	R	R

NOTES:

[1] Testing will be carried out at Baker Hughes EMEA Facility in Shannon, Ireland

[2] Deleted

[3] Baker Hughes will provide test reports for review as specified in the ITP. Stamping of said reports, if required, is the responsibility of the customer inspector

KEY :P = Perform W = Witness Point H = Hold Point R = Certification Review V = Visual Inspection F = Final Inspection

Baker Hughes Confidential

SECTION 1.3
GENERAL ARRANGEMENT DRAWINGS
ULTRASONIC FLOWMETER
1724001317-IN-DA-00003

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

GENERAL ARRANGEMENT DRAWINGS

Document Number: 1724001317-IN-DA-00003

Document Class: 2

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Sign	Date
V. Barratta	25-10-2024

Rev.	Date	Description	Prepared	Reviewed	Approved
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00	19/08/2024	Issue for Review (IFR)	BH DC	Tom Griffin	Niall Townsend

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1. FLOWMETER (QTY: 1)

TYPE:	XGF868I
ENCLOSURE:	316SS
VOLTAGE:	12 - 28 VDC
POWER USAGE:	20W
IP RATING:	IP66
HAZ AREA:	EX dIIC T6 Gb
CERT NUMBER:	SIRA 17ATEX1304X
WEIGHT:	11 kg [24 lb] B

FINISH : AS PER MANUFACTURER STANDARD

2. FLOWMETER CABLE (QTY: 1 PAIR)

TYPE:	FLAME RETARDENT RG-62
ARMOUR:	SWA
LENGTH:	10 M
CONNECTION (METER):	3/4" NPT
CONNECTION (XDUCER):	3/4" NPT
GLAND MAT'L:	316SS
HAZ AREA :	Ex nR IIC Gc
CERT. NUMBER :	CML-19ATEX4109X
WEIGHT:	0.28 kg/m B

FINISH : N/A

3. PRE-AMPLIFIER (QTY: 2)

TYPE :	XAMP
ENCLOSURE :	316SS
IP RATING :	IP65/66
HAZ. AREA :	Ex d IIC T6 Gb
CERT NUMBER :	SIRA 20ATEX1001X
WEIGHT :	2 kg [4.4 lb] EA B

FINISH : AS PER MANUFACTURER STANDARD

4. TRANSDUCER (QTY: 2)

TYPE :	T5
MATERIAL :	TITANIUM
TEMP RANGE :	-55 to 150°C (-67 to 302°F) (NT)
HAZ. AREA :	Ex d IIC T6 Gb
CERT NUMBER :	SIRA 20ATEX1001X
MAT'L CERTS :	EN10204 3.1 & NACE MR-01-75
JUNCTION BOX:	316SS
IP RATING :	IP66
WEIGHT :	2 kg [4.4 lb] EA B

FINISH : AS PER MANUFACTURER STANDARD

5. INSERTION MECHANISM (QTY: 2)

TYPE:	IMA72
SIZE:	2" x 2"
RATING:	150#
MATERIAL	
PACKING GLAND :	316SS
BARREL HOLDER:	316 / 316L SS
HYDROTEST:	PER ASME B31.3
MAT'L CERTS:	EN10204 3.1 & NACE MR-01-75
WEIGHT:	12.7 kg [28 lb] EA B

FINISH : PAINTED PER SPEC: NORSOK M-501 SYSTEM 6A

6. ISOLATION VALVE (QTY: 2)

TYPE :	GATE VALVE
SIZE :	2", 150# RF
F/F LENGTH:	177.8MM (7")
MATERIAL	
BODY:	A351 CF8M
TRIM:	316SS
MAT'L CERTS:	EN10204 3.1 & NACE MR-01-75
WEIGHT:	18 kg [39.7 lb] EA B

FINISH : PAINTED PER SPEC: NORSOK M-501 SYSTEM 6A

7. FLOWCELL (QTY : 1)

FOR DETAILS OF THE FLOWCELL, PLEASE REFER TO THE FLOWCELL FABRICATION DRAWING, REF: 182M4103
WEIGHT : 98 kg [216 lb] B

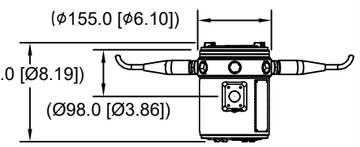
FINISH : PAINTED PER SPEC: NORSOK M-501 SYSTEM 6A

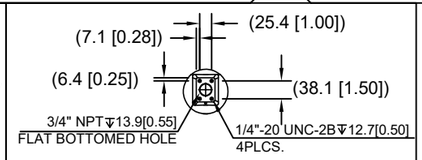
8. 2" PIPE MOUNTING BRACKET (QTY: 1)

MATERIAL : 316SS

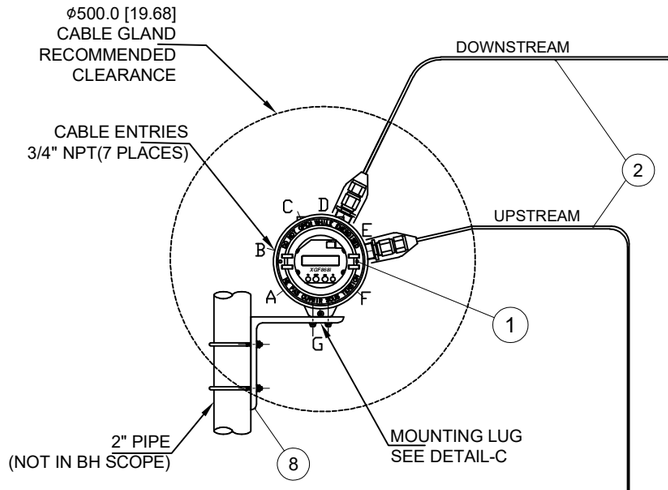
WEIGHT : 5 kg B

MISC ITEMS (NOT SHOWN)
-1x NAMEPLATE
-5x 3/4" x M20 ADAPTORS SS

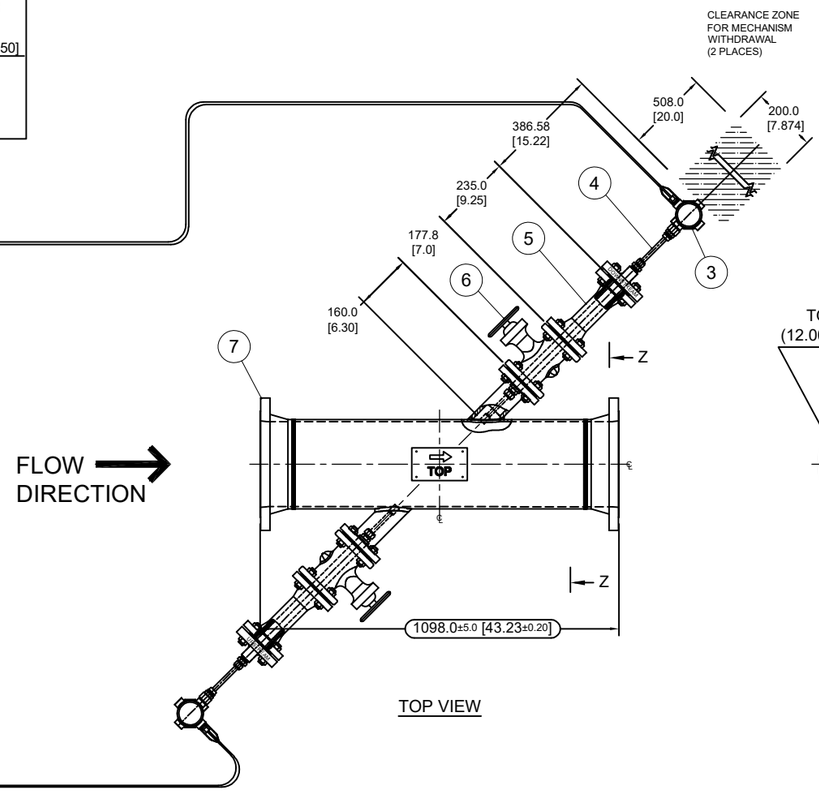




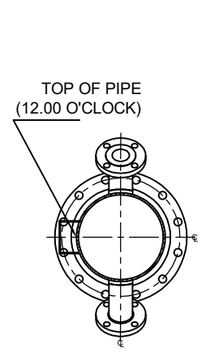
DETAIL-C
(FOR 2" PIPE MOUNTING)



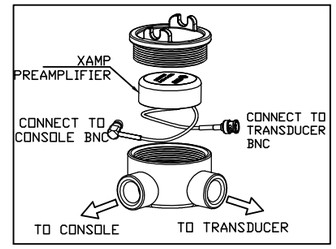
FRONT VIEW OF METER



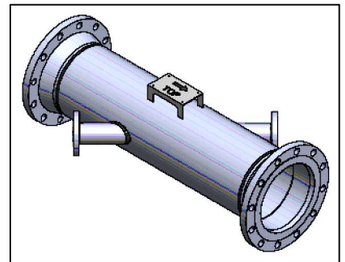
TOP VIEW



SECTION Z-Z



XAMP DETAIL

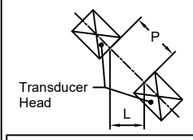


ISOMETRIC VIEW

NOTES:

1. EACH PAIR OF CABLES MUST BE CONTINUOUS IN LENGTH (NO JOINTS) AND EACH CABLE (WITHIN THE PAIR) MUST BE EQUAL IN LENGTH TO WITHIN 2.0 INCHS (50mm) OF EACH OTHER.
2. WHEN USING ARMOURED CABLE, ENSURE THAT THE ARMOURING OF THE COAXIAL CABLE AT THE INSTRUMENT ENCLOSURE END IS CONNECTED TO THE INSTRUMENT SUPPLY EARTH LINE.
3. USE ONLY Ex d CERTIFIED CABLE GLANDS / ADAPTORS PROVIDED.

WARNING
DO NOT REMOVE / REINSTALL TRANSDUCERS IF LINE PRESSURE EXCEEDS 5.5 BARG.



Path Length, P = 368.20mm[14.496"]
Axial Length, L = 260.32mm[10.248"]

Final P & L Values will be provided on Flowcell Nameplate

TAG NUMBER : 43-FT-001
PIPE SIZE : 10", 150#, SCH 20, RF
XDCR CONFIG : TILTED DIA, 1P/1T

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN "MM[INCHES]".

FLOWCELL INSTALLATION RECOMMENDATION

INSTALL FLOWCELL ON PIPELINE TO ENSURE A FULLY DEVELOPED FLOW PROFILE IS PRESENTED TO THE FLOWMETER. BAKER HUGHES RECOMMENDS A MINIMUM OF 20 DIAMETERS OF UNOBSTRUCTED STRAIGHT RUN OF PIPELINE EXIST UPSTREAM OF THE FLOWCELL LOCATION AND 10 DIAMETERS OF SAME DOWNSTREAM.

UP STREAM → FLOW → DOWN STREAM

Rev	Description of Changes	Drawn	Checked	Date
B	Issued for Approval	TG	TG	14/10/24
A	Issued for Approval	TG	TG	19/09/24
-	Issued for Approval	SG	TG	12/07/24

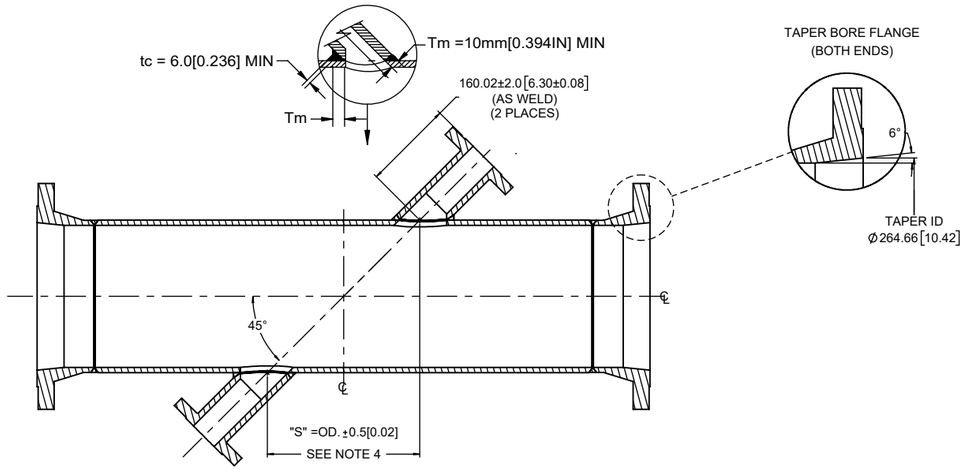
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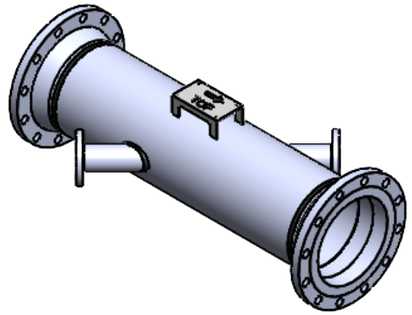
TITLE: GENERAL ARRANGEMENT FOR XGF868i FLOWMETER C/W T5 TRANSDUCERS

SCALE	NTS	DO NOT SCALE DRAWING	SHEET	1 OF 1
SIZE	A3	DRAWING NUMBER SK18028 / 1706864	REV	B

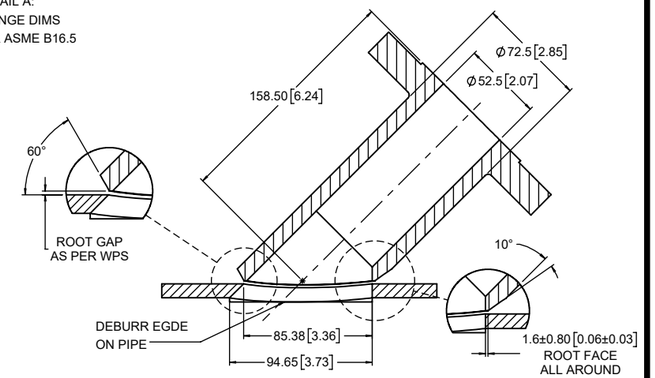
PIPE (PER ASME B36.19) :	FLOW METER NOZZLE (FORGED MATERIAL) :	PROCESS FLANGE (PER ASME B16.5) :	TAG PLATE BRACKET :
SIZE:10 IN, SCH40S, (SEAMLESS) MATERIAL: A312 Gr. TP316/316L	SIZE: 2 IN,150#, RF MATERIAL: A182 Gr. F316/316L REF DETAIL: A QTY: 2	SIZE: 10 IN, 150#, WN, RF, TAPER BORE TO MATCH PIPE SCH 10S MATERIAL: A182 Gr. F316/316L REF DETAIL: B QTY: 2	SIZE: DIMENSION AS PER "DETAIL C" MATERIAL: ASTM A240 316/316L REF DETAIL: C QTY: 1
	WPS: A CP NDE: 100% VISUAL 100% LPI (CAP & ROOT) 100% RT G A1 A2 (2 WELDS)	WPS: B NDE: 100% VISUAL CP 100% LPI (CAP & ROOT) 100% RT G B1 B2 (2 WELDS)	WPS: C NDE: 100% VISUAL 100% LPI (CAP) 3 C1 (4 WELDS)

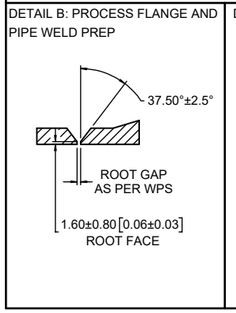


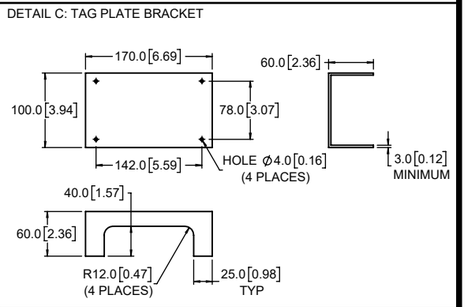
SECTION B-B

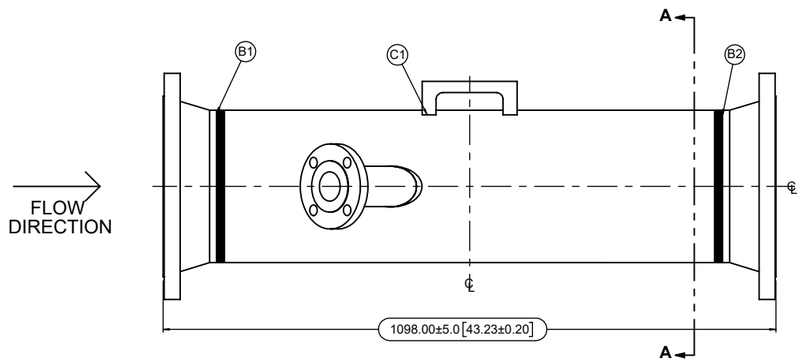


ISOMETRIC VIEW

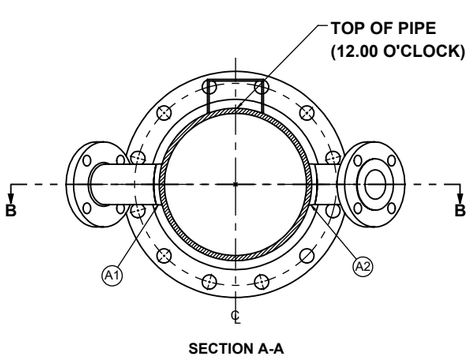








FRONT VIEW



SECTION A-A

NOTES:

1. DESIGN, FABRICATION AND WELDING TO BE IN ACCORDANCE WITH: ASME B31.12, HYDROGEN SERVICE AND ASME IX (LATEST EDITIONS).
   FLOWCELL TO BE COMPLIANT WITH PED 2014/68/EU: CATEGORY III
   EQUIPMENT TYPE - PIPING. FLUID STATE : GAS. FLUID GROUP : 1
   FLOWCELL TO COMPLY WITH THE FOLLOWING SPECIFICATIONS:
   1) 123A90-DDL-PP-SP-70000 (PIPING CLASSES).
   2) 123A90-DDL-MAT-SP-60006 (PAINT SPEC).
   3) PMI SPECIFICATION DOCUMENT NUMBER 183M5247
2. ALL WETTED PARTS TO COMPLY WITH THE MATERIAL TRACEABILITY AND CERTIFICATION REQUIREMENTS OF EN10204 3.1 AND NACE MR-01-75/ISO 15156 (LATEST EDITION). MATERIAL TEST REPORTS (MTR) ARE REQUIRED FOR ALL MATERIAL INCLUDING WELD CONSUMABLE MATERIAL & NON-WETTED ATTACHMENT MATERIALS (SUCH AS TAG BRACKET AND OTHER SUCH COMPONENTS).
3. DEFECTIVE PIPE MATERIAL WITH SURFACE IMPERFECTIONS ON THE OUTSIDE AND/OR INSIDE DIAMETER THAT PENETRATE MORE THAN 12.5% OF THE NOMINAL WALL THICKNESS OR ENCROACH ON THE MINIMUM WALL THICKNESS IS NOT ACCEPTABLE.
4. MEASURE THE PIPE O.D. AT FOUR CIRCUMFERENTIAL LOCATIONS APPROXIMATELY 45° APART, BETWEEN UPSTREAM AND DOWNSTREAM NOZZLES, AND TAKE THE AVERAGE O.D. RECORD THIS AVERAGE O.D. IN THE DATABOOK AS A PRE-FABRICATION DIMENSION. TOLERANCE ON NOZZLE POSITIONING : +/-0.5mm FOR MARKOUT AND +/-6.4mm AFTER WELDING.
5. STAMPINGS/MARKINGS ON FLOWCELL FLANGE/PIPE MUST MEET DOCUMENT 552-001 REQUIREMENTS.
6. ALL FLANGES/NOZZLES TO BE MOUNTED WITH BOLT HOLES STRADDLING THE CENTER LINES.
7. THE RAISED FACE OF EACH PROCESS FLANGE AT EITHER END OF THE FLOWCELL MUST BE ALIGNED TO THE DESIGN PLANE WITHIN 1MM/200MM (AS PER TEMA 9TH. EDITION), MEASURED ACROSS ANY OF THE RAISED FACE OUTSIDE DIAMETERS. THE DESIGN PLANE IS DEFINED AS A PLANE WHICH IS PERPENDICULAR TO THE LINE PASSING THROUGH THE PROCESS FLANGE CENTRES AT THE RF ENDS (REF DOC 552-009).
8. DE-BURR ALL SHARP EDGES.
9. GRIND ALL WELD ROOTS FLUSH WITH PIPE/FITTING I.D. GRINDING APPARATUS/PROCESS SHOULD NOT CONTAMINATE BASE METAL. NDE TO BE CARRIED OUT AFTER GRINDING ACTIVITIES AS PER COMPONENT INFORMATION PANELS ABOVE.
10. PICKLING AND PASSIVATING FLOWCELL AFTER COMPLETION OF FABRICATION.
11. HYDROSTATIC PRESSURE TEST TO BE PERFORMED AS PER PROCEDURE 552-010, FOR AT LEAST 10 MINUTES. REFER TO TABLE FOR HYDRO TEST PRESSURE.
12. EXTERIOR COATING SYSTEM: OUTSIDE SURFACES OF FLOWCELL SHALL BE PAINTED PER SPEC:
    PAINT SYSTEM: COATING AS PER NORSOK M 501 COATING SYSTEM 6A (PRIMER - PENGUARD, MID COAT - PENGUARD UNIVERSAL, TOP COAT - HARDTOP OPTIMA FROM JOTUN)
    TOP COAT COLOUR : DARK GREY
13. INTERIOR COATING SYSTEM: NONE.
14. FLOW ARROW AND "TOP OF PIPE" TO BE ON 316SS NAMEPLATE, FIXED TO TAG PLATE BRACKET USING 316SS RIVETS.
15. FIT FLANGE PROTECTORS PRIOR TO SHIPPING WHICH SHALL BE EASILY REMOVABLE. ALL FLANGE PROTECTORS TO HAVE A LABEL WITH WORDING "DO NOT CUT FLANGE PROTECTOR WITH A SHARP OBJECT DURING ITS REMOVAL".
16. PROVIDE DIMENSIONAL INSPECTION OF CTO's REPORT AS PER REF. DOC. 552-105.
17. FLOWCELL TO BE PREPARED FOR INSTALLATION PROVIDED TO BH SENSING AS PER DOCUMENT 552-003.
18. ALL MATERIALS TO BE TRACEABLE TO HEAT.
19. FULL COMPLIANCE TO ASME B31.12

NOZZLE ALIGNMENT OPTIONS	
"NOZZLES TO BE ALIGNED AT 45° +/- 1° TO THE PIPE AXIS."	
ANY EXTERNAL FORCES AND MOMENTS AT ALL CONNECTIONS ARE CONSIDERED AS ZERO.	
TAG NUMBER	43-FT-001
DESIGN PRESSURE @ HT	0.35 MPa (G) A
DESIGN PRESSURE @ LT	0.35 MPa (G) A
DESIGN TEMPERATURE	0°C TO 80°C
CORROSION ALLOWANCE	0.00
HYDRO-TEST PRESSURE	0.53 MPa(G) +0.1 MPa(G) -0.0 MPa(G) A
PIPING CLASS	01HSS
WEIGHT (APPROX.)	98 kg A
CPO (PARENT / CHILD)	2721420/600
S.O. NUMBER	1706864
COUNTRY OF INSTALLATION	HOLLAND

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN mm[INCHES].
TOLERANCES ARE:

METRIC (mm)	US CUSTOMARY (INCHES)	TOLERANCE (mm/INCHES)
.XX	.XXX	0.13/0.005
.X	.XX	0.3/0.01

ANGLES ± 1°
FRACTIONS ± 0.8 [1/32"] SURFACE FINISH : 3.2 [125]

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REV	DESCRIPTIONS	DWN	CKD	APVD
B	ISSUED FOR APPROVAL	TG 15/10/24	TG 15/10/24	TG 15/10/24
A	ISSUED FOR APPROVAL	TG 19/09/24	TG 19/09/24	TG 19/09/24
-	ISSUED FOR APPROVAL	SG 17/07/24	TG 12/07/24	TG 12/07/24

REVISIONS

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TITLE
FABRICATION FLOWCELL 10 IN, SCH40S, 150#, SS TILTED DIA, 1P, 1T

ECM	UPDATED
500000541127	15/10/2024

SIZE	DRAWING NUMBER	REV	VERSION
B	182M4103	B	02

GENERATED USING SOLIDWORKS	DRAWING NOT TO SCALE	SHEET 1 OF 1

SECTION 1.4
WIRING DIAGRAMS
ULTRASONIC FLOWMETER
1724001317-IN-DG-00004

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

WIRING DIAGRAMS

Document Number: 1724001317-IN-DG-00004

Document Class: 2

ROSETTI MARINO

1	NO COMMENTS - APPROVED - WORK MAY PROCEED
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Sign	Date
V. Barratta	25-10-2024

Rev.	Date	Description	Prepared	Reviewed	Approved
01	15/10/2024	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
00	19/08/2024	Issue for Review (IFR)	BH DC	Tom Griffin	Niall Townsend

BakerHughes

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File: 1724001317-IN-DG-00004_01_WIRING DIAGRAMS - ULTRASONIC FLOWMETER.xlsx

Table of Contents

SH.	DESCRIPTION	REVISIONS							
		00	01						
1	Cover	X	X						
2	Table of Contents	X	X						
3	Revision / Change Log / Hold List	X	X						
4	WIRING DIAGRAMS - ULTRASONIC FLOWMETER	X	X						

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Revision / Change Log

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

HOLDS LIST

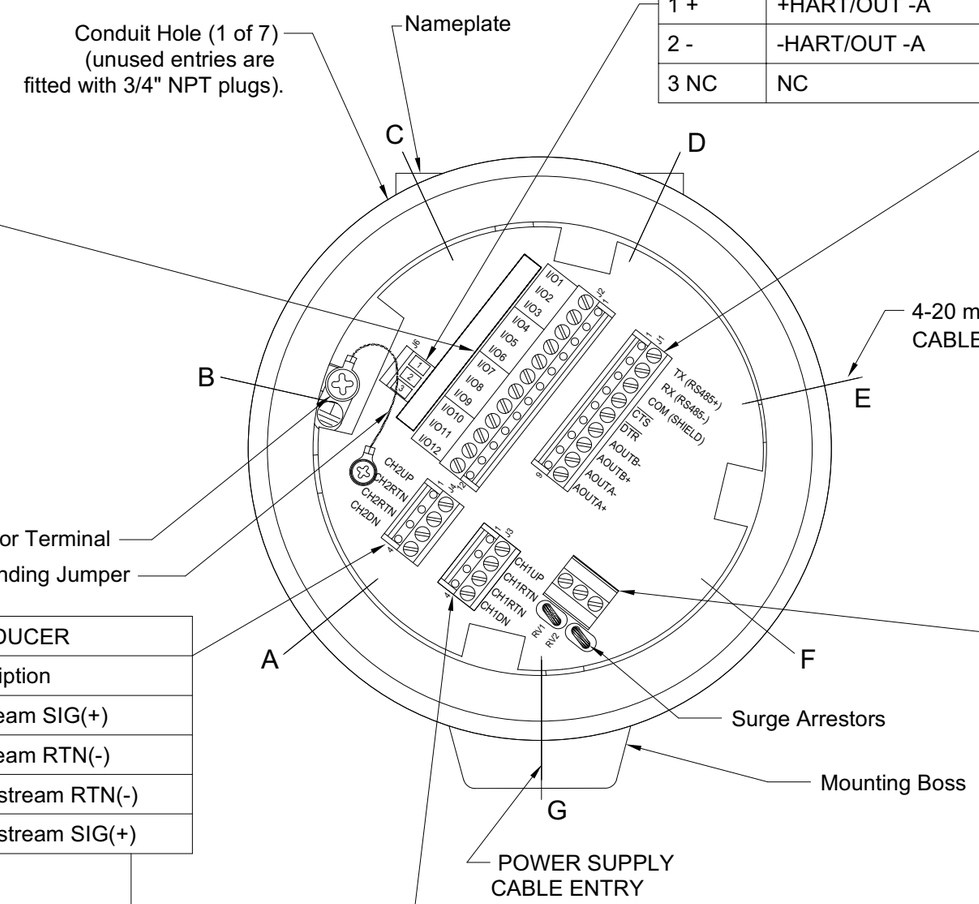
No.	Description
1.	
2.	
3.	
4.	

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INPUT/OUTPUT CONNECTIONS	
Pin No.	Description
1 I/O1	NC
2 I/O2	NC
3 I/O3	NC
4 I/O4	NC
5 I/O5	NC
6 I/O6	NC
7 I/O7	OUT C +24V
8 I/O8	INPUT C - +
9 I/O9	INPUT C - RTN
10 I/O10	OUT D +24V
11 I/O11	INPUT D - +
12 I/O12	INPUT D - RTN

HART	
Pin No.	Description
1 +	+HART/OUT -A
2 -	-HART/OUT -A
3 NC	NC

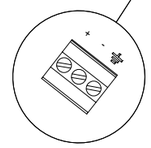
RS232 / 4-20 OUTPUT		
Pin #	Designation	Description
1	TX(RS485+)	Transmit / +
2	RX(RS485-)	Receive / -
3	COM (SHLD)	Ground
4	$\overline{CTS}$	Clear To Send
5	$\overline{DTR}$	Data Terminal Ready
6	AOUT B-	4-20 Output 2 RTN(-)
7	AOUT B+	4-20 Output 2 SIG(+)
8	AOUT A-	4-20 Output 1 RTN(-)
9	AOUT A+	4-20 Output 1 SIG(+)

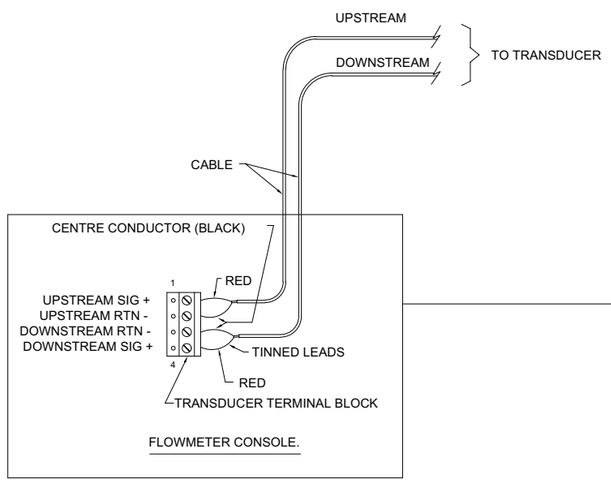


CH2 TRANSDUCER	
Pin No.	Description
1 CH2UP	Upstream SIG(+)
2 CH2RTN	Upstream RTN(-)
3 CH2RTN	Downstream RTN(-)
4 CH2DN	Downstream SIG(+)

CH1 TRANSDUCER	
Pin No.	Description
1 CH1UP	Upstream SIG(+)
2 CH1RTN	Upstream RTN(-)
3 CH1RTN	Downstream RTN(-)
4 CH1DN	Downstream SIG(+)

DC POWER INPUT	
12 TO 28 VDC	
Pin #	Description
1 +	LINE POSITIVE
2 -	LINE NEGATIVE
3 ⏚	NO CONNECTION





TRANSDUCER CONNECTION DETAIL

NOTE: Unit shown from rear with rear cover removed.

TAG No's :
43-FT-001

NOTES:
1. POWER SUPPLY SURGE PROTECTION IS IN-BUILT ON THE POWER SUPPLY BOARD.
2. TROPICALIZATION OF ELECTRONICS.

XGF868I-2-2-OI-H7-3-4-0-CC

-	Issued for Approval	SG	TG	12/07/24
Rev	Description of Changes	Checked	Approved	Date

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TITLE
INTERCONNECTION DIAGRAM FOR XGF868i FLOWMETER TWO CHANNEL

SCALE		SHEET	OF
NTS	DO NOT SCALE DRAWING	1	1
SIZE A3	DRAWING NUMBER SK18027 / 1706864	REV -	

SECTION 1.5
ULTRASONIC FLOWMETER SIZING CALCULATION - ULTRASONIC FLOWMETER 1724001317-IN-CA-00005

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

ULTRASONIC FLOWMETER SIZING CALCULATION

Document Number: 1724001317-IN-CA-00005

Document Class: 2

ROSETTI MARINO

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Sign	Date
V. Barratta	11-03-2025

04	25/02/2025	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
03	16/01/2025	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
02	04/12/2024	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
01	15/10/2024	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
00	28/08/2024	Issue for Review (IFR)	BH DC	Tom Griffin	Niall Townsend
Rev.	Date	Description	Prepared	Reviewed	Approved

Baker Hughes

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Table of Contents

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1	Cover	X	X	X	X	X			
2	Table of Contents	X	X	X	X	X			
3	Revision / Change Log / Hold List	X	X	X	X	X			
4	ULTRASONIC FLOWMETER SIZING CALCULATION - ULTRASONIC FLOWMETER	X	X	X	X	X			

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Revision / Change Log

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

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No.	Description
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G-FAST RESULTS SUMMARY

Flowmeter Application Calculator and Test System® Ver. 2.73, Dec-6-2023

Customer Name: ROSSETTI MARINO
CPO#: 2721420
Tag Number: 43-FT-001

Pipe Data

Pipe Material:	316 Stainless Steel	
Pipe Size:	10	in
Pipe Schedule:	10S	
Outer Diameter:	10.75	in
Inner Diameter:	10.42	in
Wall thickness:	0.165	in
Interal Area:	0.59219	ft²

Fluid Data

Fluid Name/Type: Gas Composition Tab 100%H2

Variables	Min	Nom	Max	Units
Provided Flowrate	153.00	1,067.00	2,381.50	kg/Hour
Velocity	6.43	44.80	100.00	m/s
Temperature	25.00	25.00	25.00	°C
Pressure	40	40	40	kPa
Density	0.120	0.120	0.120	kg/m³
Sound Speed	1314.8	1314.8	1314.8	m/s
Reynold's No.	23,059	160,787	358,874	

Base Temperature	15.6	°C
Base Pressure	101	kPa
Barometric Pressure	101	kPa
Molecular Weight	2.02	
Max Allowed Vel.	100	m/s

Configuration Data

Transducer Configuration:	Custom, Diameter (45°)
Traverses/Paths:	1 Traverse , 1 Path
Transducer Material:	316SS
PREAMP GAIN:	40

minimun measurable 0.75 kg/h / 0.03 m/s
estimated accuracy 155%

Repeatability Results (% of Reading)

Accuracy/repeatability calculated is based on velocity

	Temperature		
Flow Rate:	Min	Nom	Max
Min	0.76%		
Nom		0.75%	
Max			0.75%

Calculations evaluated at **specified** conditions:

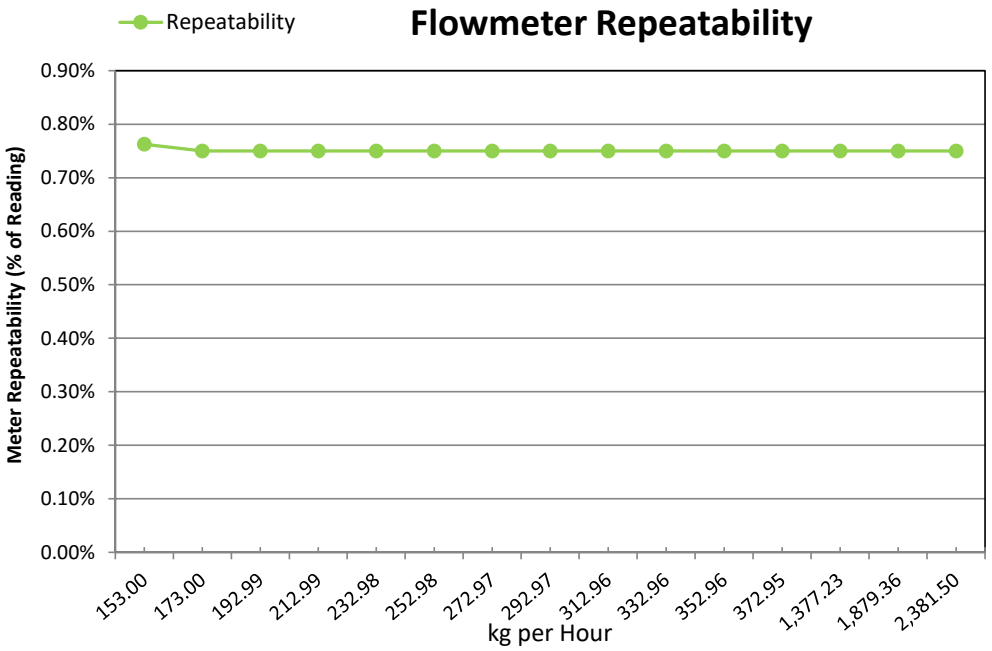
Min Flow @ Min Temp, Min Pressure, and Min Density (if applicable)
Max Flow @ Max Temp, Max Pressure, and Max Density (if applicable)

Calibrated Accuracy Results (% of Reading)

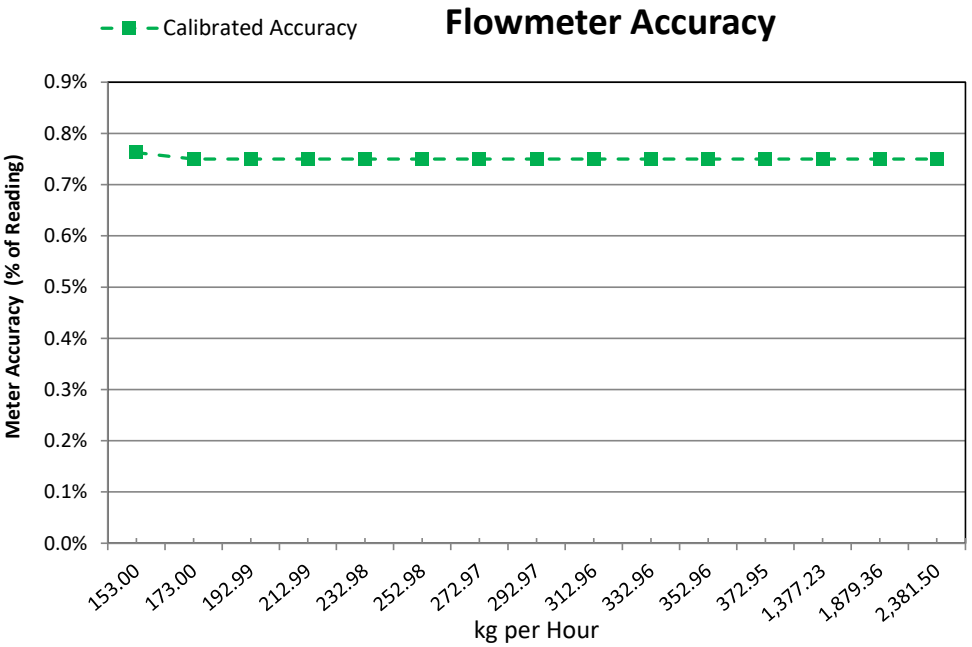
	Temperature		
Flow Rate:	Min	Nom	Max
Min	0.76%		
Nom		0.75%	
Max			0.75%

Calculations evaluated at **specified** conditions:

Min Flow @ Min Temp, Min Pressure, and Min Density (if applicable)
Max Flow @ Max Temp, Max Pressure, and Max Density (if applicable)



kg / Hour	Repeat-ability
153	0.8%
173	0.8%
193	0.8%
213	0.8%
233	0.8%
253	0.8%
273	0.8%
293	0.8%
313	0.8%
333	0.8%
353	0.8%
373	0.8%
1,377	0.8%
1,879	0.8%
2,382	0.8%



kg / Hour	Calibrated Accuracy
153	0.8%
173	0.8%
193	0.8%
213	0.8%
233	0.8%
253	0.8%
273	0.8%
293	0.8%
313	0.8%
333	0.8%
353	0.8%
373	0.8%
1,377	0.8%
1,879	0.8%
2,382	0.8%

SECTION 1.6
DATA SHEET
ULTRASONIC FLOWMETER
1724001317-IN-DS-00006

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

DATA SHEET - ULTRASONIC FLOWMETER

Document Number: 1724001317-IN-DS-00006

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
V. Barratta	23-01-2025

02	16/01/2025	Issue for Information (IFI)	BH DC	Tom Griffin	Niall Townsend
01	08/11/2024	Issue for Information (IFI)	BH DC	Tom Griffin	Niall Townsend
00	08/10/2024	Issue for Information (IFI)	BH DC	Tom Griffin	Niall Townsend
Rev.	Date	Description	Prepared	Reviewed	Approved

Baker Hughes

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Table of Contents

SH.	DESCRIPTION	REVISIONS							
		00	01	02					
1	Cover	X	X	X					
2	Table of Contents	X	X	X					
3	Revision / Change Log / Hold List	X	X	X					
4	DATA SHEET - ULTRASONIC FLOWMETER	X	X	X					

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Revision / Change Log

Rev.	Description
00	Issue for Information (IFI)
01	Issue for Information (IFI)
02	Issue for Information (IFI)

HOLDS LIST

No.	Description
1.	
2.	
3.	
4.	

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ULTRSONIC FLOWMETER APPLICATION DATA SHEET
Rev B

1	Tag Number	43-FT-001			
2	P&ID Number	123A901-DDL-PR-PID-80029			
3	Service	HDROGEN FROM KO DRUM TO HYDROGEN VENT (Q-43004)			
4	Line Size/Schedule	10"/Sch 10			
5	Line Material	ASTM 316/316L			
6	Flowcell	A312 Gr TP316/316L, Sch 40 (pipe), taper bored to Sch 10, A182 Gr F316/316L (flanges)			
7	Pre-amplifer	Xamp, 316SS enclosure, IP65/66			
8	IVA	2" 150# Gate valve, Body A351 CF8M, Trim 316SS			
9	Fluid / Phase	Gas/Single			
7		**MIN**	**NORMAL**	**MAX**	**UNIT**
8	Operating Flow Rate	690	1067	3095	kg/hr
9	Operating Pressure	0	50	50	kPa
10	Operating Temperature	-8.4	10.5	25	°C
11	Viscosity	0.01	0.01	0.01	cP
12	Density	0.11	0.11	0.11	kg/m³
13	Power Supply	12-28 VDC			
14	Measurement Mode	Transit Time			
15	Meter Range	bi-directional -100 to 100 m/s			
16	Accuracy	± 0.8% full scale			
17	Input/Output Signals	2x 4-20mA ip, 2x 4-20mA op			
18	Hazardous Protection	Exd IIG/C T6			
19	Ingress Protection	IP66			
20	Housing Material	Stainless Steel			
21	Mounting	Remote (c/w 2" pipe mount bracket)			
22	Flowmeter cable Length	10m			
23	Transducer Type	T5MAXS			
24	No of Paths/Traverse	1x Path/ 1x Traverse			
25	Transducer Material	316SS			
26	Insertion/retraction Type	IMA72			
27	Size/Rating	2" 150#			
28	Material Of Construction	316/316LSS			
29	Connection	Flange			
30	Clamping Fixture	Bolt on			
31	Material Of Construction	316SS			
32	Manufacturer	Baker Hughes			
33	Meter Model No.	XGF868i-2-2-OI-H7-3-4-0-CC			
34	Accessories	-1 x NAMEPLATE - 5 x REDUCER STAINLESS STEEL, 3/4" NPT X M20			

Baker Hughes Confidential

SECTION 1.7
PAINTING PROCEDURE
ULTRASONIC FLOWMETER
1724001317-MAT-PRO-00007

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

PAINTING PROCEDURE - ULTRASONIC FLOWMETER

Document Number: 1724001317-MAT-PRO-00007

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
Michele Sacchi	14-02-2025

Rev.	Date	Description	Prepared	Reviewed	Approved
02	28/01/2025	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
01	13/12/2024	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
00	08/11/2024	Issue for Review (IFR)	BH DC	Tom Griffin	Niall Townsend

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3	Revision / Change Log / Hold List	X	X	X					
4	PAINTING PROCEDURE - ULTRASONIC FLOWMETER	X	X	X					

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Revision / Change Log

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

HOLDS LIST

No.	Description
1.	
2.	
3.	
4.	

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F . Allen & Son, **Coating Specialist**

UNIT 13
CHILLINGTON FIELDS
WOLVERHAMPTON
WEST MIDLANDS
WV1 2BY
PHONE : 01902 351190
FAX : 01902 871491
EMAIL : markallen20001@outlook.com

PROCEDURE FOR GRITBLASTING & PAINTING STAINLESS STEEL
CUSTOMER : A . C . VALVES LTD
PURCHASE ORDER No. : SAC0002677 (2 OFF VALVES)
COATING SPECIFICATION : NORSOK M-501 PRE-QUALIFIED SYSTEM 6A

Painting Procedure for Painting System 6A (Piping with Fluids <120°C)

1**. SCOPE**

The client's specification or purchase order instructions shall rule in any case where there is conflict between it and this procedure.

2. STANDARDS (All standards used for this order are current and up to date)

The following standards include provisions and guidelines which, through reference in this procedure, constitute provisions and guidelines in accordance with NORSOK M-501 PRE-QUALIFIED SYSTEM 6A

ISO 8501-1: 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.

ISO 8502-6: 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 8502-3: Preparation of steel substrate before application of paint and related products - Tests for the assessment of surface cleanliness - Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method).

ISO 8503-1: Preparation of steel substrate before application of paint and related products - Tests for the assessment of surface cleanliness - Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces.

ISO 19840: Paints and varnishes – Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces.

ISO 4624: Paints and varnishes - Pull-off test for adhesion.

SSPC-SP 1: Solvent Cleaning

ASTM 4285: Standard Test Method for Indicating Oil or Water in Compressed Air.

3. SURFACE PREPARATION

For adhesion testing purposes, one test panel / batch will accompany the part(s) through the below procedure.

NOTE: CUSTOMER SHALL SUPPLY TEST PANEL OF SAME BASE MATERIAL AS COMPONENT BEING PROCESSED FOR THE PURPOSES OF ADHESION TESTING. IF A TEST PANEL IS NOT SUPPLIED BY CUSTOMER, F . Allen & Son WILL UTILIZE THEIR STANDARD IN-HOUSE CARBON STEEL TEST PANEL *(100mm x 100mm x 5mm)*

3.1 Parts shall be visually checked for sharp edges, weld spatter, slivers, rust grade, etc as per ISO 8501-3 Grade 2
Anything which may appear to be unacceptable shall be reported to the Customer.

3.2 If present, heavy deposits of oil, grease, dirt etc shall be removed by solvent cleaning in accordance with SSPC-SP1.

3.3 Surface not to be coated shall be masked with a suitable material prior to abrasive blast cleaning.

3.4 Environmental conditions shall be taken and recorded. Blasting shall only take place if relative humidity is below 85%, steel temperature is more than 3°C above dew point and ambient temperatures above 5°C.

3.5 Compressed air shall be checked for oil, moisture or other contamination using the 'blotter test' as per ASTM D4285. Compressed air shall be dry and clean before processing.

3.6 Parts shall be blast cleaned before coating using aluminium oxide grit. Blast abrasives shall be dry, clean and free from contaminants that would be detrimental to the performance of the system. All coating surfaces of stainless-steel substrates shall be Sweep blasted finish with a roughness of Fine G. This is in accordance with ISO 8503-2.

3.7 Component will be blown clean using clean, dry filtered compressed air, to remove any residual abrasive blast material.

3.8 Surface impurities shall be measured using the Bresle sample method (ISO 8502-6) with the maximum concentration being 20mg/m_2 NaCl (ISO 8502-9).

3.9 The surface profile shall be measured and recorded using Testex Replica tape.

3.10 Transparent adhesion sensitive tape will be used to test the blast cleaned surface for dust prior to paint application. This will be in accordance with ISO 8502-3 and shall not exceed a dust quality and size rating of 2.

3.11 Between the blasting and coating processes, the parts will be protected and not touched with bare hands. Paint shall be applied within 4 hours of blasting. Coating surface which exhibits rust, oxidation, or discolouration shall be re-blasted prior to coating application and retested.

4. APPLICATION PRIMER.

Product: SIGMACOVER 280 (GREENISH/YELLOW)

4.1 Environmental conditions shall be taken and recorded. Painting shall only take place if relative humidity is below 85%, steel temperature is more than 3°C above dew point and substrate temperature is between 5-40°C.

4.2 Stripe coating is permissible in areas that are difficult to reach with a spray gun. Batch number of paint used to be recorded.

4.3 Paint will be spray applied uniformly over areas to be coated using a conventional spray gun. Skips, runs, sags or drips to be eliminated. Wet Film thickness shall be determined and recorded and should be such that a nominal dry film thickness of 50µm is achieved. Batch Numbers of paint used to be recorded.

4.4 The minimum over coating time(s) stated in the manufacturers technical data sheet must be observed prior to proceeding to next coat.

5. APPLICATION MIDCOAT
Product: SIGMACOVER 410 (MIO)

5.1 Previous coating to be inspected to ensure coating is free from surface defects to the application of the subsequent paint system. Surface defects to be repaired and cured as per specification requirements. Dry Film thickness to be determined and recorded to ensure compliance with customer requirements.

5.2 Environmental conditions shall be taken and recorded. Painting shall only take place if relative humidity is below 85%, steel temperature is more than 3°C above dew point and substrate temperature is between 5-40°C.

5.3 Stripe coating is permissible in areas that are difficult to reach with a spray gun. Batch number of paint used to be recorded.

5.4 Paint will be spray applied uniformly over areas to be coated using a conventional spray gun. Skips, runs, sags or drips to be eliminated. Wet Film thickness shall be determined and recorded and should be such that a nominal dry film thickness of 100µm is achieved. Batch Numbers of paint used to be recorded.

5.5 The minimum over coating time(s) stated in the manufacturers technical data sheet must be observed prior to proceeding to next coat.

6. APPLICATION TOPCOAT
Product: SIGMADUR 550 (RAL 9002)

6.1 Previous coating to be inspected to ensure coating is free from surface defects to the application of the subsequent paint system. Surface defects to be repaired and cured as per specification requirements. Dry Film thickness to be determined and recorded to ensure compliance with customer requirements.

6.2 Environmental conditions shall be taken and recorded. Painting shall only take place if relative humidity is below 85%, steel temperature is more than 3°C above dew point and substrate temperature is between 5-40°C.

6.3 Stripe coating is permissible in areas that are difficult to reach with a spray gun. Batch numbers and BS 4800 number of paints used to be recorded.

6.4 Paint will be spray applied uniformly over areas to be coated using a using a conventional spray gun. Skips, runs, sags or drips to be eliminated. Wet Film thickness should be determined and recorded and should be such that a nominal dry film thickness of 75µm is achieved. Batch Numbers of paint used to be recorded.

6.5 The minimum curing time(s) stated in the manufacturer's technical data sheet must be observed and adhered to.

7. FINAL INSPECTION

7.1 Topcoat to be visually inspected to ensure coating is free from runs, sags, inclusions, pinholes, blisters, holidays etc. Surface defects shall be repaired and cured as per manufacturer's recommendations.

7.2 Wet sponge holiday testing (67½V) shall be performed on coated surface area to ensure a "holiday free" coating condition. If a holiday is detected, the non-conforming area will be isolated and locally repaired.

7.3 Paint thickness shall be determined, using the Elcometer 345, and recorded. Thickness measurement will be performed in compliance with ISO 19840 methodology and shall be a nominal of 225µm. The minimum, maximum and average results shall be recorded.

7.4 Unless otherwise requested by the Customer, the adhesion test will be performed on the accompanying test panel using an Elcometer SG 2014 to ISO 4624 procedure. Three dollies shall be attached, all adhesion tests shall meet a minimum value of 5MPa with an average of 7MPa or better. Failure mechanism shall be dolly-glue cohesive failure, cohesive failure within the coating or intercoat failure and not adhesive failure at the substrate.

8. PACKAGING AND CERTIFICATE OF CONFORMITY

8.1 All parts are to be rewrapped or otherwise protected from damage after inspection and before shipping. The minimum packaging requirements shall be as per original customer delivery.

8.2 A certificate of conformity and coating report shall be supplied after completion.

9. HEALTH AND SAFETY

The appropriate PPE shall be supplied by F. ALLEN & SON to the operator(s) performing this procedure, for instance protective clothing, protective shoes, safety glasses and filter mask.

10. REPAIR PROCEDURE

Repairs shall be performed in accordance with Manufacturers specifications

11. QUALIFICATION OF PERSONNEL

Inspection shall be performed by Mark Allen or Mike Norman NACE Level III

Appendix A: Table 1: Inspection and Testing (for reference) **No.**	**Type**	**Method**	**Frequency**	**Acceptance Criteria**	**Consequence**
1.	**Environmental Conditions**	Ambient and steel temperature. RH%, dew point.	Before start of each shift. Minimum twice per shift.	RH% <85%, Temperature >3°C above the dew point.	No blasting or coating.
2.	**Visual Examination**	Visual for sharp edges, weld splatter, slivers, rust grade etc.	100% of all surfaces.	No defects.	Defects to be repaired.
3.	**Cleanliness**	a) ISO 8501-1 b) ISO 8502-3	a) 100% visual of all surfaces. b) Spot checks *See note 1*	a) Sa2½ b) Maximum quantity and size rating 2.	a) Reblast b) Reclean and retesting until acceptable.
4.	**Salt Test**	ISO 8502-6, ISO 8502-9	One component per batch processed	< 20mg/m_2 NaCl.	Reclean and retesting until acceptable.
5.	**Roughness**	Testex Tape (NACE RP0287)	Each component or once per 10m_2	50-75µm	Reblasting
6.	**Visual examination**	Visual examination to determine curing, contamination, solvent retention, pinholes/popping, sagging, surface defects.	100% of each surface after each coat.	No defects.	Repair of defects.
7.	**Thickness**	ISO 19840	Each component	nom. 225µm	Repair, additional coats or recoating as appropriate.
8.	**Adhesion**	ISO 4624 using equipment with a hydraulic pulling force and carried out when system is fully cured.	One test panel per batch.	Min. 5MPa Ave > 7MPa Cohesive failures only.	Recoating.

F . Allen & Son Coating specialist

CERTIFICATE FOR GRITBLASTING & PAINTING STAINLESS STEEL

SHOT BLAST EQUIPMENT :	HODGE CLEMCO (96086A)
ABRASIVE SUPPLIER :	HODGE CLEMCO
ABRASIVE TYPE :	ALUMINIUM OXIDE
STANDARD OF BLASTING :	SA 2.5
SURFACE PROFILE REQUIRED :	50-75 MICRONS
SURFACE PROFILE ACHIEVED :	50 MICRONS

SURFACE COATING DETAILS

METHOD OF APPLICATION :	CONVENTIONAL
PAINT SUPPLIER :	PPG
PRIMER COAT :	SIGMACOVER 280
SEALER COAT :	N/A
INTERMEDIATE COAT :	SIGMACOVER 410
INTERMEDIATE COAT :	N/A
TOP COAT :	SIGMADUR 550
TOTAL MIN D.F.T :	225 MICRONS
FINISH COLOUR :	RAL 9002

DATES & TIMES

	BLAST/PRIME	SEALER	INTERMEDIATE	INTERMEDIATE	TOP COAT
DATE:	18/11/2024	N/A	19/11/2024	N/A	20/11/2024
START TIME:	8.00	N/A	8.00	N/A	8.00
FINISH TIME:	10.45	N/A	9.15	N/A	9.05

ENVIROMENTAL CONDITIONS

AIR TEMP °C DRY BULB	18/18/19/18	18/19/19/18	18/18/19/18	18/19/19/18
AIR TEMP °C WET BULB	17	16	17	16
HUMIDITY %	53	53	53	53
DEW POINT °C	8	9	8	9
STEEL TEMP °C	14	14	14	14
DATE	18/11/2024	19/11/2024	20/11/2024	21/11/2024

PAINT AND BATCH NUMBERS

	PAINT ID	BASE	CATALYST	COLOUR	EXPIRY DATE
PRIMER COAT 1	SIGMACOVER 280	P229378184	2230379002	YELLOW/GREEN	23/08/2025
SEALER COAT 2	N/A	N/A	N/A	N/A	N/A
INTERMEDIATE COAT 3	SIGMACOVER 410	P236398582	2151272740	MIO	21/07/2025
INTERMEDIATE COAT 4	N/A	N/A	N/A	N/A	N/A
TOP COAT COAT 5	SIGMADUR 550	2302451878	P235395230	RAL 9002	06/02/2026

	REQUIRED PAINT D.F.T	RECORDED W.F.T	RECORDED PAINT D.F.T
PRIMER COAT	50 MICRONS	80 MICRONS	70 MICRONS
TIE/SEALER COAT	N/A	N/A	N/A
INTERMEDIATE COAT	100 MICRONS	130 MICRONS	110 MICRONS
INTERMEDIATE COAT	N/A	N/A	N/A
TOP COAT	75 MICRONS	95 MICRONS	80 MICRONS
TOTAL	225 MICRONS	N/A	260 MICRONS

TEST RESULTS

BLOTTER TEST	NO STAINS
SOLVENT CLEANING	NO GREASE OR OIL
SALT TEST (MAX 20mg/m2 NaCl)	7mg/m2 NaCl
DUST TEST (MAX GRADE 2)	GRADE 1
HOLIDAY TEST	NO HOLIDAYS DETECTED
PULL TEST	10MPa / 9MPa / 9MPa

INSPECTOR COMMENTS: PASS

DATE : 26/11/2024

SIGNED : *M. Allen* (M . Allen)

SIGMACOVER™ 410/SIGMACOVER™ 410 LT

DESCRIPTION

Two-component, high solids, high-build, polyamide cured epoxy coating

PRINCIPAL CHARACTERISTICS

- General-purpose epoxy buildcoat in protective coating systems, for steel and concrete structures exposed to atmospheric land or marine conditions
- Excellent durability
- Can be recoated with various two-component and conventional coatings, even after long weathering periods
- Easy application by airless spray
- Good drying- and curing properties at low substrate temperature (down to –5°C (23°F))

COLOR AND GLOSS LEVEL

- MIO and a selected range of colors
- Flat

Notes:
- Epoxy coatings will chalk and fade upon exposure to sunlight, elevated temperatures, or chemical exposure. Discoloration and normal chalking do not impact performance. Light colors will darken over time. Some batch-to-batch variation in color is to be expected. Color matches are approximate.
- The addition of a UV stable topcoat should be considered when using epoxy coatings in cosmetic areas

BASIC DATA AT 20°C (68°F)

Data for mixed product	
Number of components	Two
Mass density	1.5 kg/l (12.5 lb/US gal), depending on color MIO: 1.8 kg/l (15.0 lb/US gal)
Volume solids	80 ± 2%
VOC (Supplied)	Directive 2010/75/EU, SED: max. 126.0 g/kg UK PG 6/23(92) Appendix 3: max. 240.0 g/l (approx. 2.0 lb/US gal) China GB 30981-2020 (tested) 208.0 g/l (approx. 1.7 lb/gal)
Recommended dry film thickness	75 - 225 µm (3.0 - 9.0 mils) depending on system
Theoretical spreading rate	10.7 m^2/l for 75 µm (428 ft^2/US gal for 3.0 mils)
Overcoating Interval	See overcoating tables
Full cure after	7 days
Shelf life	Base: at least 24 months when stored cool and dry Hardener: at least 24 months when stored cool and dry

Notes:
- See ADDITIONAL DATA – Spreading rate and film thickness
- See ADDITIONAL DATA – Overcoating intervals
- See ADDITIONAL DATA – Curing time

SIGMACOVER™ 410/SIGMACOVER™ 410 LT

RECOMMENDED SUBSTRATE CONDITIONS AND TEMPERATURES

Substrate conditions

- Suitable primer must be dry and free from any contamination
- Surface of previous coat should be sufficiently roughened if necessary
- When applied to zinc silicate, a mist coat and full coat technique is required

Substrate temperature

- Substrate temperature during application and curing down to -5°C (23°F) is acceptable; provided the substrate is free from ice and dry
- Substrate temperature during application and curing should be at least 3°C (5°F) above dew point

INSTRUCTIONS FOR USE

Mixing ratio by volume: base to hardener 80:20 (4:1)

- The temperature of the paint should preferably be above 15°C (59°F), otherwise extra thinner may be required to obtain application viscosity
- Adding too much thinner results in reduced sag resistance and slower cure
- Thinner should be added after mixing the components

Induction time

None

Pot life

6 hours at 20°C (68°F)

Note: See ADDITIONAL DATA – Pot life

Airless spray

Recommended thinner

THINNER 91-92

Volume of thinner

0 - 10%

Nozzle orifice

Approx. 0.46 – 0.53 mm (0.018 – 0.021 in)

Nozzle pressure

20.0 - 25.0 MPa (approx. 200 - 250 bar; 2901 - 3626 p.s.i.)

SIGMACOVER™ 410/SIGMACOVER™ 410 LT

Brush/roller

- Application by brush may show brush marking, due to the thixotropic nature of the paint and is most suitable to small areas, tight angle areas or for stripe coating or touch-up
- Application by roller will leave roller marking and is suitable for minimum DFT requirements only
- A roller suitable for epoxy application must be used

Recommended thinner

THINNER 91-92

Volume of thinner

0 – 5%

Cleaning solvent

THINNER 90-53

ADDITIONAL DATA

Spreading rate and film thickness	
DFT	**Theoretical spreading rate**
75 µm (3.0 mils)	10.7 m^2/l (428 ft^2/US gal)
150 µm (6.0 mils)	5.3 m^2/l (214 ft^2/US gal)
200 µm (8.0 mils)	4.0 m^2/l (160 ft^2/US gal)

Overcoating interval for DFT up to 200µm (8 mils) - SIGMACOVER 410						
Overcoating with...	**Interval**	**5°C (41°F)**	**10°C (50°F)**	**20°C (68°F)**	**30°C (86°F)**	**40°C (104°F)**
various two-pack epoxy and polyurethane coatings	Minimum Maximum	36 hours Extended	24 hours Extended	8 hours Extended	6 hours Extended	4 hours Extended

Overcoating interval for DFT up to 200µm (8 mils) -SIGMACOVER 410LT						
Overcoating with...	**Interval**	**-5°C (23°F)**	**0°C (32°F)**	**5°C (41°F)**	**10°C (50°F)**	**15°C (59°F)**
various two-pack epoxy and polyurethane coatings	Minimum Maximum	48 hours Extended	24 hours Extended	16 hours Extended	12 hours Extended	8 hours Extended

Notes:

- Actual maximum overcoating times will be influenced by local conditions
- To ensure optimal adhesion of the next coat, the surface must be dry and free from all contaminations (oil, grease, chalking, etc...) which would require cleaning and/or abrading
- The LT hardener is not available in all regions, please check this with your PPG representative

SIGMACOVER™ 410/SIGMACOVER™ 410 LT

Curing time for DFT up to 200µm (8 mils) - SIGMACOVER 410			
Substrate temperature	**Dry to touch**	**Dry to handle**	**Full cure**
5°C (41°F)	12 hours	30 hours	20 days
10°C (50°F)	6 hours	24 hours	14 days
15°C (59°F)	4 hours	10 hours	10 days
20°C (68°F)	3 hours	8 hours	7 days
30°C (86°F)	2 hours	6 hours	5 days
40°C (104°F)	1.5 hours	4 hours	3 days

Curing time for DFT up to 200µm (8 mils) - SIGMACOVER 410LT			
Substrate temperature	**Dry to touch**	**Dry to handle**	**Full cure**
-5°C (23°F)	16 hours	24 hours	20 days
0°C (32°F)	11 hours	16 hours	14 days
5°C (41°F)	6 hours	10 hours	10 days
10°C (50°F)	4 hours	8 hours	7 days
15°C (59°F)	3 hours	5 hours	5 days

Notes:
- Ambient temperature during application at -5°C (23°F) is acceptable; however curing to hardness takes longer and complete cure will be reached when the temperature increases
- Adequate ventilation must be maintained during application and curing
- The LT hardener is not available in all regions, please check this with your PPG representative

Pot life (at application viscosity)	
Mixed product temperature	**Pot life**
10°C (50°F)	12 hours
15°C (59°F)	8 hours
20°C (68°F)	6 hours
25°C (77°F)	4 hours
30°C (86°F)	3 hours
40°C (104°F)	2 hours

SAFETY PRECAUTIONS

- See Safety Data Sheet and product label for complete safety and precaution requirements
- This is a solvent-borne paint and care should be taken to avoid inhalation of spray mist or vapor, as well as contact between the wet paint and exposed skin or eyes

SIGMACOVER™ 410/SIGMACOVER™ 410 LT

WORLDWIDE AVAILABILITY

It is always the aim of PPG Protective and Marine Coatings to supply the same product on a worldwide basis. However, slight modification of the product is sometimes necessary to comply with local or national rules/circumstances. Under these circumstances an alternative product data sheet is used.

REFERENCES

• EXPLANATION TO PRODUCT DATA SHEETS	INFORMATION SHEET	1411

WARRANTY

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SIGMADUR™ 550

DESCRIPTION

Two-component, aliphatic acrylic polyurethane finish

PRINCIPAL CHARACTERISTICS

- Unlimited recoatable
- Excellent resistance to atmospheric exposure conditions
- Excellent color and gloss retention
- Non-chalking, non-yellowing
- Cures at temperatures down to -5°C (23°F)
- Resistant to splash of mineral and vegetable oils, paraffins, aliphatic petroleum products and mild chemicals
- Can be recoated even after long atmospheric exposure
- Good application properties

COLOR AND GLOSS LEVEL

- White and various other colors (see also SIGMACARE shade card)
- Gloss

BASIC DATA AT 20°C (68°F)

Data for mixed product	
Number of components	Two
Mass density	1.3 kg/l (10.8 lb/US gal)
Volume solids	55 ± 2%
VOC (Supplied)	Directive 1999/13/EC, SED: max. 334.0 g/kg max. 430.0 g/l (approx. 3.6 lb/US gal) EUR Directive: 2004/42/IIA(j)(500) 459 g/l)
Recommended dry film thickness	50 - 60 µm (2.0 - 2.4 mils) depending on system
Theoretical spreading rate	11.0 m^2/l for 50 µm (441 ft^2/US gal for 2.0 mils)
Dry to touch	1 hour
Overcoating Interval	Minimum: 6 hours Maximum: Unlimited
Full cure after	4 days
Shelf life	Base: at least 36 months when stored cool and dry Hardener: at least 24 months when stored cool and dry

Notes:

- See ADDITIONAL DATA – Spreading rate and film thickness
- See ADDITIONAL DATA – Overcoating intervals
- See ADDITIONAL DATA – Curing time

SIGMADUR™ 550

RECOMMENDED SUBSTRATE CONDITIONS AND TEMPERATURES

Substrate conditions

- Previous coat (epoxy or polyurethane) must be dry and free from any contamination
- Previous coat: surface should be sufficiently roughened if necessary

Substrate temperature and application conditions

- Substrate temperature during application at -5°C (23°F) is acceptable; provided the substrate is free from ice and dry
- Substrate temperature during application and curing should be at least 3°C (5°F) above dew point
- Relative humidity during application and curing should not exceed 85%
- Should condensation on the surface occur during, or soon after application, this could result in color and gloss change

INSTRUCTIONS FOR USE

Mixing ratio by volume: base to hardener 88:12

- The temperature of the mixed base and hardener should be above 10°C (50°F), otherwise extra thinner may be required to obtain application viscosity
- Thinner should be added after mixing the components
- Adding too much thinner results in reduced sag resistance

Induction time

None

Pot life

5 hours at 20°C (68°F)

Note: See ADDITIONAL DATA – Pot life

Air spray

Recommended thinner

THINNER 21-06

Volume of thinner

3 - 5%, depending on required thickness and application conditions

Nozzle orifice

1.0 - 1.5 mm (approx. 0.040 - 0.060 in)

Nozzle pressure

0.3 - 0.4 MPa (approx. 3 - 4 bar; 44 - 58 p.s.i.)

SIGMADUR™ 550

Airless spray

Recommended thinner
THINNER 21-06

Volume of thinner
3 - 5%, depending on required thickness and application conditions

Nozzle orifice
Approx. 0.43 – 0.48 mm (0.017 – 0.019 in)

Nozzle pressure
20.0 MPa (approx. 200 bar; 2901 p.s.i.)

Brush/roller

Recommended thinner
THINNER 21-06

Volume of thinner
0 – 5%

Cleaning solvent
THINNER 90-53

ADDITIONAL DATA

Spreading rate and film thickness	
DFT	**Theoretical spreading rate**
50 µm (2.0 mils)	11.0 m^2/l (441 ft^2/US gal)
60 µm (2.4 mils)	9.2 m^2/l (368 ft^2/US gal)

Overcoating interval for DFT up to 50 µm (2.0 mils)							
Overcoating with...	**Interval**	**-5°C (23°F)**	**0°C (32°F)**	**10°C (50°F)**	**20°C (68°F)**	**30°C (86°F)**	**40°C (104°F)**
itself	Minimum	24 hours	16 hours	8 hours	6 hours	5 hours	3 hours
	Maximum	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited

Note: Surface should be dry and free from any contamination

SIGMADUR™ 550

Curing time for DFT up to 60 µm (2.4 mils)		
Substrate temperature	**Dry to handle**	**Full cure**
-5°C (23°F)	24 hours	15 days
0°C (32°F)	16 hours	11 days
10°C (50°F)	8 hours	6 days
20°C (68°F)	6 hours	4 days
30°C (86°F)	5 hours	3 days
40°C (104°F)	3 hours	48 hours

Notes:
- Adequate ventilation must be maintained during application and curing (please refer to INFORMATION SHEETS 1433 and 1434)
- Premature exposure to early condensation and rain may cause color and gloss change

Pot life (at application viscosity)	
Mixed product temperature	**Pot life**
10°C (50°F)	7 hours
20°C (68°F)	5 hours
30°C (86°F)	3 hours
40°C (104°F)	2 hours

SAFETY PRECAUTIONS

- For paint and recommended thinners see INFORMATION SHEETS 1430, 1431 and relevant Material Safety Data Sheets
- This is a solvent-borne paint and care should be taken to avoid inhalation of spray mist or vapor, as well as contact between the wet paint and exposed skin or eyes
- Contains a toxic polyisocyanate curing agent
- Avoid at all times inhalation of aerosol spray mist

WORLDWIDE AVAILABILITY

It is always the aim of PPG Protective and Marine Coatings to supply the same product on a worldwide basis. However, slight modification of the product is sometimes necessary to comply with local or national rules/circumstances. Under these circumstances an alternative product data sheet is used.

SIGMADUR™ 550

REFERENCES

• CONVERSION TABLES	INFORMATION SHEET	1410
• EXPLANATION TO PRODUCT DATA SHEETS	INFORMATION SHEET	1411
• SAFETY INDICATIONS	INFORMATION SHEET	1430
• SAFETY IN CONFINED SPACES AND HEALTH SAFETY, EXPLOSION HAZARD – TOXIC HAZARD	INFORMATION SHEET	1431
• SAFE WORKING IN CONFINED SPACES	INFORMATION SHEET	1433
• DIRECTIVES FOR VENTILATION PRACTICE	INFORMATION SHEET	1434
• RELATIVE HUMIDITY – SUBSTRATE TEMPERATURE – AIR TEMPERATURE	INFORMATION SHEET	1650

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SIGMACOVER™ 280

DESCRIPTION

Two-component, aluminum pigmented polyamide cured universal primer

PRINCIPAL CHARACTERISTICS

- General-purpose epoxy primer in protective coating systems for steel and non-ferrous metals
- Excellent adhesion to steel, shop primer, galvanized steel and non-ferrous metals
- Suitable as sealer or tie-coat at DFT 25 - 40 µm (1.0 - 1.6 mils)
- Suitable for immersion service
- Cures at temperatures down to 5°C (41°F)
- Suitable for touching up of weld seams and damages of epoxy coatings during construction
- Suitable on wet blast cleaned substrates (damp or dry)
- Compatible with well-designed cathodic protection systems
- ACQPA 24142-certified

COLOR AND GLOSS LEVEL

- Gray, yellow/green and redbrown
- Low sheen

Note:

- The addition of a UV stable topcoat should be considered when using epoxy coatings in cosmetic areas

BASIC DATA AT 20°C (68°F)

Data for mixed product	
Number of components	Two
Mass density	1.3 kg/l (11.0 lb/US gal)
Volume solids	57 ± 2%
VOC (Supplied)	Directive 2010/75/EU, SED: max. 327.0 g/kg UK PG 6/23(92) Appendix 3: max. 432.0 g/l (approx. 3.6 lb/US gal) China GB 30981-2020 (tested) 336.0 g/l (approx. 2.8 lb/gal)
Recommended dry film thickness	50 - 100 µm (2.0 - 4.0 mils) depending on system
Theoretical spreading rate	11.4 m^2/l for 50 µm (457 ft^2/US gal for 2.0 mils) 5.7 m^2/l for 100 µm (229 ft^2/US gal for 4.0 mils)
Dry to touch	2 hours
Overcoating Interval	Minimum: 2 hours
Full cure after	7 days
Shelf life	Base: at least 24 months when stored cool and dry Hardener: at least 24 months when stored cool and dry

Notes:

SIGMACOVER™ 280

- See ADDITIONAL DATA – Spreading rate and film thickness
- See ADDITIONAL DATA – Overcoating intervals
- See ADDITIONAL DATA – Curing time

RECOMMENDED SUBSTRATE CONDITIONS AND TEMPERATURES

- Apply this product to the specified thickness as soon as possible after the surface is prepared

Atmospheric exposure conditions

- Steel blast cleaned to ISO-Sa2½, blasting profile 30 - 75 µm (1.2 – 3.0 mils) or according to ISO-St3
- Shop primed steel; pretreated to SPSS-Pt3

Galvanized steel

- The surface must be properly prepared, dry, clean and free of any contamination
- The surface should be sufficiently roughened by sweep blasting to achieve a uniform matt appearance
- Sweep blast in accordance with the SSPC-SP16 guidelines

Stainless steel

- The surface must be properly prepared, dry, clean and free of any contamination
- The surface should be sufficiently roughened by sweep blasting with inert non-metallic abrasives
- Sweep blast in accordance with the SSPC-SP16 guidelines

Thermal Sprayed Metallization (TSM)

- Surface must be dry and free from any contamination
- The mist coat / full coat technique is required. See mist coat thinning recommendation in the Instructions For Use part below

Concrete / Masonry

- Dried for at least 28 days in good ventilation conditions
- Moisture content should not exceed 4.5%
- Concrete must be sound, dry, free from laitance and any contamination
- Surface should be sufficiently roughened

SIGMACOVER™ 280

Immersion exposure

- Steel or steel with not approved zinc silicate shop primer; blast cleaned (dry or wet) to ISO-Sa2½, blasting profile 30 - 75 µm (1.2 – 3.0 mils)
- Steel with approved zinc silicate shop primer; weld seams and areas of damaged shop primer or breakdown should be blast cleaned to ISO-Sa2½, blasting profile 30 - 75 µm (1.2 – 3.0 mils) or power tool cleaned to SPSS-Pt3
- Existing pipelines may have to be cleaned first by scraper pigs and solvents

Substrate temperature and application conditions

- Substrate temperature during application and curing should be above 5°C (41°F)
- Substrate temperature during application and curing should be at least 3°C (5°F) above dew point
- Relative humidity during application and curing should not exceed 85%

INSTRUCTIONS FOR USE

Mixing ratio by volume: base to hardener 4:1

- The temperature of the mixed base and hardener should preferably be above 15°C (59°F), otherwise extra thinner may be required to obtain application viscosity
- Adding too much thinner results in reduced sag resistance and slower cure
- Thinner should be added after mixing the components

Pot life

8 hours at 20°C (68°F)

Note:

- See ADDITIONAL DATA – Pot life

Air spray

Recommended thinner

THINNER 91-92

Volume of thinner

0 - 10%, depending on required thickness and application conditions

Nozzle orifice

1.5 – 2.0 mm (approx. 0.060 – 0.079 in)

Nozzle pressure

0.3 - 0.4 MPa (approx. 3 - 4 bar; 44 - 58 p.s.i.)

SIGMACOVER™ 280

Airless spray

Recommended thinner

THINNER 91-92

Volume of thinner

0 - 10%, depending on required thickness and application conditions

Nozzle orifice

Approx. 0.46 mm (0.018 in)

Nozzle pressure

15.0 MPa (approx. 150 bar; 2176 p.s.i.)

Note:

- Volume of thinner up to 30% for sealer or tie-coat application at DFT range 25 - 40 µm (1.0 - 1.6 mils)

Brush/roller

Recommended thinner

No extra thinner is necessary

Volume of thinner

Up to 5% THINNER 91-92 can be added if desired

Cleaning solvent

- THINNER 90-53

ADDITIONAL DATA

Spreading rate and film thickness	
DFT	**Theoretical spreading rate**
50 µm (2.0 mils)	11.4 m^2/l (457 ft^2/US gal)
75 µm (3.0 mils)	7.6 m^2/l (305 ft^2/US gal)
100 µm (4.0 mils)	5.7 m^2/l (229 ft^2/US gal)

Note:

- Maximum DFT when brushing: 50 µm (2.0 mils)

SIGMACOVER™ 280

Overcoating interval for DFT up to 100 µm (4.0 mils)						
Overcoating with...	**Interval**	**5°C (41°F)**	**10°C (50°F)**	**20°C (68°F)**	**30°C (86°F)**	**40°C (104°F)**
itself and various two-pack epoxy coatings	Minimum	12 hours	6 hours	2 hours	1 hour	30 minutes
	Maximum exposed to direct sunshine	3 months	3 months	3 months	2 months	2 months
	Maximum NOT exposed to direct sunshine	6 months	6 months	6 months	4 months	3 months
polyurethane topcoat	Minimum	36 hours	16 hours	6 hours	4 hours	3 hours
	Maximum exposed to direct sunshine	3 months	3 months	3 months	2 months	2 months
	Maximum NOT exposed to direct sunshine	6 months	6 months	6 months	4 months	3 months

Notes:

- Surface should be dry and free from any contamination
- Glossy finishes require a corresponding undercoat

Curing time for DFT up to 100 µm (4.0 mils)			
Substrate temperature	**Dry to touch**	**Dry to handle**	**Full cure**
5°C (41°F)	8 hours	13 hours	21 days
10°C (50°F)	4 hours	6 hours	14 days
20°C (68°F)	2 hours	2.5 hours	7 days
30°C (86°F)	1 hour	1.5 hours	5 days
40°C (104°F)	45 minutes	1 hour	4 days

Note:

- Adequate ventilation must be maintained during application and curing

SIGMACOVER™ 280

Pot life (at application viscosity)	
Mixed product temperature	**Pot life**
15°C (59°F)	10 hours
20°C (68°F)	8 hours
30°C (86°F)	5 hours
35°C (95°F)	4 hours

SAFETY PRECAUTIONS

- This is a solvent-borne paint and care should be taken to avoid inhalation of spray mist or vapor, as well as contact between the wet paint and exposed skin or eyes
- See Safety Data Sheet and product label for complete safety and precaution requirements

WORLDWIDE AVAILABILITY

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REFERENCES

- Information sheet | Explanation of product data sheets

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CUSTOMER NAME: Rosetti Marino

SYSTEM: NORSOK M 501 System 6A

1.0 Scope

This Painting Procedure covers the requirements for surface preparation and coating of:

Packing gland, exposed stainless steel material
Barrell flange, exposed stainless steel material

Applicable to Tag:
43-FT-001

2.0 Pre-Cleaning

Prior to abrasive blasting, all surfaces shall be checked for defects, such as, but not limited to “scabs”, weld spatter, sharp edges, sharp corners, cavities, weld slag, laminations, etc. These defects shall be repaired and “dressed” smooth providing a relatively smooth surface before abrasive blasting commences.

Oil and grease shall be removed by solvent washing in accordance with SSPC- SP1; by water washing (if contamination is water soluble) with an appropriate detergent or by steam cleaning followed by a freshwater wash.

The presence of oil shall be checked by rubbing with a clean white cloth, or by sprinkling water on the surface (if present, the water will not spread but will form “heads”).

Surfaces shall be checked for soluble salt contamination, and if present, shall be washed with clean potable water until soluble salt levels are in line with the limits detailed in Specification, and per ISO8501-3. Soluble salts levels should not exceed 40 mg/m2. Test Method will be Bresle test.

Dust level test shall be carried out as per ISO8502-3 with Level 2 maximum accepted.

All traces of dirt, grime and substances deleterious to good adhesion shall be removed by water washing using clean potable water.

4.0 Surface Preparation

All components shall be Brush-Off Blast Cleaned per SSPC SP16 light blast cleaning to achieve 25-40 microns.

The depth of profile shall be checked and verified using Testex Tape and Micrometer per ISO8503-5.

Surfaces shall be checked for soluble salt contamination, and if present, shall be washed with clean potable water until soluble salt levels are in line with the limits detailed in Specification, and per ISO8501-3. Soluble salts levels should not exceed 40 mg/m2. Test Method will be Bresle test.

5.0 Coating Application

Application will be by Air Spray.

The Primer shall be applied within 3 hours of completion of abrasive blast cleaning, to achieve a Dry Film Thickness of 50 DFT.

The Finish Coat shall be applied to achieve a Dry Film Thickness of 30 DFT microns.

Overall Total Dry Film Thickness shall be 60 DFT DFT Positector 6000 Dry Film Thickness Gage* (with SSPC-PA-2 as a guide, Acceptance levels as a guide: 80% Minimum, 120% Maximum).

The over-coating intervals shall comply with the paint coating manufacturer's details, located on the relevant Technical Data Sheets.

6.0 Coating System

The manufacturer of the applied coatings shall be Hempels

Primer: Hempadur 15570 or 15590
@ DFT 50 micron

Intermediate coat: Hempaprime Multi 500
@ DFT 100 micron

Topcoat: Hempel's Pro Acrylic 55883
@ DFT 75 micron

The finish coat COLOUR shall be White (RAL9002)

7.0 Packing of finished Components

All finished components shall be packed in Foam packaging.

8.0 Handling of Coated Components

Care shall be exercised when handling finish-coated components to ensure minimum damage to applied coatings.

9.0 Repairs to damaged paint coatings

A. Cover all coated areas near the defective area before commencing repair or patching up. Use heavy duty textile or fabric adhesive tape.
B. For areas less than 0.1 m2 grind to a rough metal surface using at least an 80 grit disc sander. Alternatively spot blast to bare steel Feather edge the coating to at least 25 mm beyond bare metal.
C. For areas greater than 0.1 m2, blast clean to obtain the metal surface pre-treatment originally specified. Feather edge the coating to at least 25 mm beyond bare metal.
D. Dust and debris shall be removed from the substrate prior to coating application.
E. Apply coating by brush for areas less than 0.1m2 and by spray for areas greater than 0.1m2 to the original specification except that the first coat of a multicoat system shall be thinned as recommended in the product datasheet
F. Test the coating for Holidays when it is cured. Any defects shall be repaired and re-tested for assurance.

10.0 Quality Control

All quality checks will be carried out as per the approved Inspection Test Plan.

A. Air quality shall be checked in accordance with ASTM D 4285.
B. Ambient temperature, Surface temperature, Humidity and Dew point are checked and recorded to ensure they are within the correct parameters.
C. Dust level shall be checked per ISO 8502-3. Max acceptable size Class 2.
D. Surface salt contamination shall be checked in accordance with ISO 8502-6 (Bresel method) Salt concentration on blast cleaned surface shall not exceed 20 mg/m2 as per Norsok M-501.
E. The Dry Film shall be free from any application related defects such as but not limited to runs, drips, dry spray or foreign matter.
F. Areas with blisters, cracks, porous or below required DFT will be repaired.
G. Adhesion strength of all coating systems shall not be less than 5MPa pass on coupon sample.
H. The dry film shall have a uniform appearance.

Kilkishen Coatings Limited
Bay 199 Shannon Ind Estate Shannon Co Clare
Phone 061 474444 E-mail eldergroveltd@eircom.net www.kilkishencoatings.ie

INSPECTION REPORT

Report No:	
Client:	
Project Title:	
Project Reference:	
Specification:	
Contractor:	Kilkishen Coatings Shannon
Date of Inspection:	
Location of Inspection:	Kilkishen Coatings Shannon

ENVIRONMENTAL CONDITIONS				
Date	**Air Temp °C**	**Steel Temp °C**	**Dew Point °C**	**% Rel Humidity**

SURFACE PREPARATION		
Pre Surface Condition		
Painted Steel		NO
Type & Grade of Abrasive		
Surface Profile		
Abrasive Blasting Standard Achieved		SA 3
Cleaning		Solvent and Detergent wash
Imperfections		

PAINT APPLICATION		
Paint Mixing		Mechanical Agitation
Application		Spray

PAINT COATINGS

Coat No	Specification	Brand Name	Colour	Batch Number A	Batch Number B	Manufacturer
1						
2						
3						
4						

APPLICATION OF COATINGS

Coat No	Specification	Brand name	Specified DFT	Average Measured DFT	Tag No
1					
2					
3					
4					

COMMENTS/REMARKS:

Signed: Aidan Duggan

FOR
Kilkishen Coatings Ltd.

DATE:

Baker Hughes Confidential

Hempadur 15570

Product characteristics

Description
Hempadur 15570 is a two component, polyamide-adduct cured epoxy paint, which cures to a strong and highly corrosion resistant coating, at temperatures down to -10°C/14°F. The Micaceous Iron Oxide pigmented reddish grey 12430 shade is also well suited for application under humid conditions, on damp steel surfaces, and may be applied on moist surfaces. The greyish yellow 21780 and the grey 11320 shades contains zinc phosphate.
Complies with EU Directive 2004/42/EC, The Paints Directive on the limitation of volatile organic compounds: subcategory j.

Recommended use
As a maintenance and repair primer, intermediate, and/or finishing coat in Hempadur systems in severely corrosive environment. As a finishing coat where a cosmetic appearance is of less importance.
As a low temperature curing epoxy primer, intermediate, and/or finishing coat in paint systems according to specification. Well suited as a (blast) primer in epoxy systems.
Mist coat on Galvosil.

Service temperature:
- Maximum, dry exposure only: 140°C [284°F].

Certificates / Approvals
- EC-type examined as a low flame spread material when used as part of a predefined paint system. Please refer to “Declaration of Conformity” on hempel.com for further details.
- Reaction to fire tested (as part of a coating system with approved primer and topcoat) according to EN13501-1 B-s1, d0.

Product safety

Flash point 25°C [77°F]

VOC content mixed product

Legislation	Value
EU	412 g/L [3.44 lb/US gal]
US (coatings)	412 g/L [3.44 lb/US gal]
US (regulatory)	412 g/L [3.44 lb/US gal]
China	388 g/L [3.24 lb/US gal]

According to specific legislation, see details in the Explanatory Notes available at Hempel website, hempel.com or at your local Hempel website. VOC values may vary with shade, please consult the Safety Data Sheet, section 9. [a]EU Directive 2004/42/CE.

Handling
Handle with care. Before and during use, observe safety labels on packaging and paint containers and follow all local and national safety regulations. Always consult Hempel’s Safety Data Sheet for this product along with the Product Data Sheet.

For professional use only.

Product data

Product code
15570

Product components
Base 15579
Curing Agent 95570

Standard shade* / code
Brownish red 50630

Gloss
Flat

Volume solids
54 ± 2%

Specific gravity
1.3 kg/L [11 lb/US gal]

* Other shades are available, please contact your local Hempel representative.

Hempadur 15570

Reference dry film thickness
100 micron [4.0 mils]

Micaceous iron oxide (MIO) shade / code
Metallic grey 12430

Gloss
Flat

Volume solids
54 ± 2%

Specific gravity
1.4 kg/L [12 lb/US gal]

Reference dry film thickness
100 micron [4.0 mils]

Surface preparation

Cleanliness
- Remove oil, grease and other contaminants by suitable detergent cleaning.
- Remove salts, detergents and other contaminants by high pressure fresh water cleaning.
- All damage of shopprimer and contamination from storage and fabrication should be thoroughly mechanically/chemically cleaned prior to final painting.

New build:
- Abrasive blasting to min. Sa 2½ (ISO 8501-1) / SP 10 (SSPC).
- Stainless steel, aluminium and other non ferric metals and alloys: use non-metallic blast media (corundum, garnet, etc.). Sweep blasting to a uniform dense sharp profile, without blank spots.
- Remove dust, blast media and loose materials.

Maintenance and Repair
- Abrasive blasting to min. Sa 2 (ISO 8501-1) / SP 6 (SSPC).
- Water jetting to min. Wa 2 (ISO 8501-4).
- Flash rust degree of maximum FR M (ISO 8501-4).
- Minor areas can be cleaned by power tool to St 3 provided the surface is roughened and not polished.
- Stainless steel, aluminium and other non ferric metals and alloys: use non-metallic blast media (corundum, garnet, etc.). Sweep blasting to a uniform dense sharp profile, without blank spots.
- Remove dust, blast media and loose materials.

Roughness
- Surface profile Medium (G) (ISO 8503-2).

Consult Hempel's separate Surface Preparation Guidelines for more details.

Application

Mixing ratio
Base 15579 : Curing Agent 95570
(3 : 1 by volume)

Stir well before use.

Hempadur 15570

Thinner
Hempel's Thinner 08450

Cleaner
Hempel's Tool Cleaner 99610

Pot life

Product temperature	20°C [68°F]
Pot life	2 hours

Application method

Tool	Thinning max vol.	Application parameters
Airless spray	5%	Nozzle pressure: 175 bar [2500 psi] Nozzle orifice: 0.019-0.021"
Air spray	15%	Not Applicable.
Brush	5%	Not Applicable.

If brush or roller application is used, more coats will be necessary to achieve the specified dry film thickness. Spray data are indicative and subject to adjustment. Pressure is for a material temperature of 20°C [68°F].

Film thickness

Specification range	Low	High	Recommended
Dry film thickness	50 micron [2.0 mils]	125 micron [5.0 mils]	100 micron [4.0 mils]
Wet film thickness	93 micron [3.7 mils]	231 micron [9.3 mils]	185 micron [7.4 mils]
Theoretical spreading rate	11 m²/L [448 sq ft/US gal]	4.3 m²/L [175 sq ft/US gal]	5.4 m²/L [220 sq ft/US gal]

For best performance, avoid excessive film thickness. Product may be specified in another film thickness than indicated depending on purpose and area of use. This will alter spreading rate, drying and curing time and overcoating interval.

Application conditions
- To avoid condensation, apply on a clean and dry surface with a temperature that is at least 3°C [5°F] above the dew point.
- Surface temperature must be above -10°C [14°F] during application and curing.
- Beware of ice on the surface at low temperatures.
- Temperature of product must be above 15°C [59°F] during application.

Relative Humidity:
- Relative humidity must be below 85% during application.
- Relative humidity must be below 85% during curing.

Application remarks
- Metallised surfaces should be overcoated before exposure to open air conditions.
- Flash-coat technique is recommended when overcoating porous substrates.

Drying and overcoating

Product compatibility
- Previous coat: None or according to Hempel's specification.
- Subsequent coat: According to Hempel's Specification. Recommended products are: Hempadur, Hempathane, Hempatex

Drying time

Surface temperature		20°C [68°F]
Touch dry	min	60
Hard dry	hours	5
Fully cured	days	7

Determined for dry film thickness 100 micron [4.0 mils] at standard conditions, see Hempel's Explanatory Notes for details.

Hempadur 15570

Overcoating

Hempel's specification supersedes any guidelines indicated in the overcoating table

Quality name		0°C [32°F]	10°C [50°F]	20°C [68°F]	30°C [86°F]
Atmospheric medium					
Hempadur 15570	Min	18 h	8 h	4 h	3 h
	Max	Ext*	Ext*	Ext*	Ext*
Hempathane HS 55610	Min	18 h	8 h	4 h	3 h
	Max	Ext*	Ext*	Ext*	Ext*
Hempatex Enamel 56360	Min	9 h	4 h	2 h	90 min
	Max	36 h	16 h	8 h	6 h
Immersion					
Hempadur 15570	Min	36 h	16 h	8 h	6 h
	Max	Ext*	Ext*	Ext*	Ext*

Ext*: Depending on the actual exposure conditions, the coated surface is overcoatable for an extended period of time. Contact your local Hempel representative for advice.
Overcoating times are indicative for products of the same generic chemistry. Consult Hempel's specification for more information.

Drying conditions

- To obtain the drying time stated, it is important to maintain sufficient ventilation during application, drying and curing.

Overcoating details

- If the maximum overcoating interval is exceeded, roughening of the surface is necessary to ensure intercoat adhesion.
- The surface must be clean before overcoating.

Other remarks

- Epoxy coats have an inherent tendency of chalking in outdoor exposure. This does not affect the performance of the coating.
- Hempel's Specification supersedes any recommendations given in the Product Data Sheets.

Storage

Shelf life

Ambient temperature	25°C [77°F]
Base	36 months
Curing Agent	36 months

Shelf life from date of production, when stored in original, unopened containers. Thereafter, the product quality must be re-inspected. Storage at elevated temperatures may reduce shelf life. For advice, please consult Hempel.

Storage conditions

- Product must be stored according to local legislation, at maximum 40°C [104°F], without direct sunlight and protected from rain and snow.

Carbon Footprint

Dry film thickness	1 µm	1 mil
GWP (Global Warming Potential)	9.1 g CO_2e/m^2	0.047 lb CO_2e/ft^2

The carbon footprint is for 1 square meter / square foot of surface area with a dry film thickness of 1 micron / mil.

The scope includes raw materials, in-bound transport to the Hempel factory, Hempel manufacturing processes, and any Volatile Organic Compounds emitted during and after the application of the product.

It is calculated based on the standard shade defined in this PDS. Values may vary with shade.

Hempadur 15570

Additional documents

Additional information is available at the Hempel website
https://www.hempel.com/service-and-support/technical-guidelines
or at your local Hempel website:

- Explanatory Notes for Product Data Sheet.
- Application methods.
- General Application Guidelines

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No.	Document description	Location/comments
1.	Technical Statement	One-off specific advice provided on request for specific projects
2.	Specification	Only issued for specific projects
3.	PDS	This document
4.	Explanatory Notes to the PDS	Available at www.hempel.com and contain relevant information about the Product testing parameters
5.	Application Instruction	Where available, at www.hempel.com
6.	Generic technical guidelines (e.g. on application and surface preparation)	Where available, at www.hempel.com

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Hempel shall not be liable for defects where the application of the Product has not been made fully in accordance with the recommendations and requirements set out in the relevant PDS and the Additional Documents. The information and terms of this disclaimer apply to this PDS, the Additional documents and any other documents supplied by Hempel in respect of the Product. In addition, the Product is supplied and all technical assistance is given subject to Hempel's General Conditions of Sale, Delivery and Service, unless otherwise expressly agreed in writing.

Hempaprime Multi 500

Product characteristics

Description
Hempaprime Multi 500 is a fast drying, high solids epoxy paint. It provides hard wearing and long lasting barrier protection in coating systems for severe corrosive environments. The product meets the requirements of ISO 12944 Part 5, 2019 when used as part of a predefined paint system.

Recommended use
Hempaprime Multi 500 is recommended as a high-build, intermediate coat in high performance coating systems where fast handling and short overcoating times are required. Due to its fast drying, the product is excellent for projects where fast throughput is key. The product can also be used as a self-priming, surface tolerant coat and a finishing coat in heavy-duty coating systems. Suited for application down to 10°C [50°F].
The product is available in several MIO shades such as 18021 and 18061; both with 80% MIO content and with volume solids 82% ± 2. Other MIO shades like 12430, 16980 and non-MIO Grey 13600 are available, and complies with volume solids 85% ± 2.

Service temperature:
- Maximum, dry exposure only: 120°C [248°F].

Certificates / Approvals
- Meets requirements to ISO 12944 when used as part of a predefined paint system. Part 6, Im2; Part 9, CX.
- Meets requirements to NORSOK M-501 when used as part of a predefined paint system. Edition 6, System 1. Edition 7, System 1A, 1B.
- Complies with the requirements in EN1504-2 Products and systems for the protection and repair of concrete structures, meeting CE Mark performance qualification.

Features
- Fast overcoating.
- Crack resistant in high film thickness.
- Low VOC.
- Ready to use - optimised application properties.
- Surface tolerant.

Product safety

Flash point 25°C [77°F]

VOC content mixed product

Legislation	Value
EU	196 g/L [1.64 lb/US gal]
US (coatings)	196 g/L [1.64 lb/US gal]
US (regulatory)	196 g/L [1.64 lb/US gal]
China	196 g/L [1.64 lb/US gal]

According to specific legislation, see details in the Explanatory Notes available at Hempel website, hempel.com or at your local Hempel website. VOC values may vary with shade, please consult the Safety Data Sheet, section 9.

Handling
Handle with care. Before and during use, observe safety labels on packaging and paint containers and follow all local and national safety regulations. Always consult Hempel's Safety Data Sheet for this product along with the Product Data Sheet.

For professional use only.

Product data

Product code
45950

Product components
Base 45959
Curing Agent 95090

Standard shade / code
Brownish red 50630 *

Wide range of colours is available via Hempel's tinting system.

Gloss
Semi-gloss

* Slight discolouration may occur. This does not affect the performance of the coating.

Hempaprime Multi 500

Volume solids
85 ± 2%

Specific gravity
1.4 kg/L [12 lb/US gal]

Reference dry film thickness
150 micron [6.0 mils]

Aluminium shade / code
Aluminium grey 19002

Gloss
Please consult Hempel’s Guideline on aluminium pigmented coatings.

Volume solids
78 ± 2%

Specific gravity
1.3 kg/L [11 lb/US gal]

Reference dry film thickness
150 micron [6.0 mils]

Surface preparation

Cleanliness
- Remove oil, grease and other contaminants by suitable detergent cleaning.
- Remove salts, detergents and other contaminants by high pressure fresh water cleaning.

New build:
- Abrasive blasting to min. Sa 2½ (ISO 8501-1) / SP 10 (SSPC).
- Stainless steel, aluminium and other non ferric metals and alloys: use non-metallic blast media (corundum, garnet, etc.). Sweep blasting to a uniform dense sharp profile, without blank spots.
- Remove dust, blast media and loose materials.

Maintenance and Repair
- Spot abrasive blasting to min. PSa 2 (ISO 8501-2) / SP 6 (SSPC).
- Minor areas may be hand or power tool cleaned instead of abrasive blasting.
- Water jetting to min. Wa 2 (ISO 8501-4).
- Flash rust degree of maximum FR M (ISO 8501-4).
- Stainless steel, aluminium and other non ferric metals and alloys: use non-metallic blast media (corundum, garnet, etc.). Sweep blasting to a uniform dense sharp profile, without blank spots.
- Feather edges to sound surrounding coating.
- Remove dust, blast media and loose materials.

Roughness
- Surface profile Medium (G) (ISO 8503-2).

Consult Hempel's separate Surface Preparation Guidelines for more details.

Application

Mixing ratio
Base 45959 : Curing Agent 95090
(4 : 1 by volume)

Stir well before use.

Thinner
Hempel's Thinner 08450

Hempaprime Multi 500

Cleaner
Hempel's Tool Cleaner 99610
Hempel's Thinner 08450

Pot life

Product temperature	10°C [50°F]	20°C [68°F]	30°C [86°F]	40°C [104°F]
Pot life	2½ hours	1 hour	¾ hours	½ hours
Pot life (brush)	-	90 min	-	-

Application method

Tool	Thinning max vol.	Application parameters
Airless spray	5%	Nozzle pressure: 225 bar [3300 psi] Nozzle orifice: 0.019-0.023"
Brush/Roller	5%	Not Applicable.

If brush or roller application is used, more coats will be necessary to achieve the specified dry film thickness. Spray data are indicative and subject to adjustment. Pressure is for a material temperature of 20°C [68°F].

Film thickness

Specification range	Low	High	Recommended
Dry film thickness	100 micron [4.0 mils]	250 micron [10 mils]	150 micron [6.0 mils]
Wet film thickness	118 micron [4.7 mils]	295 micron [12 mils]	177 micron [7.1 mils]
Theoretical spreading rate	8.5 m²/L [346 sq ft/US gal]	3.4 m²/L [139 sq ft/US gal]	5.6 m²/L [228 sq ft/US gal]

Product may be specified in another film thickness than indicated depending on purpose and area of use. This will alter spreading rate, drying and curing time and overcoating interval. For best performance, avoid excessive film thickness.

Application conditions
- Optimal paint temperature for proper mixing, pumping and spraying is: 20°C [68°F].
- To avoid condensation, apply on a clean and dry surface with a temperature that is at least 3°C [5°F] above the dew point.
- Surface temperature must be above 10°C [50°F] during application and curing.

Relative Humidity:
- Relative humidity must be below 85% during application.
- Relative humidity must be below 85% during curing.

Application remarks
- Product requires heavy duty spray equipment; spray hoses shall be as short as possible.
- Metallised surfaces should be overcoated before exposure to open air conditions.
- Flash-coat technique is recommended when overcoating porous substrates.

Drying and overcoating

Product compatibility
- Previous coat: None or according to Hempel's specification.
- Subsequent coat: None or according to Hempel's specification. Recommended products are: Hempadur, Hempaprime, Hempathane

Drying time

Surface temperature		10°C [50°F]	20°C [68°F]	30°C [86°F]	40°C [104°F]
Touch dry	hours	2½	1	⅔	⅓
Surface dry	hours	5½	2½	1	½
Hard dry	hours	8	3½	1½	¾
Fully cured	days	-	7	-	-

Determined for dry film thickness 150 micron [6.0 mils] at standard conditions, see Hempel's Explanatory Notes for details.

Hempaprime Multi 500

Overcoating

Hempel's specification supersedes any guidelines indicated in the overcoating table

Quality name		10°C [50°F]	20°C [68°F]	30°C [86°F]	40°C [104°F]
Atmospheric medium					
Hempaprime Multi 500	Min	7 h	3 h	2 h	90 min
	Max	Ext*	Ext	Ext	Ext
Hempathane HS 55610	Min	7 h	3 h	2 h	90 min
	Max	Ext*	Ext	Ext	Ext

Overcoating times are indicative for products of the same generic chemistry. Consult Hempel's specification for more information.

Drying conditions

- To obtain the drying time stated, it is important to maintain sufficient ventilation during application, drying and curing.
- According to Hempel's Specification.

Overcoating details

- If the maximum overcoating interval is exceeded, roughening of the surface is necessary to ensure intercoat adhesion.
- The surface must be dry and clean prior to application.

Other remarks

- Epoxy coats have an inherent tendency of chalking in outdoor exposure. This does not affect the performance of the coating.
- Hempel's Specification supersedes any recommendations given in the Product Data Sheets.

Storage

Shelf life

Ambient temperature	25°C [77°F]
Base	24 months
Curing Agent	24 months

Shelf life from date of production, when stored in original, unopened containers. Thereafter, the product quality must be re-inspected. Storage at elevated temperatures may reduce shelf life. For advice, please consult Hempel.

Storage conditions

- Product must be stored according to local legislation, at maximum 40°C [104°F], without direct sunlight and protected from rain and snow.

Carbon Footprint

Dry film thickness	1 µm	1 mil
GWP (Global Warming Potential)	5.5 g CO_2e/m^2	0.028 lb CO_2e/ft^2

The carbon footprint is for 1 square meter / square foot of surface area with a dry film thickness of 1 micron / mil.

The scope includes raw materials, in-bound transport to the Hempel factory, Hempel manufacturing processes, and any Volatile Organic Compounds emitted during and after the application of the product.

It is calculated based on the standard shade defined in this PDS. Values may vary with shade.

Hempaprime Multi 500

Additional documents

Additional information is available at the Hempel website
https://www.hempel.com/service-and-support/technical-guidelines
or at your local Hempel website:

- Explanatory Notes for Product Data Sheet.
- Application methods.
- Substrates.
- Surface Preparation.
- Application Instruction for this product.
- Repair & maintenance.
- Inspection & quality control.

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3.	PDS	This document
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5.	Application Instruction	Where available, at www.hempel.com
6.	Generic technical guidelines (e.g. on application and surface preparation)	Where available, at www.hempel.com

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Hempel's Pro Acrylic

Product characteristics

Description
Hempel's Pro Acrylic 55883 is a two-component, isocyanate-free, acrylic finishing coat with good gloss and colour retention. It is resistant to water and spillage of aliphatic hydrocarbons.
Minimum curing temperature is 0°C/32°F.

Recommended use
Hempel's Pro Acrylic is recommended as a finishing coat for protection of structural steel in severely corrosive environment, where light-fastness and gloss retention are required.
The product may be specified as a one-coat direct-to-metal system in corrosive environments classified as C2 and C3.

Service temperature:
- Maximum, dry exposure only: 120°C [248°F].

Certificates / Approvals
- Meets requirements to NORSOK M-501 when used as part of a predefined paint system. Edition 6, System 1. Edition 7, System 1A, 1B.

Product safety

Flash point 32°C [90°F]

VOC content mixed product

Legislation	Value
EU	362 g/L [3.02 lb/US gal]
US (coatings)	362 g/L [3.02 lb/US gal]
US (regulatory)	362 g/L [3.02 lb/US gal]
China	362 g/L [3.02 lb/US gal]

According to specific legislation, see details in the Explanatory Notes available at Hempel website, hempel.com or at your local Hempel website. VOC values may vary with shade, please consult the Safety Data Sheet, section 9.

Handling
Handle with care. Before and during use, observe safety labels on packaging and paint containers and follow all local and national safety regulations. Always consult Hempel's Safety Data Sheet for this product along with the Product Data Sheet.

For professional use only.

Product data

Product code
55883

Product components
Base 55889
Curing Agent 97883

Standard shade / code
White 10000 *

Wide range of colours is available via Hempel's tinting system.

Gloss
Glossy

Volume solids
58 ± 2%

Specific gravity
1.3 kg/L [11 lb/US gal]

Reference dry film thickness
50 micron [2.0 mils]

Aluminium shade / code
Aluminium grey 19000 **

Gloss
Please consult Hempel's Guideline on aluminium pigmented coatings.

* Colour stability may be affected by exposure to chemicals, elevated temperatures, low light conditions and/ or inadequate ventilation.
** Appearance of the aluminium pigmented coats will depend on application method, drying conditions, handling etc. Please see the Guideline on Aluminium pigmented coatings at hempel.com or at your local Hempel website.

Hempel's Pro Acrylic

Volume solids
57 ± 2%

Specific gravity
1.2 kg/L [10 lb/US gal]

Reference dry film thickness
50 micron [2.0 mils]

Surface preparation

Cleanliness
- According to Hempel's Specification.

Consult Hempel's separate Surface Preparation Guidelines for more details.

Application

Mixing ratio
Base 55889 : Curing Agent 97883
(7 : 1 by volume)

Stir well before use.

Thinner
Hempel's Thinner 08450

Cleaner
Hempel's Thinner 08450

Pot life

Product temperature	20°C [68°F]
Pot life	4 hours

Application method

Tool	Thinning max vol.	Application parameters
Airless spray	5%	Nozzle pressure: 150 bar [2200 psi] Nozzle orifice: 0.017-0.019"

If brush or roller application is used, more coats will be necessary to achieve the specified dry film thickness. Spray data are indicative and subject to adjustment. Pressure is for a material temperature of 20°C [68°F].

Film thickness

Specification range	Low	High	Recommended
Dry film thickness	50 micron [2.0 mils]	120 micron [4.8 mils]	50 micron [2.0 mils]
Wet film thickness	86 micron [3.4 mils]	207 micron [8.3 mils]	86 micron [3.4 mils]
Theoretical spreading rate	12 m²/L [489 sq ft/US gal]	4.8 m²/L [196 sq ft/US gal]	12 m²/L [489 sq ft/US gal]

For best performance, avoid excessive film thickness.

Application conditions
- To avoid condensation, apply on a clean and dry surface with a temperature that is at least 3°C [5°F] above the dew point.
- Surface temperature must be above 0°C [32°F] during application and curing.

Relative Humidity:
- Relative humidity must be below 85% during application.
- Relative humidity must be below 85% during curing.

Application remarks
- Two coats of the topcoat may be necessary to obtain full hiding power.

Hempel's Pro Acrylic

Drying and overcoating

Product compatibility

- Previous coat: According to Hempel's Specification. Recommended products are: Hempadur Mastic 4588W, Hempadur 45141/45143
- Subsequent coat: None.

Drying time

Surface temperature		**20°C** [68°F]
Surface dry	hours	4½
Hard dry	hours	10
Fully cured	days	7

Determined for dry film thickness 50 micron [2.0 mils] at standard conditions, see Hempel's Explanatory Notes for details.

Overcoating

Hempel's specification supersedes any guidelines indicated in the overcoating table

Quality name		**0°C** [32°F]	**10°C** [50°F]	**20°C** [68°F]
Atmospheric medium				
Hempel's Pro Acrylic	Min	18 h	9 h	6 h
	Max	Ext*	Ext	Ext

Overcoating times are indicative for products of the same generic chemistry. Consult Hempel's specification for more information.

Drying conditions

- To obtain the drying time stated, it is important to maintain sufficient ventilation during application, drying and curing.
- Condensation on the freshly applied coating should be avoided.

Overcoating details

- The surface must be dry and clean prior to application.

Other remarks

- Hempel's Specification supersedes any recommendations given in the Product Data Sheets.

Storage

Shelf life

Ambient temperature	**25°C** [77°F]
Base	36 months
Curing Agent	18 months

Shelf life from date of production, when stored in original, unopened containers. Thereafter, the product quality must be re-inspected. Storage at elevated temperatures may reduce shelf life. For advice, please consult Hempel.

Storage conditions

- The curing agent is sensitive to moisture. Store in a dry place and keep the can tightly closed until use.

Carbon Footprint

Dry film thickness	**1 µm**	**1 mil**
GWP (Global Warming Potential)	11.4 g CO_2e/m^2	0.059 lb CO_2e/ft^2

The carbon footprint is for 1 square meter / square foot of surface area with a dry film thickness of 1 micron / mil.

The scope includes raw materials, in-bound transport to the Hempel factory, Hempel manufacturing processes, and any Volatile Organic Compounds emitted during and after the application of the product.

It is calculated based on the standard shade defined in this PDS. Values may vary with shade.

Hempel's Pro Acrylic

Additional documents

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https://www.hempel.com/service-and-support/technical-guidelines
or at your local Hempel website:

- Explanatory Notes for Product Data Sheet.
- Application methods.
- General Application Guidelines

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6.	Generic technical guidelines (e.g. on application and surface preparation)	Where available, at www.hempel.com

In the event of a conflict of information between the PDS and the Additional documents, the order of priority of information shall be in the order as set out above. In such event you should also contact your representative at Hempel for clarification. Furthermore, the buyer/applicator must have full regard to the relevant Safety Data Sheet provided with each Product and which can also be downloaded from www.hempel.com.

Hempel shall not be liable for defects where the application of the Product has not been made fully in accordance with the recommendations and requirements set out in the relevant PDS and the Additional Documents. The information and terms of this disclaimer apply to this PDS, the Additional documents and any other documents supplied by Hempel in respect of the Product. In addition, the Product is supplied and all technical assistance is given subject to Hempel's General Conditions of Sale, Delivery and Service, unless otherwise expressly agreed in writing.

SECTION 1.8

NON DESTRUCTIVE EXAMINATION PROCEDURES and NDE OPERATORS LIST and QUALIFICATIONS - ULTRASONIC FLOWMETER 1724001317-MAT-PRO-00008

N/A

SECTION 1.9

WELDING PROCEDURE SPECIFICATION (WPS) AND QUALIFICATIONS (PQR) RECORDS and WELD OPERATORS LIST and WELDER QUALIFICATIONS RECORDS (WPQ) - ULTRASONIC FLOWMETER - 1724001317-WEL-PRO-00009

N/A

SECTION 1.10
FAT(FINAL ACCEPTANCE TEST) PROCEDURES
ULTRASONIC FLOWMETER
1724001317-QC-PRO-00010

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

FAT (FINAL ACCEPTANCE TEST) PROCEDURES - ULTRASONIC FLOWMETER

TAG NUMBER: 43-FT-001

Document Number: 1724001317-QC-PRO-00010

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
V. Barratta	08-01-2025

Rev.	Date	Description	Prepared	Reviewed	Approved
02	17/12/2024	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
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00	06/09/2024	Issue for Review (IFR)	BH DC	Tom Griffin	Niall Townsend

Baker Hughes

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1	Cover	X	X	X					
2	Table of Contents	X	X	X					
3	Revision / Change Log / Hold List	X	X	X					
4	FAT (FINAL ACCEPTANCE TEST) PROCEDURES - ULTRASONIC FLOWMETER	X	X	X					

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Revision / Change Log

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1.0 Scope

This document defines the Factory Acceptance Test (FAT) procedure to be followed by the Baker Hughes Gas Flowlab for all ultrasonic gas flowmeters.

2.0 EQUIPMENT / DOCUMENTATION REQUIRED

Automated Flow Loop System
Flowmeter User's Manuals

3.0 OVERVIEW

The flowloop used by Baker Hughes to test all manufactured ultrasonic gas flowmeters consists of a 500mm diameter closed loop pipe section, transducer installation spoolpiece, reference meter and automated control system. Refer to Appendix A for schematic layout of the system. The flowtest medium is air, flowing at atmospheric pressure and room temperature.
The reference meter is calibrated every 24 months by an accredited calibration facility. The certificate of calibration is available to view at Baker Hughes during FAT.
The objective of the FAT is to determine if the flowmeter and transducers are in full functional condition prior to shipping the order. i.e. that there are no component failures in the flowmeter, either electronic / pcb issues or transducer signal issues.

4.0 FAT Procedure

Each FAT consists of testing the ultrasonic flowmeter console along with its allocated transducers on the Baker Hughes 20" gas flowloop system. The transducers are set up on the transducer installation spoolpiece as required for the particular instrument undergoing test and the console is connected to the control system. The flow test consists of taking and recording four active flow test points and checking two zero flow points in the following sequence:

Test Point	:	**Velocity (m/s)**	
1	:	Zero Flow	(***Checked by test system, but results not recorded)***
2	:	3.0	
3	:	6.0	
4	:	9.0	
5	:	12.0	
6	:	Zero Flow	(***Checked by test system, but results not recorded)***

Six flow measurement readings are taken at each flow point and the flowmeter output reading is compared with the Reference meter output. On 2-path systems, each channel is tested independently. After each test has been completed a test report, as presented in Fig 1 below shows the results format that is produced. The acceptance criteria for the test is + / - 10% deviation from the Reference meter reading. The Zero Flow conditions are just checked by the test system, but no Zero Flow results are reported as per the sample image below:

Fig. 1

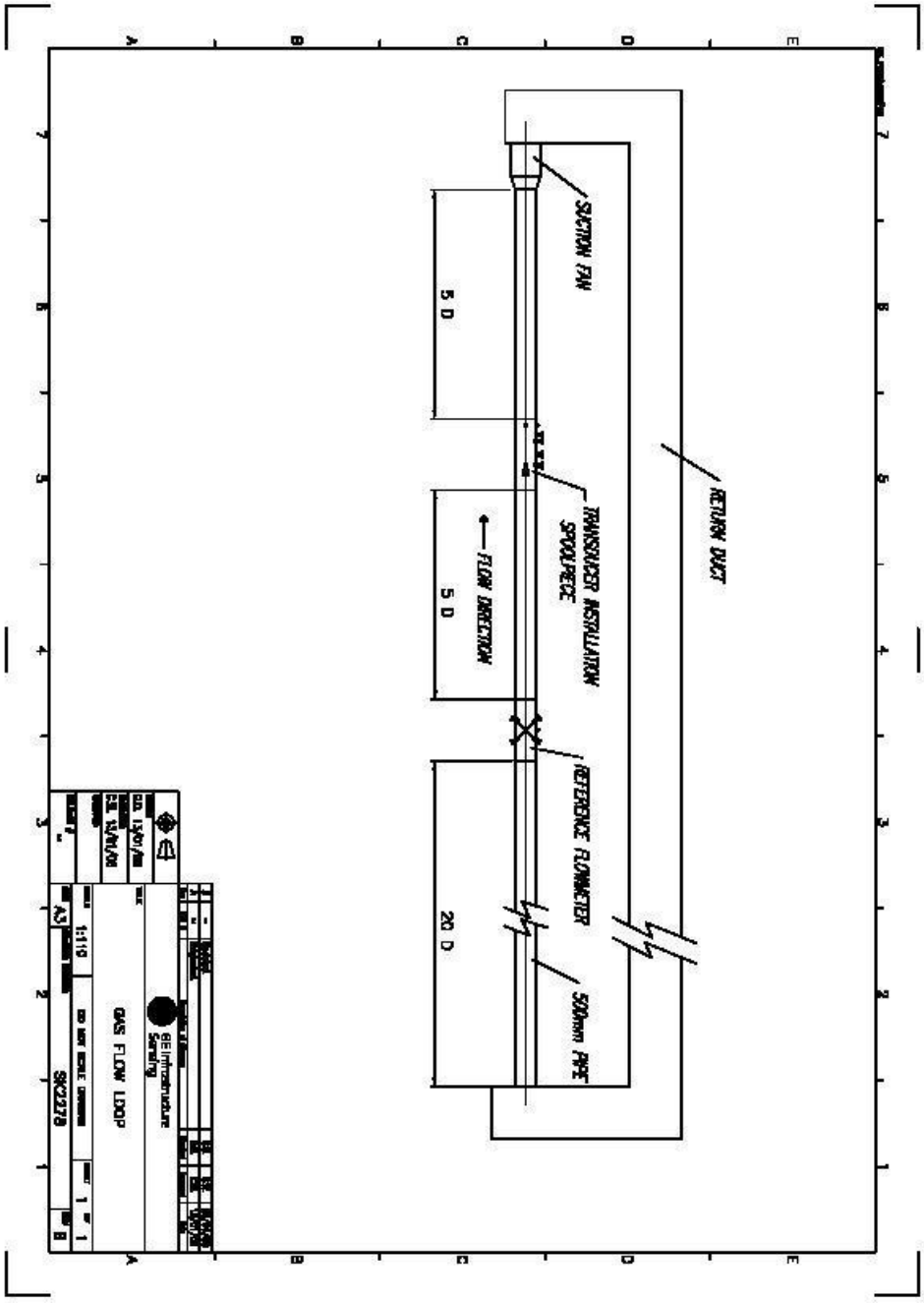
Time Stamp	Reference m/s	Flowmeter m/s	Flowmeter Error m/s	Flowmeter Error (%)
11:50:20	2.98	3.07	0.09	3.02
11:53:23	6.03	6.23	0.20	3.32
11:56:25	8.98	9.17	0.19	2.12
11:59:27	12.09	12.25	0.16	1.32

[The 10% criteria is used, as in many cases the transducers will have been designed for a different size pipe (i.e. not a 20" dia) so the transducer will be out of the desired position in the 20" flowloop pipe. Additionally the absence of process pressure, temperature and process gas etc, add a degree of uncertainty]

After the FAT has completed successfully, the instrument is programmed with the required specific dimensional data (i.e. path length, axial dimension and pipe diameter / wall thickness data) ready for field installation.

Appendix A

Gas Flowloop Schematic



APPROVALS / REVISION RECORD

REV NO.	PARA. NUMBER	REVISION	DCO NO.
A	ALL	Initial Release	
B	Appendix B	Removed original Appendix B, sample calibration certificate.	1868
C	Section 4 (previously section 6)	Section 6 edited to clarify the report format and the state that Zero Flow conditions are checked during testing. But no Zero Flow results are reported.	2166
	Throughout	Removal of redundant information and changed references from GE/GE Sensing to Baker Hughes	
	Approvals table	Updated the Approver Role name to more relevant roles in the business now; Q.A. Manager to Quality and General MGR to Subject Matter Expert / Area Manager	
D	3.0	Reference meter calibration changed from annually to every 24 months	2296

APPROVALS

REV	SIGN/DATE	SIGN/DATE	SIGN/DATE
D	Eoin Barron 28/Feb/2024	Niamh Cahalan 28/Feb/2024	Jody Bleach 28/Feb/2024
C	Robert Price 03/06/2021	Niamh Cahalan 9-July-2021	Tom O'Connor 24/06/2021
B	John Hickey 06/07/2015	Niall Mahony 06/07/2015	N/A
A	Noel Broderick 04/04/2012	Niamh Kinsella 04/04/2012	Paul Sheahan 04/04/2012
	PREPARED BY	**QUALITY**	**SUBJECT MATTER EXPERT / PROCESS OWNER**

SECTION 1.11
COMMISSIONING PROCEDURES
ULTRASONIC FLOWMETER
1724001317-COM-PRO-00011

N/A

SECTION 1.12
ATEX REGISTER
ULTRASONIC FLOWMETER
1724001317-IN-LIS-00015

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

ATEX REGISTER - ULTRASONIC FLOWMETER

Document Number: 1724001317-IN-LIS-00015

Document Class: 2

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4	APPROVAL NOT REQUIRED

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Sign	Date
V. Barratta	15-10-2025

Rev.	Date	Description	Prepared	Reviewed	Approved
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4	Atex Register - Ultrasonic Flowmeter			X	X				
5	Atex Certificates	X	X	X	X				

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00	Issue for Review (IFR)
01	Accepted for Construction (AFC)
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03	Accepted for Construction (AFC)

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No.	Revision	Tag Number	Description	Location	Manufacturer	Model Type Catalogue Number	Serial Number	ATEX Certification Marking	Reference Document	ATEX Certificate Number	Installation Zone	Notes / Comments	P.O.	Vendor	Skid / Package	Barrier Calculation Ref.	Non-Electrical Equipment	Special Conditions of safe use Applicable
01	3	43-FT-001	Ultrasonic flowmeter	Upper Deck	Panametrics LLC	XGF868I-2-2-OI-H7-3-4-0-CC	XGFI-2588E	II 2 G Ex db IIC T6 Gb Ta = -40°C to +60°C	1724001317-IN-DS-00006	Sira 17ATEX1304X	Zone 2	N/A	1724001317 123A90A	Baker Hughes	N/A	N/A	N/A	Yes
02	3	43-FE-001A	Transducer	Upper Deck	Panametrics LLC	T5MAXS-18-10-33-NT-S6-2-2-4-2-0-PMI	3241654	II 2G Ex db IIC T6 Gb, Ta= -40°C to +60°C	1724001317-IN-DS-00006	Sira 20ATEX1001X	Zone 2	N/A	1724001317 123A90A	Baker Hughes	N/A	N/A	N/A	Yes
03	3	43-FE-001B	Transducer	Upper Deck	Panametrics LLC	T5MAXS-18-10-33-NT-S6-2-2-4-2-0-PMI	12246636	II 2G Ex db IIC T6 Gb, Ta= -40°C to +60°C	1724001317-IN-DS-00006	Sira 20ATEX1001X	Zone 2	N/A	1724001317 123A90A	Baker Hughes	N/A	N/A	N/A	Yes
04	3	N.A.	SS Cable Glands	Upper Deck	Peppers Cable Glands Limited	IECEx CML 19.0106X	N.A.	Ex db IIC Gb	1724001317-IN-LIS-00015	IECEx CML 19.0106X	Zone 2	N/A	1724001317 123A90A	Baker Hughes	N/A	N/A	N/A	Yes
05	3	N.A.	SS Reducer 3/4" NPT x M20	Upper Deck	Peppers Cable Glands Limited	IECEx SIR 09.0131X	N.A.	Ex d IIC Gb	1724001317-IN-LIS-00015	IECEx SIR 09.0131X	Zone 2	N/A	1724001317 123A90A	Baker Hughes	N/A	N/A	N/A	Yes
06	3	N.A.	SS Plug 3/4" NPT	Upper Deck	Peppers Cable Glands Limited	IECEx SIR 09.0131X	N.A.	Ex d IIC Gb	1724001317-IN-LIS-00015	IECEx SIR 09.0131X	Zone 2	N/A	1724001317 123A90A	Baker Hughes	N/A	N/A	N/A	Yes

Notes:
1. Total quantity of SS Cable Glands - 4 nos.
2. Total quantity of SS Reducer 3/4" NPT x M20 - 5 nos.
3. Total quantity of SS Plug 3/4" NPT - 4 nos.

Baker Hughes Confidential

1 **EU-TYPE EXAMINATION CERTIFICATE**

2 Equipment intended for use in Potentially Explosive Atmospheres Directive 2014/34/EU

3 Certificate Number: **Sira 17ATEX1304X** Issue: **3**

4 Equipment: **DigitalFlow 868i, 878 series Transmitters and Panaflow PF8x series Ultrasonic Gas Flowmeter**

5 Applicant: **Panametrics LLC.**

6 Address: 1100 Technology Park Drive
Billerica
Massachusetts 01821
USA

7 This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 CSA Group Netherlands B.V., notified body number 2813 in accordance with Articles 17 and 21 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in the confidential reports listed in Section 14.2.

9 Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule to this certificate, has been assured by compliance with the following documents:

EN IEC 60079-0:2018 + AC:2020 EN 60079-1:2014 + AC:2018 EN 60079-11:2012

10 If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to Specific Conditions of Use identified in the schedule to this certificate.

11 This EU-Type Examination Certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment.

12 The marking of the equipment shall include the following:

868i* and 878 series
II 2 G
Ex db IIC T6 Gb
Ta = -40°C to +60°C
IP66

PF8x series:
II 2 G
Ex db IIB+H2 T6…T3 Gb
Ta = -40°C to +60°C
IP66

Note: See Condition of Use 15.6 for Temperature Class disambiguation

*FOR FIELDBUS OPTION ONLY:
INSTALL PER DRAWING 752-326
FISCO FIELD DEVICE

Signed: Michelle Halliwell

Title: Director of Operations

PRODUCTS
RvA C 652

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SCHEDULE

EU-TYPE EXAMINATION CERTIFICATE **Sira 17ATEX1304X**
Issue 3

13 **DESCRIPTION OF EQUIPMENT**

The DigitalFlow 868i and 878 series of transmitters includes models XMT868i, XGF868i, XGN868i, XGM868i, XGS868i, IGM878A and IGM878N. The 868i and 878 series are fluid flow meters intended for permanent connection / mounting on a remote pedestal or a process flange, by means of the four threaded mounting holes or threaded mounting boss in the base. The 868i and 878 series deect and measure the flow rate of acoustically conductive fluids by means of ultrasonic (piezo electric) flow transducers, which can be either wetted process type or external clamp-on type.

The 868i and 878 series are available in either AC (100 to 240 Vac, 50/60 Hz) or DC (12 to 28 Vdc) versions. Communication boards are available for HART, MODBUS / TCP, and Foundation Fieldbus communication options. Option boards are available for digital signal processing (DSP), 4 to 20mA analog I/O, data logging, auxiliary output "alarm" contacts, or totalizer / frequency I/O. Either IR or magnetic HMI display is optional available, which is accessible through the threaded window cover.

The 868i and 878 series assembly consists of a cylindrical, single-compartment, painted cast aluminium or stainless steel enclosure with one threaded window cover and one threaded blind cover. The IGM878N (Dual Housing) model is comprised of two identical enclosures mounted to a steel bracket and interconnected by means of a mineral insulated cable. Field wiring connections for supply, communications, I/O and transducers are accommodated through threaded conduit entries. Each conduit entry is provided with a suitably rated blanking element. The overall physical dimensions of the 868i and 878 series enclosure are 16.8 x 14.0 x 20.8 cm or 21.34 x 14.91 x 16.21 cm (L x W x H).

The Panaflow PF8x series of ultrasonic flowmeters includes models PF8M-Z1G, PF8F-Z1G, PF8S-Z1G, PF8M-Z2G, PF8F-Z2G and PF8S-Z2G. The flange-connected flowmeter is designed for single or dual channel measurement of a wide range of acoustically conductive gases (e.g. steam, flare, etc.). The PF8x system uses the transit time measurement technique by sending ultrasonic signals back and forth across the pipe, where the difference in single arrival times is proportional to flowrate.

The PF8x Flowmeter assembly is comprised of the ZxG Meter Body (flowcell) pipeline flange with integral ultrasonic transducer sensors, the ZxG Adapter and the 868i series Transmitter, and is available as either the Remote Mount version or Local Mount version as well as the Standalone Remote Mount version.

The ZxG Meter Body is a single-interconnected-compartment, painted cast carbon steel, stainless steel or nickel base steel enclosure, with a flanged connection of either Remote or Local Mount Adapters. The 868i Transmitter is as described above. The overall physical dimensions for the smallest (2 inch) ZxG Meter Body are 50.8 x 48.7 x 24.1 cm, and for the largest (24 inch) ZxG Meter Body are 132.0 x 119.9 x 83.2 cm.

The optical radiation output of the apparatus with respect to explosion protection is covered in this certificate based on exception 5) to the scope of IEC 60079-28:2015.

The equipment has been separately tested against the requirements of IEC 60529 and meets IP66.

Note: Individual ultrasonic flow transducers are not assessed for compliance under this report.

DigitalFlow 868i and 878 series Transmitter model code:
XMT868i-b-c-d-e-f-g-h-i
XGa868i-c-d-e-0-g-h-i-j
XGF868i-c-d-k-m-3-j

SCHEDULE

EU-TYPE EXAMINATION CERTIFICATE **Sira 17ATEX1304X**
Issue 3

IGM878#-c-l-j-p-q

# = Housing:	A = Single housing N = Dual housing
a = Model:	M = Multipurpose S = Steam N = Natural Gas F = Flare Gas
b = Channels:	1 = Single 2 = Dual
c = Power:	1 = 100 to 240 Vac 2 = 12 to 28 Vdc
d = Package:	1 = Epoxy coated aluminium 2 = 316 stainless steel
e = I/O:	OO = None TO = 2 totalizer outputs TA = 2 totalizer outputs and 2 standard alarms TH = 2 totalizer outputs and 2 hermetically sealed alarms OI = 2 Analog inputs TI = 2 Analog inputs and 2 totalizer / frequency outputs AI = 2 standard alarms and 2 Analog inputs HI = 2 hermetically sealed alarms and 2 Analog inputs AA = 4 standard alarms HH = 4 hermetically sealed alarms TT = 4 totalizer outputs CT = 2 isolated 4 to 20 mA outputs and 4 totalizer / frequency outputs CO = 2 isolated 4 to 20 mA outputs CA = 2 isolated 4 to 20 mA outputs and 2 standard alarms CH = 2 isolated 4 to 20 mA outputs and 2 hermetically sealed alarms CF = 2 isolated 4 to 20 mA outputs and 2 frequency outputs II = 4 Analog outputs IR = 2 current input, 2 RTD input FR = 2 temperature inputs and 2 frequency outputs OR = 2 temperature inputs TR = 2 temperature inputs and 2 totalizer / frequency outputs AR = 2 temperature inputs and 2 standard alarms HR = 2 temperature inputs and 2 hermetically sealed alarms RR = 4 temperature inputs FF = 4 frequency outputs FO = 2 frequency outputs FA = 2 frequency outputs and 2 standard alarms FH = 2 frequency outputs and 2 hermetically sealed alarms

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FT = 2 frequency outputs and 2 totalizer outputs
FI = 2 current inputs and 2 frequency outputs
RI = 2 temperature inputs and 2 Analog inputs
CI = 2 isolated 4 to 20 mA inputs and 2 Analog inputs
CR = 2 isolated 4 to 20 mA outputs and 2 Analog inputs
CIR = 2 isolated 4 to 20 mA outputs or 1 Analog input and 1 temperature input
AO = Dual standard Alarms

f = DSP Coprocessor:
0 = None
1 = fast response

g = Logging:
0 = None
1 = 1 MB memory
2 = Extended memory
3 = HART
4 = MODBUS
5 = MODBUS TCP
6 = Ethernet
7 = Foundation Fieldbus

h = Display:
0 = None
1 = 16 x 2 LCD

l = Communications:
1 = RS232
2 = RS485
5 = RS232 serial communication port with ATEX certification for Hazardous locations
6 = RS485 multi-user communication port with ATEX certification for Hazardous locations
7 = RS232 serial communication port with IECEX certification for Ex d IIC T6 Gb IP66 Ta= -20°C to +60°C hazardous location installations
8 = RS485 serial communication port with IECEX certification for Ex d IIC T6 Gb IP66 Ta= -20°C to +60°C hazardous location installations

j = Transducer Frequency (Gas only):
1 = 25 kHz
2 = 33 kHz
3 = 50 kHz
4 = 100 kHz
5 = 200 kHz
6 = 500 kHz

k = Input/output
OI = Two 4-20 mA outputs, two 4-20 mA inputs
ORI = Two 4-20 mA outputs, one 4-20 mA input, and one RTD input
FI = Two 4-20 mA outputs, Two 4-20 mA inputs, and two frequency outputs

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	FRI = Two 4-20 mA outputs, one 4-20 mA input, one RTD input and two frequency outputs
m = Digital Communications	H = HART M = ModBus digital output MTCP = ModBus TCP digital output for MODBUS via Ethernet E = Ethernet card. F = Foundation Fieldbus
p = AGA 8 calculation	0 = none 1 = included
q = Option Card	1 = 1 hermetic alarm, 1 frequency, 2 Analog input 2 = Redundant frequency output with 2 hermetic alarms programmable

Panaflow PF8x Ultrasonic Gas Flowmeter (standalone and local mount and remote mount versions)
Model code: a-b-c-d-e-f-g-h-i-j-k-l-m-n-o-p-q-r-s-t-z

a = Model	PF8M = Panaflow gas ultrasonic Flowmeter system PF8F = Panaflow flare ultrasonic Flowmeter system PF8S = Panaflow steam ultrasonic Flowmeter system
b = Path	Z1G = Single path meter body Z2G = Dual path meter body
c = Meter Body (flowcell) Size	02 = 02 inch meter body 03 = 03 inch meter body 04 = 04 inch meter body 06 = 06 inch meter body 08 = 08 inch meter body 10 = 10 inch meter body 12 = 12 inch meter body 14 = 14 inch meter body 16 = 16 inch meter body 18 = 18 inch meter body 20 = 20 inch meter body 24 = 24 inch meter body
d = Meter Body (flowcell) Flange Rating	00 = None, weld-in 1 = ASME 150# WNRF, B16.5 2 = ASME 300# WNRF, B16.5 3 = ASME 600# WNRF, B16.5 1R = ANSI 150# WN RTJ, B16.5 2R = ANSI 300# WN RTJ, B16.5 7 = ANSI 600# WN RTJ, B16.5 E = PN10 EN 1092-1 F = PN16 EN 1092-1 G = PN25 EN 1092-1

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H = PN40 EN 1092-1
J = PN63 EN 1092-1
Q = 10K B2220 WN JIS
R = 16K B2220 WN JIS
S = 20K B2220 WN JIS
T = 30K B2220 WN JIS
U = 40K B2220 WN JIS
W = ANSI 400# WNRF, B16.5
X = ANSI 150# WNRF, B16.5
Y = ANSI 300# WNRF, B16.5
Z = ANSI 600# WNRF, B16.5
XX = Custom flange (can be represented with any alpha-numeric character)

e = Meter Body (flowcell) Material

CS = SA-216 GR. WCB
LC = SA-352 GR. LCB
S4 = SA-351 GR. CF8
S6 = SA-351 GR. CF8M
SA = SA-351 GR. CK-3MCuN
SD = SA-351 GR. CD3MWCuN
HA = SA-494 GR. CW-12MW
I6 = SA-494 GR. CW6MC
CC = SA-352 GR. LCC
WC = SA-216 GR. WCC
M4 = SA-494 GR. M30-C
XX = Custom flowcell material (can be represented with any alpha-numeric character)

f = Meter Body (flowcell) Schedule

010 = Schedule 10 meter body
020 = Schedule 20 meter body
030 = Schedule 30 meter body
STD = Schedule STD meter body
040 = Schedule 40 meter body
060 = Schedule 60 meter body
0XS = Schedule XS meter body
080 = Schedule 80 meter body
100 = Schedule 100 meter body
120 = Schedule 120 meter body
140 = Schedule 140 meter body
160 = Schedule 160 meter body
XXS = Schedule XXS meter body
5S = Schedule 5S meter body
10S = Schedule 10S meter body
40S = Schedule 40S meter body
80S = Schedule 80S meter body

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	CUS = Custom schedule meter body (can be represented with any alpha-numeric character) note: minimum wall thickness per pipe schedule 5S
g = System Design	A = ASME B31.3 and NACE MR0175/MR0103 C = ASME B31.3, CRN and NACE MR0175/MR0103 P = ASME B31.3, PED and NACE MR0175/MR0103 D = DIN DESIGN, PED and NACE MR0175/MR0103 J = JIS DESIGN and NACE MR0175/MR0103
h = Paint	A = No paint (stainless steel and duplex stainless steel meter body only) G = Standard paint S = Custom paint (can be represented with any alpha-numeric character)
i = NDE	0 = No NDE requirements 1 = NDE documentation 2 = PMI and standard NDE documentation
j = Transducer O-ring	V = Viton, standard applications E = EPDM, steam and non-standard applications M = MARKEZ (FFKM), special applications S = Special elastomer (can be represented with any alpha-numeric character)
k = Electronics Mounting Style	000L = Local mount (process temperature -40°C to +85°C) 0R25 = Standalone / remote mount with 25 ft armored cable length (process temperature > +85°C) 0R50 = Standalone / remote mount with 50 ft armored cable length (process temperature > +85°C) R100 = Standalone / remote mount with 100 ft armored cable length (process temperature > +85°C) R150 = Standalone / remote mount with 150 ft armored cable length (process temperature > +85°C) Rxxx = Standalone / remote mount with custom armored cable length (process temperature > +85°C)
l = Electronics Enclosure Material	AL = Epoxy coated aluminum enclosure SS = 316 stainless steel enclosure Blank for standalone remote version
m = Conduit Connection	1 = 6x standard 3/4-14 NPT 2 = 6x standard 3/4-14 NPT with M20 adapters Blank for standalone remote version
n = Power Supply	AC = 100 to 240 Vac power supply DC = 12 to 28 Vdc power supply Blank for standalone remote version

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SCHEDULE

EU-TYPE EXAMINATION CERTIFICATE **Sira 17ATEX1304X**
Issue 3

o = Pressure and Temperature	0 = None 1 = With 1x external 1/2-NPT port in meter body S = Special (can be represented with any alpha-numeric character) Blank for standalone remote version
p = Additional Input / Output	O = No additional input/output F = 2 frequency outputs T = 2 totalizer outputs A = 2 standard alarms Blank for standalone remote version
q = Digital Communications	2 = MODBUS digital output 3 = HART 4 = Foundation Fieldbus Blank for standalone remote version
r = Calibration and Meter Range	x = (can be represented with any alpha-numeric character) Blank for standalone remote version
s = Preamplifier	00 = No preamp 02 = 2x gain preamp 10 = 10x gain preamp 20 = 20x gain preamp 40 = 40x gain preamp Blank for standalone remote version
t = PF8x System Certification	1 = US / CANADA 2 = ATEX 3 = IECEx
z = Special	0 = None S = Special

Variation 1 - This variation introduced the following changes:

i. Update Applicant's name from GE Infrastructure Sensing, Inc. to Panametrics LLC
ii. Introduction of new PF8X Flowmeter model series, with amended Marking and Description.
iii. Update ambient temperature ratings of 868i and 878 Transmitter model series, with amended Marking and Description.
iv. Updated internal PCB assembly for the 868i and 878 Transmitter model series.
v. Revised schedule drawings for the 868i and 878 Transmitter model series.
vi. Following an appropriate assessment to demonstrate compliance with the latest technical knowledge, EN 60079-0:2012/A11:2013 was replaced by EN IEC 60079-0:2018 +AC:2020, EN 60079-1:2014 was replaced by EN 60079-1:2014 + AC:2018.
vii. Three Specific Conditions of Use were added related to the introduced PF8X Flowmeters.
viii. The Condition of Manufacture referencing "previously certified components" was revised.
ix. Introduction of Condition of Manufacture referencing "Routine Overpressure Test".

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Variation 2 - This variation introduced the following changes:

i. Introduce 703-2000 PCBA as an alternative optional Foundation Fieldbus FISCO card option to existing 703-1475 and re-evaluation of the existing 703-1475 card from FNICO to FISCO based on the project 80072179 report 1369980. EN 60079-11:2012 was added to the list of standards.

ii. Change of manufacturer's name from "GE Sensing EMEA" to "Baker Hughes EMEA, formerly GE Sensing EMEA".

14 DESCRIPTIVE DOCUMENTS

14.1 Drawings

Refer to Certificate Annexe.

14.2 Associated Reports and Certificate History

Issue	Date	Report number	Comment
0	20 December 2017	R70137637A	The release of the prime certificate.
1	31 October 2019	0639	Transfer of certificate Sira 17ATEX1304X from Sira Certification Service to CSA Group Netherlands B.V.
2	14 January 2021	R80057398A	The introduction of Variation 1.
3	31 July 2023	R80156577A	The introduction of Variation 2.

15 SPECIFIC CONDITIONS OF USE (denoted by X after the certificate number)

15.1 The 868i and 878 series transmitters shall only be mounted in such an orientation that the mounting base is pointed downwards with the cylindrical enclosure in a horizontal position. (See clause 26.5.1.1 of EN 60079-0).

15.2 Contact the manufacturer if dimensional information of flameproof joints is needed. (See clause 5.1 of EN 60079-1).

15.3 Field connections to the 868i and 878 series transmitters (e.g. ultrasonic transducers, accessories or similar peripherals) shall be appropriately certified for the location and installed in accordance with wiring method requirements of the local electrical code as applicable.

15.4 The PF8x series Flowmeters have non-conducting coating which may generate an ignition-capable level of electrostatic charge under certain extreme conditions. The user shall take the necessary precautions to minimize the risk from electrostatic discharge. For example, controlling the environmental humidity where installed in order to minimize generation of static electricity, with the equipment protected from direct airflow which could cause a transfer of charge to the surface of the equipment. Cleaning should be done only with a damp cloth.

15.5 Contact the manufacturer for genuine replacement of special fasteners for the PF8x series Flowmeters: (See clause 11.3 of EN 60079-1)

a. Meter Body to Adapter flange: M10x1.5 35.0 mm length socket head screws, of zinc plated steel (A574) or better, with a minimum yield strength of 135,000 PSI.

b. Local Mount Bracket: M6x1 16.0 mm length socket head screws, of stainless steel (A4-70 SS) or better, with a minimum yield strength of 65,257 PSI.

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15.6 The hazardous locations temperature classification of both local mount version and remote mount version of the PF8x series Flowmeter is contingent upon the process temperature, as follows. At process temperatures higher than 85°C, remote mounting is deemed necessary in order to accommodate the T-class.

Mounting configuration	Process temperature	T-Class
Local	-40°C to +80°C	T6 (85°C)
Local	-40°C to +85°C	T5 (100°C)
Remote	-40°C to +80°C	T6 (85°C)
Remote	-40°C to +95°C	T5 (100°C)
Remote	-40°C to +115°C	T4 (135°C)
Remote	-40°C to +130°C	T4 (135°C)
Remote	-40°C to +150°C	T3 (200°C)

16 **ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II** (EHSRs)

The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in the reports listed in Section 14.2.

17 **CONDITIONS OF MANUFACTURE**

17.1 The use of this certificate is subject to the Regulations Applicable to Holders of CSA Group Netherlands B.V. certificates.

17.2 Holders of EU-Type Examination Certificates are required to comply with the conformity to type requirements defined in Article 13 of Directive 2014/34/EU.

17.3 Routine Overpressure Test (per EN 60079-1, clause 16, 15.2.3.2): Each of the following enclosure parts / assemblies shall withstand the static test pressures and durations identified below. The test may be conducted at normal ambient temperatures. There shall be no permanent deformation of the joints or damage to the enclosure and no leakages through the cemented joints.

a. 868i and 878 series Transmitter: The routine static test pressure of 570 PSIG shall be applied for a minimum duration of 10 seconds.
b. 868i series Transmitter and ZxG Local Mount Adapter with Trombone Adapter: The routine static test pressure of 470 PSIG shall be applied for a minimum duration of 10 seconds.

17.4 Ex Component Enclosure: The PF8x series Flowmeter assemblies incorporate the following Ex Components which are certified to previous editions of the aforementioned standards. The major technical changes between editions have been assessed with no technical differences found applicable, see ExTR for details. It is therefore the responsibility of the manufacturer to continually monitor the status of the certification associated with these components, and to inform CSA Group / Sira of any modifications of the devices which may impinge upon the explosion safety design of the aforementioned products.

a. Enclosure, IME model series: 7080. Certificate number: Sira 07ATEX1331U. Standards: EN 60079-0:2012+A1:2013, EN 60079-1:2014

b. Enclosure, IME model series: 7100. Certificate number: Sira 08ATEX1325U Standards: EN 60079-0:2012+A1:2013, EN 60079-1 :2014

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Certificate Annexe

Certificate Number: **Sira 17ATEX1304X**

Equipment: **DigitalFlow 868i, 878 series Transmitters and Panaflow PF8x series Ultrasonic Gas Flowmeter**

Applicant: **Panametrics LLC.**

Issue 0:

Drawing	Rev.	Sheets	Date (Sira stamp)	Description
238-103	E.1	1 of 1	06 Nov 17	Model IGM878N – Interconnect cable assembly
421-1782	A	1 of 1	06 Nov 17	Heat Sink – AC Power Supply
421-1783	A	1 of 1	06 Nov 17	Heat Sink – I/O PCB
421-3997	9	1 to 2	06 Nov 17	Enclosure Design B – Housing Casting and Machining
421-3999	7	1 to 2	06 Nov 17	Enclosure Design B – Threaded Window Cover Casting and Machining
421-4001	6	1 to 2	06 Nov 17	Enclosure Design B – Threaded Blind Cover Casting and Machining
421-4067	2	1 of 1	06 Nov 17	Enclosure Design B – Window Cover Retaining ring
421-4120	1	1 of 1	06 Nov 17	Enclosure Design B – Glass Window
425-271	M	1 to 5	06 Nov 17	Enclosure Design A – Housing Covers and Assembly Drawing (stainless steel)
442-615	N	1 of 1	06 Nov 17	Adhesive Label – Configuration Options
442-618	C	1 to 2	06 Nov 17	Adhesive Label – Warning / Caution Symbols
442-696	H	1 to 2	06 Nov 17	Markings Nameplate – Model Numbers (Enclosure Design A)
442-869	A	1 to 2	06 Nov 17	Adhesive Label – High Voltage Insulator
442-895	F	1 of 1	06 Nov 17	Adhesive Label – Electrical Ratings, Model and Serial Numbers
442-962	C	1 to 2	06 Nov 17	Adhesive Label – Keypad Interface
442-1446	H.2	1 of 1	06 Nov 17	Markings Nameplate – Certification Information (Enclosure Design A)
442-1907	4	1 of 1	06 Nov 17	Markings Nameplate – Certification Information (Enclosure Design B)
442-1908	1	1 to 2	06 Nov 17	Markings Nameplate – Model Numbers (Enclosure Design B)
700-1021	E	1 of 1	06 Nov 17	PCB Schematic – Fast Response Board
700-1215	F	1 to 2	06 Nov 17	PCB Schematic – Frequency / Totalizer / Alarm Option Board
700-1223	D	1 to 4	06 Nov 17	PCB Schematic – Frequency / Totalizer / Alarm / Analog Input Option Board
700-1225	C	1 to 3	06 Nov 17	PCB Schematic – Frequency / Totalizer / Alarm / Analog Output Option Board
700-1233	C	1 to 4	06 Nov 17	PCB Schematic – Quad Analog Input Option Board
700-1272	B	1 to 4	06 Nov 17	PCB Schematic – Analog I/O Option Board
703-1273	D	1 to 2	06 Nov 17	PCB Schematic – Flow DSP Board
700-1284	J	1 of 1	06 Nov 17	PCB Schematic – Receiver Communications Board
700-1291	C	1 of 1	06 Nov 17	PCB Schematic – Terminal Board
700-1299	A	1 to 1	06 Nov 17	PCB Schematic – Dual Transmit Communications Board
700-1332	A	1 to 2	06 Nov 17	PCB Schematic – Data Logging Board
700-1345	B	1 to 2	06 Nov 17	PCB Schematic – Communications Board
700-1385	A	1 to 3	06 Nov 17	PCB Schematic – Hart Communications Board
700-1402	2	1 of 1	06 Nov 17	PCB Schematic – DC Power Supply Board
700-1403	H	1 of 1	06 Nov 17	PCB Schematic – AC Power Supply Board
700-1418	B	1 to 2	06 Nov 17	PCB Schematic – Interconnect Board
700-1422	B	1 to 7	06 Nov 17	PCB Schematic – Main Board
700-1440	B	1 of 1	06 Nov 17	PCB Schematic – Terminal Board
700-1473	D	1 to 5	06 Nov 17	PCB Schematic – Frequency / Totalizer / Alarm / Analog Input Option Board
700-1475	G	1 to 5	06 Nov 17	PCB Schematic – Foundation Fieldbus Communications Board

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Certificate Annexe

Certificate Number: **Sira 17ATEX1304X**

Equipment: **DigitalFlow 868i, 878 series Transmitters and Panaflow PF8x series Ultrasonic Gas Flowmeter**

Applicant: **Panametrics LLC.**

Drawing	Rev.	Sheets	Date (Sira stamp)	Description
700-1910	4	1 to 2	06 Nov 17	PCB Schematic – HMI Board
703-1021	E	1 of 1	06 Nov 17	PCB Assembly – Fast Response Board
703-1130	F	1 of 1	06 Nov 17	PCB Assembly – AC Power Supply Board
703-1146	D	1 of 1	06 Nov 17	PCB Assembly – Data Logging Board
703-1213	B	1 of 1	06 Nov 17	PCB Assembly – DC Power Supply Board
703-1215	A	1 of 1	06 Nov 17	PCB Assembly – Frequency / Totalizer / Alarm Option Board
703-1223	D	1 of 1	06 Nov 17	PCB Assembly – Frequency / Totalizer / Alarm / Analog Input Option Board
703-1225	A	1 of 1	06 Nov 17	PCB Assembly – Frequency / Totalizer / Alarm / Analog Output Option Board
703-1233	B	1 of 1	06 Nov 17	PCB Assembly – Quad Analog Input Option Board
703-1244	J	1 to 2	06 Nov 17	PCB Assembly – AC Power Supply Board
703-1272	C	1 of 1	06 Nov 17	PCB Assembly – Analog I/O Option Board
703-1273	B	1 of 1	06 Nov 17	PCB Assembly – Flow DSP Board
703-1277	1	1 of 1	06 Nov 17	PCB Assembly – DC Power Supply Board
703-1281	3	1 of 1	06 Nov 17	PCB Assembly – DC Power Supply Board
703-1284	J	1 of 1	06 Nov 17	PCB Assembly – Receiver Communications Board
703-1291	D	1 of 1	06 Nov 17	PCB Assembly – Terminal Board
703-1299	A	1 of 1	06 Nov 17	PCB Assembly – Dual Transmit Communications Board
703-1332	A	1 to 2	06 Nov 17	PCB Assembly – Data Logging Board
703-1345	B	1 of 1	06 Nov 17	PCB Assembly – Communications Board
703-1385	B	1 of 1	06 Nov 17	PCB Assembly – Hart Communications Board
703-1402	2	1 to 2	06 Nov 17	PCB Assembly – DC Power Supply Board
703-1403	L	1 to 3	06 Nov 17	PCB Assembly – AC Power Supply Board
703-1418	B	1 to 2	06 Nov 17	PCB Assembly – Interconnect Board
703-1422	C	1 to 2	06 Nov 17	PCB Assembly – Main Board
703-1440	H	1 to 3	06 Nov 17	PCB Assembly – Terminal Board
703-1473	D	1 to 2	06 Nov 17	PCB Assembly – Frequency / Totalizer / Alarm / Analog Input Option Board
703-1475	J	1 to 2	06 Nov 17	PCB Assembly – Foundation Fieldbus Communications Board
703-1910	4	1 to 2	06 Nov 17	PCB Assembly – HMI Board
705-683	AN	1 to 3	06 Nov 17	Overall Assembly – XMT868
705-1106	4	1 to 3	06 Nov 17	Assembly – XMT868i with IR Keypad
705-1107	4	1 to 3	06 Nov 17	Assembly – XGX868i with IR Keypad
705-1848	3	1 to 2	06 Nov 17	Enclosure Design B – Assembly Drawing (aluminium)
752-108	P.2	1 to 4	06 Nov 17	Enclosure Design A – Housing Covers and Assembly Drawing (aluminium)
752-546	4	1 to 2	06 Nov 17	Enclosure Design B – Certification Drawing

Issue 1. No new drawings were introduced.

Certificate Annexe

Certificate Number: **Sira 17ATEX1304X**

Equipment: **DigitalFlow 868i, 878 series Transmitters and Panaflow PF8x series Ultrasonic Gas Flowmeter**

Applicant: **Panametrics LLC.**

Issue 2.

Drawing	Rev.	Sheets	Date	Description
421-3997	A	1 to 2	20 Nov 20	Enclosure Design B – Housing Casting and Machining
421-3999	A	1 to 2	20 Nov 20	Enclosure Design B – Threaded Window Cover Casting and Machining
421-4001	A	1 to 2	20 Nov 20	Enclosure Design B – Threaded Blind Cover Casting and Machining
421-4067	A	1 of 1	20 Nov 20	Enclosure Design B – Window Cover Retaining ring
421-4120	A	1 of 1	20 Nov 20	Enclosure Design B – Glass Window
421-4232	A	1 of 1	20 Nov 20	Heat Sink – AC Power Supply
442-696	J00	1 of 1	11 Jan 21	Markings Nameplate – Model Numbers (Enclosure Design A)
442-895	G00	1 to 2	11 Jan 21	Adhesive Label – Electrical Ratings, Model and Serial Numbers
442-1446	K02	1 of 1	11 Jan 21	Markings Nameplate – Certification Information (Enclosure Design A)
442-1881	B00	1 of 1	11 Jan 21	Markings Nameplate – Model Numbers (Enclosure Design B)
442-1883	C01	1 of 1	11 Jan 21	Markings Nameplate – Certification Information (Enclosure Design B)
700-1284	L	1 of 1	20 Nov 20	PCB Schematic – Receiver Communications Board
700-1345	D	1 to 2	20 Nov 20	PCB Schematic – Communications Board
700-1354	F	1 of 1	20 Nov 20	PCB Schematic – DC Power Supply Board
700-1385	C	1 to 3	20 Nov 20	PCB Schematic – Hart Communications Board
700-1418	C	1 to 2	20 Nov 20	PCB Schematic – Interconnect Board
700-1419	C	1 to 3	20 Nov 20	PCB Schematic – IR Keypad / Display Interface Board
700-1430	D	1 to 5	20 Nov 20	PCB Schematic – 4 Analog Input Board
700-1473	E	1 to 5	20 Nov 20	PCB Schematic – Frequency / Totalizer / Alarm / Analog Input Option Board
700-1475	H	1 to 5	20 Nov 20	PCB Schematic – Foundation Fieldbus Communications Board
700-1477	E	1 to 4	20 Nov 20	PCB Schematic – MODBUS / TCP Board
700-1481	A	1 of 1	20 Nov 20	PCB Schematic – Terminal Ethernet Board
700-1589	D	1 to 7	20 Nov 20	PCB Schematic – Main Board
700-1658	B	1 to 3	20 Nov 20	PCB Schematic – HART Board
700-1674	A	1 to 4	20 Nov 20	PCB Schematic – Magnetic Keypad / Display Interface Board
703-1146	F	1 of 1	20 Nov 20	PCB Assembly – Data Logging Board
703-1215	F	1 of 1	20 Nov 20	PCB Assembly – Frequency / Totalizer / Alarm Option Board
703-1225	C	1 of 1	20 Nov 20	PCB Assembly – Frequency / Totalizer / Alarm / Analog Output Option Board
703-1273	C	1 of 1	20 Nov 20	PCB Assembly – Flow DSP Board
703-1284	K	1 of 1	20 Nov 20	PCB Assembly – Receiver Communications Board
703-1345	D	1 of 1	20 Nov 20	PCB Assembly – Communications Board
703-1354	L	1 of 1	20 Nov 20	PCB Assembly – DC Power Supply Board
703-1385	D	1 to 2	20 Nov 20	PCB Assembly – Hart Communications Board
703-1403	M	1 to 3	20 Nov 20	PCB Assembly – AC Power Supply Board
703-1418	E	1 to 2	20 Nov 20	PCB Assembly – Interconnect Board
703-1419	D	1 to 2	20 Nov 20	PCB Assembly – IR Keypad / Display Interface Board
703-1430	D	1 to 2	20 Nov 20	PCB Assembly – 4 Analog Input Board
703-1440	J	1 to 3	20 Nov 20	PCB Assembly – Terminal Board
703-1473	K	1 to 2	20 Nov 20	PCB Assembly – Frequency / Totalizer / Alarm / Analog Input Option Board

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Certificate Annexe

Certificate Number: **Sira 17ATEX1304X**

Equipment: **DigitalFlow 868i, 878 series Transmitters and Panaflow PF8x series Ultrasonic Gas Flowmeter**

Applicant: **Panametrics LLC.**

Drawing	Rev.	Sheets	Date	Description
703-1475	L	1 to 2	20 Nov 20	PCB Assembly – Foundation Fieldbus Communications Board
703-1477	D	1 to 2	20 Nov 20	PCB Assembly – MODBUS / TCP Board
703-1481	A	1 to 2	20 Nov 20	PCB Assembly – Terminal Ethernet Board
703-1589	D	1 to 2	20 Nov 20	PCB Assembly – Main Board
703-1658	D	1 to 2	20 Nov 20	PCB Assembly – HART Board
703-1674	B	1 to 2	20 Nov 20	PCB Assembly – Magnetic Keypad / Display Interface Board
705-1106	C	1 to 3	20 Nov 20	Assembly – XMT868i with IR Keypad
705-1107	C	1 to 3	20 Nov 20	Assembly – XGX868i with IR Keypad
705-1848	A	1 to 2	20 Nov 20	Enclosure Design B – Assembly Drawing (aluminium)
410-1468	3	1 to 2	20 Nov 20	410 series Line Bushing Seal – 4-pin, 1/2-14 NPT
410-1471	1	1 of 1	20 Nov 20	410 series Line Bushing Seal – 6-pin, 3/4-14 NPT
410-1488	1	1 of 1	20 Nov 20	410 series Line Bushing Seal – 8-pin, 1-11.5 NPT
421-4295	A	1 of 1	20 Nov 20	ZxG Local Mount Adapter – Trombone Adapter
421-4296	A	1 to 2	20 Nov 20	ZxG Local Mount Adapter
421-4297	A	1 to 2	20 Nov 20	ZxG Local Mount Adapter – 868i Mounting Bracket
703-1416	D	1 to 2	20 Nov 20	PCB Assembly – Preamp Board
705-1941	A	1 of 1	20 Nov 20	ZxG Remote Mount Adapter
752-561	- 01	1 to 15	20 Nov 20	Panaflow PF8x Ultrasonic Gas Flowmeter - Remote and Local Assemblies – Certification Drawing

Issue 3

Drawing	Sheets	Rev.	Date (Stamp)	Title
442-1446	1 of 1	M	28 Jun 23	LABEL, CERTIFICATION, AL
442-1883	1 of 1	F	28 Jun 23	LABEL, CERTIFICATION, SS
700-2000	1 to 9	B	26 Jun 23	PCB Schematic – Foundation Fieldbus Option Card PCB (alternative FISCO)
710-2000	1 of 1	B	26 Jun 23	Fabrication - Foundation Fieldbus Option Card PCB (alternative FISCO)
700-1475	1 to 5	J	26 Jun 23	PCB Schematic – Foundation Fieldbus Board
710-1475	1 of 1	F	26 Jun 23	Fabrication - Foundation Fieldbus Option Card PCB
752-326	1 of 1	E	26 Jun 23	CONTROL DRAWING 868 FLOWMETER FISCO

1 **EU-TYPE EXAMINATION CERTIFICATE**

2 Equipment intended for use in Potentially Explosive Atmospheres Directive 2014/34/EU

3 Certificate Number: **Sira 20ATEX1001X** Issue: **3**

4 Equipment: **Ultrasonic Flow Transducer Series T5, T5MAX, T17 and T8**

5 Applicant: **Panametrics LLC**

6 Address: 1100 Technology Park Drive
Billerica, Massachusetts 01821 USA

7 This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 CSA Group Netherlands B.V., notified body number 2813 in accordance with Articles 17 and 21 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in the confidential reports listed in Section 14.2.

9 Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule to this certificate, has been assured by compliance with the following documents:

EN IEC 60079-0:2018 EN 60079-1:2014

10 If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to Specific Conditions of Use identified in the schedule to this certificate.

11 This EU-Type Examination Certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment.

12 The marking of the equipment shall include the following:

II 2 G

T5, T5MAX and T17:	**T8:**
Ex db IIC T6…T1 Gb	Ex db IIC T6…T3 Gb
Ta = -40°C to +60°C	Ta = -40°C to +60°C
Ingress Protection IP66	Ingress Protection IP66

Signed: Michelle Halliwell

Title: Director of Operations

PRODUCTS RvA C 652

Project Number 80162177

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13 **DESCRIPTION OF EQUIPMENT**

The T5, T5MAX, T17 and T8 model series of flow transducer assemblies are ultrasonic piezoelectric sensors with varying tube lengths, intended to be mounted in direct contact (i.e. wetted type) within gas pipeline processes. Electrical field wiring connections are enclosed within an Ex Component flameproof enclosure with an Ex Component cable gland and/or Ex Component thread adapter, located a minimum distance of 20 cm from the process connection.

The T5, T5MAX, T17 and T8 are optionally available with an internal XAMP preamplifier.

The T5, T5MAX, T17 and T8 transducer assemblies are comprised of a single compartment, stainless steel or aluminium enclosure, with up to four threaded conduit entries. Each unused conduit entry is provided with a suitably rated blanking element. The overall physical dimensions (L x W x H) are 105.9 x 69.6 x 105.9 mm, with a maximum transducer tube length of 1.8 meters.

The equipment has been separately tested against the requirements of IEC 60529 and meets IP66.

Model code:

T5, T5MAX, and T17 Ultrasonic Transducer Assembly model code: aa-bb-cc-dd-ee-ff-gg-hh-ii-jj-zz

aa = Model
- T5
- T5MAX
- T17

bb = Transducer head:
- 17 = Oblique / 174°
- 18 = Straight body / 180°
- 45 = Oblique / 45° (T5 only)
- 90 = Right angle / 90° (T5 and T5MAX only)

cc = Frequency:
- 05 = 50 kHz
- 10 = 100 kHz
- 20 = 200 kHz
- 50 = 500 kHz

dd = Tube length: specified per application
- 8.5 to 72 = 0.2 to 1.8 meters (8.5 to 72 inches)

ee = Process temperature range:
- LT = Low temperature -220°C to +100°C
- NT = Normal temperature -55°C to +150°C
- HT = High temperature -50°C to +250°C
- XT = Extremely high temperature -180°C to +300°C

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ff = Transducer material:
- Ti = Titanium CP2
- MN = Monel 400
- HC = Hastelloy C276
- SS = Stainless steel 316 / 304

gg = Junction box:
- 01 = Aluminium
- 02 = Stainless steel

hh = Preamplifier type:
- 00 = No internal XAMP preamplifier
- 01 = Internal XAMP with transformer
- 02 = Internal XAMP without transformer

ii = Preamplifier gain
- 00 = No internal XAMP
- 01 = Internal XAMP with gain of 10
- 02 = Internal XAMP with gain of 20
- 03 = Internal XAMP with gain of 02
- 04 = Internal XAMP with gain of 40

jj = Certification:
- 02 = ATEX (II 2G Ex db IIC)
- 03 = IECEx (Ex db IIC)

zz = Miscellaneous:
- 0 = None
- S = Special

T8 Ultrasonic Transducer Assembly model code: aa-bb-cc-dd-ee-ff-gg-hh-ii-jj-zz

aa = Model
- T8

bb = Transducer head:
- 18 = Straight body / 180°
- 30 = Oblique / 30°
- 45 = Oblique / 45°

cc = Frequency:
- 05 = 50 kHz
- 10 = 100 kHz
- 20 = 200 kHz
- 50 = 500 kHz

dd = Tube length: specified per application
- 12 to 72 = 0.3 to 1.8 meters (12 to 72 inches)

This certificate and its schedules may only be reproduced in its entirety and without change
CSA Group Netherlands B.V. Utrechtseweg 310, Building B42, 6812AR Arnhem, The Netherlands

ee = Process temperature range:
NT = Normal temperature -50°C to +150°C

ff = Transducer material:
Ti = Titanium CP2
MN = Monel 400
HC = Hastelloy C276
SS = Stainless steel 316 / 304

gg = Junction box:
UX = Aluminium
UXSS = Stainless steel

hh = Preamplifier type:
00 = No internal XAMP preamplifier
01 = Internal XAMP with transformer
02 = Internal XAMP without transformer

ii = Preamplifer gain:
00 = No internal XAMP
01 = Internal XAMP with gain of 10
02 = Internal XAMP with gain of 20
03 = Internal XAMP with gain of 02
04 = Internal XAMP with gain of 40

jj = Certification
02 = ATEX (II 2 G Ex db IIC)
03 = IECEx (Ex db IIC)

zz = Miscellaneous:
0 = None
S = Special

Variation 1 - This variation introduced the following change:

i. The certificate holder and manufacturer's name was changed:

From:	To:
GE Infrastructure Sensing Inc.	Panametrics LLC

Variation 2 - This variation introduced the following changes:

i. Addition of the new model "T5MAX", the description was amended accordingly.
ii. Correction of product nomenclature of the model T8 (XAMP option).
iii. Release of documentation supporting the new model "T5MAX".
iv. Minor update to previously assessed Ex Components and Ex Equipment:
-Enclosure with Preamplifier – Name change went from "GE Infrastructure Sensing" to "Panametrics LLC". Refer to report R80097040A where the name change was documented.
-Thread Adapter (ATEX certs) – Change of Certificate numbers and update of standards.

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"Schedule of Limitations" did not change and original analysis performed in report R80028901A, section 3.10.3.6 remains applicable.

v. Correction to "Manufacturing location B" address.

14 DESCRIPTIVE DOCUMENTS

14.1 Drawings

Refer to Certificate Annexe.

14.2 Associated Reports and Certificate History

Issue	Date	Report number	Comment
0	19 March 2020	R80028901A	The release of the prime certificate.
1	11 December 2020	R80065145A	Transfer of certificate Sira 20ATEX1001X from Sira Certification Service to CSA Group Netherlands B.V.
2	02 February 2022	R80097040A	The introduction of Variation 1.
3	27 June 2023	R80162176A	The introduction of Variation 2.

15 SPECIFIC CONDITIONS OF USE (denoted by X after the certificate number)

15.1 Consult the manufacturer if dimensional information on the flameproof joints is necessary.

15.2 It is end-user's responsibility to ensure that the ambient around the T5, T5MAX, T17 and T8 assembly does not exceed the permitted ambient of -40°C to +60°C, regardless of process temperature.

15.3 The T5, T5MAX, T17 and T8 transducers made of titanium (where ff = Ti) are potential ignitions sources when subjected to impact or friction, which shall be taken into consideration during installation.

15.4 The T5, T5MAX, T17 and T8 have non-conducting coating which may generate an ignition-capable level of electrostatic charge under certain extreme conditions. The user shall take the necessary precautions to minimise the risk from electrostatic discharge. For example, controlling the environmental humidity where installed in order to minimize generation of static electricity, with the equipment protected from direct airflow which could cause a transfer of charge to the surface of the equipment. Cleaning should be done only with a damp cloth.

15.5 The temperature classification rating of the T5, T5MAX, T17 and T8 assemblies is dependent upon the maximum process temperature (see table below).

Model (where aa = T5, T5MAX or T17)	Process temperature	T-Class
aa-bb-cc-dd-LT-ff-gg-hh-ii-jj-zz	-220℃ to +85℃	T6
	+85℃ to +100℃	T5
aa-bb-cc-dd-NT-ff-gg-hh-ii-jj-zz	-55℃ to +85℃	T6
	+86℃ to +100℃	T5
	+101℃ to +135℃	T4
	+136℃ to +150℃	T3
aa-bb-cc-dd-HT-ff-gg-hh-ii-jj-zz	-50℃ to 85℃	T6
	+86℃ to +100℃	T5
	+101℃ to +135℃	T4
	+136℃ to +200℃	T3

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SCHEDULE

EU-TYPE EXAMINATION CERTIFICATE **Sira 20ATEX1001X**
Issue 3

Model (where aa = T5, T5MAX or T17)	Process temperature	T-Class
	+201℃ to +250℃	T2
aa-bb-cc-dd-XT-ff-gg-hh-ii-jj-zz	-180℃ to 85℃	T6
	+86℃ to +100℃	T5
	+101℃ to +135℃	T4
	+136℃ to +200℃	T3
	+201℃ to +300℃	T2
Model T8	Process temperature	T-Class
T8-bb-cc-dd-NT-ff-gg-hh-ii-jj-zz	-50℃ to +85℃	T6
	+86℃ to +100℃	T5
	+101℃ to +135℃	T4
	+136℃ to +150℃	T3

16 **ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II** (EHSRs)

The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in the reports listed in Section 14.2.

17 **CONDITIONS OF MANUFACTURE**

17.1 The use of this certificate is subject to the Regulations Applicable to Holders of CSA Group Netherlands B.V. certificates.

17.2 Holders of EU-Type Examination Certificates are required to comply with the conformity to type requirements defined in Article 13 of Directive 2014/34/EU.

17.3 Routine Overpressure Test (EN 60079-1 clause 16): Welded T5, T5MAX, T17 and T8 transducer head and tube assemblies are subjected to routine overpressure testing of 290 PSI (2000 kPa) for a minimum duration of 10 seconds during assembly, before potting.

17.4 Ex Component Disclosure: The T5, T5MAX, T8, and T17 assemblies incorporate the following previously certified Ex Components. It is therefore the responsibility of the manufacturer to continually monitor the status of the certification associated with these components, and to inform CSA Group / Sira of any modifications of the devices which may impinge upon the explosion safety design of the aforementioned products.

- Enclosure, IME model series: 7080. Certificate number: IECEx SIR 07.0111U, SIRA 07ATEX1331U
- Enclosure, IME model series: 6080. Certificate number: IECEx FMG 19.0008U, FM19ATEX0010U
- Enclosure with Preamplifier, **Panametrics** model series XAMP. Certificate number: IECEx SIR 13.0071, Sira 13ATEX1184
- Cable Gland, nVent model: 500SSGL34EX. Certificate number: IECEx BAS 08.0107X, Baseefa08ATEX0327X
- Thread adapter, Peppers model series: AR. Certificate number: CML19ATEX1090X

Certificate Annexe

Certificate Number: **Sira 20ATEX1001X**

Equipment: **Ultrasonic Flow Transducer Series T5, T5MAX T17 and T8**

Applicant: **Panametrics LLC**

Issue 0

Drawing	Sheets	Rev.	Date (Stamp)	Title
531-160	1 of 1	J	19 Mar 20	T5 transducer 180° head
531-161	1 of 1	E	19 Mar 20	T5 transducer 180° long head
531-170	1 of 1	K	19 Mar 20	T5 extended tube length
531-308	1 of 1	H	19 Mar 20	T5 transducer 45° head
531-309	1 of 1	J	19 Mar 20	T5 transducer 90° head
531-310	1 of 1	H	19 Mar 20	T5 transducer 90° long head
531-578	1 of 1	H	19 Mar 20	T5 and T17 tube length
531-1022	1 of 1	A	19 Mar 20	T5 and T17 standard tube length
752-057	1 of 1	C	19 Mar 20	T5 180° NT transducer assembly
752-058	1 of 1	C	19 Mar 20	T5 180° XT / HT / LT transducer assembly
752-059	1 of 1	C	19 Mar 20	T5 90° NT transducer assembly
752-060	1 of 1	C	19 Mar 20	T5 90° XT / HT / LT transducer assembly
752-061	1 of 1	C	19 Mar 20	T5 45° NT transducer assembly
752-062	1 of 1	C	19 Mar 20	T5 45° XT / HT / LT transducer assembly
752-063	1 of 1	N	19 Mar 20	T5 and T17 series assemblies
752-116	1 of 1	E	19 Mar 20	T8 30° NT transducer assembly
752-117	1 of 1	E	19 Mar 20	T8 45° NT transducer assembly
752-118	1 of 1	E	19 Mar 20	T8 180° NT transducer assembly
752-119	1 of 1	F	19 Mar 20	T8 tube body
752-121	1 of 1	D	19 Mar 20	T8 transducer 30° head
752-122	1 of 1	D	19 Mar 20	T8 transducer 180° head
752-123	1 of 1	E	19 Mar 20	T8 transducer 45° head
752-124	1 of 1	E	19 Mar 20	T8 transducer head cap
752-125	1 of 1	D	19 Mar 20	T8 series assembly
752-321	1 of 1	A	19 Mar 20	T17 180° transducer assembly

Issue 1. No new drawings were introduced.

Issue 2

Drawing	Sheets	Rev.	Date (Stamp)	Title
752-125	1 of 1	A	01 Feb 22	T8 Transducer
752-063	1 of 1	P	01 Feb 22	T5/T17 Transducer

Issue 3

Drawing	Sheets	Rev.	Date (Stamp)	Title
752-063	1 to 2	00	24 Apri23	T5/T17/T5MAX TOP LEVEL CERT DWG
173M2721	1 of 1	00	24 Apri23	T5MAX 180 NT TRDCR CONSTRUCTION CERT DWG
173M2754	1 of 1	00	24 Apri23	T5MAX 90 NT TRDCR CONSTRUCTION CERT DWG

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IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification System for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	**IECEx CML 19.0106X**	Page 1 of 3	Certificate history:
Status:	**Current**	Issue No: 0	
Date of Issue:	2019-10-10		
Applicant:	**Peppers Cable Glands Limited** Stanhope Road, Camberley, Surrey, GU15 3BT **United Kingdom**		
Equipment:	**Type CR-***, CR-D** & CR-O*** Cable Glands**		
Optional accessory:			
Type of Protection:	**Flameproof, Increased Safety, Dust, Restricted Breathing**		
Marking:	CR-O*** Ex eb IIC Gb Ex ta IIIC Da CR-*** and CR-D** Ex db IIC Gb Ex eb IIC Gb Ex ta IIIC Da Ex nR IIC Gc		

Approved for issue on behalf of the IECEx Certification Body: **A C Smith**

Position: **Technical Operations Director**

Signature:
(for printed version)

Date:
(for printed version)

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting www.iecex.com or use of this QR Code.

Certificate issued by:

Eurofins E&E CML Limited
Unit 1, Newport Business Park
New Port Road
Ellesmere Port, CH65 4LZ
United Kingdom

IECEx Certificate of Conformity

Certificate No.: **IECEx CML 19.0106X** Page 2 of 3

Date of issue: 2019-10-10 Issue No: 0

Manufacturer: **Peppers Cable Glands Limited**
Stanhope Road, Camberley, Surrey, GU15 3BT
United Kingdom

Manufacturing locations:

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements.This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended

STANDARDS :
The equipment and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards

IEC 60079-0:2017 Explosive atmospheres - Part 0: Equipment - General requirements
Edition:7.0

IEC 60079-1:2014 Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
Edition:7.0

IEC 60079-15:2010 Explosive atmospheres - Part 15: Equipment protection by type of protection "n"
Edition:4

IEC 60079-31:2013 Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"
Edition:2

IEC 60079-7:2017 Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
Edition:5.1

This Certificate **does not** indicate compliance with safety and performance requirements other than those expressly included in the Standards listed above.

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in:

Test Report:

GB/CML/ExTR19.0133/00

Quality Assessment Report:

GB/CML/QAR19.0022/00

IECEx Certificate of Conformity

EQUIPMENT:
Equipment and systems covered by this Certificate are as follows:

The type CR-***, CR-D** and CR-O*** ranges of cable glands may be supplied in gland size 16 to 100 with entry thread sizes M20 to M100 or with the equivalent size NPT, NPSM, BSPP, BSPT, PG or ET
entry thread forms.

Refer to Certification Annex for full equipment description.

SPECIFIC CONDITIONS OF USE: YES as shown below:

1. Glands fitted with neoprene sealing rings (black) shall not be used in enclosures where the temperature, at the point of mounting, is outside the range of -35°C to +90°C.
2. Glands fitted with silicone sealing rings (white or red) shall not be used in enclosures where the temperature, at the point of mounting, is outside the range of –60°C to +180°C.
3. When the gland is used with increased safety and/or dust protected equipment, the entry thread shall be suitably sealed to maintain the ingress protection rating of the associated enclosure.
4. If the CR-***, CR-D** and CR-O*** types of cable glands only grip the cable sheath of the cable and do not clamp the cable armour or if they are used to terminate unarmoured, braided or screened cables, then they shall only be used for fixed installations, hence, the cables shall be effectively clamped to prevent pulling or twisting.
5. The CR-*** and CR-D** cable glands, when installed in accordance with the manufacturer's instructions and with an appropriate enclosure on which they are fixed, are capable of providing an ingress protection of IP66 and IP68 (50 metres 7 days).
6. The CR-O*** range of cable glands, when installed in accordance with the manufacturer's instructions and with an appropriate enclosure on which they are fixed, are capable of providing an ingress protection of IP66.
7. The threaded entry component threads without interface O-ring seals installed in an explosive dust atmosphere, within threaded entries, shall only be fitted into enclosures that have either:

- parallel entries that will ensure that a minimum of 5 full threads of contact will be maintained, this is in accordance with clause 5.1.2 of EN 60079-31:2014.
- tapered entries that will ensure that a minimum of 3 ½ full threads of contact will be maintained, this is in accordance with clause 5.1.2 of EN 60079-31:2014.

Annex:

Annex IECEx CML 19.0106X Issue 0_1.pdf

Annexe to:	IECEx CML 19.0106X Issue 0
Applicant:	Peppers Cable Glands Limited
Apparatus:	Type CR-***, CR-D** & CR-O*** Cable Glands

The type CR-***, CR-D** and CR-O*** ranges of cable glands may be supplied in gland size 16 to 100 with entry thread sizes M20 to M100 or with the equivalent size NPT, NPSM, BSPP, BSPT, PG or ET entry thread forms. They are intended for use with effectively filled and circular armoured, unarmoured, braided, tape or screened sheathed cables and compromise the following components: -

a.	An entry component	f.	A tapered clamp ring
b.	An elastomeric inner sealing ring	g.	A middle nut
c.	A metal inner skid washer	h.	An elastomeric outer sealing ring
d.	A compression nut	i.	A nylon outer skid washer
e.	An armour clamping cone	j.	A back nut

Additional assembly options are described by the following designation coding:

Type CR-*** Cable Glands Gland Type:	CR-***					
Available Part No's.:	C	R	*	*	*	
			1	B	R	
			2	S		
			3			
			4			

Options:	1	Neoprene Seals
	2	Neoprene Seals with Lead Sheath Cable Continuity Washer
	3	Silicone Seals
	4	Silicone Seals with Lead Sheath Cable Continuity Washer
	B	Brass material
	S	316 Stainless Steel material
	R	Reduced Bore option

Type CR-*** Cable Glands:

Unit 1, Newport Business Park
New Port Road
Ellesmere Port
CH65 4LZ
T +44 (0) 151 559 1160
E info@cmlex.com
www.cmlex.com
Company Reg No. 8554022 VAT No. GB163023642

Gland Size	Standard Entry threads		Inner Sheath		Outer Sheath		Reduced Bore		Armour Dia./Thickness	
									Steel wire & Tape (Universal) or Braid/Screen	
	Metric	NPT	Min	Max	Min	Max	Min	Max	Min	Max
16	M20	½”	3.4	8.4	8.4	13.5	6.7	10.3	0.15	1.25
16H	M20	½”	3.4	8.4	11.5	16.0	9.4	12.5	0.15	1.25
20S	M20	½”	7.2	11.7	11.5	16.0	9.4	12.5	0.15	1.25
20	M20	½”	9.4	14.0	15.5	21.1	12.0	17.6	0.15	1.25
25	M25	¾”	13.5	20.0	20.3	27.4	16.8	23.9	0.15	1.6
32	M32	1”	19.5	26.3	26.7	34.0	23.2	30.5	0.15	2.0
40	M40	1 ¼”	23.0	32.2	33.0	40.6	28.6	36.2	0.2	2.0
50S	M50	1 ½”	28.1	38.2	39.4	46.7	34.8	42.4	0.2	2.5
50H	M50	1 ½”	28.1	38.2	45.7	53.2	41.1	48.5	0.2	2.5
50	M50	2”	33.1	44.1	45.7	53.2	41.1	48.5	0.3	2.5
63S	M63	2”	39.2	50.1	52.1	59.5	47.5	54.8	0.3	2.5
63H	M63	2”	39.2	50.1	58.4	65.8	53.8	61.2	0.3	2.5
63	M63	2 ½”	46.7	56.0	58.4	65.8	53.8	61.2	0.3	2.5
75S	M75	2 ½”	52.1	62.0	64.8	72.2	60.2	68.0	0.3	2.5
75H	M75	2 ½”	52.1	62.0	71.1	78.0	66.5	73.4	0.3	2.5
75	M75	3”	58.0	68.0	71.1	78.0	66.5	73.4	0.3	2.5
80	M80	3”	62.2	72.0	77.0	84.0	71.9	79.4	0.45	3.15
80H	M80	3”	62.2	72.0	79.6	90.0	75.0	85.4	0.45	3.15
85	M85	3”	69.0	78.0	79.6	90.0	75.0	85.4	0.45	3.15
90	M90	3 ½”	74.0	84.0	88.0	96.0	82.0	91.4	0.45	3.15
90H	M90	3 ½”	74.0	84.0	92.0	102.0	87.4	97.4	0.45	3.15
100	M100	3 ½”	82.0	90.0	92.0	102.0	87.4	97.4	0.45	3.15
110	M110	4”	92.0	102.0	104.0	117.0	-	-	0.45	3.15

Type CR-D Cable Glands**

The Type CR-D** Cable Glands are used with armoured, unarmoured, braided or screened sheathed cables. They are formed by removing the outer cap, outer seal and outer skid washer from the Type CR-*** cable glands and fitting an alternative middle cap component, in addition these glands are fitted with an O-ring entry body seal. The Type CR-D** Cable Glands are available with ISO metric entry threads of M20 to M100 (alternative thread forms are available in equivalent sizes) in cable gland sizes 16 through to 100, they can be made from either brass (B) or stainless steel (S).

Gland Type: CR-D**

Available Part No's.:	C	R	D	*	*
				1	B
				2	S
				3	
				4	

Options:		
	1	Neoprene Seals
	2	Neoprene Seals with Lead Sheath Cable Continuity Washer
	3	Silicone Seals
	4	Silicone Seals with Lead Sheath Cable Continuity Washer
	B	Brass material
	S	316 Stainless Steel material

Type CR-D** Type Cable Glands:

Gland Size	Standard Entry threads		Inner Sheath		Outer Sheath	Armour Dia./Thickness	
						Steel wire & Tape (Universal) or Braid/Screen	
	Metric	NPT	Min	Max	Max	Min	Max
16	M20	½"	3.4	8.4	16.0	0.15	1.25
20S	M20	½"	7.2	11.7	16.0	0.15	1.25
20	M20	½"	9.4	14.0	21.1	0.15	1.25
25	M25	¾"	13.5	20.0	27.5	0.15	1.6
32	M32	1"	19.5	26.3	34.0	0.15	2.0
40	M40	1 ¼"	23.0	32.2	40.6	0.2	2.0

Gland Size	Standard Entry threads		Inner Sheath		Outer Sheath	Armour Dia./Thickness	
						Steel wire & Tape (Universal) or Braid/Screen	
	Metric	NPT	Min	Max	Max	Min	Max
50S	M50	1 ½”	28.1	38.2	53.2	0.2	2.5
50	M50	2”	33.1	44.1	53.2	0.3	2.5
63S	M63	2”	39.2	50.1	65.8	0.3	2.5
63	M63	2 ½”	46.7	56.0	65.8	0.3	2.5
75S	M75	2 ½”	52.1	62.0	78.0	0.3	2.5
75	M75	3”	58.0	68.0	78.0	0.3	2.5
80	M80	3”	62.2	72.0	90.0	0.45	3.15
85	M85	3”	69.0	78.0	90.0	0.45	3.15
90	M90	3 ½”	74.0	84.0	102.0	0.45	3.15
100	M100	3 ½”	82.0	90.0	102.0	0.45	3.15

The Type CR-D** Cable Glands are formed by removing the outer cap, outer seal and outer skid washer from the CR-*** gland and fitting an alternative middle cap component. They are available in the same size, entry thread options and materials as the CR-*** cable gland.

Type CR-O* Cable Glands**

The Type CR-O*** Cable Glands are used with armoured, non-lead sheathed cables. They are formed by removing the inner sealing ring and its associated skid washer from the Type CR-*** cable glands, in addition these glands are fitted with an O-ring entry body seal. The Type CR-O*** Cable Glands are available with ISO metric entry threads of M20 to M100 (alternative thread forms are available in equivalent sizes) in cable gland sizes 16 through to 100, they can be made from either brass (B), stainless steel (S) and fitted with an optional reduced bore outer seal (R).

Gland Type: CR-O***

Available Part No’s.:	C	R	O	*	*	*
				1	B	R
				3	S	

Options:
1 Neoprene Seals
3 Silicone Seals

B	Brass material
S	316 Stainless Steel material
R	Reduced Bore Option

Type CR-O*** Cable Glands

Gland Size	Standard Entry threads		Inner Sheath Max	Outer Sheath		Reduced Bore		Armour Dia./Thickness	
								Steel wire & Tape (Universal) or Braid/Screen	
	Metric	NPT		Min	Max	Min	Max	Min	Max
16	M20	½”	11.7	8.4	13.5	6.7	10.3	0.15	1.25
20S	M20	½”	11.7	11.5	16.0	9.4	12.5	0.15	1.25
20	M20	½”	14.0	15.5	21.1	12.0	17.6	0.15	1.25
25	M25	¾”	20.0	20.3	27.4	16.8	23.9	0.15	1.6
32	M32	1”	26.3	26.7	34.0	23.2	30.5	0.15	2.0
40	M40	1 ¼”	32.2	33.0	40.6	28.6	36.2	0.2	2.0
50S	M50	1 ½”	38.2	39.4	46.7	34.8	42.4	0.2	2.5
50H	M50	1 ½”	44.1	39.4	46.7	34.8	42.4	0.3	2.5
50	M50	2”	44.1	45.7	53.2	41.1	48.5	0.3	2.5
63S	M63	2”	50.1	52.1	59.5	47.5	54.8	0.3	2.5
63H	M63	2”	56.0	52.1	59.5	47.5	54.8	0.3	2.5
63	M63	2 ½”	56.0	58.4	65.8	53.8	61.2	0.3	2.5
75S	M75	2 ½”	62.0	64.8	72.2	60.2	68.0	0.3	2.5
75H	M75	2 ½”	68.0	64.8	72.2	60.2	68.0	0.3	2.5
75	M75	3”	68.0	71.1	78.0	66.5	73.4	0.3	2.5
80	M80	3”	72.0	77.0	84.0	71.9	79.4	0.45	3.15
80H	M80	3”	78.0	79.6	90.0	75.0	85.4	0.45	3.15
85	M85	3”	78.0	79.6	90.0	75.0	85.4	0.45	3.15
90	M90	3 ½”	84.0	88.0	96.0	82.0	91.4	0.45	3.15
90H	M90	3 ½”	90.0	88.0	96.0	82.0	91.4	0.45	3.15

Gland Size	Standard Entry threads		Inner Sheath Max	Outer Sheath		Reduced Bore		Armour Dia./Thickness	
								Steel wire & Tape (Universal) or Braid/Screen	
	Metric	NPT		Min	Max	Min	Max	Min	Max
100	M100	3 ½”	90.0	92.0	102.0	87.4	97.4	0.45	3.15
110	M110	4”	102.0	104.0	117.0	-	-	0.45	3.15

Notes:

BAS01ATEX2271X, Sira 09ATEX1221X and IECEx SIR 07.0099X are superseded by certificates CML 19ATEX1348X, CML 19ATEX4109X and IECEx CML 19.0106X.

The product covered by Issue 0 of this certificate remains identical to that previously covered by BAS01ATEX2271X, Sira 09ATEX1221X and IECEx SIR 07.0099X.

Where BAS01ATEX2271X and/or Sira 09ATEX1221X and/or IECEx SIR 07.0099X is specified in other product certification, or other technical specifications, this certificate reference for the product shall be used in its place; updating of the other product certificate or technical specification is not required.

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification System for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: **IECEx SIR 09.0131X**

Certificate history:
Issue 3 (2011-06-30)
Issue 2 (2011-03-29)
Issue 1 (2010-04-27)
Issue 0 (2010-03-05)

Status: **Current**

Issue No: 4

Date of Issue: 2014-07-31

Applicant: **Peppers Cable Glands Ltd**
Stanhope Road
Camberley
Surrey, GU15 3BT
United Kingdom

Equipment: **AR range of Adaptors and Reducers SPA, SPB, SPMH and SPHH ranges of Stopping Plugs**

Optional accessory:

Type of Protection: **Flameproof, Increased Safety, Type N and Dust**

Marking: **Adapters and Reducers**
Ex d IIC Gb / Ex d I Mb, Ex e IIC Gb / Ex e I Mb, Ex nR IIC Gc, Ex tb III C Db IP66/ 68

Stopping Plugs
Ex d IIC Gb / Ex d I Mb, Ex e IIC Gb / Ex e I Mb Ex nR IIC Gc, Ex tb III C Db IP66* (*refer to the description)

Approved for issue on behalf of the IECEx Certification Body: **C Ellaby**

Position: **Deputy Certification Manager**

Signature:
(for printed version)

Date:

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting www.iecex.com or use of this QR Code.

Certificate issued by:

SIRA Certification Service
CSA Group
Unit 6, Hawarden Industrial Park
Hawarden, Deeside, CH5 3US
United Kingdom

IECEx Certificate of Conformity

Certificate No.: **IECEx SIR 09.0131X** Page 2 of 5

Date of issue: 2014-07-31 Issue No: 4

Manufacturer: **Peppers Cable Glands Ltd**
Stanhope Road
Camberley
Surrey
GU15 3BT
United Kingdom

Additional manufacturing locations:

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements.This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended

STANDARDS :
The equipment and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards

IEC 60079-0:2011 Explosive atmospheres - Part 0: General requirements
Edition:6.0

IEC 60079-1:2007-04 Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
Edition:6

IEC 60079-15:2010 Explosive atmospheres - Part 15: Equipment protection by type of protection "n"
Edition:4

IEC 60079-31:2013 Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"
Edition:2

IEC 60079-7:2006-07 Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
Edition:4

This Certificate **does not** indicate compliance with safety and performance requirements other than those expressly included in the Standards listed above.

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in:

Test Reports:

GB/SIR/ExTR14.0163/00
GB/SIR/ExTR11.0074/00
GB/SIR/ExTR10.0037/00
GB/SIR/ExTR10.0038/01
GB/SIR/ExTR10.0073/00

Quality Assessment Reports:

GB/SIR/QAR06.0018/05
GB/SIR/QAR06.0018/01
GB/SIR/QAR06.0018/02
GB/SIR/QAR06.0018/03
GB/SIR/QAR06.0018/04

IECEx Certificate of Conformity

Certificate No.: **IECEx SIR 09.0131X** Page 3 of 5

Date of issue: 2014-07-31 Issue No: 4

EQUIPMENT:
Equipment and systems covered by this Certificate are as follows:

Refer to the Annexe for the Description, design options etc.

The Manufacturer shall comply with the following condition of manufacture:

1. Aluminium devices shall not be marked with any information indicating that they are suitable for Group I use.

SPECIFIC CONDITIONS OF USE: YES as shown below:

1.	The Stopping Plugs and Blanking elements shall not be used in conjunction with an adapter or reducer when installed in a flameproof enclosure.
2.	Where Adapters and Reducers without sealing rings are installed in protection by enclosure (Ex t) equipment for use in explosive dust atmospheres, they shall only be fitted into enclosures offering a minimum of 5 full threads, in accordance with IEC 60079-31:2008 clause 5.1.1.
3.	When no seal is fitted and the stopping plug is installed in an increased safety (Ex e) enclosure, the user shall ensure that a minimum degree of protection IP54 is maintained.
4.	Where Stopping Plugs without sealing rings are installed in protection by enclosure (Ex t) equipment for use in explosive dust atmospheres, they may only be fitted into enclosures offering a minimum of 5 full threads, in accordance with IEC 60079-31:2008 clause 5.1.1
5.	Adapters and Reducers shall not to be used for the direct inter-connection of enclosures.
6.	Only one adapter or reducer is to be used with any single cable entry on the associated equipment.
7.	The products are approved for a temperature range at their point of mounting based upon the interface seal and material combinations of construction: See EQUIPMENT (continued) for Table

Equipment (continued):

	0	=	No seal fitted	(-100°C to +400°C)
	1	=	Nitrile O-ring	(-30°C to +100°C)
	2	=	Neoprene O-ring	(-35°C to +90°C)
	3	=	Silicone O-ring	(-60°C to +200°C)
	4	=	Fluorosilicone O-ring	(-55°C to +200°C)
	5	=	Viton O-ring	(-20°C to +180°C)
	6	=	EPDM O-ring	(-50°C to +110°C)

IECEx Certificate of Conformity

Certificate No.: **IECEx SIR 09.0131X** Page 5 of 5

Date of issue: 2014-07-31 Issue No: 4

DETAILS OF CERTIFICATE CHANGES (for issues 1 and above)

Issue 1 – this Issue introduced the following changes:		
1.	The recognition of an increase in the width of the marking band on the adaptors.	
2.	To allow amendments to dimensions of the adaptors and reducers, the changes do not affect the type of protection.	
Issue 2 – this Issue introduced the following change:		
1.	The introduction of male to male and female to female adaptors was recognised, the description in the annexe is amended accordingly	
Issue 3 – this Issue introduced the following change:		
1.	Issued to allow GB/SIR/ExTR10.0038/01 to replace GB/SIR/ExTR10.0038/00	
Issue 4 – this Issue introduced the following change:		
1.	The introduction of the:	
	•	M12, 1/4” and 3/8” NPT/NPSM/BSPT/BSPP sizes of the SPA, SPB, SPMH and SPHH ranges of stopping plugs.
	•	PG7 size of the SPMH and SPHH ranges of stopping plugs.
	•	M24 size for the SPMH stopping plug.
	•	ET conduit thread type for the SPA, SPB, SPMH and SPHH stopping plugs.
	Note: the range of thread types in the Description was amended to bring it up to date with this change.	
2.	Following appropriate re-assessment to demonstrate compliance with the requirements of the latest standards, the documents originally listed, IEC 60079-0:2007 Ed 5, IEC 60079-15:2005 Ed 3 and IEC 60079-31:2008 Ed 1, were replaced by, IEC 60079-0:2011 Ed 6, IEC 60079-15:2010 Ed 4 and IEC 60079-31:2013 Ed 2 respectively.	
3.	The marking Section was updated in relation to the IP ratings of the stopping plugs.	

Annex:

Annex to IECEx SIR 09.0131X Issue 4 Annexe.pdf

SECTION 1.13

SPARE PART INDEX REGISTER, (COMMISSIONING & 2YR OPERATION) ULTRASONIC FLOWMETER

1724001317-COM-LIS-00016

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

SPARE PART INDEX REGISTER (COMMISSIONING and 2 YEAR OPERATION)

Document Number: 1724001317-COM-LIS-00016

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
V. Barratta	19-02-2025

Rev.	Date	Description	Prepared	Reviewed	Approved
03	17/02/2025	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
02	28/01/2025	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
01	26/11/2024	Accepted for Construction (AFC)	BH DC	Tom Griffin	Niall Townsend
00	25/10/2024	Issue for Review (IFR)	BH DC	Tom Griffin	Niall Townsend

Baker Hughes

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Table of Contents

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1	Cover	X	X	X	X				
2	Table of Contents	X	X	X	X				
3	Revision / Change Log / Hold List	X	X	X	X				
4	SPARE PART INDEX REGISTER (COMMISSIONING and 2 YEAR OPERATION) - ULTRASONIC FLOWMETER	X	X	X	X				

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00	Issue for Review (IFR)
01	Accepted for Construction (AFC)
02	Accepted for Construction (AFC)
03	Accepted for Construction (AFC)

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2.	
3.	
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SPARE PARTS LIST

Document Title	**Commissioning and 2 years spare parts list**
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°	**1724001317-COM-LIS-00016**
Issued for review	
Rev. Date	B. 10/02/2025
	IFR
Class	**2**

The equipment consists of the following

1	Tag no.	43-FT-001					
2	Tag description	Ultrasonic flowmeter					
3	Manufacturer model/type no.	XGF868i-2-2-OH7-3-4-0-CC					
4	Manufacturer serial no.						
5	No. of units	1					
6	Quantity of parts FITTED						

Supplier:	Baker Hughs	PO Number: 1724001317 123A90A	PO description:	Ultrasonic Flowmeter	Contact name: Niall Townsend
Address:	Sensing House East Park, Shannon Co. Clare Ireland		Supplier telephone no:	+353 61 470200	Contact mobile no:
			E-mail:	niall.townsend@bakerhughes.com	WEBSITE http://www.bakerhughes.com/

General Information:

	Item Number	Total number of identical spares installed	MATERIALS DATA			Material	Certicate Type (if applicable)	Certicate 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.	Manufacturer name	Commissioning spares			2 Years spares			Remarks
			Description of recommended spare parts	Datasheets/drawing ref.																Quantity ordered			Quantity ordered			
				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								
6	1		1	Assy Receiver (100K NB)															703-1284-03		Baker Hughes				1		SK18027									
	1		2	UNIV DC POWER SUPPLY HV TRANSMIT PCB															703-1354-02		Baker Hughes				1		SK18027									
	1		3	Preamplifier for gas FM, mountable, XDCR JB															XAMP		Baker Hughes				2		SK18027									
	1		4	Comm Spare Prts: Stop Ring 316LSS, Male															RSPKIT-FLOW-IMA		Baker Hugh	2			2		SK18027									
	1		5	Comm Spare Prts: Fuses; Terminal Blocks															RSPKIT-FLOW-02		Baker Hugh	1					SK18027									

SECTION 1.14
INSTALLATION, OPERATING AND MAINTENANCE MANUAL - ULTRASONIC FLOWMETER
1724001317-IN-MAN-00017

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

INSTALLATION, OPERATING AND MAINTENANCE MANUAL - ULTRASONIC FLOWMETER

Document Number: 1724001317-IN-MAN-00017

Document Class: 2

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2	MINOR COMMENTS - REVISE AND RESUBMIT - WORK MAY PROCEED
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Sign	Date
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00	14/10/2024	Issue for Review (IFR)	BH DC	Tom Griffin	Niall Townsend
Rev.	Date	Description	Prepared	Reviewed	Approved

BakerHughes

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		00	01						
1	Cover	X	X						
2	Table of Contents	X	X						
3	Revision / Change Log / Hold List	X	X						
5	INSTALLATION, OPERATING AND MAINTENANCE MANUAL - ULTRASONIC FLOWM	X	X						

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Panametrics
a Baker Hughes business

T5/T5MAX Flare Gas Transducer

(Standard and Extended Velocity Range)

Installation Guide



panametrics.com

BH045C21 EN G

Panametrics
a Baker Hughes business

T5/T5MAX Flare Gas Transducer

(Standard and Extended Velocity Range)

Installation Guide

BH045C21 Rev. G
April 2024

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[no content intended for this page]

Services

Panametrics provides customers with an experienced staff of customer support personnel ready to respond to technical inquiries, as well as other remote and on-site support needs. To complement our broad portfolio of industry-leading solutions, we offer several types of flexible and scalable support services including: Training, Product Repairs, Service Agreements and more.

Please visit https://www.bakerhughes.com/panametrics/panametrics-services for more details.

Typographical Conventions

Note: *These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.*

IMPORTANT: These paragraphs provide information that emphasizes instructions that are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.

CAUTION! **This symbol indicates a risk of potential minor personal injury and/or severe damage to the equipment, unless these instructions are followed carefully.**

WARNING! **This symbol indicates a risk of potential serious personal injury, unless these instructions are followed carefully.**

Safety Issues

WARNING! **It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.**

Attention European Customers!To meet CE Mark requirements for all units intended for use in the EU, all electrical cables must be installed as described in this manual.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area

WARNING! **Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.**

WARNING! **Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on this equipment.**

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

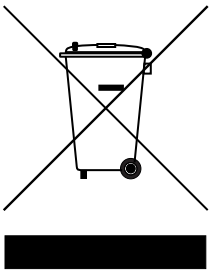
Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

Panametrics is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2012/19/EU.



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end of life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Please visit www.bakerhughesds.com/health-safety-and-environment-hse for take-back instructions and more information about this initiative.

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Chapter 1. Installing Pipe Nozzles

1.1 Introduction

Before the T5 transducers can be installed into the pipe, you will need to install pipe nozzles. Nozzles may be installed as part of a fabricated spoolpiece or by using the hot or cold tap process with a Panametrics *Nozzle Installation Kit.*

IMPORTANT: This procedure only applies if you are using a Nozzle Installation Kit. If you are tapping the pipe without using a Nozzle Installation Kit, refer to the supplied drawings in your shipment. This procedure is written and illustrated for installations on horizontal pipes. However, the procedure is the same for vertical pipe installations.



WARNING! Please follow all applicable site, local, and regional safety measures when conducting tapping of nozzles to pipe. Great care should be taken to ensure activity is not being conducted in a flammable environment without proper mitigation strategies.



WARNING! Any deviation from this prescribed procedure can result in accidental release of process gas that may be dangerous or hazardous due to its pressure, flammability, or composition. Safe work practices should be followed and periodic review of this procedure is highly recommended before conducting this work.

This section describes how to install nozzles in the following configurations:

1. Bias 90° Installation
   - Standard transducer spacings of 10” and 9”, with both transducers facing straight at each other, are for applications with gas velocities up to 100 m/s (328 ft/s). This is the standard velocity range.
   - A shorter transducer spacing of 6.4”, with only the downstream transducer rotated 6° into the flow is for applications with gas velocities up to 120 m/s (394 ft/s). This is the extended velocity range.
2. Tilted 45° Installation
   - Standard transducer face to face spacings, with both transducer body axes concentric and parallel to each other are for applications with gas velocities up to 100 m/s (328 ft/s). This is the standard velocity range.
   - A shorter transducer face to face spacing of approximately 7.85”, with only the downstream transducer tilted 6° into the flow, is for applications with gas velocities up to 120 m/s (394 ft/s). This is the extended velocity range.

Bias 90° Installation

This procedure includes the following steps:

- Identifying and checking the nozzle installation kit components
- Selecting and marking the pipe for nozzle locations
- Installing the first welding boss
- Installing the first nozzle
- Installing the second welding boss
- Installing the second nozzle
- Tapping the pipe

1.1.1 Identifying and Checking the Nozzle Installation Kit Components

The *Nozzle Installation Kit* contains the materials listed below. Use *Figure 1* below to help identify each component.

- 2 Nozzles (if purchased)
- 2 Welding bosses
- 1 Jig
- 1 Alignment plate (9", 10" or 6.4" spacing)
- 1 Spacer flange
- 1 Threaded rod (1" diameter), with washer and nut

IMPORTANT: You will need eight 5/8" studs with two nuts each, or 3/4" studs with two nuts each. The 5/8" studs are needed for 2"-150#, 2"-300# and 3"-150# flanges. The 3/4" studs are needed for 3"-300# flanges.

After you are familiar with each component, verify that the welding bosses and alignment plate shipped are for the required transducer spacing and the pipe size described in the following steps.

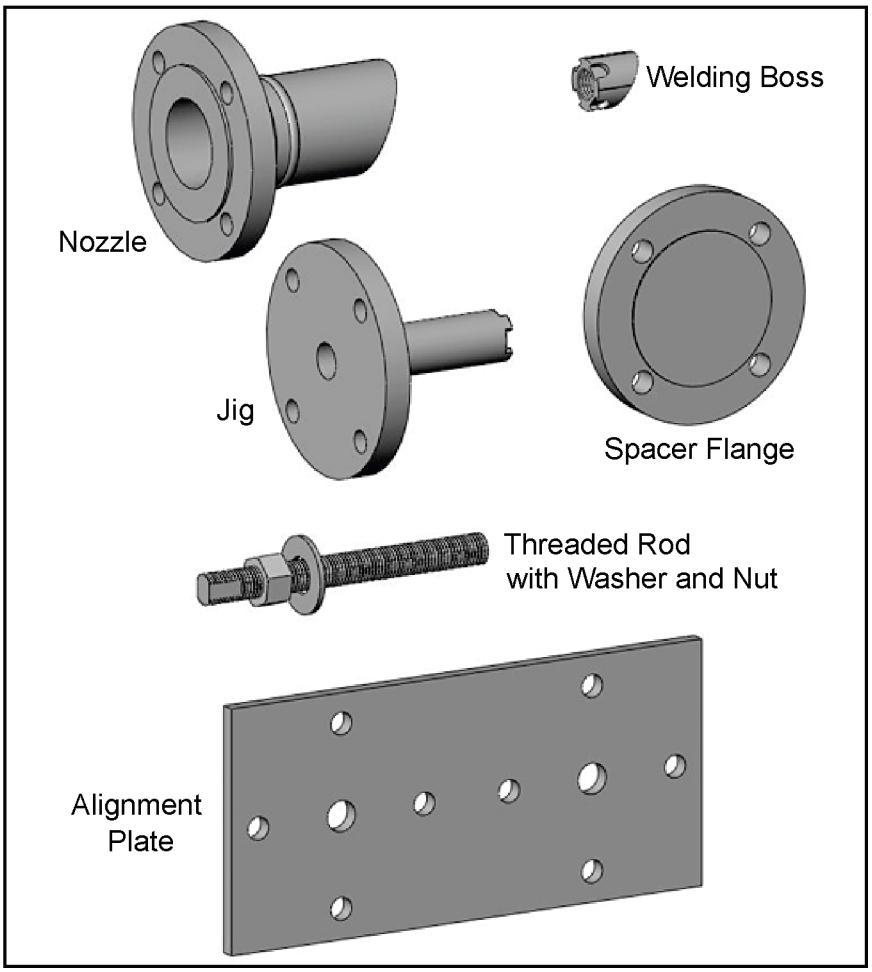
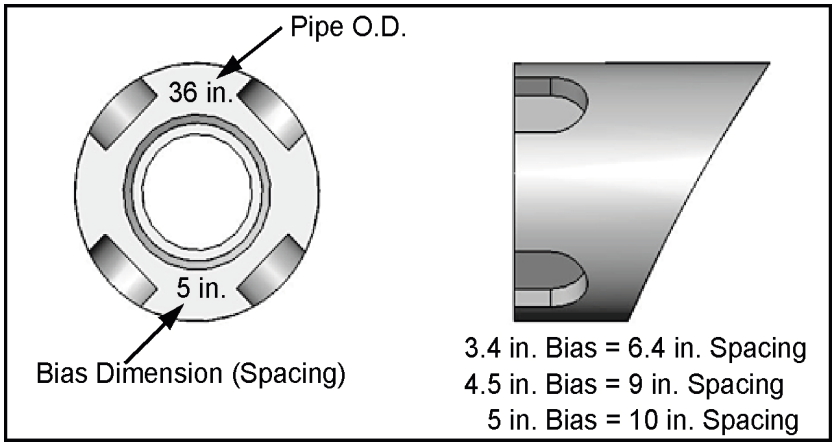


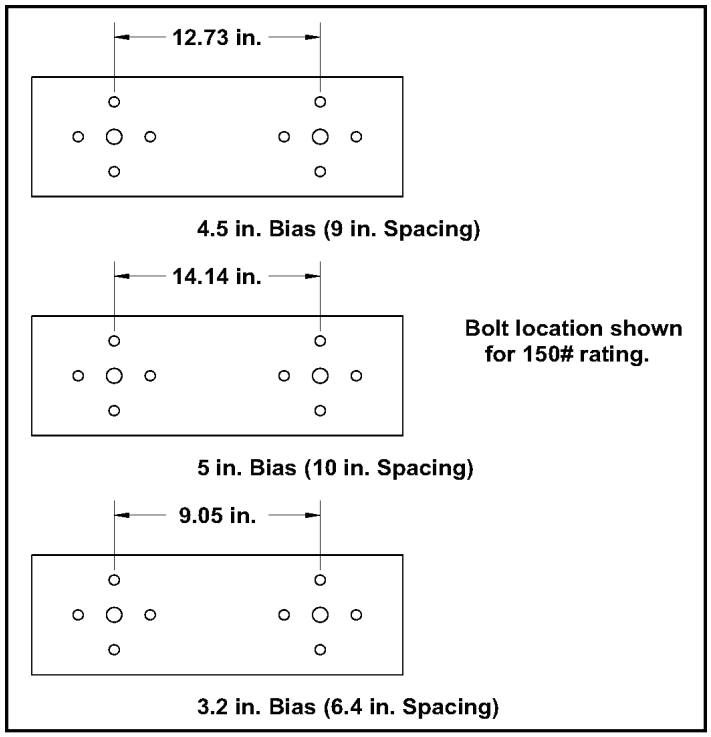
Figure 1: Components for Nozzle Installation Kit

1. Check the marking on the end of the welding boss. The pipe O.D. and the *bias dimension* (i.e., the *transducer spacing*) are engraved on the boss as shown below. Typically,
   - For flow velocities up to 100 m/s (328 ft/s), the 10 in. spacing is used on pipes 18 in. (450 mm) in diameter or larger, while the 9 in. spacing is used on pipes 16 in. (400 mm) in diameter or on larger pipes when attenuating gases are present.
   - For flow velocities up to 120 m/s (394 ft/s), the 6.4 in. spacing is used on pipes 14 in. (356 mm) in diameter or larger.

Note: *Bias dimension refers to the distance between the centerof the nozzle location and the center line of the pipe.*



2. Check the spacing between the holes on the alignment plate, as shown below. The dimensions should correspond to the bias/spacing dimension on the welding boss.

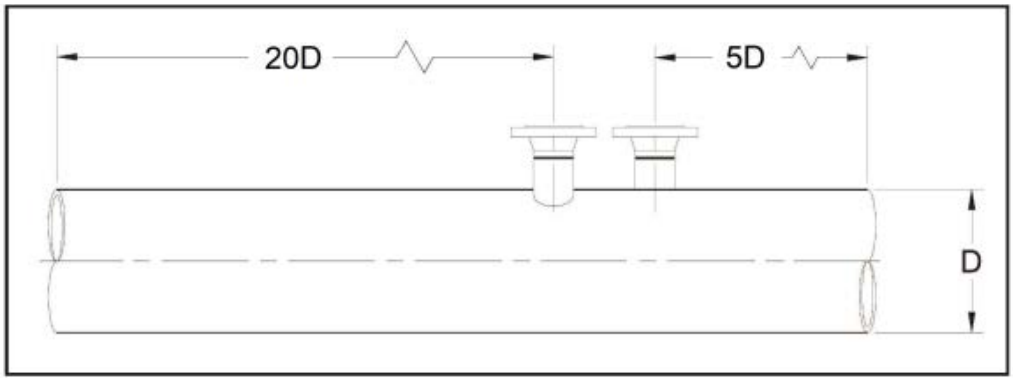


1.1.2 Selecting and Marking the Pipe for Nozzle Locations

CAUTION! **Correct nozzle alignment is critical to the successful operation of the flowmeter. Therefore, all marking, positioning and welding operations must be carried out with the utmost attention to accuracy. Unless otherwise stated, dimensional positioning of the nozzles must be held to a tolerance of ±1/16 in. (±1.6 mm) relative to each other and with respect to the pipe centerline. The angular tolerance must be held to ±1°. All hole cutting in process piping must be performed using hot tapping equipment.**

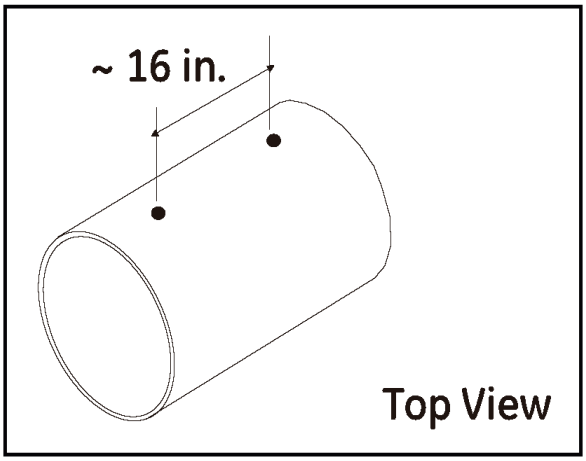
WARNING! **Be sure to adhere to all applicable safety regulations.**

1. For optimum performance, you should select a location that has at least 20 pipe diameters of straight, undisturbed flow upstream and 5 pipe diameters of straight, undisturbed flow downstream from the point of measurement. Undisturbed flow means avoiding sources of turbulence such as flanges, elbows and tees; avoiding swirl; and avoiding disturbed flow profiles. Never install the flowmeter downstream of control valves, especially butterfly valves. If you cannot find a proper location, please consult with Panametrics Flow Application engineering.

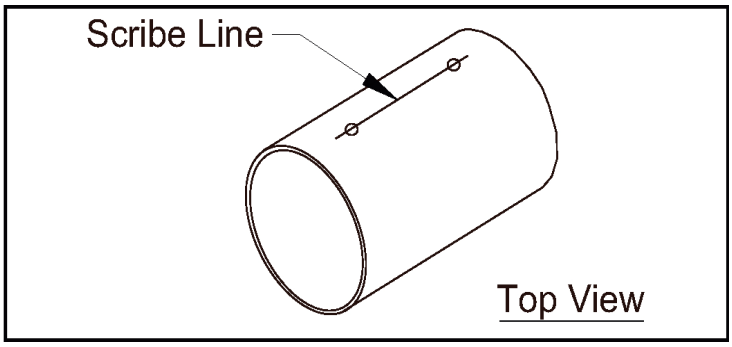


2. Use a center finder device to locate the center of the pipe. **"EYEBALLING" IS NOT ADEQUATE FOR ACCURATE FLOW MEASUREMENT!**

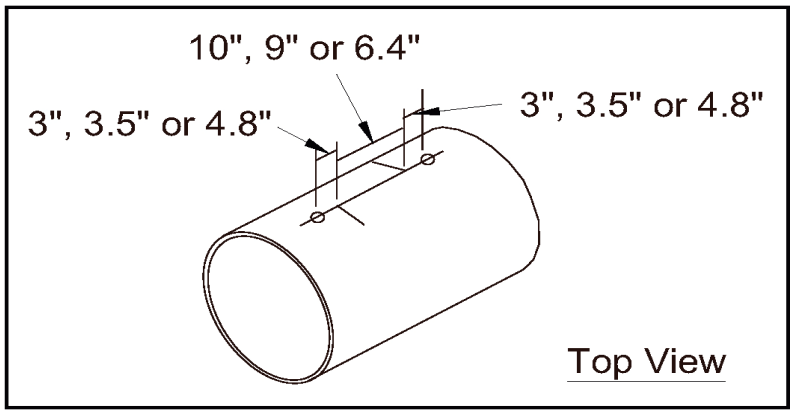
3. Lightly punch two marks approximately 16 in. apart on the top of the pipe, running along the center line. The two nozzle locations will be located between these two center punch marks.



4. Spray the area between the two punch marks on the top of the pipe with a marking dye product. Using a metal straight edge, scribe a line between the two punch marks.



5. Along the new scribe line, mark off a length equal to your transducer spacing (10 in., 9 in. or 6.4 in.) and scribe two lines at least 10 in. in length and perpendicular to the scribe line on different sides of the scribe line.



6. Along each of the perpendicular scribe lines, lightly punch a mark at a distance equal to half of your transducer spacing (5 in., 4.5 in. or 3.2 in.) from the center line, depending on the bias distance for your transducers. Keep in mind that the distance along the arc of the pipe (L) from the pipe centerline is slightly greater than the point-to-point distance through the pipe. These marks pinpoint the centers for the nozzles. Refer to Table 1 on page 7 for arc distances for the most commonly used pipe sizes. If your pipe size is not shown in Table 1, use the equation in the figure on page 6 to calculate the arc distance.

IMPORTANT: For a 3.2 in.bias distance, the downstream port must be located on the right side of the long scribe line when viewed from the downstream end of the pipe (see the figure below). This convention is mandatory for the 6.4 in. transducer spacing and is optional (not required) for a 10 in. or 9 in. spacing.

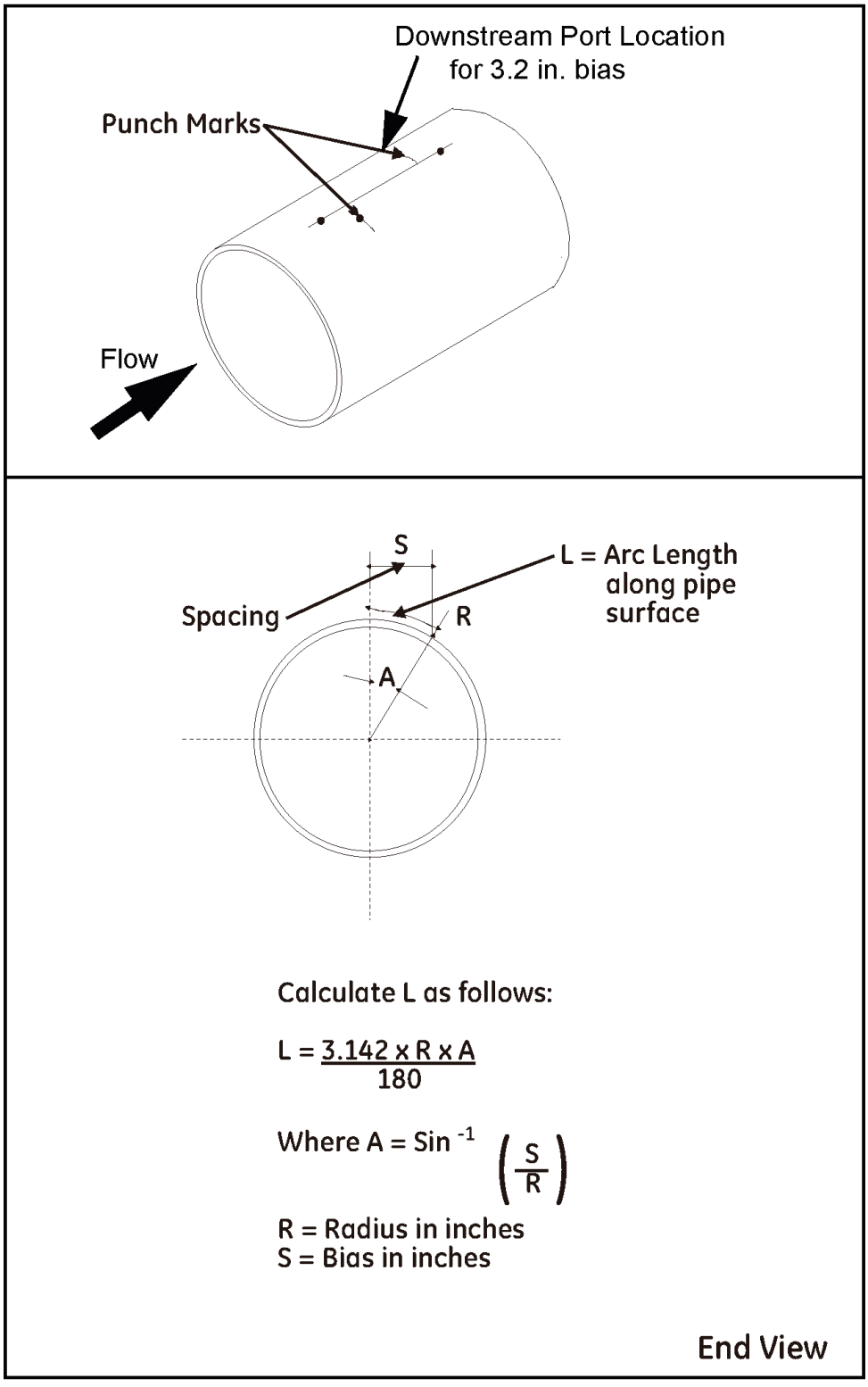
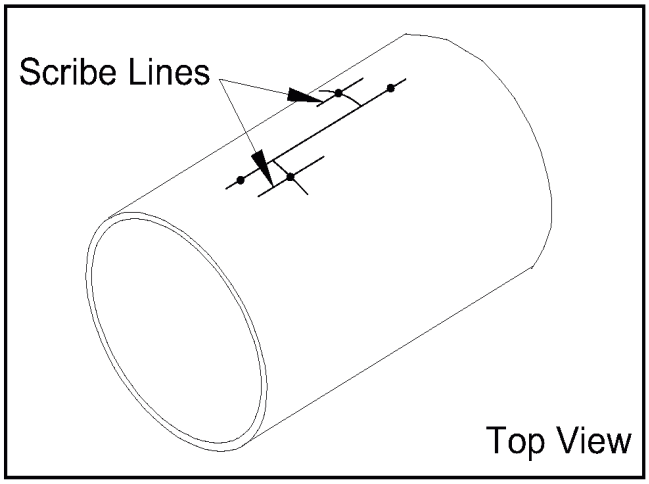


Table 1: Calculated Arc Distances for Common Pipe Sizes

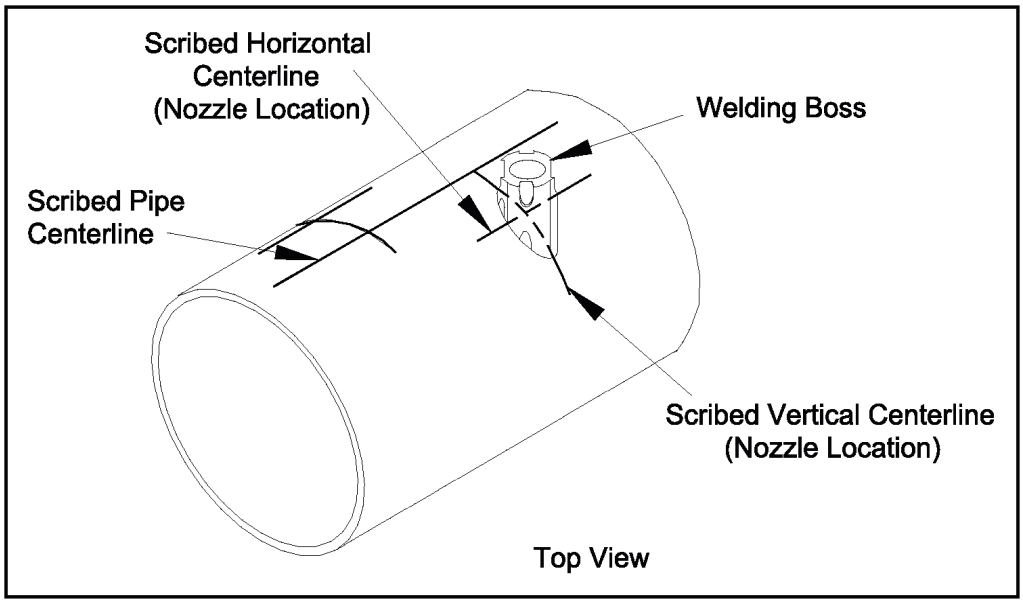
Pipe O.D.	Arc Distance
5 in. Bias	
18 in. (450 mm)	5.301 in. (134.6 mm)
24 in. (600 mm)	5.157 in. (131.0 mm)
30 in. (750 mm)	5.098 in. (129.5 mm)
36 in. (900 mm)	5.067 in. (128.7 mm)
42 in. (1050 mm)	5.048 in. (128.2 mm)
4.5 in. Bias	
16 in. (400 mm)	4.779 in. (121.4 mm)
18 in. (450 mm)	4.713 in. (119.7 mm)
24 in. (600 mm)	4.613 in. (117.2 mm)
30 in. (750 mm)	4.571 in. (116.1 mm)
36 in. (900 mm)	4.549 in. (115.5 mm)
42 in. (1050 mm)	4.536 in. (115.2 mm)
3.2 in. Bias	
14 in. (350 mm)	3.323 in. (84.4 mm)
16 in. (400 mm)	3.292 in. (83.6 mm)
18 in. (450 mm)	3.272 in. (83.1 mm)
24 in. (600 mm)	3.239 in. (82.3 mm)
30 in. (750 mm)	3.225 in. (81.9 mm)
36 in. (900 mm)	3.217 in. (81.7 mm)
42 in. (1050 mm)	3.213 in. (81.6 mm)

7. Scribe a 6 in. long horizontal centerline through each nozzle center location point and parallel to the original centerline.



1.1.3 Installing the First Welding Boss

1. Each welding boss has four scribe marks indicating the center of the bias.Take one welding boss and line up its scribe marks with the horizontal and perpendicular scribe marks on the pipe as shown below. Make sure you position the boss on the pipe so that the contoured end of the boss matches the pipe arc. That is, the shorter side of the boss should be closer to the original scribed pipe centerline.

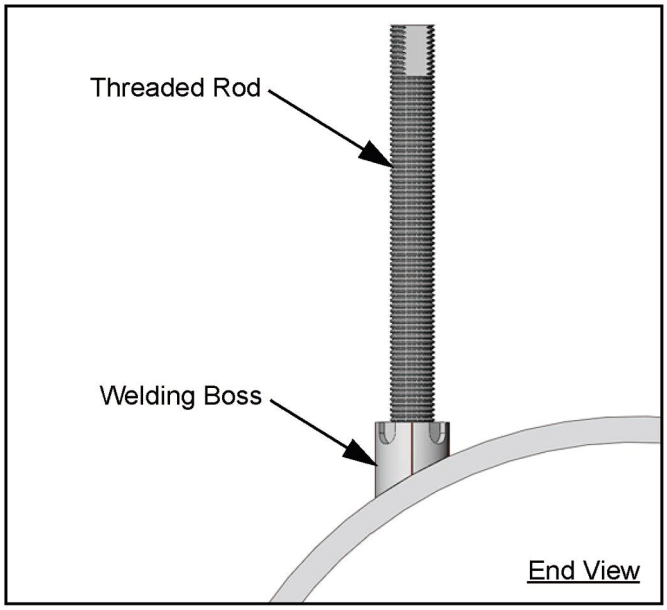


2. Clamp the boss in place, using a pipe strap or equivalent, so that it cannot move during tack welding.
3. Check the boss alignment again, and then tack weld the boss in each of the four grooves between the boss scribe marks. Make sure you keep the boss contour flush with the pipe contour during the entire tack welding operation. The boss is constructed of carbon steel.
4. Check the alignment again. If the boss is misaligned by 0.02 in. (0.5 mm) or more, remove the boss, grind off the welds and reinstall the boss.

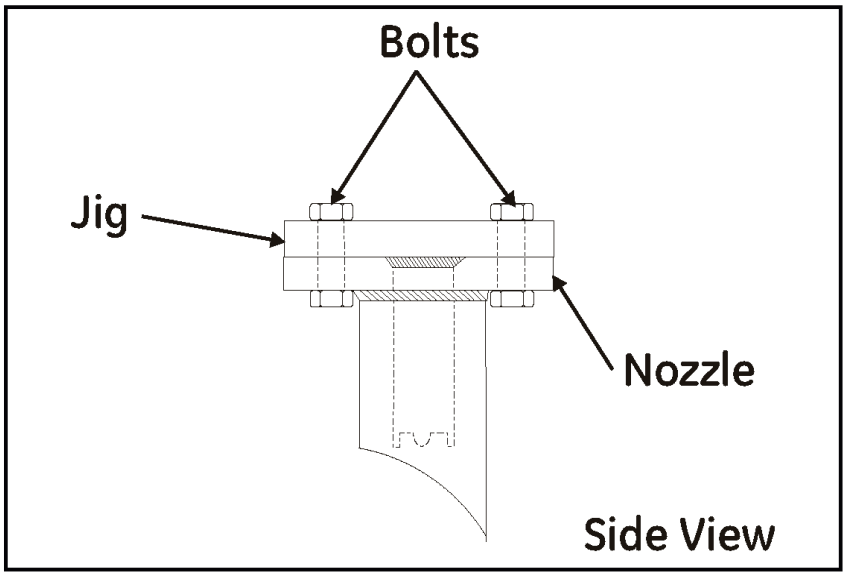
1.1.4 Installing the First Nozzle

CAUTION! **It is essential that the nozzles are set up and fixed in position using the jig and alignment plate provided, prior to welding the nozzle.**

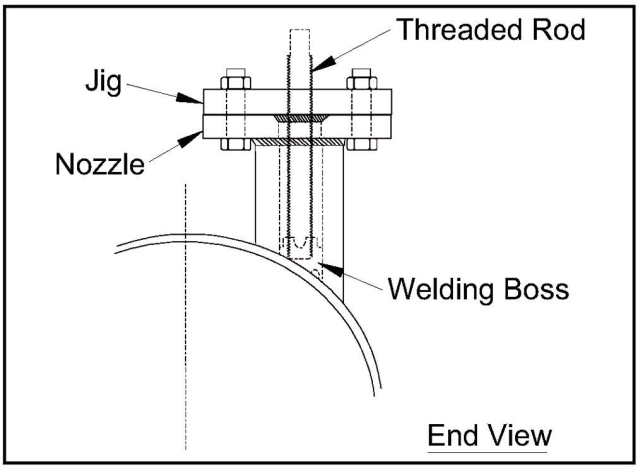
1. Screw the threaded rod into the boss that is welded onto the pipe. If necessary, remove the washer and nut from the threaded rod.



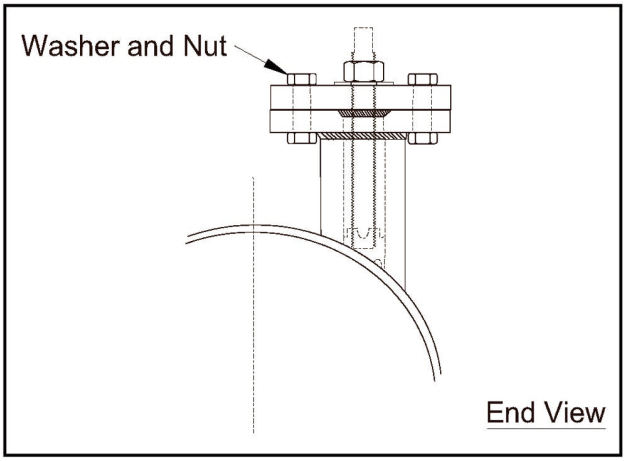
2. Insert the pipe section of the jig (the key cut section) into the pipe section of the nozzle, and fasten the assembly together using four nuts and bolts.



3. Slide the jig/nozzle assembly over the threaded rod, fitting the jig into the key cut end of the welding boss while aligning the contoured end of the nozzle to the pipe arc.



4. Align the nozzle scribe marks with the pipe scribe marks and tighten the assembly in place using the 1-in. washer and nut provided. If slight misalignment occurs between the nozzle scribe marks and pipe scribe marks, loosen the four bolts holding the jig and nozzle assembly, and rotate the nozzle for the best alignment. After the nozzle has been accurately aligned, retighten the four bolts.



5. The jig, boss, and nozzle assembly is designed to provide a 0.094 in. (2.4 mm) root gap between the beveled edge of the nozzle and the outside diameter of the pipe. If this gap is not present all the way around the nozzle, the nozzle must be removed and ground appropriately to provide the required clearance. If the root gap is larger than the 0.094 in. (2.4 mm) dimension evenly all the way around the nozzle, then suitably sized washers may be inserted between the jig and the nozzle to reduce the root gap dimension.

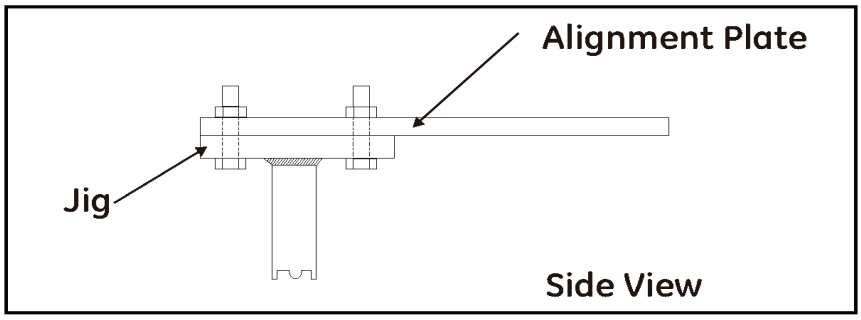


WARNING! **Only qualified personnel should weld bosses and nozzles, using a suitable ASME IX qualified welding procedure. All applicable safety codes should be observed.**

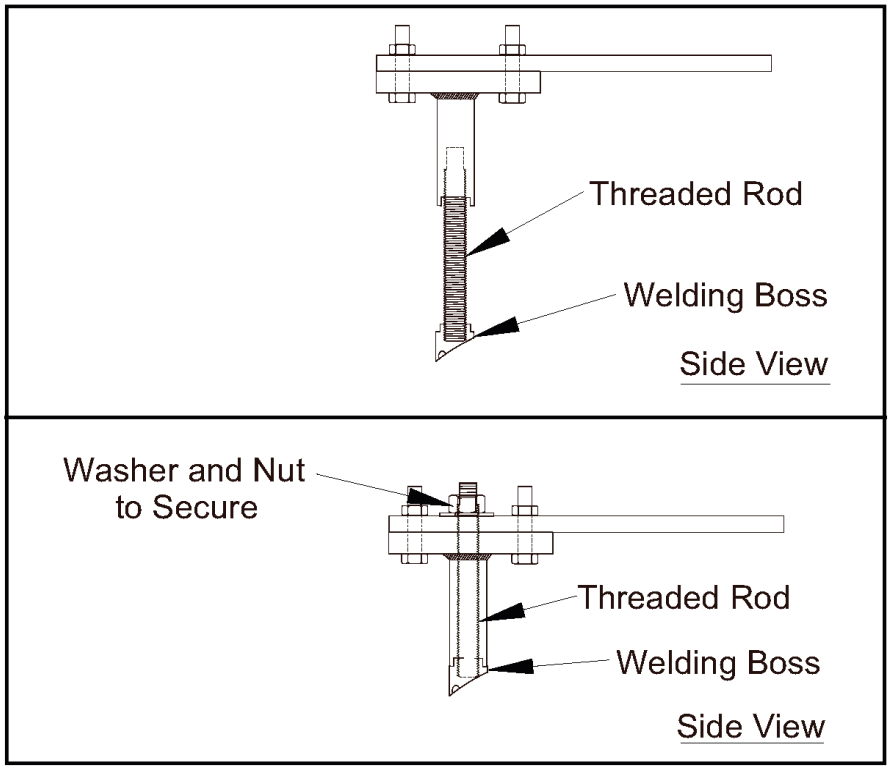
6. Tack weld the nozzle to the pipe at four diametrically opposed points, each tack being approximately 0.2 in. (5 mm) in length. Allow the weld to cool for 30 seconds between tacks.
7. Complete the root pass and subsequent filler passes as required.
8. Allow the weld to cool, and then remove the nut, washer, jig and threaded rod.

1.1.5 Installing the Second Welding Boss

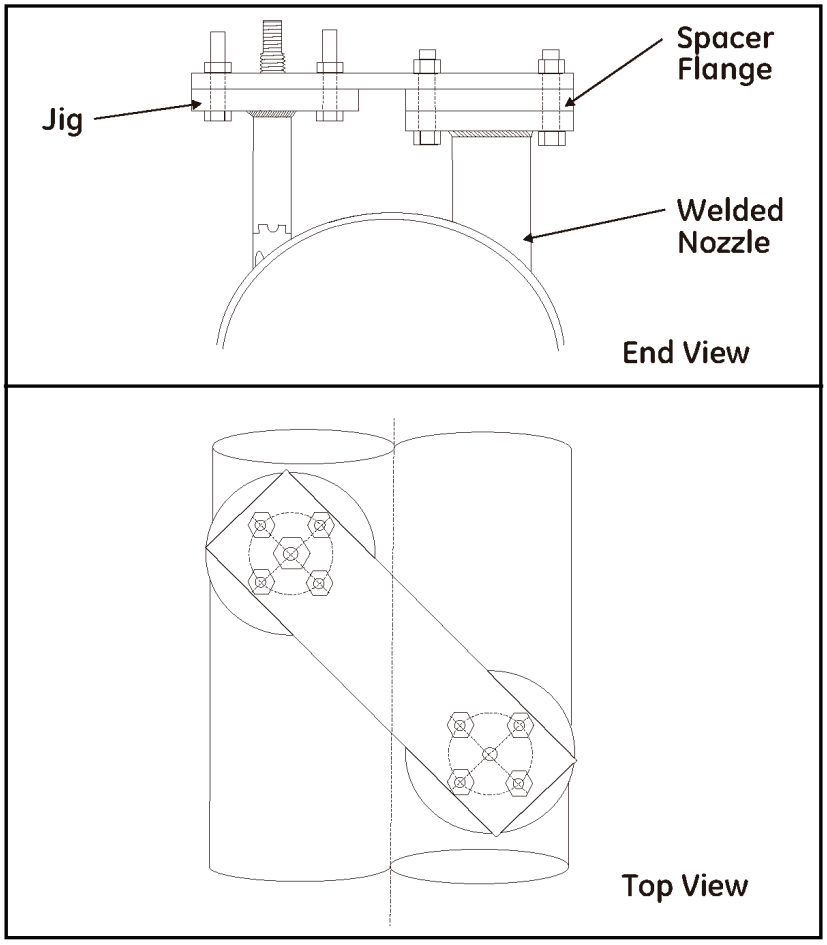
1. Bolt the jig to one end of the alignment plate using four bolts.



2. Screw the threaded rod into the second boss. Then, insert the bolt/boss assembly into the jig key cut grooves and secure it with a washer and nut on top.



3. Remember to orient the boss in the jig to maintain the proper contour location to the pipe for installation.
4. Place the spacer flange on top of the welded nozzle and then mount the second end of the alignment plate on top of the spacer flange. Bolt the alignment plate into position with the remaining bolts.

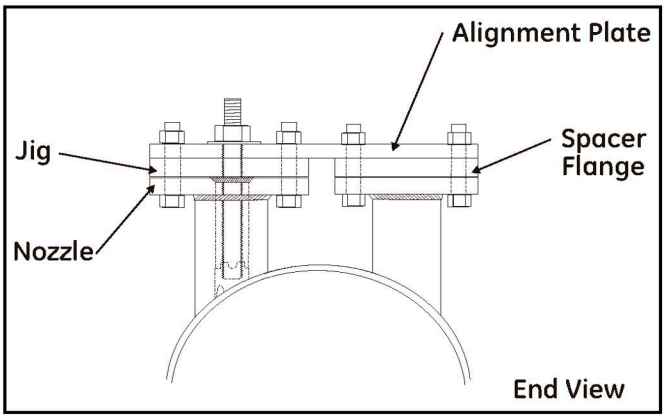


5. The second welding boss should now be positioned over the second nozzle location scribe marks. Align the boss scribe marks with the pipe scribe marks, and then tighten all of the nuts securely.
6. Check the boss alignment again, then tack weld the boss in each of the four grooves between the boss scribe marks.
7. After tacking, check the boss alignment once more. If the boss is misaligned by 0.02 in. (0.5 mm) or more, remove the boss by grinding off the welds, and then reinstall the boss.
8. Remove the threaded rod and the jig. Leave the alignment plate bolted to the first nozzle, with the spacer flange sandwiched between them.

1.1.6 Installing the Second Nozzle

To install the second nozzle, complete the following steps:

1. Insert the jig into the second nozzle and position this assembly over the boss and under the alignment plate. Then, insert the threaded rod.

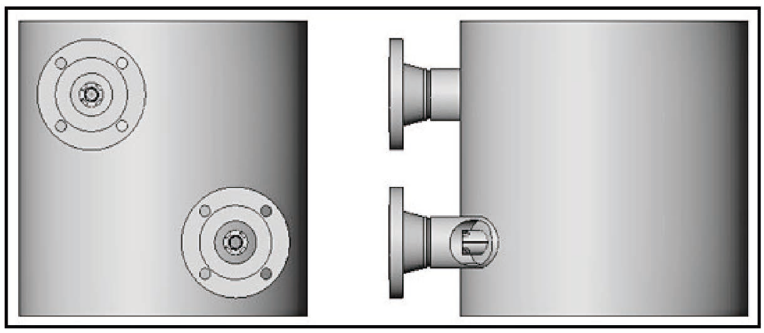


2. The jig, boss, and nozzle assembly is designed to provide a 0.094 in. (2.4 mm) root gap between the beveled edge of the nozzle and the outside diameter of the pipe. If this gap is not present all the way around the nozzle, the nozzle must be removed and ground appropriately to provide the required clearance. If the root gap is larger than the 0.094 in. (2.4 mm) dimension evenly all the way around the nozzle, then suitably sized washers may be inserted between the jig and the nozzle to reduce the root gap dimension.
3. Secure the alignment plate by installing the two sets of four bolts on the alignment plate. Also, install the washer and nut on the threaded rod.
4. Line up the nozzle scribe marks with the pipe scribe marks and tighten all the nuts.
5. Make sure the nozzle is still in alignment..



WARNING! **Only qualified personnel should weld bosses and nozzles, using a suitable ASME IX qualified welding procedure. All applicable safety codes should be observed.**

6. Tack weld the nozzle to the pipe at four diametrically opposed points, each tack being approximately 0.2 in. (5 mm) in length. Allow the weld to cool for 30 seconds between tacks.
7. Complete the root pass and subsequent filler passes as required.
8. Allow the weld to cool, and then remove all nuts and bolts, the alignment plate, the jig, the spacer flange and the threaded rod. The completed installation should appear as shown below.



1.1.7 Hot Tapping the Pipe



WARNING! **Hot tapping should only be performed by qualified personnel. Follow all applicable code and safety practices during these procedures.**

1.1.7.1 Hot Tapping For 3” Flanges

To hot tap the pipe for 3” flanges, complete the following steps:

1. Obtain two suitable 3 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 8 in. or 300# RF flanges and a face-to-face length of 11.125 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with either 5/8 in. studs and nuts for 150# flanges or 3/4 in. studs and nuts for 300# flanges.
3. Orient the isolation valve handles to minimize interference during operation of the valves.
4. Hot tap holes in the pipe using a hot tap machine equipped with a 3/4 in. (19.05 mm) drill bit.
5. Then use a coupon retaining hole saw to cut a hole with a diameter of 2.36 in. (60 mm) minimum to 2.875 in. (73 mm) maximum.

1.1.7.2 Hot Tapping For 2” Flanges

To hot tap the pipe for 2” flanges, complete the following steps:

1. Obtain two suitable 2 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 7 in. or 300# RF flanges and a face-to-face length of 8.50 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with 5/8 in. studs and nuts.
3. Orient the isolation valve handles to minimize interference during operation of the valves.
4. Hot tap holes in the pipe using a hot tap machine equipped with a 3/4 in. (19.05 mm) drill bit.
5. Then use a coupon retaining hole saw to cut a hole with a diameter of 1.81 in. (46 mm) minimum to 1.89 in. (48 mm) maximum.

1.1.8 Cold Tapping the Pipe



WARNING! **Cold tapping should only be performed by qualified personnel. Follow all applicable code and safety practices during these procedures**

The procedure for cold tapping a pipe is the same as the hot tapping procedure described above. However, isolation valves are not necessary during the tapping process. The hot tap machine is used directly on the nozzles. The isolation valves are added after the tapping process has been completed.

1.2 Tilted 45° Installation

This procedure includes the following steps:

- Identifying and checking the nozzle installation kit components
- Selecting and marking the pipe for nozzle locations
- Installing the first welding boss
- Installing the first nozzle
- Installing the second welding boss
- Installing the second nozzle
- Tapping the pipe

1.2.1 Identifying and Checking the Nozzle Installation Kit Components

The *Nozzle Installation Kit* contains the materials listed below. Use Figure 2 below to help identify each component.

- 2 Nozzles (if purchased)
- 2 Welding bosses
- 1 Jig
- 1 Threaded rod (1" diameter), with washer and nut

IMPORTANT: You will need eight 5/8" studs with two nuts each, or 3/4" studs with two nuts each. The 5/8" studs are needed for 2"-150#, 2"-300# and 3"-150# flanges. The 3/4" studs are needed for 3"-300# flanges.

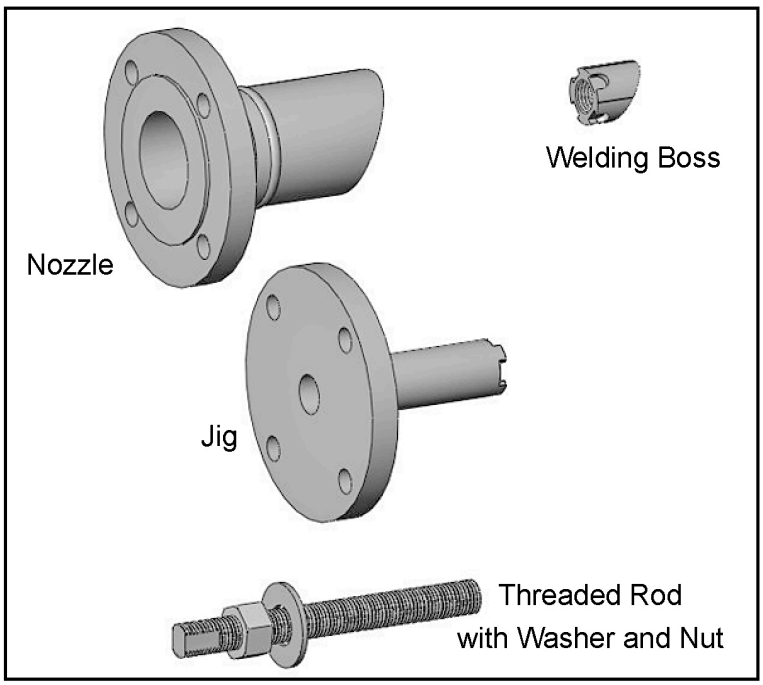
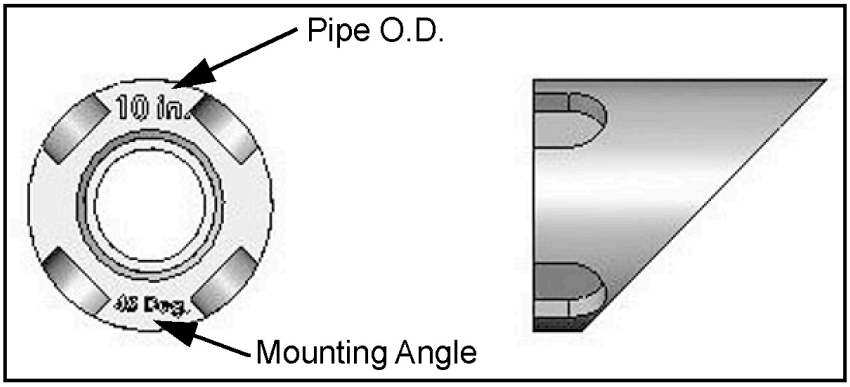


Figure 2: Components for Nozzle Installation Kit

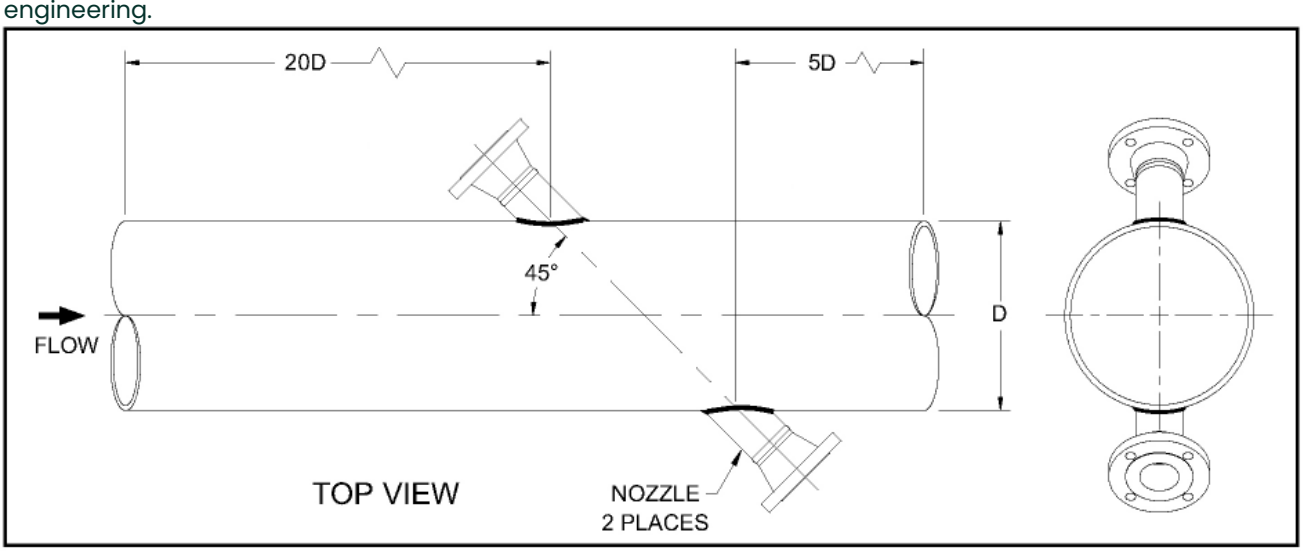
Check the markings on the end of the welding boss. The pipe OD and the mounting angle are engraved on the boss, as shown below.



1.2.2 Selecting and Marking the First Nozzle Location

CAUTION! **Correct nozzle alignment is critical to the successful operation of the flowmeter. Therefore, all marking, positioning and welding operations must be carried out with the utmost attention to accuracy. Unless otherwise stated, dimensional positioning of the nozzles must be held to a tolerance of ±1/16 in. (±1.6 mm) relative to each other and with respect to the pipe centerline. The angular tolerance must be held to ±1°. All hole cutting in process piping must be performed using hot tapping equipment.**

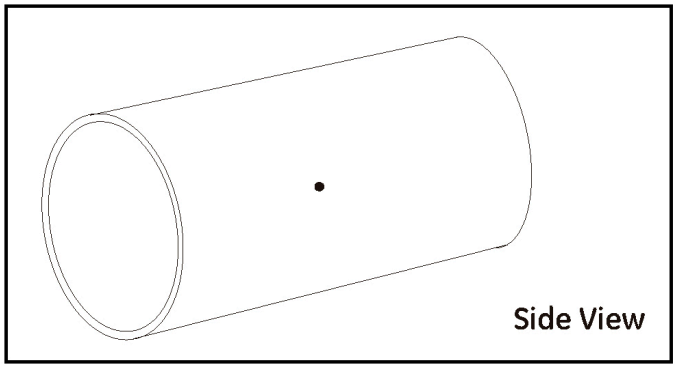
1. For optimum performance, you should select a location that has at least 20 pipe diameters of straight, undisturbed flow upstream and 5 pipe diameters of straight, undisturbed flow downstream from the point of measurement. Undisturbed flow means avoiding sources of turbulence such as flanges, elbows and tees; avoiding swirl; and avoiding disturbed flow profiles. Never install the flowmeter downstream of control valves, especially butterfly valves. If you cannot find a proper location, please consult with Panametrics Flow Application engineering.



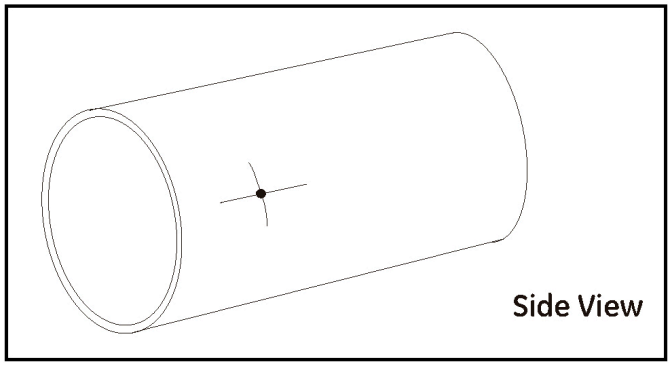
2. Install the pipe nozzles on a pipe diameter as near as possible to the horizontal plane. This would be at the 3 o'clock and 9 o'clock positions for a horizontal pipe.

Note: *If you cannot find a proper location, please consult with Panametrics Flow Application engineering.*

3. At the 3 o'clock position, center punch the pipe to mark the position for the center of the first nozzle.



4. Spray this area with a marking dye product. Using a metal straight edge, scribe 6 in. long vertical and horizontal lines that intersect at the center punch mark.

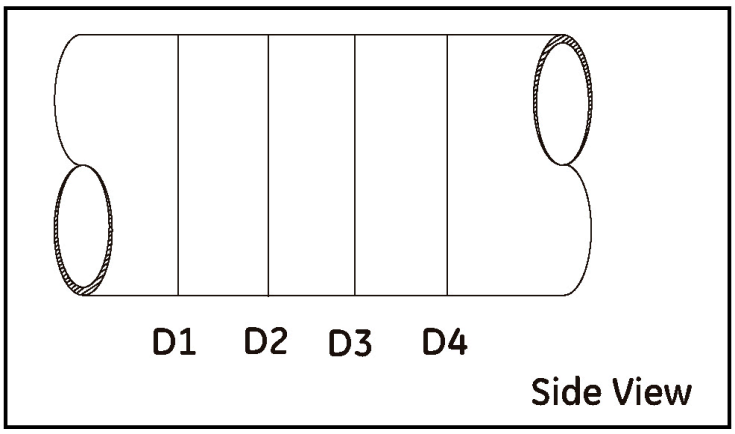


1.2.3 Determining and Marking the Second Nozzle Location

1. The second nozzle is located a distance equal to one pipe O.D. along the pipe centerline and on the opposite side of the pipe (180° around the circumference). Spray this area with a marking dye product.

Note: *For installation angles other than 45°, the distance along the pipe centerline is equal to the pipe O.D. times the tangent of the installation angle.*

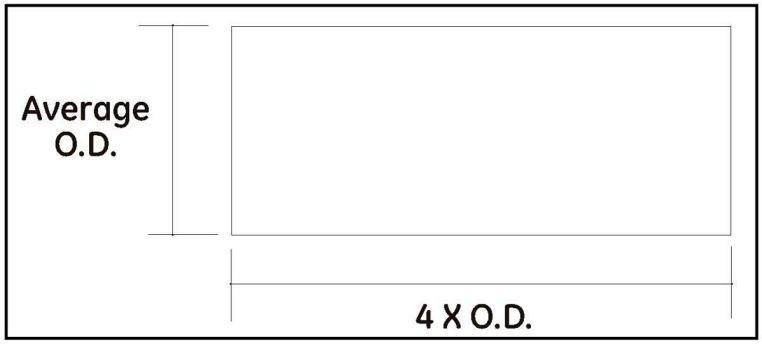
2. To account for possible variations in the O.D. of the pipe, measure the pipe O.D. at four location between the nozzle centers. Calculate the average outside diameter based on these measurements.



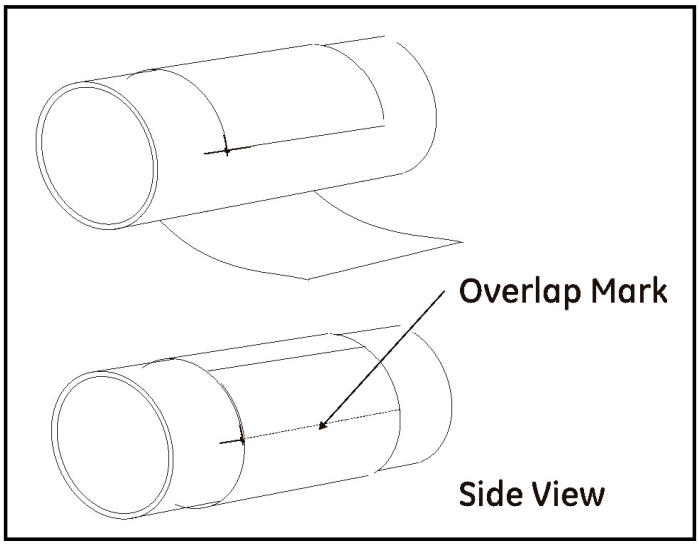
3. Using a roll of polyester film (or equivalent), cut a strip of film to the following width and length:

IMPORTANT: Ensure that the sides of the film are cut parallel to each other.

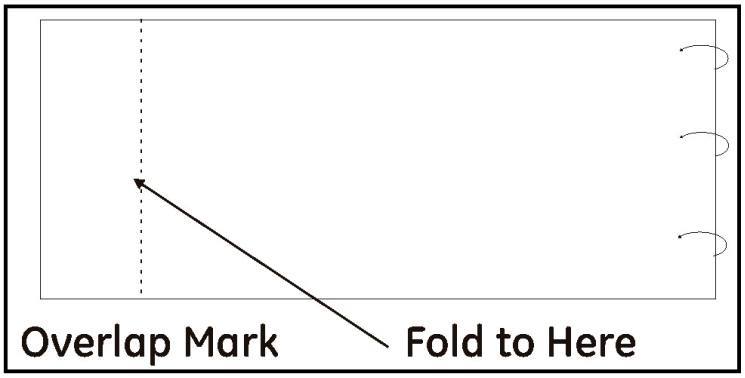
- **Width** - equal to the average pipe O.D., as calculated in Step 1 above.
- **Length** - equal to 4 times the average pipe O.D., as calculated in Step 1 above.



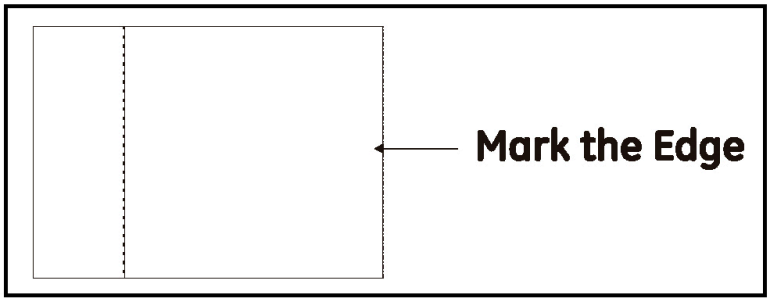
4. Wrap the strip of film around the pipe with one edge running along the vertical scribe line at the first nozzle location. Make sure the strip overlaps squarely all the way around the pipe, and mark the overlap location of the strip. This equals the circumference of the pipe.



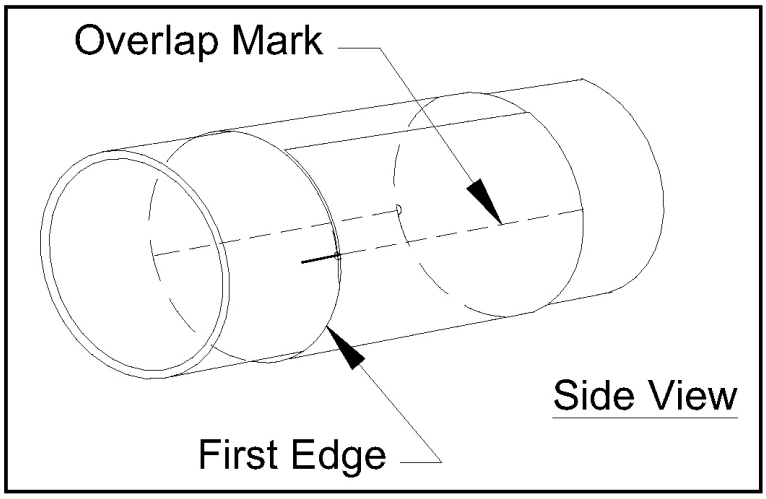
5. Remove the strip of film and fold it as shown below to determine the position which is diametrically opposite the overlap position when the film is reapplied to the pipe.



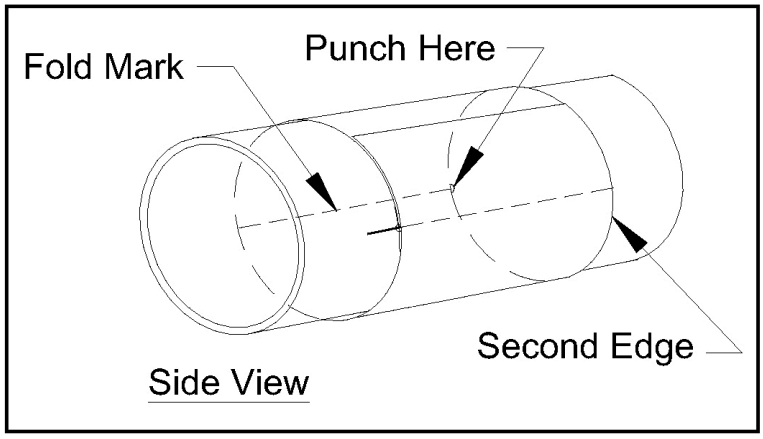
6. Mark the outside of the fold for reference.



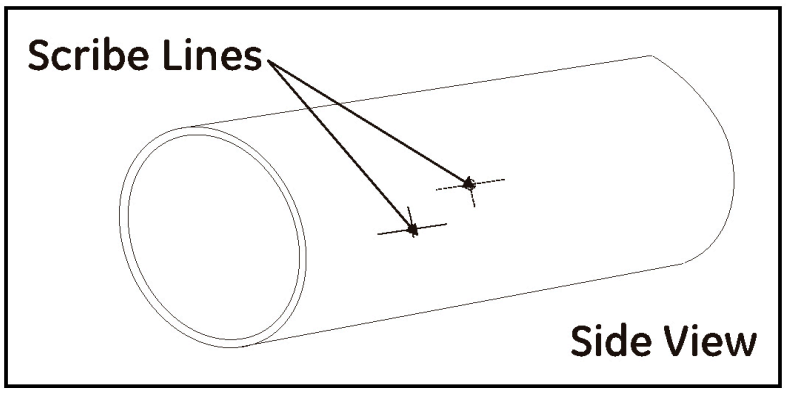
7. Wrap the strip of film around the pipe again. This time, line up the overlap mark with the horizontal and vertical scribe lines. Again, make sure you wrap the strip of film squarely all the way around the pipe.



8. The new location of the center of the second nozzle is now identified as the intersection of the fold line and the second edge of the strip of film. Center punch this location prior to removing the strip of film.



9. Remove the strip of film from the pipe.
10. Scribe 6 in. long vertical and horizontal lines which intersect at the new center-punch mark.



1.2.4 Installing the First Welding Boss

1. Before welding the first boss, you must add another scribe line known as the oblique center line. The oblique center line compensates for the slope or oblique of the boss. The oblique center line is offset from the true center (vertical) scribe line marked earlier by a distance of X, which is dependent on the pipe outside diameter as follows:

$$X = D/2 - \frac{d/2}{\tan[\sin^{-1}(d/D)]}$$

where, D = pipe outside diameter

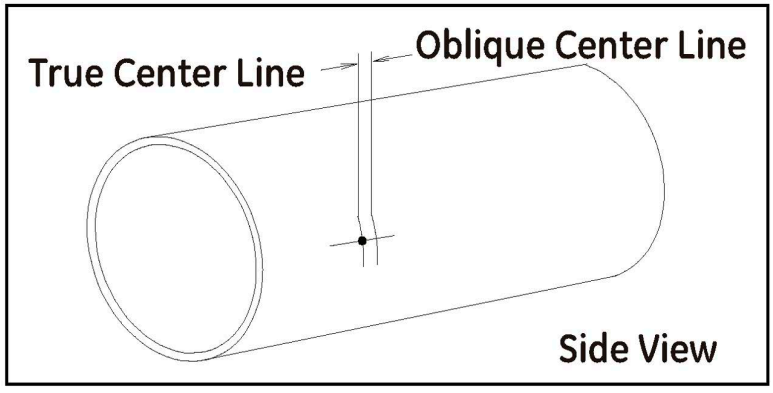
d = welding boss outside diameter (1.660 in.)

Table 2 below shows values of X for various pipe sizes.

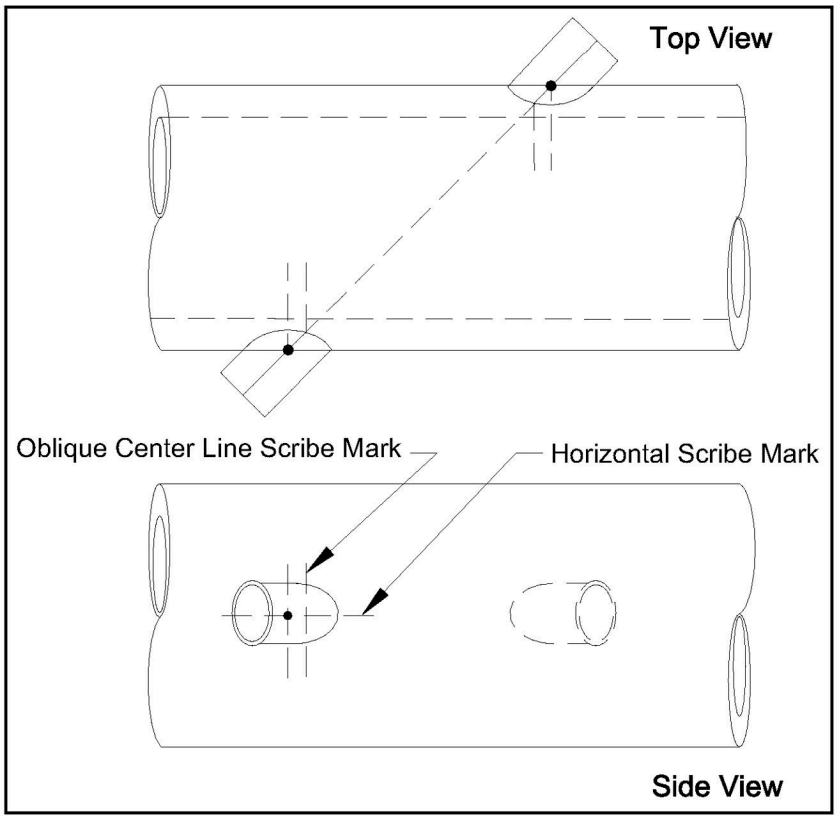
Table 2: Values for Various Pipe Sizes

Pipe Size		
NPS (DN)	O.D.	X Dimensions
6 in. (150 mm)	6.625 in. (168 mm)	0.106 in. (2.69 mm)
8 in. (200 mm)	8.625 in. (219 mm)	0.081 in. (2.06 mm)
10 in. (250 mm)	10.750 in. (273 mm)	0.064 in. (1.62 mm)
12 in. (300 mm)	12.750 in. (324 mm)	0.054 in. (1.37 mm)
14 in. (350 mm)	14.000 in. (356 mm)	0.049 in. (1.24 mm)

2. Scribe the oblique center line on the pipe at the calculated distance from the true center line. The oblique center line should be marked on the side of the true center line that is closer to the second nozzle location.



3. Position the welding boss such that the four scribe lines on the welding boss are lined up with the horizontal scribe mark and the oblique center line on the pipe. Make sure you orient the boss as shown below.

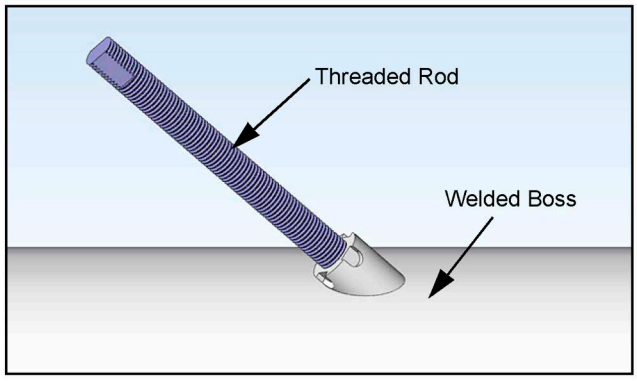


4. Clamp the boss in place using a pipe strap or equivalent so that it cannot move during tack welding.
5. Check the boss alignment, then tack weld the carbon steel boss to the pipe in each of the four grooves between the boss scribe marks.
6. Remove the clamp and check the alignment again. If the boss is misaligned by 0.02 in. (0.5 mm) or more, remove the boss, grind off the welds and reinstall the boss.

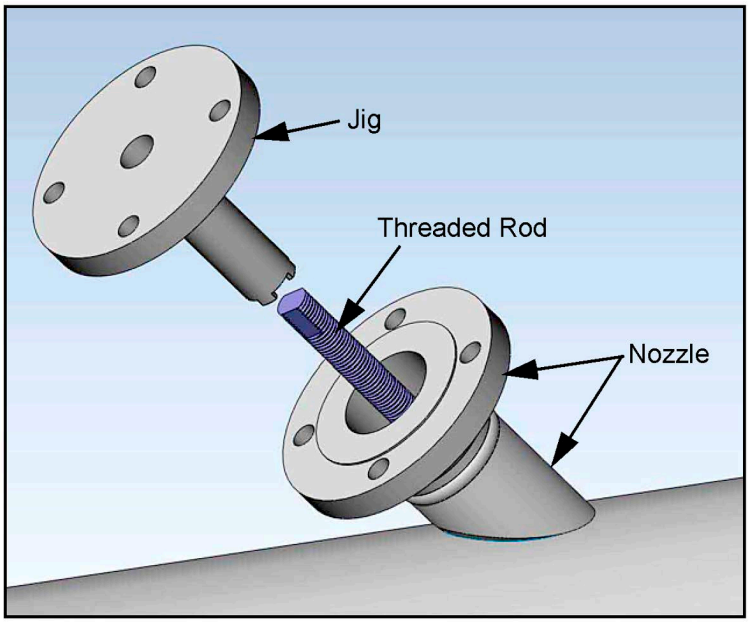
1.2.5 Installing the First Nozzle

IMPORTANT: Prior to welding the nozzle, it is essential that the nozzle is set up and fixed in position using the jig and the 1-in. threaded rod provided in the kit.

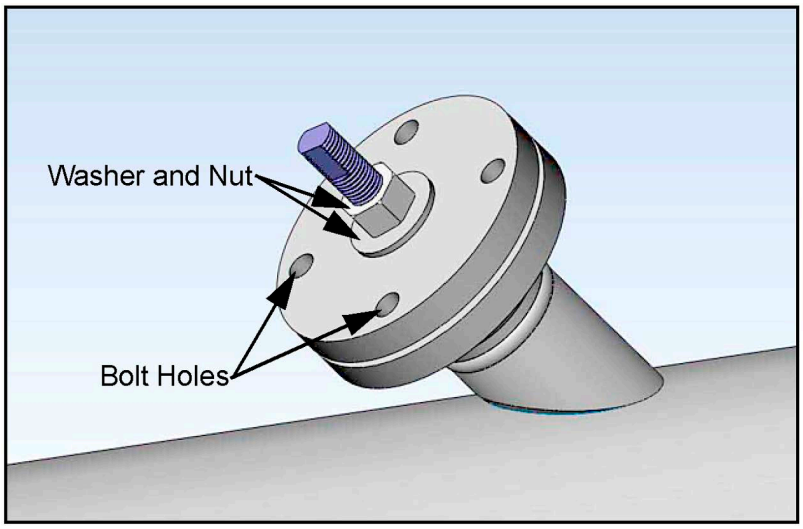
1. Screw the threaded rod into boss that is welded onto the pipe. If necessary, remove the washer and nut from the threaded rod.



2. Slide the nozzle over the threaded rod, and align the contoured end of the nozzle so that it matches the pipe arc. Then slide the jig over the threaded rod and fit the jig into the welding boss.



3. Align the jig bolt holes with the nozzle bolt holes. Then, tighten the assembly together, using the washer and nut on the threaded rod.



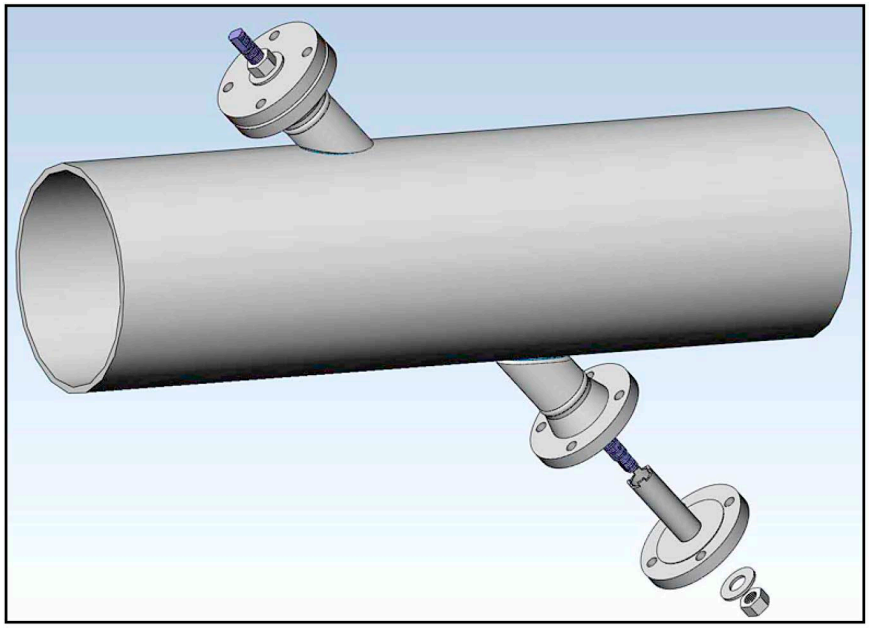
4. The jig, boss, and nozzle assembly is designed to provide a 0.094 in. (2.4 mm) root gap between the beveled edge of the nozzle and the outside diameter of the pipe. If this gap is not present all the way around the nozzle, the nozzle must be removed and ground appropriately to provide the required clearance. If the root gap is larger than the 0.094 in. (2.4 mm) dimension evenly all the way around the nozzle, then suitably sized washers may be inserted between the jig and the nozzle to reduce the root gap dimension..

WARNING! **Only qualified personnel should weld bosses and nozzles, using a suitable ASME IX qualified welding procedure. All applicable safety codes should be observed.**

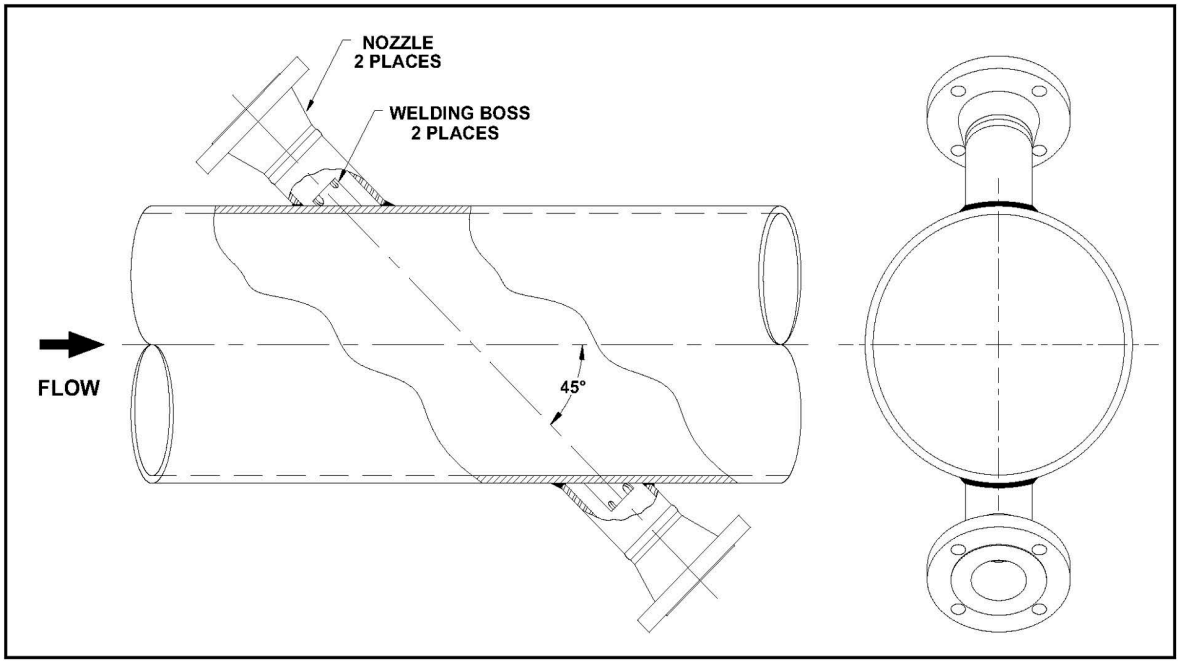
5. Tack weld the nozzle to the pipe at four diametrically opposed points, each tack being approximately 0.6 in. (15 mm) in length. Allow the weld to cool for 30 seconds between tacks.
6. Complete the root pass and subsequent filler passes as required.
7. Allow the weld to cool, and then remove the nut, washer, jig and threaded rod.

1.2.6 Installing the Second Welding Boss and Nozzle

Using the same procedures used for installing the first welding boss and nozzle, install the second welding boss and nozzle at the marked position on the pipe.



The completed installation should appear as shown below.



1.2.7 Hot Tapping the Pipe

Note: *Hot tapping a tilted 45° installation is possible only for the standard velocity range (100 m/s, 328 ft/s). For the extended velocity range (120 m/s, 394 ft/s), only the 4" pipe size can be hot topped.*



WARNING! **Hot tapping should only be performed by qualified personnel. Follow all applicable code and safety practices during these procedures.**

1.2.7.1 Hot Tapping For 3" Flanges

To hot tap the pipe for 3" flanges, complete the following steps:

1. Obtain two suitable 3 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 8 in. or 300# RF flanges and a face-to-face length of 11.125 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with either 5/8 in. studs and nuts for 150# flanges or 3/4 in. studs and nuts for 300# flanges.
3. Orient the isolation valve handles to minimize interference during operation of the valves.
4. Hot tap holes in the pipe using a hot tap machine equipped with a 3/4 in. (19.05 mm) drill bit.
5. Then use a coupon retaining hole saw to cut a hole with a diameter of 2.36 in. (60 mm) minimum to 2.875 in. (73 mm) maximum.

1.2.7.2 Hot Tapping For 2" Flanges

To hot tap the pipe for 2" flanges, complete the following steps:

1. Obtain two suitable 2 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 7 in. or 300# RF flanges and a face-to-face length of 8.50 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with 5/8 in. studs and nuts.
3. Orient the isolation valve handles to minimize interference during operation of the valves.
4. Hot tap holes in the pipe using a hot tap machine equipped with a 3/4 in. (19.05 mm) drill bit.
5. Then use a coupon retaining hole saw to cut a hole with a diameter of 1.81 in. (46 mm) minimum to 1.89 in. (48 mm) maximum.

1.2.8 Cold Tapping the Pipe



WARNING! **Cold tapping should only be performed by qualified personnel. Follow all applicable code and safety practices during these procedures.**

The cold tapping procedure is the same as the hot tapping procedure described above for a standard velocity range (100 m/s, 328 ft/s) installation. Except for the 4 in. pipe size, cold tapping can be performed only before the isolation valve is installed. The hot tap machine is used directly on the nozzles, and the isolation valves are added after the tapping process has been completed.

Chapter 2. Installing the Isolation Valves

This chapter provides instructions for installing an isolation valve onto a nozzle for applications using the flare gas insertion mechanism.

Note: *Installation of the isolation valves may have been done already during the hot tapping operation.*

2.1 Bias 90° Installation (Standard or Extended Velocity Range)

2.1.1 For 3 inch Flanges

1. Obtain two suitable 3 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 8 in. or 300# RF flanges and a face-to-face length of 11.125 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with either 5/8 in. studs and nuts for 150# flanges or 3/4 in. studs and nuts for 300# flanges.
3. Orient the isolation valve handles to minimize interference during operation of the valves.

2.1.2 For 2 inch Flanges

1. Obtain two suitable 2 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 7 in. or 300# RF flanges and a face-to-face length of 8.50 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with 5/8 in. studs and nuts.
3. Orient the isolation valve handles to minimize interference during operation of the valves.

2.2 Tilted 45° Installation (Standard Velocity Range)

2.2.1 For 3 inch Flanges

1. Obtain two suitable 3 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 8 in. or 300# RF flanges and a face-to-face length of 11.125 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with either 5/8 in. studs and nuts for 150# flanges or 3/4 in. studs and nuts for 300# flanges.
3. Orient the isolation valve handles to minimize interference during operation of the valves.

2.2.2 For 2 inch Flanges

1. Obtain two suitable 2 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 7 in. or 300# RF flanges and a face-to-face length of 8.50 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with 5/8 in. studs and nuts.
3. Orient the isolation valve handles to minimize interference during operation of the valves.

2.3 Tilted 45° Installation (Extended Velocity Range)

Note: *The upstream valve and transducer are installed without wedges, as described in the previous section.*

To install the downstream isolation valve, the items shown in Figure 3 below are required.

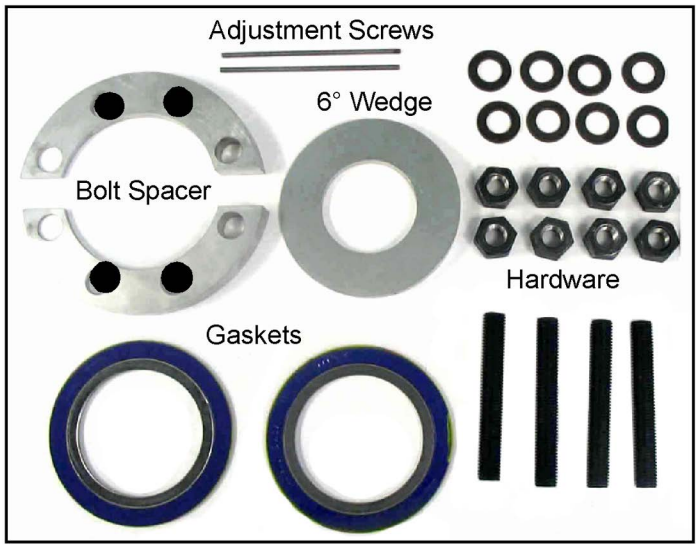


Figure 3: Parts for 150# RF Flange Isolation Valve Installation

1. Insert the four bolts into the nozzle flange holes.
2. With the Nut Side marking facing the pipe, place the split bolt spacer halves over the bolts behind the flange, with the thin ends corresponding to what will be the thickest side of the other wedge (see Figure 4 below).

Note: *The wedge positions are based on the need to tilt the transducer 6° against the flow.*

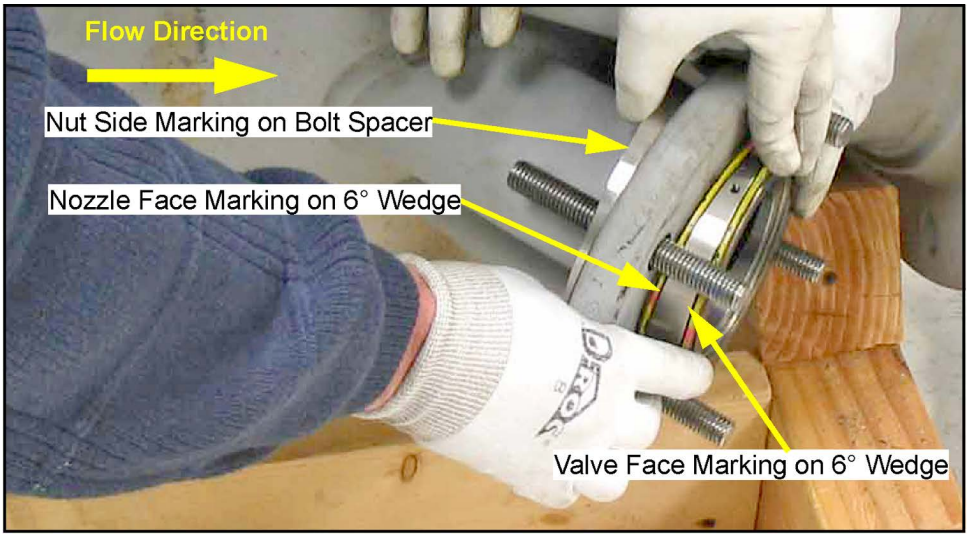


Figure 4: Mounting Bolts, Bolt Spacers, Wedge and Gaskets Positions

3. With the Nozzle Face marking facing the pipe and the Valve Face marking facing outward, hold the gasket/wedge/gasket combination in line with the insertion hole and oriented as shown in Figure 4 on page 28.
4. While one person holds the gaskets and wedges in place, another person should line up the isolation valve mounting holes with the bolts in the nozzle flange, push the isolation valve against the gasket/wedge/gasket combination, and install the washers and nuts to secure the isolation valve to the nozzle flange (see Figure 5 below).

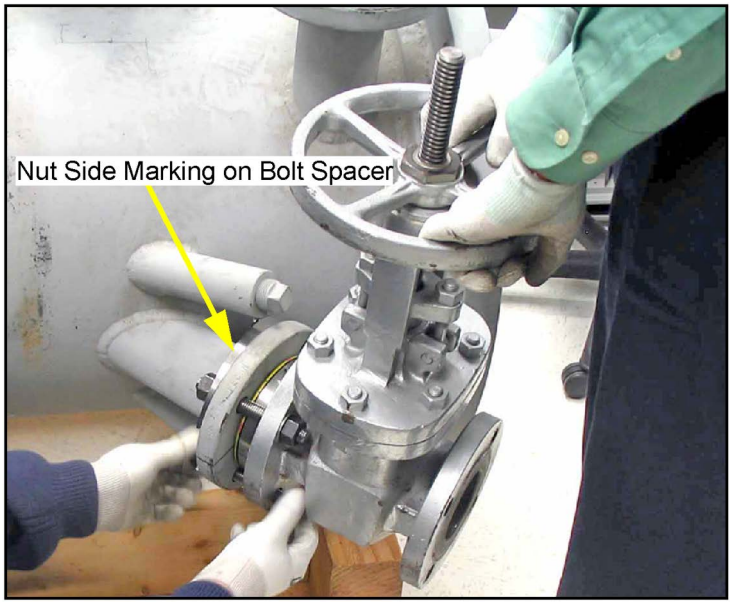


Figure 5: Mounting the Isolation Valve

5. Insert the two adjustment screws into the threaded holes on the 6° wedge (see Figure 6 below) and use them to rotate the wedge until the scribe line is centered between the two bolts.

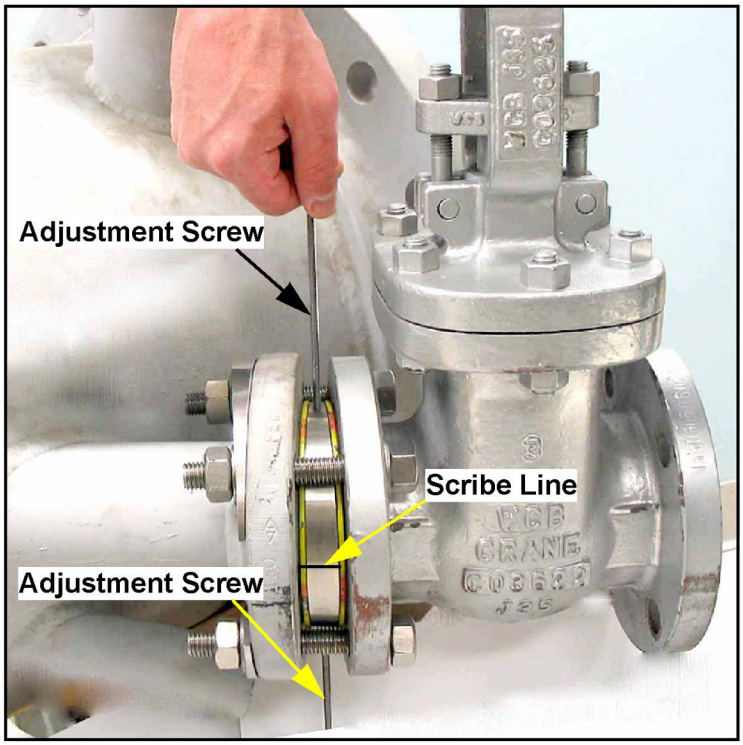


Figure 6: Adjusting the Wedge Position

6. After the wedge is positioned correctly, use two wrenches to tighten the hardware and secure the isolation valve to the nozzle. Then remove the adjustment screws from the wedge.

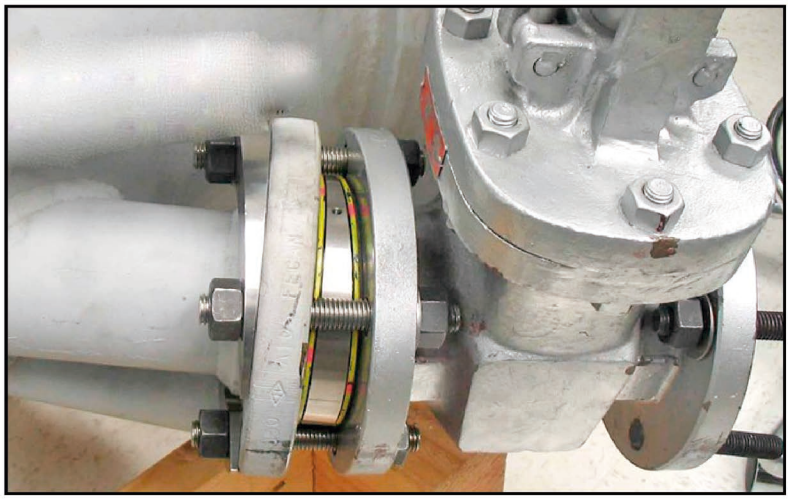


Figure 7: Completed Isolation Valve Installation

Note: *The upstream valve and transducer are installed without wedges, as described in the previous section.*

Chapter 3. Installing the Transducer Assemblies

3.1 Introduction

Transducers and their holder assemblies are installed into a meter body, which is a section of pipe that contains the ports for mounting the transducer assemblies. The meter body may be prefabricated or created by installing ports on an existing pipe. The transducers can be inserted into the meter body using the following holder methods:

- Low-pressure insertion mechanism
- Barrel holder
- Flanged holder

Note: *As an example, this chapter describes the use of the low-pressure insertion mechanism type only.*

3.2 Using the Low-Pressure Insertion Mechanism

Note: *The Low-Pressure Insertion Mechanism is designed for manual (non-assisted) transducer insertion into operating pipes at low pressure. The mechanism uses an isolation valve and a packing gland for sealing.*

Inserting the transducers into the pipe requires the following steps:

- Preparing for installation
- Mounting the insertion mechanism
- Inserting the transducer into the pipe
- Aligning the transducers



WARNING! **The manual insertion mechanism is used for low-pressure applications (80 psig/6.5 bar absolute or less). Use the appropriate safety precautions when inserting or withdrawing the insertion mechanism.**

3.2.1 Preparing for Installation

Before you begin, find a work area where you can stand the insertion mechanism upright without placing any weight on the transducer (e.g., a bench with a cutout large enough for the transducer to slide through).

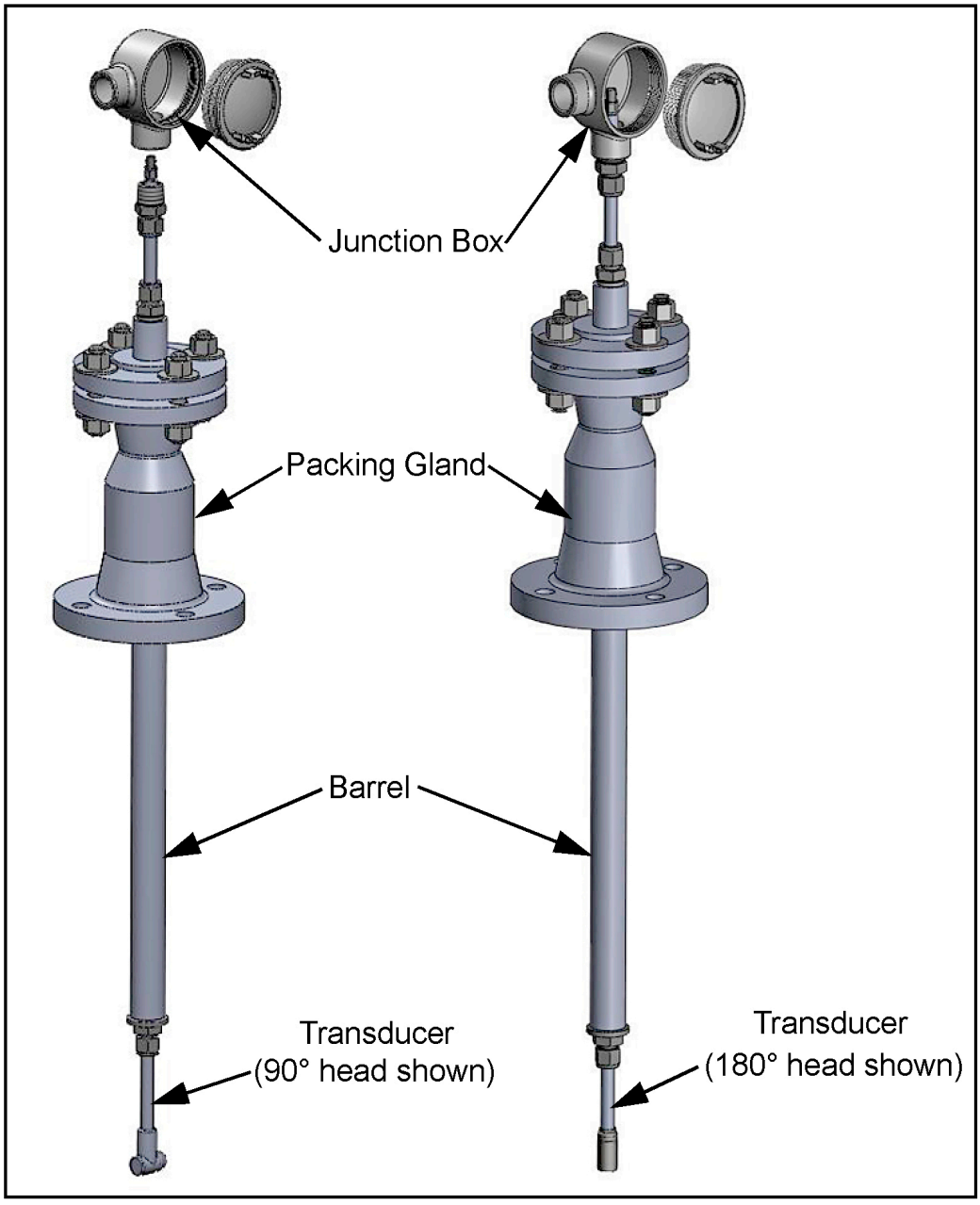
You will need the following items for installation:

- A packing tool (may be shipped with the flowmeter)
- A gasket for the isolation valve
- A straight edge ruler
- A tag to place on the isolation valve
- Bolts

3.2.2 Mounting the Insertion Mechanism

1. Before mounting the insertion mechanism on the isolation valve you should familiarize yourself with its components (see the figure below):
   - Junction box
   - Barrel
   - Packing gland
   - Transducer

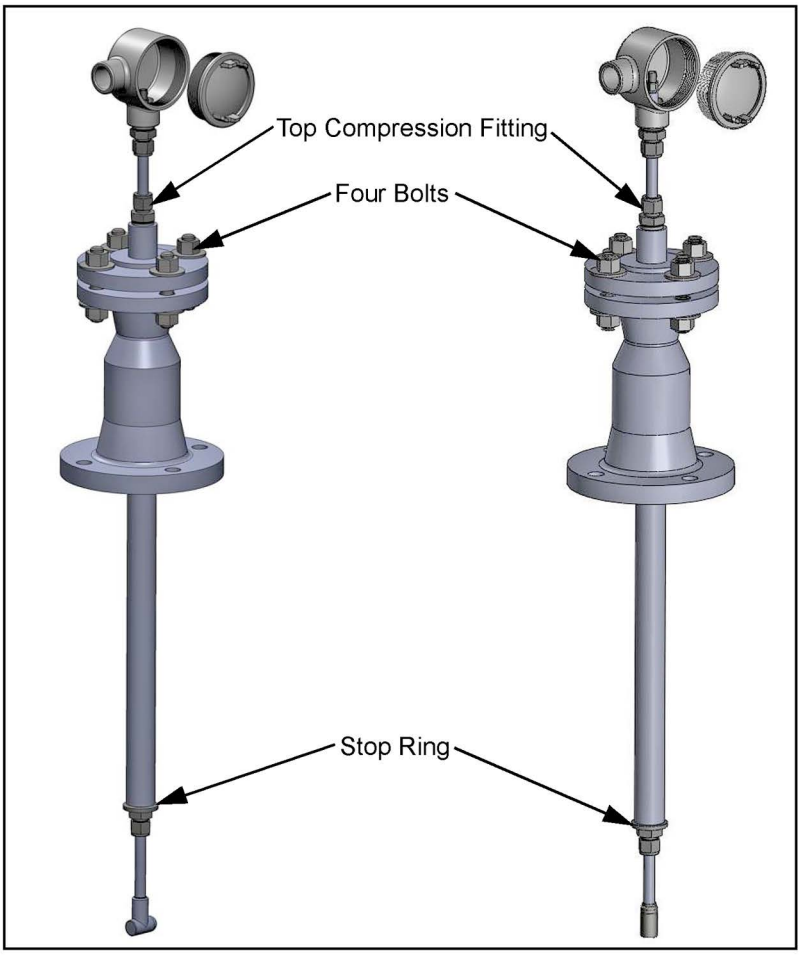
Note: *Explosion-proof junction boxes are not pre-mounted on the end of the transducer when shipped.*


Junction Box
Packing Gland
Barrel
Transducer
(90° head shown)
Transducer
(180° head shown)

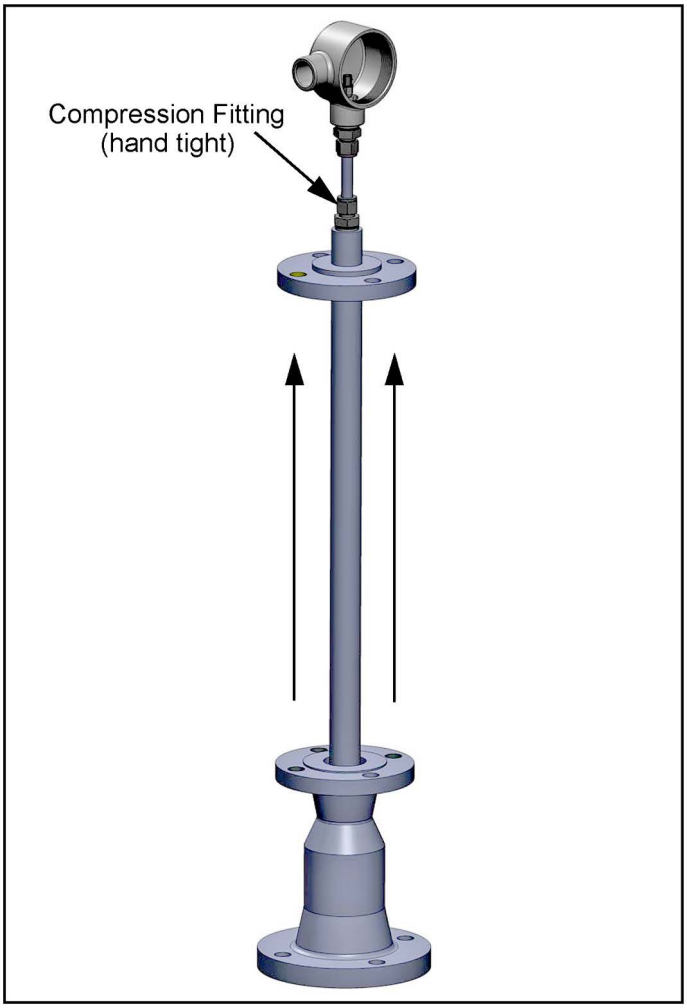
2. Visually inspect the transducer, and make sure the top compression fitting is not loose.

IMPORTANT: The stop ring at the end of the barrel should be loose. DO NOT tighten the compression fitting or you could change the transducer alignment.

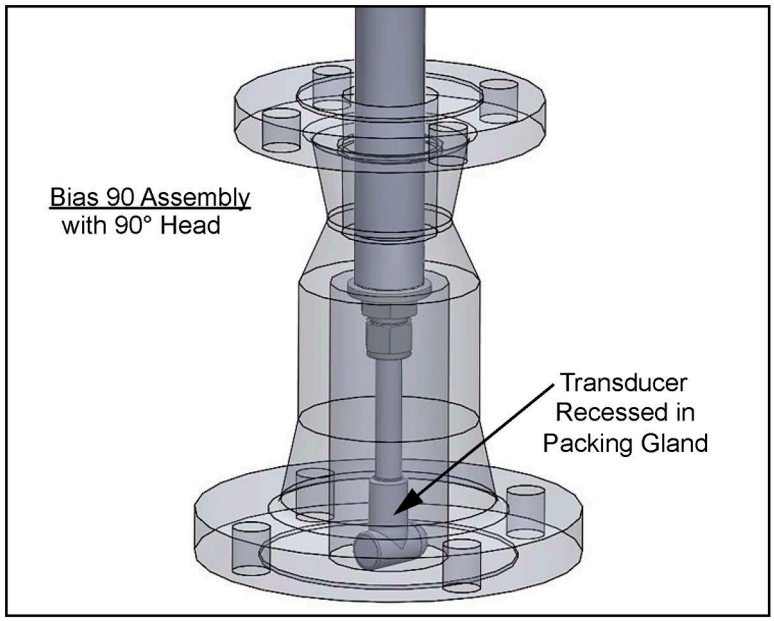
3. Remove the four bolts that fasten the barrel to the packing gland.

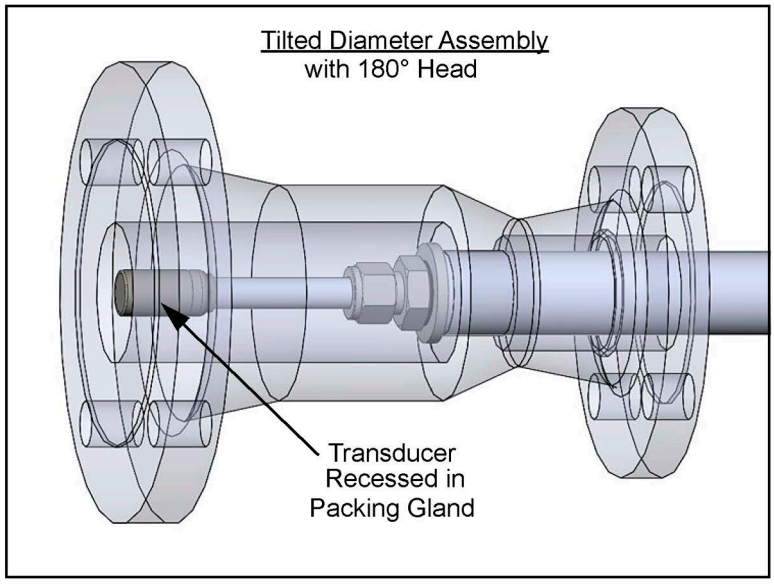


4. Retract the barrel from the packing gland so that the transducer head is recessed in the packing gland. You will hear the stop ring click into place when the transducer is fully recessed.



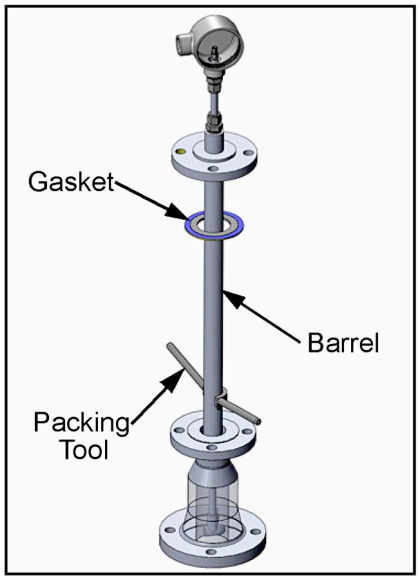
5. Visually inspect the mechanism. Make sure the transducer is recessed in the packing gland. Again, make sure the top compression fitting is secure and hand tight.



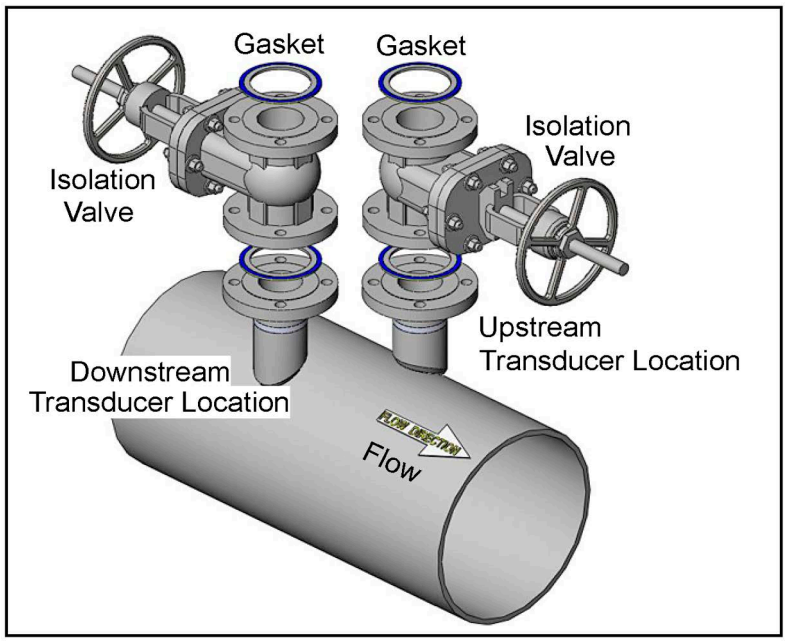


3.3 Mounting the Bias 90 Insertion Mechanism/Transducer Assembly

1. Lift the gasket and insert the packing tool into the packing nut. By turning the packing tool clockwise, tighten the packing material so that the barrel stays up without support.



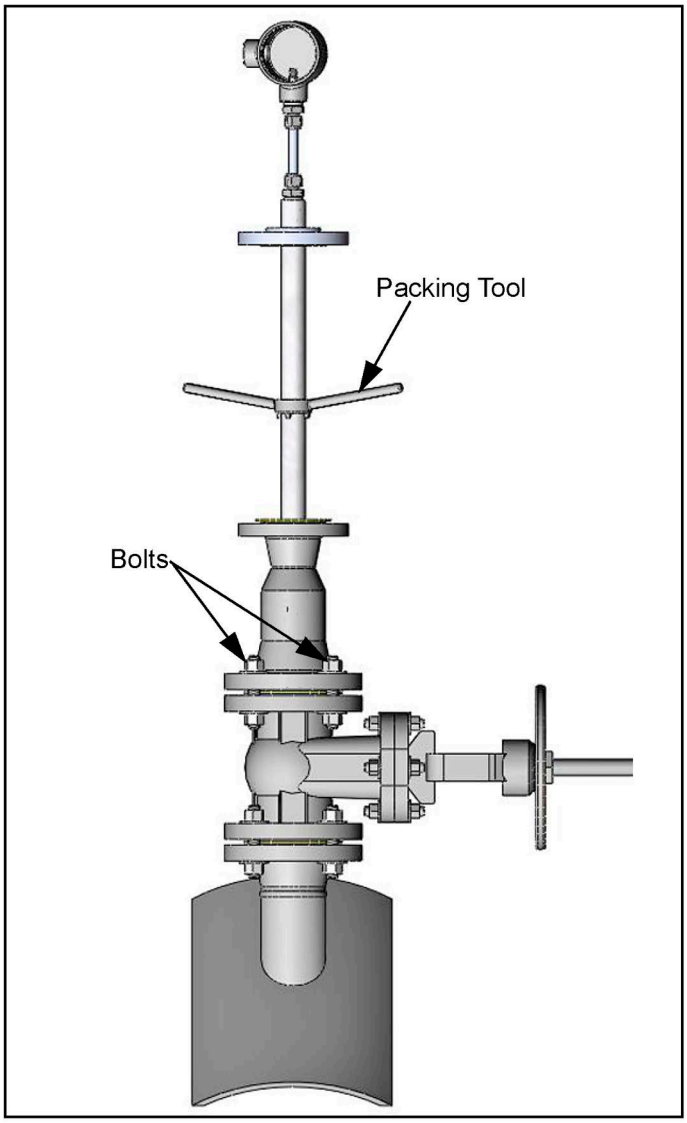
2. Verify that the isolation valves are securely installed with gaskets and hardware. Then, place a gasket on the face of each isolation valve.



3. Identify the upstream and downstream nozzles as follows:
   - For a Standard Velocity Range application, the upstream and downstream nozzles are interchangeable, because the system is bi-directional.
   - For an Extended Velocity Range application, the system is not bi-directional. Note which nozzle is designated as upstream and which is designated as downstream on the pipe. Then, identify the upstream and downstream insertion mechanism assemblies. The downstream assembly is labeled with a ring marked Downstream at the end of the assembly near the junction box (see the figure below).
4. Proceed with either the upstream or downstream assembly.
5. Lift the insertion mechanism by the barrel and place the insertion mechanism on the isolation valve.



6. Line up the flange holes and bolt the packing gland to the isolation valve.

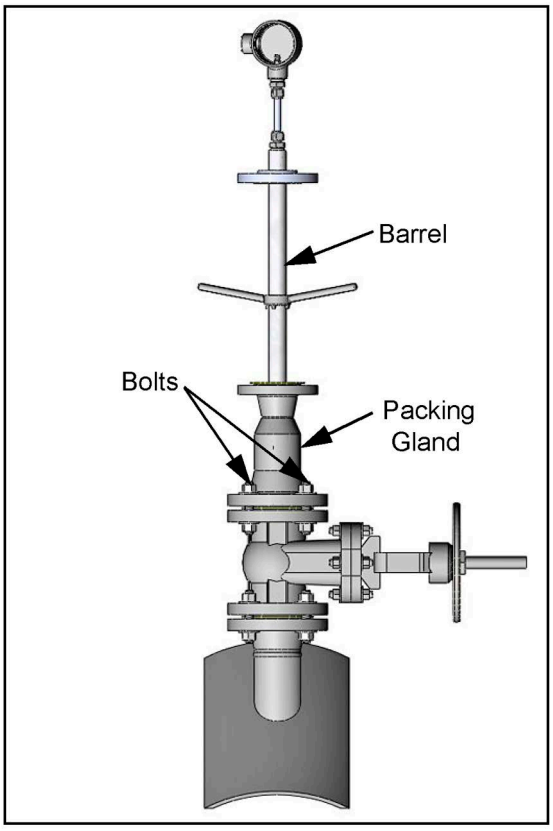


7. Using the packing tool, tighten the packing nut again so the nut is recessed.

WARNING! **The packing material must be securely packed before the isolation valve is opened.**

3.4 Inserting the Bias 90 Transducer into the Pipe

1. Before you open the isolation valve, carefully verify the following:
   - The barrel is pulled up as far as it can go
   - All bolts are secure
   - The transducer head is recessed in the packing gland

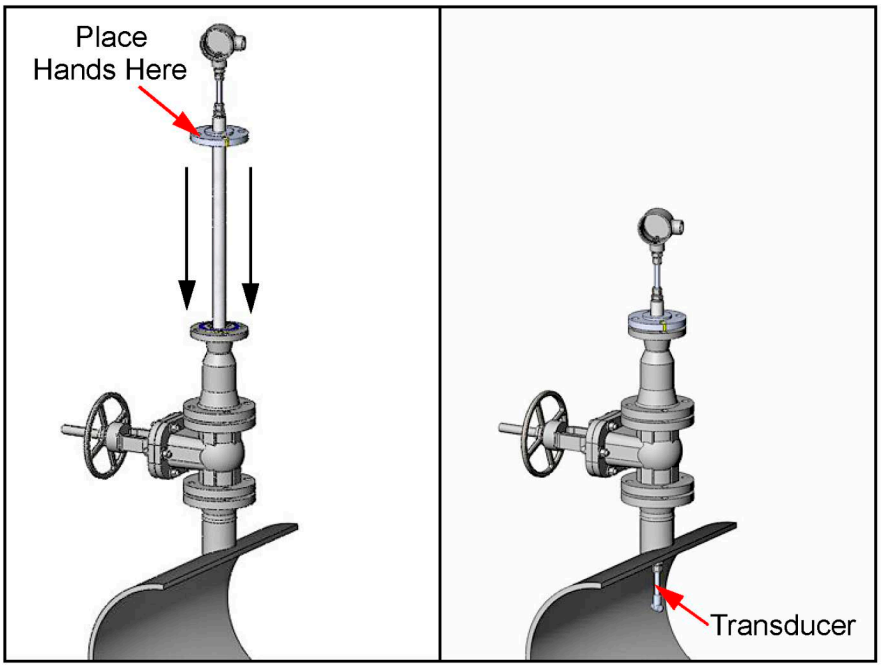




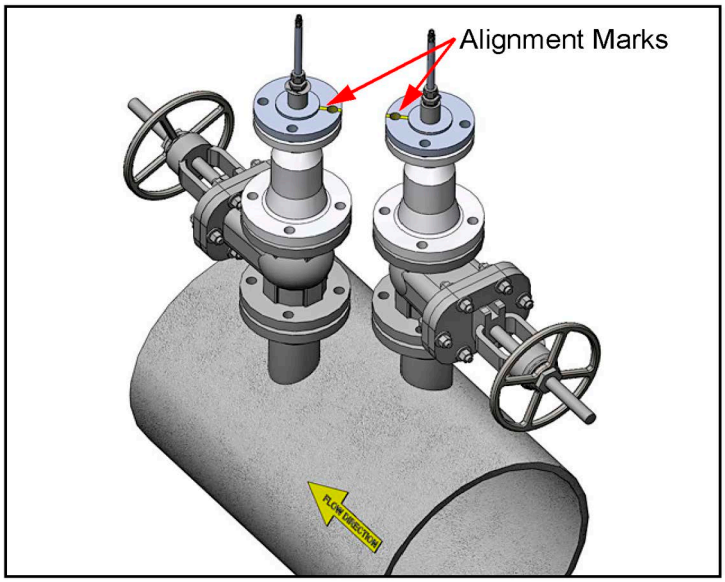
WARNING! **Follow all applicable safety codes and practices before opening the isolation valve.**

2. Open the isolation valve.

3. Placing your hands on top of the barrel, push the barrel/transducer down into the pipe so that the barrel flange and the packing gland flange meet. You may have to twist the barrel to get it moving.

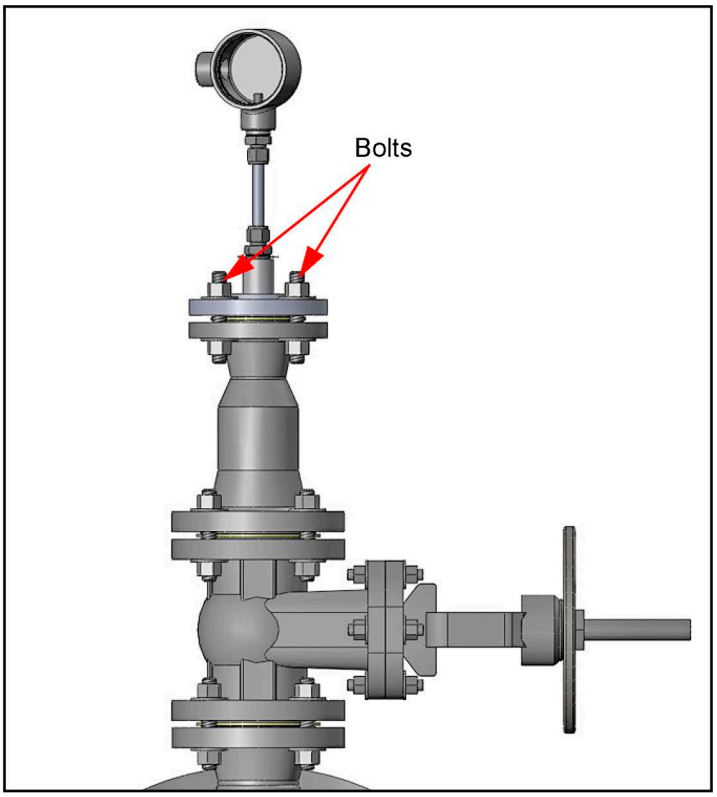


4. For this Bias 90 configuration, orient the alignment marks on each barrel flange so that they are facing each other. The alignment mark, which is marked with yellow paint, is scribed on the top and outside of the flange.



5. Place two bolts into the flange in holes opposite each other, but not in the hole with the scribe mark. Then, hand tighten the nuts.

Note: **DO NOT** insert the remaining bolts until instructed to do so in the following section.



6. Install the second insertion mechanism by repeating the steps in the two previous sections. After the second insertion mechanism is installed, proceed to one of the following sections:

- “Aligning the Transducers (Standard Velocity Range)” on page 42
- “Aligning the Transducers (Extended Velocity Range)” on page 42

3.5 Aligning the Transducers (Standard Velocity Range)

For applications with gas flow velocities up to 100 m/s, align the transducers as follows:

Note: *These instructions apply to both the upstream and downstream transducer assemblies.e*

1. Use a straight edge to line up the alignment marks on the two barrel flanges.
2. Place the remaining bolts into the flanges and tighten them securely.
3. Place a tag on each isolation valve stating the following:

DO NOT OPERATE (CLOSE) WHEN
TRANSDUCER IS INSERTED INTO PIPE.

4. Refer to your flowmeter Startup Guide to make the transducer electrical connections.

3.6 Aligning the Transducers (Extended Velocity Range)

For applications with gas flow velocities up to 120 m/s, align the transducers as follows:

Note: *The downstream transducer is pre-installed at the factory in the barrel of the downstream insertion mechanism, to shift the signal direction 6° away from the upstream transducer signal.*

1. Verify that the downstream transducer is located on the right to a person looking from the downstream end of the pipe (see Figure 8 below). Contact Panametrics if the port locations do not follow this convention.

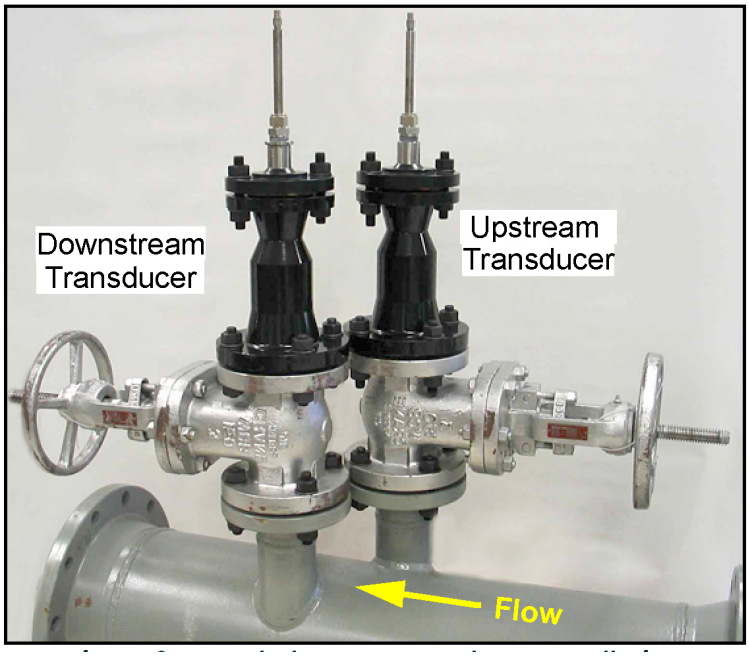


Figure 8: Extended Range Transducer Installation

2. Slide the end slot of the guide plate around the upstream transducer, and rotate the plate until the side slot is around the downstream transducer (see Figure 9 below). Then, align the mark on the upstream transducer barrel with the guide plate mark. Slightly tighten the upstream barrel flange bolts to maintain the alignment.

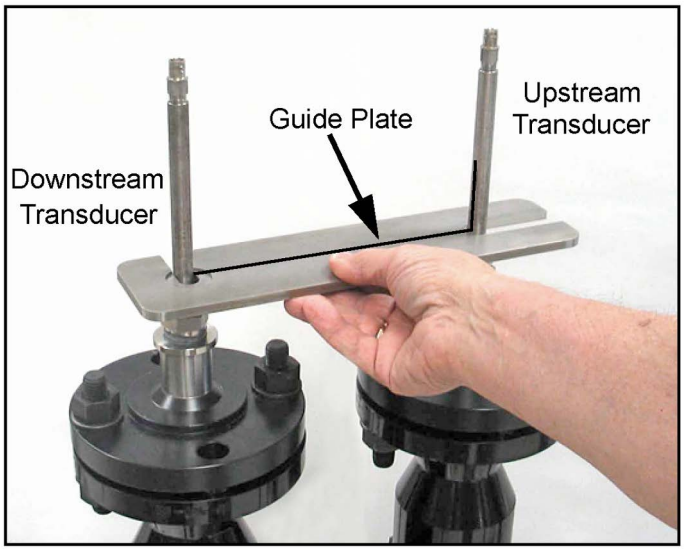


Figure 9: Installing the Guide Plate

3. Place the cover plate on top of the guide plate and slide it as far as possible until it is positioned around the upstream transducer, as shown in Figure 10 below. Then, tighten the screws to secure it.

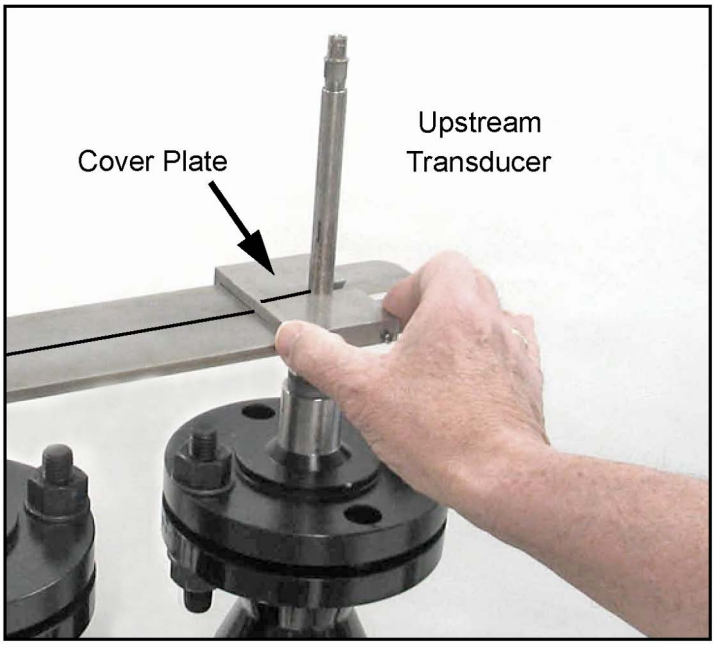


Figure 10: Installing the Cover Plate

4. Slide the locking collar over the downstream transducer to the cavity on top of the guide plate. Align the 6° mark on the top of the collar with the line on the transducer (see Figure 11 below). Then, tighten the collar set screws until the collar is secured to the transducer.

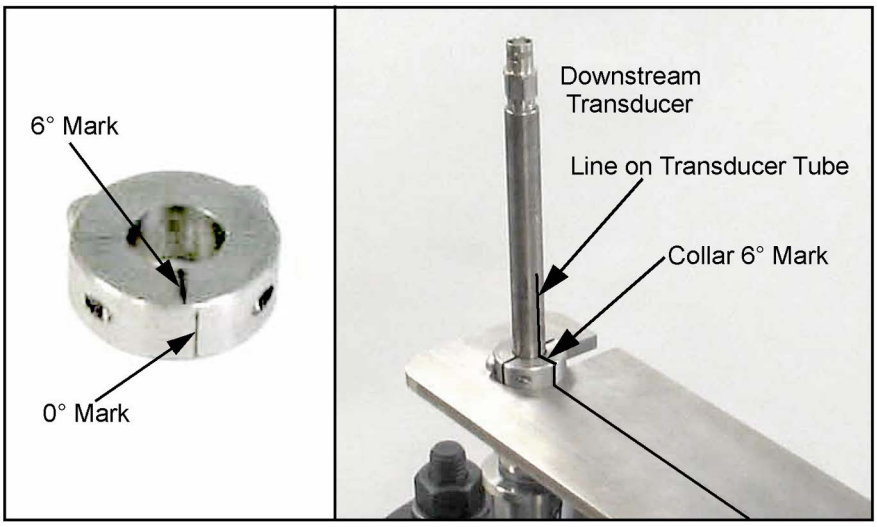


Figure 11: Installing the Locking Collar

5. Check to see if the 0° mark on the side of the locking collar is aligned with the line on the guide plate. If they are not aligned, then loosen the nuts on top of the barrel flange and rotate the transducer assembly until the two lines are aligned (see Figure 12 below). Then, re-tighten the nuts.

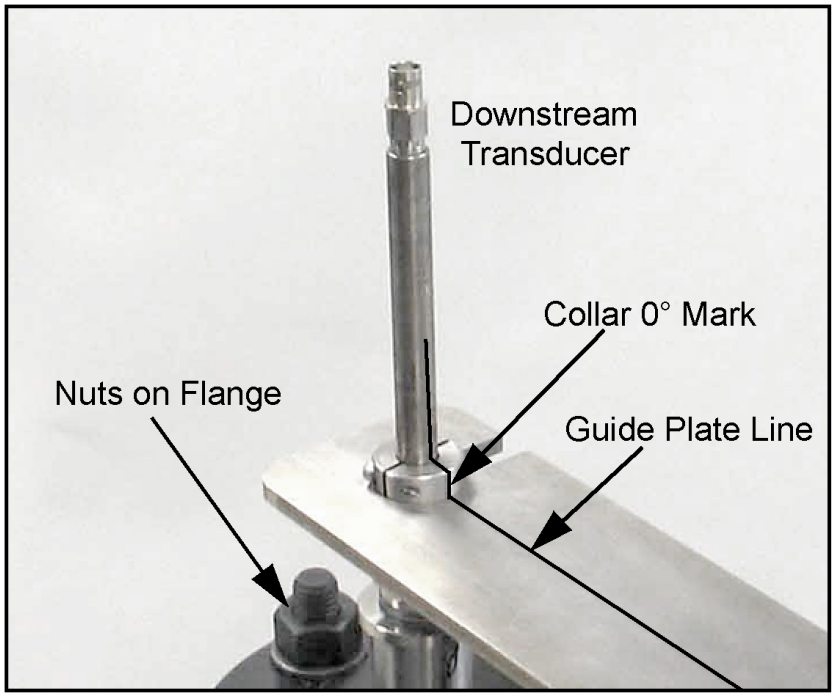


Figure 12: Locking Collar 0° Mark Aligned with Guide Plate Line

6. Check to see if the line on the upstream transducer tube is aligned with the line on the cover plate. If they are not aligned, loosen the nuts on top of the barrel flange and rotate the transducer assembly until the two lines are aligned (see Figure 13 below). Then, re-tighten the nuts.

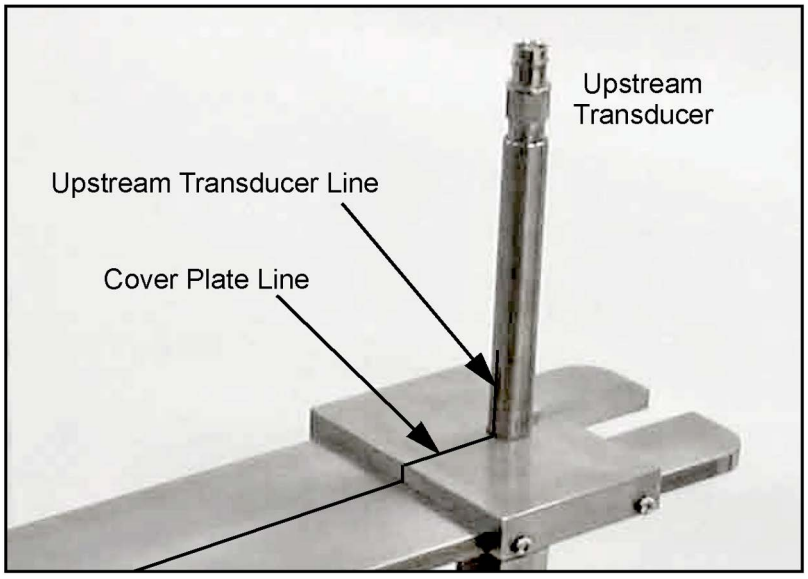


Figure 13: Upstream Transducer Mark Aligned with Cover Plate Linea

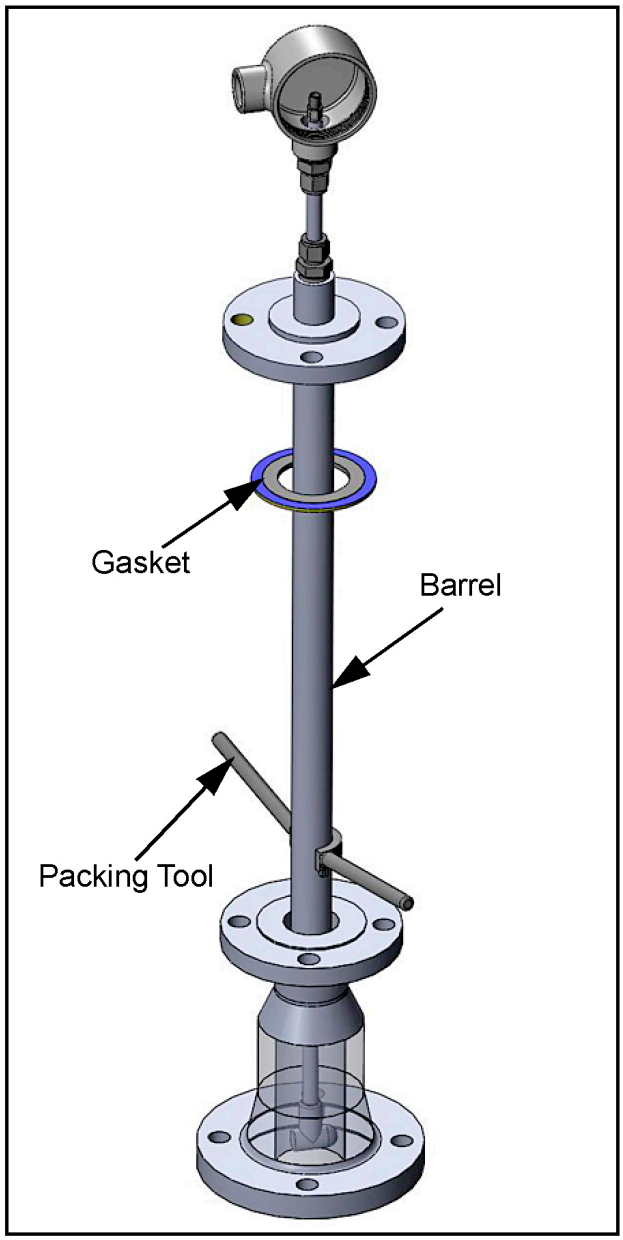
7. Upon completion of the above steps, remove the cover plate, locking collar and guide plate from the transducer assemblies.
8. Place the remaining bolts into the flanges and tighten them securely.
9. Place a tag on each isolation valve stating the following:

DO NOT OPERATE (CLOSE) WHEN
TRANSDUCER IS INSERTED INTO PIPE.

10. Refer to your flowmeter Startup Guide to make the transducer electrical connections.

3.7 Mounting the Tilted 45 Insertion Mechanism/Transducer Assembly

1. Lift the gasket and insert the packing tool into the packing nut. Turning the packing tool clockwise, tighten the packing material so that the barrel will stay up without support.



2. Check and make sure the isolation valves are securely installed with gaskets and hardware. Then, place a gasket on the face of each isolation valve (see either Figure 14 below or Figure 15 on page 48).

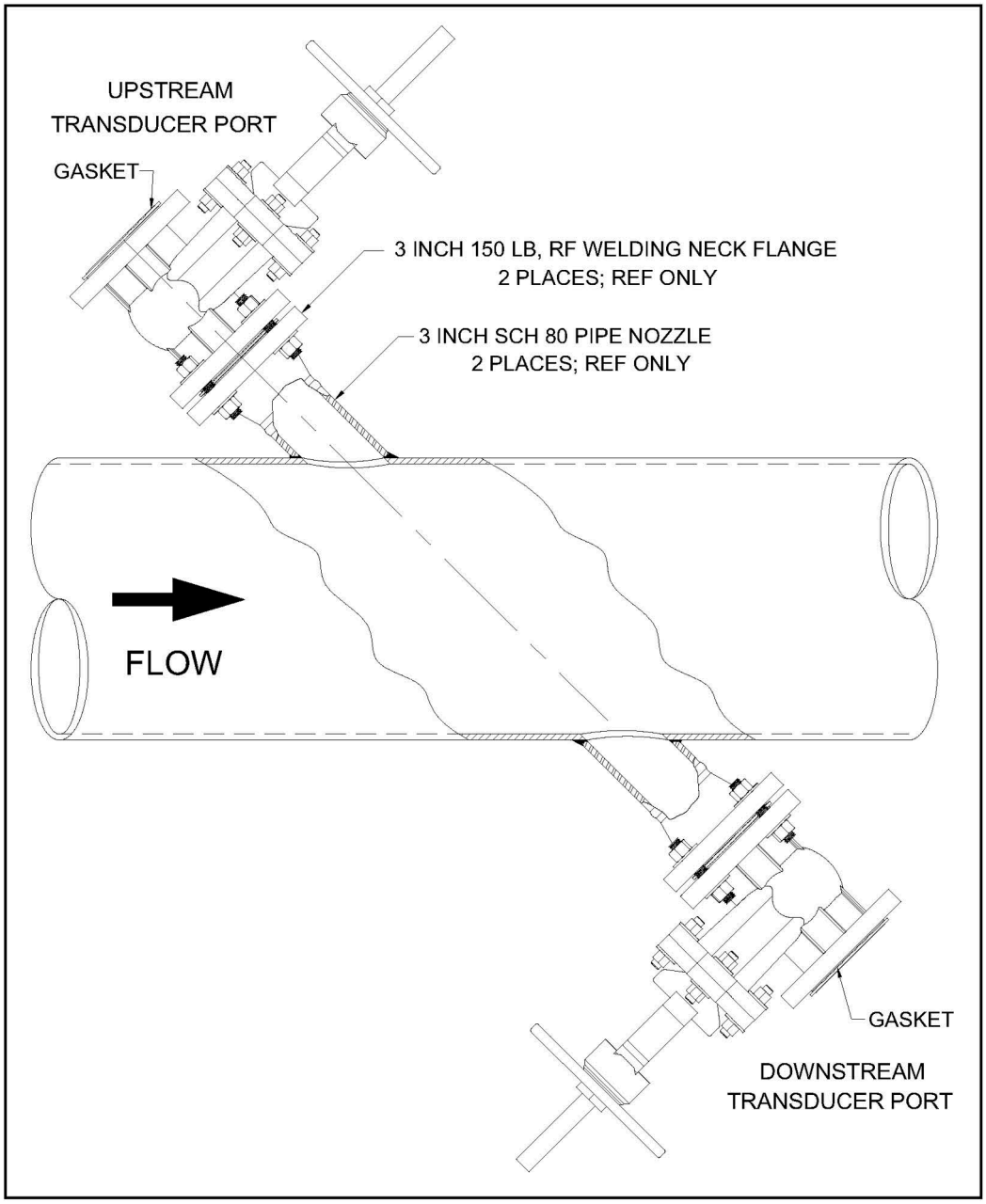


Figure 14: Standard Velocity Range Assembly

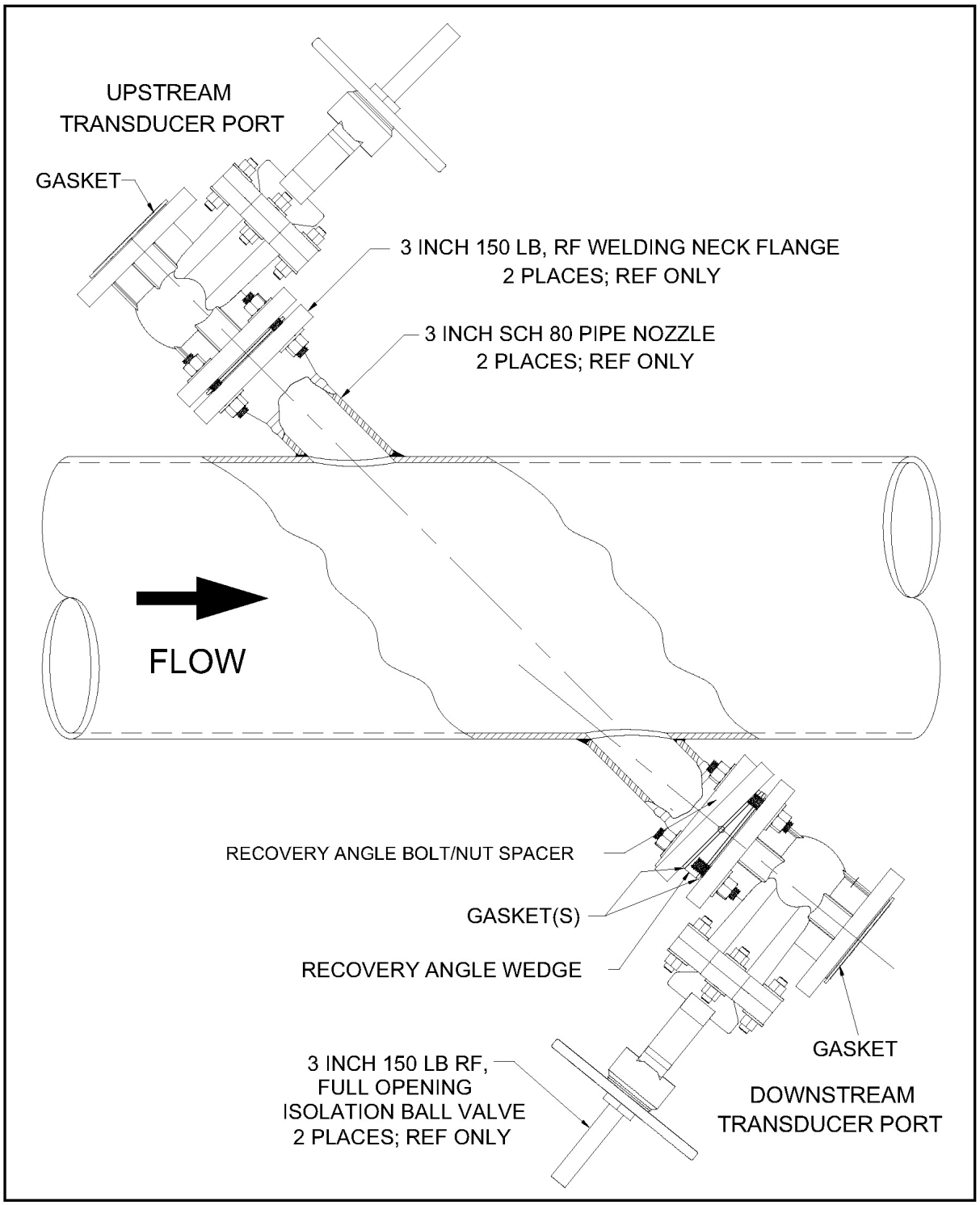
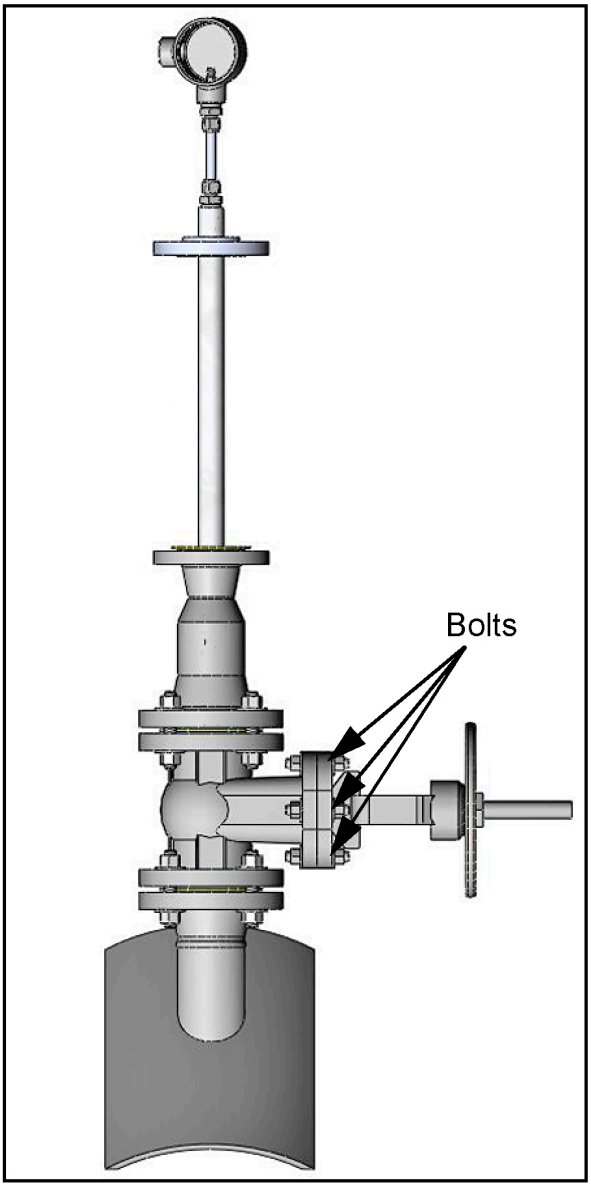


Figure 15: Extended Velocity Range Assembly

3. Identify the upstream and downstream nozzles as follows:
   - For a Standard Velocity Range application, the upstream and downstream nozzles are interchangeable, because the system is bi-directional.
   - For an Extended Velocity Range application, the system is not bi-directional. Note which nozzle is designated as upstream and which is designated as downstream on the pipe. Then, identify the upstream and downstream insertion mechanism assemblies. The downstream assembly is labeled with a ring marked Downstream at the end of the assembly near the junction box (see the figure below).
4. Proceed with either the upstream or downstream assembly.
5. Lift the insertion mechanism by the barrel and place the insertion mechanism on the isolation valve.

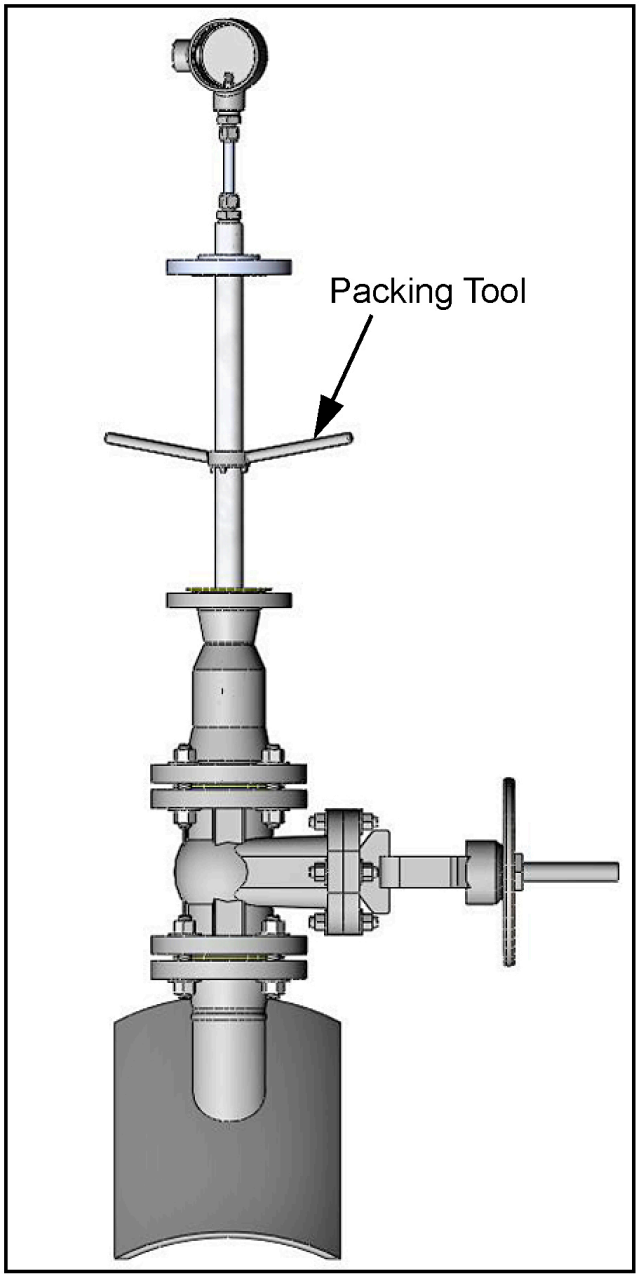


6. Line up the flange holes and bolt the packing gland to the isolation valve.



7. Using the packing tool, tighten the packing nut again until the nut is recessed.

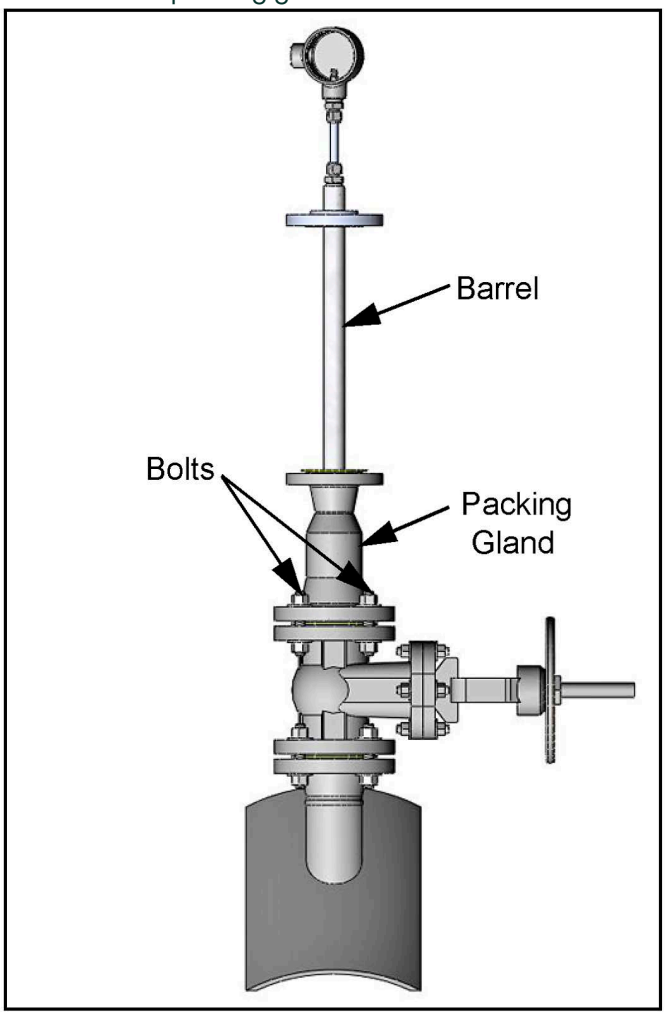
WARNING! **The packing material must be securely packed before the isolation valve is opened.**



3.8 Inserting the Tilted 45 Transducer into the Pipe

1. Before you open the isolation valve, carefully verify the following:

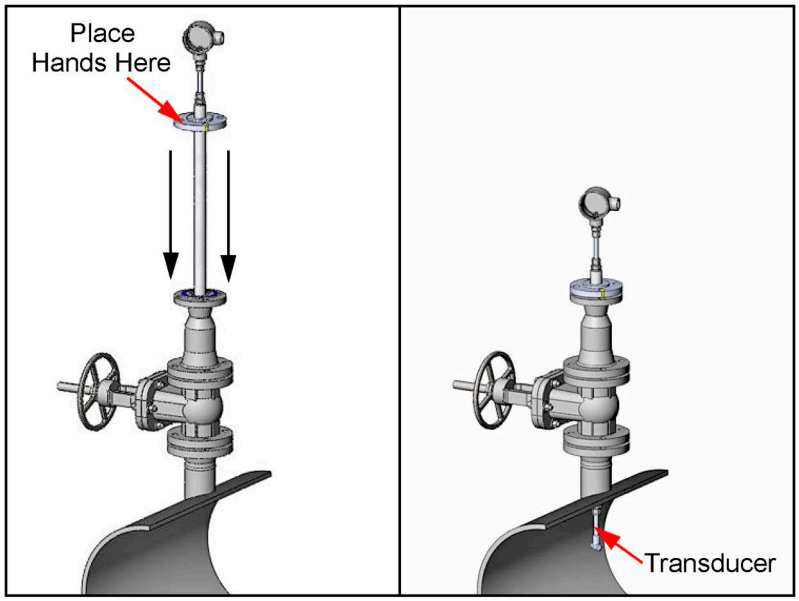
- The barrel is pulled up as far as it can go
- All bolts are secure
- The transducer head is recessed in the packing gland.



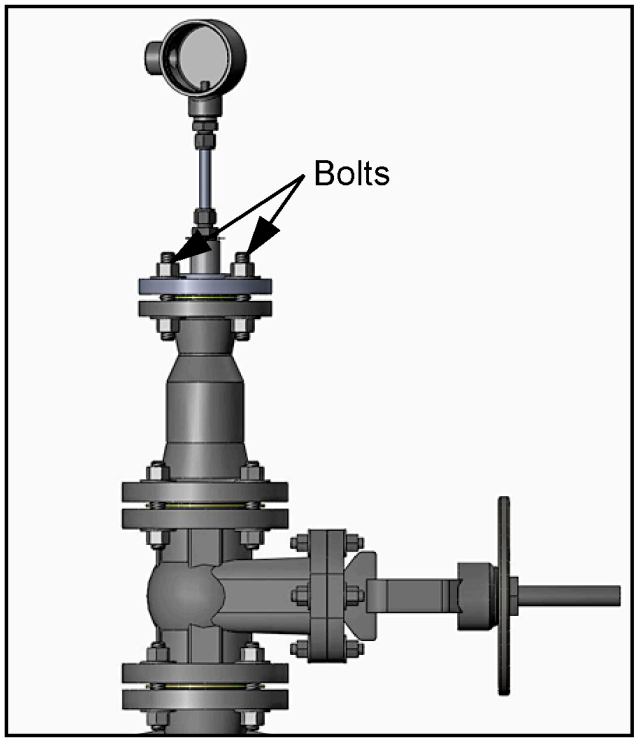
WARNING! **Follow all applicable safety codes and practices before opening the isolation valve.**

2. Open the isolation valve.

3. Placing your hands on top of the barrel, push the barrel/transducer down into the pipe so that the barrel flange and the packing gland flange meet. You may have to twist the barrel to get it moving.



4. Place the bolts into the flange joining the barrel flange to the packing gland flange.
5. 5. Tighten the bolts securely.



6. Install the second insertion mechanism by repeating the steps in the previous sections. Confirm that the downstream transducer assembly is in the downstream port and the upstream transducer assembly is in the upstream port.

Note: *The following steps apply to both the upstream and downstream assemblies equally.*

7. Place a tag on each isolation valve stating the following:

DO NOT OPERATE (CLOSE) WHEN
TRANSDUCER IS INSERTED INTO PIPE

8. Refer to your flowmeter Startup Guide to make the transducer electrical connections.

3.9 Connecting an XAMP

This section explains how to correctly install and assemble an XAMP into a transducer junction box. It applies to all three possible junction box options, but only one of the junction box options is used as an example in the steps below.

1. Place a 3/4" NPT compression fitting on the stem of the transducer closest to the BNC connector.
2. Torque the fitting into one of the 3/4" NPT ports of the junction box with at least 5 threads engaged. After the fitting is torqued into place, ensure that the BNC head of the transducer extends slightly past the ground screw bosses, as shown in Figure 16 below::

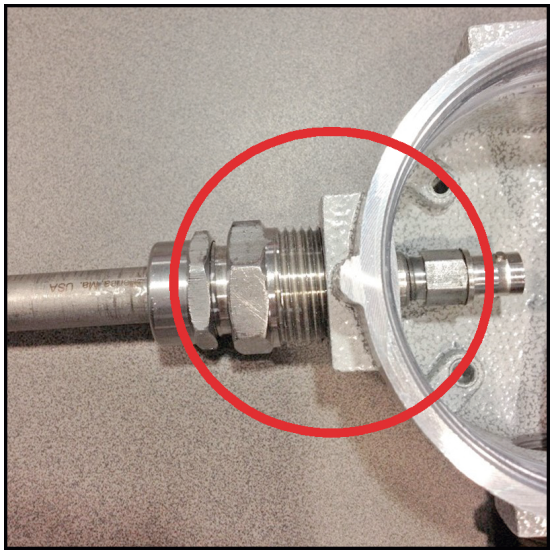


Figure 16: Torquing the NPT Reducer

3. If the BNC head extends too far into the junction box, it will make the assembly more difficult to install by reducing the amount of area needed to properly store the excess cable. If the BNC head is not positioned approximately where it is pictured in Figure 16 above, loosen the compression fitting and adjust the transducer. Then, re-tighten the compression fitting.

4. Torque the cable gland coming from the flowmeter electronics main housing into the other 3/4" NPT port in the junction box until there are at least 5 threads of engagement (see Figure 17 below).

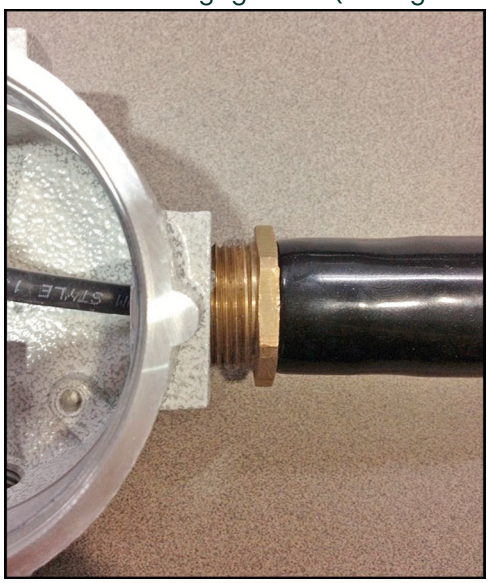


Figure 17: Torquing the Cable Gland

5. Verify that, with the transducer and the cable gland assembled, the junction box looks like Figure 18 below:

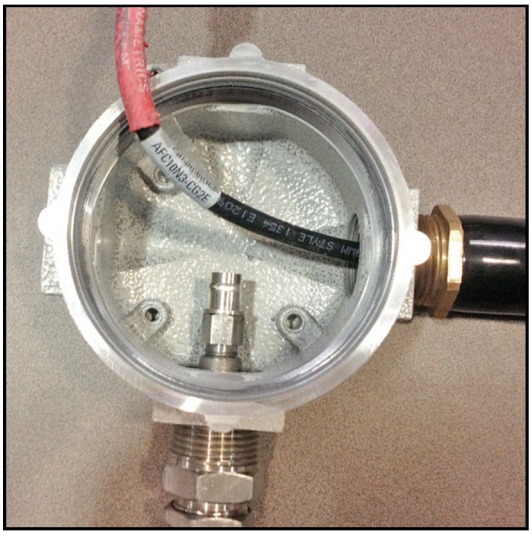


Figure 18: Assembled Transducer and Cable Gland

6. Connect the right angle male BNC plug to the exposed BNC cable from the cable gland assembly, as shown in Figure 19 below.

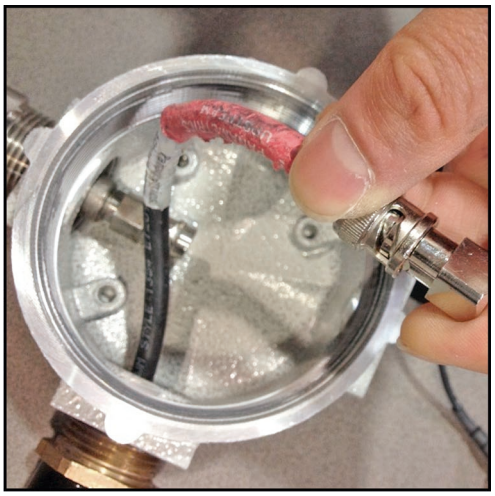


Figure 19: Connecting BNC Plug to the Cable

7. Connect the female BNC plug of the XAMP to the male BNC transducer head as shown in Figure 20 below:



Figure 20: Female Plug to Male BNC Head

8. Wrap the extra length of cable around the inside of the junction box such that the BNC heads do not rest on other cables or on each other. The assembly should now look like Figure 21 below.

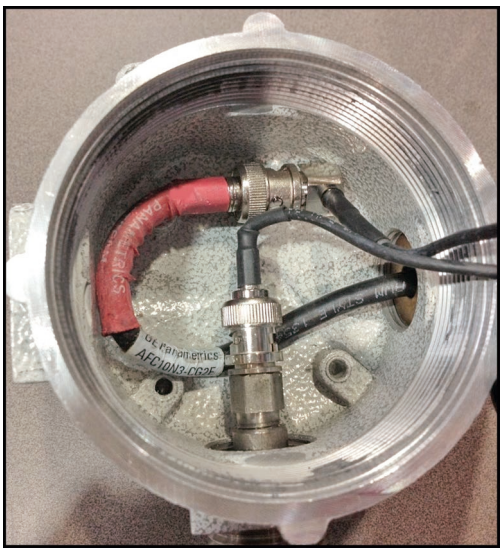


Figure 21: BNC Heads

9. Place the XAMP body into the junction box, resting the puck gently on the cables below it. To reduce stress and strain on the joint. ensure that the cables of the XAMP rest naturally according to the slant at which they exit the epoxy. The XAMP should remain still, and the cap of the junction box should rotate freely around the XAMP.



Figure 22: Junction Box Cap

10. Place the cap of the junction box over the XAMP and tighten the cap until the junction box is firmly closed. Engage the set screw (see Figure 23 below) to secure the cap in place.

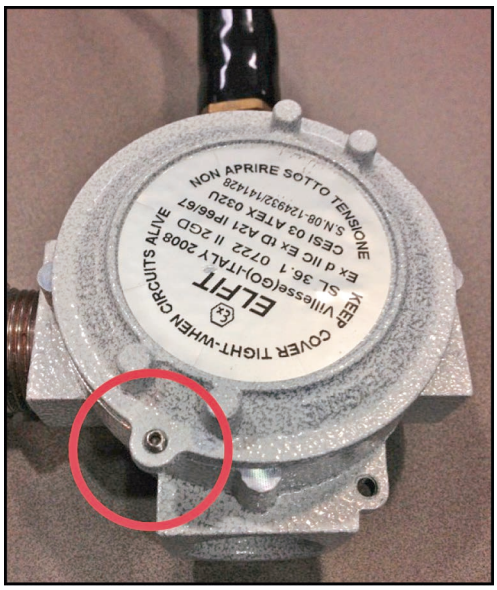


Figure 23: Junction Box Set Screw

Note: *To disconnect or uninstall the XAMP from the assembly, perform the above steps in reverse order.*

Chapter 4. Specifications

4.1 T5/T5 MAX Transducer Physical Specifications

Applications:	Hazardous Area, Flare Gas, Hydrocarbon Gases, Saturated Steam
Installation Type:	Wetted
Material:	Standard: Titanium *Optional: 316 Stainless Steel, Monel® or Hastelloy®*
Field Mounting:	Flowcell, Hot or Cold Tap
Process Connection:	Flanged, 1.5 in. to 3 in. (40 mm to 80 mm)
Holder Type:	Insertion Mechanism
Holder Ratings:	150#, 300#, 600#
Operating Frequency:	Standard: 100 kHz Optional: 50 kHz and 200 kHz
Pressure Range:	0 to 2700 psig Standard, 0 to 1500 psig for USA/Canada Certified Products
Electrical Rating:	200 V peak-to-peak, 5 mA
Ambient Temperature Range:	–40° to +140°F (–40° to +60°C)
Process Temperature Range:	–364° to +572°F (–220° to +300°C) -55°C to 150°C for T5 Max Only

4.2 T5/T5MAX Transducer Certifications

North American - Explosion proof:	C US	Class I, Division 1, Group B, C, D
European/International Flameproof:	Ex	II 2 G Ex db IIC T6...XX Gb (T code dependent on Process Temperature) Tamb –40° to +140°F (–40° to +60°C) SIRA 20ATEX10001X, IECEx SIR 20.0006X
North American - Weatherproof:	C US	IP66, TYPE 4X 200Vpp, 5mA
European/International - Weatherproof:	CE	IP 66

4.3 Specific conditions of use

Consult the manufacturer if dimensional information on the flameproof joints is necessary.

It is end-user's responsibility to ensure that the ambient around the T5 and T5MAX assembly does not exceed the permitted ambient of -40°C to +60°C, regardless of process temperature.

The T5 and T5MAX transducers made of titanium (where ff = Ti) are potential ignitions sources when subjected to impact or friction, which shall be taken into consideration during installation.

The T5 and T5MAX have non-conducting coating which may generate an ignition-capable level of electrostatic charge under certain extreme conditions. The user shall take the necessary precautions to minimise the risk from electrostatic discharge. For example, controlling the environmental humidity where installed in order to minimize generation of static electricity, with the equipment protected from direct airflow which could cause a transfer of charge to the surface of the equipment. Cleaning should be done only with a damp cloth.

The temperature classification rating of the T5 and T5MAX assemblies is dependent upon the maximum process temperature (see table below).

Table 3: Temperature Classification Rating of the T5 and T5MAX

Model (where aa = T5, T5MAX)	Process temperature	T-Class
aa-bb-cc-dd-LT-ff-gg-hh-ii-jj-zz	-220°C to +85°C	T6
	+85°C to +100°C	T5
aa-bb-cc-dd-NT-ff-gg-hh-ii-jj-zz	-55°C to +85°C	T6
	+86°C to +100°C	T5
	+101°C to +135°C	T4
	+136°C to +150°C	T3
aa-bb-cc-dd-HT-ff-gg-hh-ii-jj-zz	-50°C to 85°C	T6
	+86°C to +100°C	T5
	+101°C to +135°C	T4
	+136°C to +200°C	T3
	+201°C to +250°C	T2
aa-bb-cc-dd-XT-ff-gg-hh-ii-jj-zz	-180°C to 85°C	T6
	+86°C to +100°C	T5
	+101°C to +135°C	T4
	+136°C to +200°C	T3
	+201°C to +300°C	T2

Warranty

Each instrument manufactured by Panametrics is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of Panametrics. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics determines that the equipment was defective, the warranty period is:

- One year from delivery for electronic or mechanical failures.
- One year from delivery for sensor shelf life.

If Panametrics determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Panametrics, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a Panametrics instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify Panametrics, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, Panametrics will issue a RETURN MATERIAL AUTHORIZATION (RMA), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, Panametrics will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If Panametrics determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

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Customer Support Centers

U.S.A.
The Boston Center
1100 Technology Park Drive
Billerica, MA 01821
U.S.A.
Tel: 800 833 9438 (toll-free)
978 437 1000
E-mail: panametricstechsupport@bakerhughes.com

Ireland
Sensing House
Shannon Free Zone East
Shannon, County Clare
Ireland
Tel: +353 (0)61 470291
E-mail: panametricstechsupport@bakerhughes.com

Scan here for Panametrics support and service information

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DigitalFlow™ XGF868i

Flare Gas Mass Flow Ultrasonic Transmitter

Startup Guide



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Flare Gas Mass Flow Ultrasonic Transmitter

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April 2024

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Services

Panametrics provides customers with an experienced staff of customer support personnel ready to respond to technical inquiries, as well as other remote and on-site support needs. To complement our broad portfolio of industry-leading solutions, we offer several types of flexible and scalable support services including: Training, Product Repairs, Service Agreements and more.

Please visit https://www.bakerhughes.com/panametrics/panametrics-services for more details.

Typographical Convention

Note: *These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.*

IMPORTANT: These paragraphs provide information emphasizing instructions which are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.



WARNING! Indicates a potentially hazardous situation which can result in serious personal injury or death, if it is not avoided.



CAUTION! Indicates a potentially hazardous situation which can result in minor or moderate injury to personnel or damage to the equipment, if it is not avoided.



HIGH VOLTAGE! This symbol indicates the presence of high voltage. It calls your attention to situations or operations that could be dangerous to you and other persons operating the equipment. Read these messages and follow the instructions carefully.

Safety Issues



WARNING! It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area

WARNING! **Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.**

WARNING! **Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on the equipment.**

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

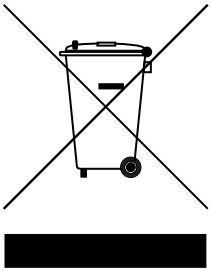
Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

Panametrics is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2012/19/EU.



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

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Chapter 1. Installation

1.1 Introduction

To ensure safe and reliable operation of the *XGF868i Ultrasonic Flow Transmitter*, the system must be installed in accordance with the guidelines established by Panametrics engineers. Those guidelines, which are explained in detail in this chapter, include the following specific topics:

- Unpacking the XGF868i system
- Selecting suitable sites for the electronics enclosure, the flowcell and the transducers
- Installing the flowcell and the transducers

Note: *See the appropriate* Transducer Installation Guide *for detailed instructions on transducer installation.*

- Installing optional temperature and pressure transmitters
- Installing the electronics enclosure
- Wiring the electronics enclosure



WARNING! **The XGF868i flow transmitter can measure the flow rate of many gases, some of which are potentially hazardous. In such cases, observing the proper safety practices is critical. Be sure to follow all applicable local safety codes and regulations for installing electrical equipment and for working with hazardous gases or flow conditions. Consult company safety personnel or local safety authorities to verify the safety of any procedure or practice.**



Attention European Customers!
To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.

1.2 Unpacking

Carefully remove the electronics enclosure, the transducers, and the cables from the shipping containers. Before discarding any of the packing materials, account for all components and documentation listed on the packing slip. The discarding of an important item along with the packing materials is all too common. If anything is missing or damaged, contact the factory immediately for assistance.

1.3 Site Considerations

Because the relative location of the flowcell and the electronics enclosure is important, use the guidelines in this section to plan the XGF868i installation.



WARNING! **Before beginning installation, please refer to *"Installing Panametrics Measurement & Control Ultrasonic Flow Transmitters in a Potentially Hazardous Area"* near the back of this manual.**

1.3.1 Electronics Enclosure Location

The standard XGF868i electronics enclosure is a powder-coated, cast-aluminum, Type-7/4X explosion-proof enclosure. An optional stainless steel enclosure is available. Typically, the enclosure is mounted as close as possible to the transducers. When choosing a site, make sure the location permits easy access to the electronics enclosure for programming, maintenance and service.

IMPORTANT: For compliance with the EU Low Voltage Directive (2006/95/EC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.

1.3.2 Flowcell Location

The pipeline flowcell consists of the flow rate transducers and any pressure and/or temperature transducers employed as part of the flow measurement system. Ideally, choose a section of pipe with unlimited access to the flowcell, such as a long stretch of pipe that is above ground. However, if the flowcell is to be mounted on an underground pipe, dig a pit around the pipe to facilitate installation of the transducers.

1.3.3 Transducer Location

For a given fluid and pipe, the accuracy of the XGF868i depends primarily on the location and alignment of the transducers. In addition to accessibility, when planning for transducer location, adhere to the following guidelines:

1. Locate the transducers so that there are at least 20 pipe diameters of straight, undisturbed flow upstream and 5 pipe diameters of straight, undisturbed flow downstream from the measurement point. To ensure undisturbed flow, avoid sources of turbulence in the fluid such as valves, flanges, expansions, elbows and dips or low spots in which condensed liquid may collect.
2. Because condensate or sediment at the bottom of the pipe may cause attenuation of the ultrasonic signal, locate the transducers on the side of a horizontal pipe, when possible. If limited pipe access necessitates top-mounted transducers and the sound beam path includes a reflection, shift the transducers to at least 10° off top dead center. This will minimize the influence of any sediment on the reflected ultrasonic signals.

1.3.4 Cable Lengths

Locate the electronics enclosure as close as possible to the flowcell and transducers, preferably directly on the flowcell. However, Panametrics can supply transducer cables up to 1000 ft (300 m) in length for remote location of the electronics enclosure. If longer cables are required, contact Panametrics for assistance.

1.3.5 Temperature and Pressure Transmitters

When installing temperature and/or pressure transmitters in the flowcell, locate them downstream of the transducers. These transmitters should be positioned no closer to the XGF868i transducers than 2 pipe diameters and no further away from the transducers than 20 pipe diameters.

1.3.6 Transducer Cables

When installing the transducer cables, always observe established standard practices for the installation of electrical cables. Specifically, do not route transducer cables alongside high-amperage AC power lines or any other cables that could cause electrical interference. Also, protect the transducer cables and connections from the weather and from corrosive atmospheres.

IMPORTANT: When using non-Panametrics cables to connect the flow transducers to the XGF868i electronics enclosure, the cables must have electrical characteristics identical to the Panametrics cables. Type RG62A/U coaxial cable should be used, and each cable must be the same length (within ±4 in.).

All interconnecting cables must comply with IEC/EN 60079-14.

1.4 Installing a Flowcell

A flowcell is the section of pipe upon which the transducers are mounted. It can be created either by mounting the transducers on the existing pipeline or by mounting them on a spoolpiece. A spoolpiece is a separately manufactured pipe section, matched to the existing pipe, which contains ports for mounting the transducers. This approach allows the transducers to be aligned and calibrated before inserting the spoolpiece into the pipeline.

Figure 6 on page 18 shows a typical right-angle mounting bracket for installing the XGF868i electronics enclosure. For detailed instructions on installing the transducers and the spoolpiece, refer to any supplied drawings and to the appropriate *Transducer Installation Guide*.

1.5 Installing Temperature and Pressure Transmitters

Optional temperature and pressure transmitters may be installed near the ultrasonic transducer ports as part of the flowcell. Be sure to observe the siting requirements given earlier in this chapter. These transmitters should send a 0/4-20 mA signal to the XGF868i. In turn, the XGF868i must be fitted with a suitable option card to process the signals and to provide the required 24 VDC power to the transmitters. Any desired transmitters or sensors may be used, but they must have an accuracy equal to ±0.5% of the reading or better.

Note: *Resistive Thermal Devices (RTDs) are a good choice for measuring the temperature.*

Typically, a 1/2" NPT or 3/4" NPT female threaded port is used to mount the transmitters on the flowcell. If the pipeline is insulated, the coupling may need to be extended to provide convenient access. Of course, other types of mounting ports, including flanged ports, may be used for the transmitters.

Figure 1 below shows a typical mounting arrangement for the pressure and temperature transmitters. The temperature sensor should extend into the pipe by 1/4 to 1/2 of the pipe inside diameter.

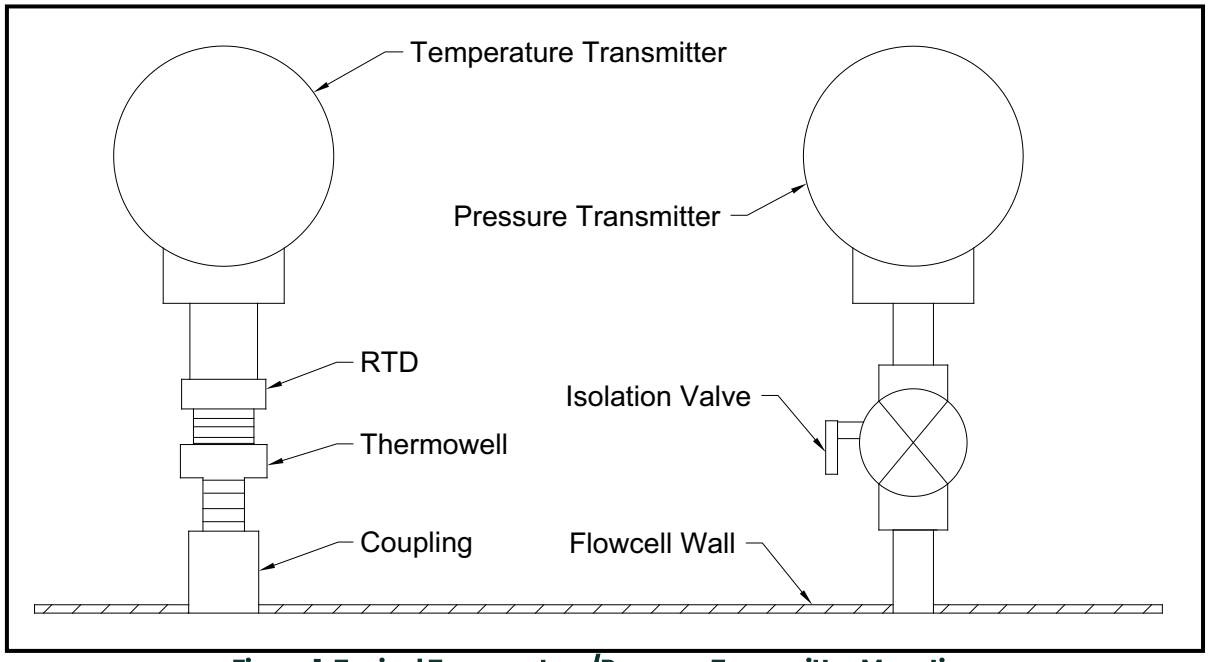


Figure 1: Typical Temperature/Pressure Transmitter Mounting

1.6 Mounting the XGF868i Electronics Enclosure

The standard XGF868i electronics package is housed in a Type-4X weather-resistant enclosure suitable for indoor or outdoor use. Refer to *Figure 5 on page 17* for the mounting dimensions and the weight of this enclosure.

The XGF868i electronics enclosure is fitted with a mounting boss that has a single 3/4" NPT-F threaded hole at its center and four 1/4-20 tapped holes at its corners. By using this mounting boss, the electronics enclosure may be mounted by any of the typical techniques shown in *Figure 6 on page 18*.



WARNING! Proper grounding of the XGF868i chassis is required to prevent possible electric shock. See *Detail A in Figure 6 on page 18* for the location of the chassis grounding screw.

1.7 Making the Electrical Connections

This section contains instructions for making all the necessary electrical connections to the XGF868i flow transmitter. Refer to *Figure 7 on page 19* for a complete wiring diagram.



WARNING! Refer to *Installing Panametrics Ultrasonic Flow Transmitters in a Potentially Hazardous Area* near the rear of this manual for additional installation instructions.

Except for the power connector, all electrical connectors are stored on their terminal blocks during shipment and may be removed from the enclosure for more convenient wiring. Simply, feed the cables through the conduit holes on the side of the enclosure, attach the wires to the appropriate connectors and plug the connectors back onto their terminal blocks.



WARNING! To ensure safe and reliable operation of the XGF868i, be sure to install and tighten all cable glands in accordance with the gland manufacturer's instructions.



WARNING! To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.



WARNING! Always disconnect the line power from the XGF868i before removing either the front cover or the rear cover. This is especially important in a hazardous environment.

Refer to *Figure 2* below and prepare the XGF868i for wiring by completing the following steps:

1. Disconnect any existing power line from its source.
2. Loosen the set screw on the rear cover.

3. Place a rod or long screwdriver across the cover in the slots provided, and rotate the cover counterclockwise until it comes free from the enclosure.
4. Install any required cable clamps in the appropriate conduit holes around the side of the enclosure.
5. Note the labels inside the rear cover to assist in wiring the power and option card connections. Also, *Figure 8 on page 20* shows the rear cover option card labels for every available option card configuration.

Proceed to the appropriate section of this chapter to make the desired wiring connections.

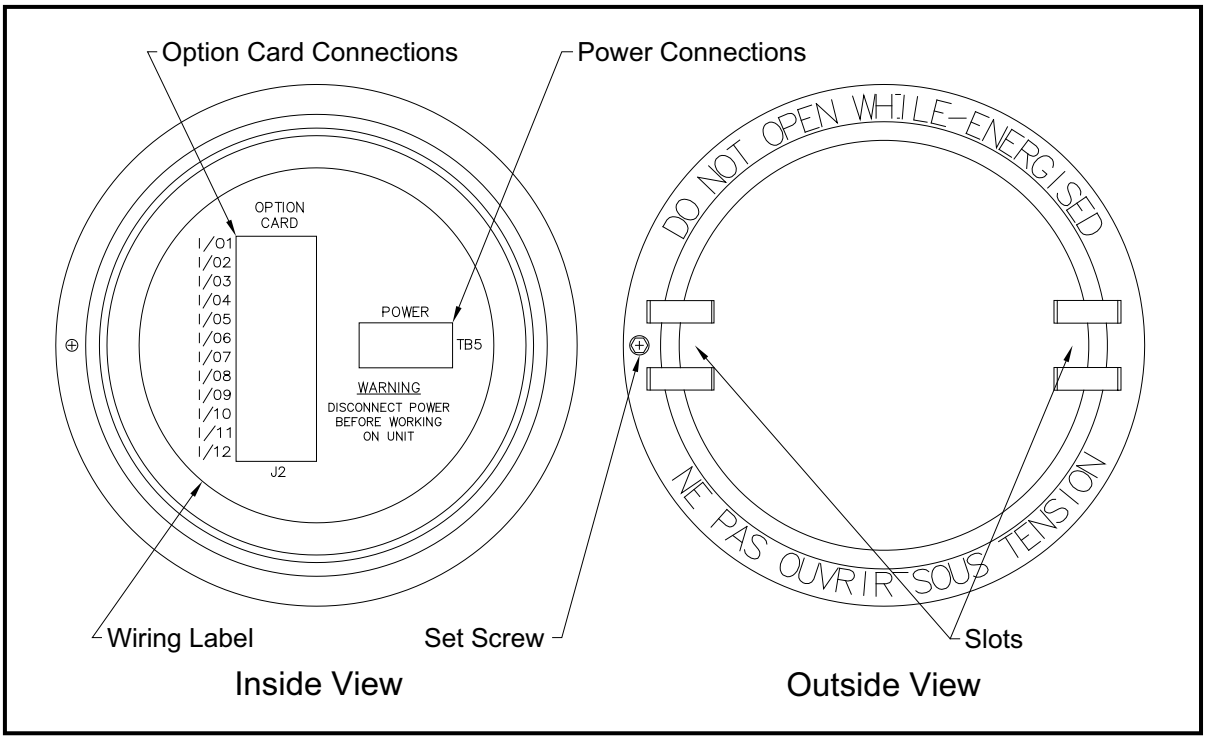


Figure 2: Rear Cover with Connection Labels

1.7.1 Wiring the Line Power

The XGF868i may be ordered for operation with power inputs of 100-120 VAC, 220-240 VAC, or 12-28 VDC. The label on the side of the electronics enclosure lists the required line voltage and the power rating for the unit. Be sure to connect the meter only to the specified line voltage. The fuse size is listed in *Table 1* below.

Table 1: Line Voltages and Fuse Ratings

Line Voltage	Fuse Rating
85-250 VAC	Not field-replaceable (contact Panametrics)
12-28 VDC	2.0 A, Slow-Blow

IMPORTANT: For compliance with the EU Low Voltage Directive (2006/95/EC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.

Note: *Only use Class 2 Rated Power supply for line power connection to DC instrument.*

Refer to *Figure 7 on page 19* to locate terminal block TB5 and connect the line power as follows:



HIGH VOLTAGE! **Improper connection of the line power leads or connecting the meter to the incorrect line voltage may damage the unit. It may also result in hazardous voltages at the flowcell and associated piping as well as within the electronics enclosure.**

1. Prepare the line power leads by trimming the line and neutral AC power leads (or the positive and negative DC power leads) to a length 0.5 in. (1 cm) shorter than the ground lead. This ensures that the ground lead is the last to detach if the power cable is forcibly disconnected from the meter.
2. Install a suitable cable clamp in the conduit hole indicated in *Figure 7 on page 19*. If possible, avoid using the other conduit holes for this purpose, to minimize any interference in the circuitry from the AC power line.



WARNING! **To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.**

3. Strip 1/4 in. of insulation from the end of each of the three power line leads.
4. Route the cable through the conduit hole and connect the line power leads to terminal block TB5, using the pin number assignments shown in *Figure 7 on page 19*.
5. Leaving a bit of slack, secure the power line with the cable clamp.



WARNING! **Make sure that both covers with the o-ring seals are installed and the set screws are tightened before applying power to the unit in a hazardous environment.**



CAUTION! **The transducers must be properly wired before applying power to the meter.**

1.7.2 Wiring the Transducers and Preamplifiers

Before wiring the XGF868i transducers and preamplifiers, complete the following steps:

- Disconnect the main power from the electronics enclosure
- Remove the rear cover and install all required cable clamps

The *electronics enclosure* may be located either directly on the flowcell (*local*) or some distance away from the flowcell (*remote*). The *preamplifiers* may be located either in the transducer junction boxes (*local*) or some distance away from the transducers in their own separate enclosures (*remote*). Based on the specific configuration of your system, proceed to one of the following sections for detailed instructions:

- Local or Remote electronics enclosure with **Local preamplifiers** (see *Section 1.7.2.1 on page 8*)
- Local or Remote electronics enclosure with **Remote preamplifiers** (see *Section 1.7.2.2 on page 9*)

1.7.2.1 Local or Remote Electronics Enclosure with Local Preamplifiers



WARNING! **Before connecting the transducers, take them to a safe area and discharge any static buildup by shorting the center conductor of the transducer cables to the metal shield on the cable connector.**

IMPORTANT: The cable lengths for a given pair of transducers, including the preamplifier-to-electronics enclosure cables, must be equal to within ±4 in. (10 cm) of each other.

For an XGF868i system configured with either a local or remote electronics enclosure and local preamplifiers, wire the transducers and preamplifiers as follows:

1. The local preamplifier must be installed in the junction box on the end of the transducer. Connect the BNC cable with the mating connector from the preamplifier to the transducer BNC connector.
2. Locate the two CH1 preamplifier-to-electronics enclosure cables and connect one to each of the two CH1 preamplifiers in the junction boxes, using the remaining preamplifier connections. Then, feed the free ends of the cables through the selected conduit holes in the electronics enclosure.
3. See *Figure 7 on page 19* for the location (**J3**) of the connections for the Channel 1 transducers in the electronics enclosure. Then, refer to *Figure 10* to wire the transducer to preamplifier and preamplifier to electronics enclosure connections.

Note: *The* RED *cable leads are the SIG(+) leads and the* BLACK *cable leads are the RTN(-) leads.*



Attention European Customers!
To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.

4. For a 2-Channel XGF868i, repeat steps 1-3 to connect the CH2 transducers to terminal block **J4** in the electronics enclosure. Note that it is not required that both channels of a 2-channel unit be connected.
5. If wiring of the system has been completed, reinstall the rear cover and o-ring on the electronics enclosure and tighten the set screw.

Note: *A channel must be activated in the* Channel Menu *before it can begin taking measurements. See* Chapter 2, Initial Setup*, for instructions.*

1.7.2.2 Local or Remote Electronics Enclosure with Remote Preamplifiers



WARNING! **Before connecting the transducers, take them to a safe area and discharge any static buildup by shorting the center conductor of the transducer cables to the metal shield on the cable connector.**

IMPORTANT: The cable lengths for a given pair of transducers, including the preamplifier-to-electronics enclosure cables, must be equal to within ±4 in. (10 cm) of each other.

Note: *A dual preamplifier is typically used in these installations, and you must note the labeled upstream and downstream connections on the preamplifier. Be sure to connect the upstream transducer to the upstream connection on the preamplifier and in the XGF868i electronics enclosure. Follow the same procedure for the downstream connections.*

The remote preamplifier (PRE868) uses a transformer (p/n 705-603) which connected to the ***"XDCR"*** *BNC connector on the preamplifier (see* Figure 9 on page 21*).*

For an XGF868i system configured with either a local or remote electronics enclosure and a *dual remote preamplifier*, wire the transducers and preamplifier as follows:

1. Refer to *Figure 9 on page 21* and use the pair of coaxial cables with BNC to BNC connectors supplied by Panametrics (or equivalent cables) to connect both **CH1** transducers to the dual preamplifier, using the connections on the transformer.



CAUTION! **As part of maintaining the FM/CSA environmental rating (TYPE 4) on the remote preamplifier, thread sealant is required on all conduit entries.**

2. If an optional lightning protector is installed, connect it between the preamplifier and the electronics enclosure. Locate the device near the electronics enclosure and install it according to the supplied wiring documentation for the device.
3. See *Figure 7 on page 19* for the location (**J3**) of the connections for the Channel 1 transducers in the electronics enclosure. Using the supplied coaxial cables with BNC to flying lead connectors (or equivalent cables), route the cables through one of the conduit holes in the electronics enclosure and connect the preamplifier to terminal block **J3**. Secure the cables with the cable clamp.

Note: *The* RED *cable leads are the SIG(+) leads and the* BLACK *cable leads are the RTN(-) leads..*



Attention European Customers!
To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.

4. For a 2-Channel XGF868i, repeat steps 1-3 to connect the CH2 transducers to terminal block **J4** in the electronics enclosure. Note that it is not required that both channels of a 2-channel unit be connected.
5. If wiring of the system has been completed, reinstall the rear cover and o-ring on the electronics enclosure and tighten the set screw.

Note: *A channel must be activated in the* Channel Menu *before it can begin taking measurements. See* Chapter 2, Initial Setup*, for instructions.*

1.7.3 Wiring Std 0/4-20 mA Analog Outputs

The standard configuration of the XGF868i flow transmitter includes two isolated 0/4-20 mA analog outputs (designated as outputs 1 and 2). Connections to these outputs may be made with standard twisted-pair wiring, but the current loop impedance for these circuits must not exceed 600 ohms.

To wire the analog outputs, complete the following steps:

1. Disconnect the main power and remove the rear cover.
2. Install the required cable clamp in the chosen conduit hole on the side of the electronics enclosure.
3. Refer to *Figure 7 on page 19* for the location of terminal block **J1** and wire the analog outputs as shown. Secure the cable clamp.

Note: *Analog outputs 1 and 2 in the wiring diagram correspond to analog outputs A and B in Slot 0 in the XGF868i software.*



WARNING! **To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.**

4. If wiring of the unit has been completed, reinstall the rear cover on the enclosure and tighten the set screw.



WARNING! **Make sure that both covers with the o-ring seals are installed and the set screws are tightened before applying power to the unit in a hazardous environment.**

Note: *Prior to use, the analog outputs must be set up and calibrated. See Chapter 1,* Calibration*, of the* Service Manual *for detailed instructions.*

1.7.4 Wiring the Serial Port

The XGF868i flowmeter is equipped with an RS232 serial interface. The serial port is used to transmit stored data and displayed readings to a personal computer by connecting the meter's serial interface to the serial port of the PC. In addition, the XGF868i can receive and execute remote commands, using the *Instrument Data Manager* or *PanaView* software via this link.

For more information on serial communications refer to your *EIA-RS Serial Communications* manual (916-054). Proceed to the appropriate sub-section for wiring instructions.



WARNING! **To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.**

1.7.4.1 Wiring the RS232 Interface

Use the serial port to connect the XGF868i flow transmitter to a printer, an ANSI terminal or a personal computer. The RS232 interface is wired as Data Terminal Equipment (DTE). *Table 2* below lists the standard cables available from the factory for this purpose.

Table 2: Panametrics Serial Cables

Part Number	PC Connector	XGF868i Connector
704-659	DB-25 Male	Flying Leads (5)
704-660	DB-9 Male	Flying Leads (5)
704-661	DB-25 Female	Flying Leads (5)
704-662	DB-9 Female	Flying Leads (5)

Each of the cables listed in the table above is available in several standard lengths. However, a user-supplied cable may be used, if preferred. In either case, wire the XGF868i end of the serial cable in accordance with the pin designations listed in *Table 3*.

Refer to *Figure 7 on page 19* to complete the following steps:



HIGH VOLTAGE! Dangerous voltages exist within the electronics enclosure. Do not attempt to wire the unit until the main power has been disconnected.

1. Disconnect the main power and remove the rear cover.



WARNING! The XGF868i must be moved to a safe environment before removing either cover

2. Install the required cable clamp in the chosen conduit hole on the side of the electronics enclosure.
3. Use the information in *Table 3* below to construct a suitable cable for connecting the XGF868i to the external device. If desired, an appropriate cable may be purchased from Panametrics.

Table 3: RS232 Connection to DCE or DTE Device

J1 Pin #	Signal Description	DCE DB25 Pin #	DCE DB9 Pin #	DTE DB25 Pin #	DTE DB9 Pin #
5	DTR (Data Terminal Ready)	20	4	20	4
6	CTS (Clear to Send)	4	7	5	8
7	COM (Ground)	7	5	7	5
8	RX (Receive)	2	3	3	2
9	TX (Transmit)	3	2	2	3

4. Feed the cable's flying leads through the conduit hole and wire it to terminal block J1. Connect the other end of the cable to the external serial device and secure the cable clamp.

After the wiring has been completed, consult the *User's Manual* for the external device to configure it for use with the XGF868i.

1.7.5 Wiring the Option Cards

The XGF868i can accommodate one option card in **Slot 1** and one option card in **Slot 2**. The following option card functions are available only in the combinations listed in *Table 13*:

- Analog Inputs (Slot 1)
- Totalizer/Frequency Outputs (Slot 1)
- RTD Inputs (Slot 1)
- Analog Outputs (Slot 1)
- MODBUS Communications (Slot 2)
- MODBUS/TCP Communications (Slot 2)
- Ethernet (Slot 2)
- Foundation Fieldbus (Slot 2)
- Data Logging (Slot 2) - *no wiring required*

Wiring any option card installed in Slot 1 requires completion of the following general steps:

1.7.5.1 Preparing for Wiring

1. Disconnect the main power and remove the rear cover.
2. Install a cable clamp in the chosen conduit hole on the side of the electronics enclosure and feed a standard twisted-pair cable through this conduit hole.
3. Locate the 12-pin terminal block (**J2**) in *Figure 7 on page 19* and wire the option card as indicated on the label inside the rear cover (see *Figure 2 on page 6* and *Figure 8 on page 20*). Secure the cable clamp.

IMPORTANT: Because of the attached wiring label, all rear covers must remain with their original meters.



WARNING! **To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.**

4. If wiring of the unit has been completed, reinstall the rear cover on the enclosure and tighten the set screw.

Note: *Prior to use, the option card must be set up and calibrated. See Chapter 1,* Programming Site Data*, in the* Programming Manual *and Chapter 1,* Calibration*, in the* Service Manual *for detailed instructions.*

For more specific instructions on particular option cards, proceed to the appropriate section(s) that follow.

1.7.5.2 Wiring a 0/4-20 mA Analog Inputs Option Card

To calculate the standard flow rates, the XGF868i requires accurate *temperature* and *pressure data* from the measurement site. Transmitters installed in the flowcell can provide this information via an optional 0/4-20 mA analog inputs option card. This option card includes two or four isolated 0/4-20 mA analog inputs (designated as A, B, C and D), each of which includes a 24 VDC power supply for loop-powered transmitters. Either input may be used to process the temperature signal, while the other input is used to process the pressure signal.

Note: *To properly enter programming data into the meter, it is necessary to know which input is assigned to which process parameter. This information should be entered in Appendix B,* Data Records.

The analog inputs, which have an impedance of 118 ohms, should be connected with standard twisted-pair wiring. Power to the transmitters may be supplied either by the integral 24 VDC power supply on the analog input option card or by an external power supply. *Figure 3* below shows typical wiring diagrams, with and without an external power supply, for one of the analog inputs.

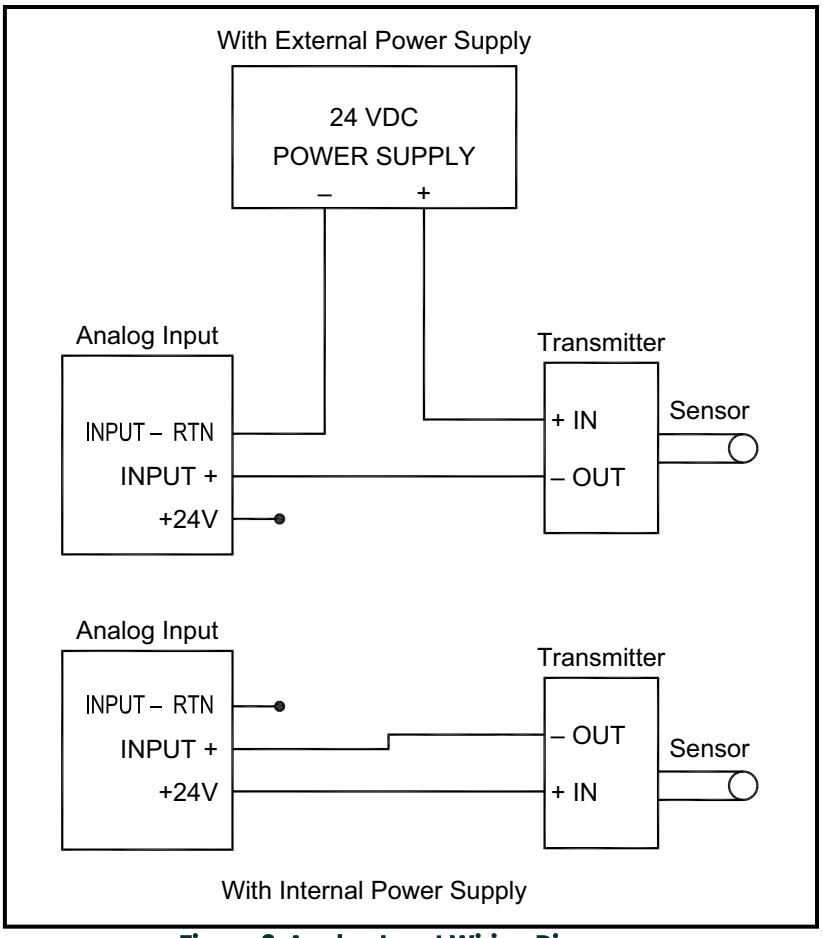


Figure 3: Analog Input Wiring Diagram

Before making any connections, complete the steps in *Preparing for Wiring* on *page 12*. Wire the analog inputs as shown on the label in the rear cover (see *Figure 8 on page 20*).

Note: *The analog inputs option card can be calibrated with the XGF868i built-in analog outputs. However, be certain that the analog outputs have been calibrated first. See Chapter 1,* Calibration*, in the* Service Manual *for the appropriate procedures.*

1.7.5.3 Wiring a Totalizer/Frequency Outputs Option Card

Each totalizer/frequency outputs option card provides two or four outputs (designated as A, B, C, and D) that can be used as either totalizer or frequency outputs.

Before making any connections, complete the steps in *Preparing for Wiring* on *page 12*. Then, wire this option card in accordance with the connections shown on the label in the rear cover (see *Figure 2 on page 6* and *Figure 8 on page 20*). *Figure 4* below shows sample wiring diagrams of a totalizer output circuit and a frequency output circuit. Refer to *See "Optional Inputs and Outputs" on page 44.* for load and voltage requirements.

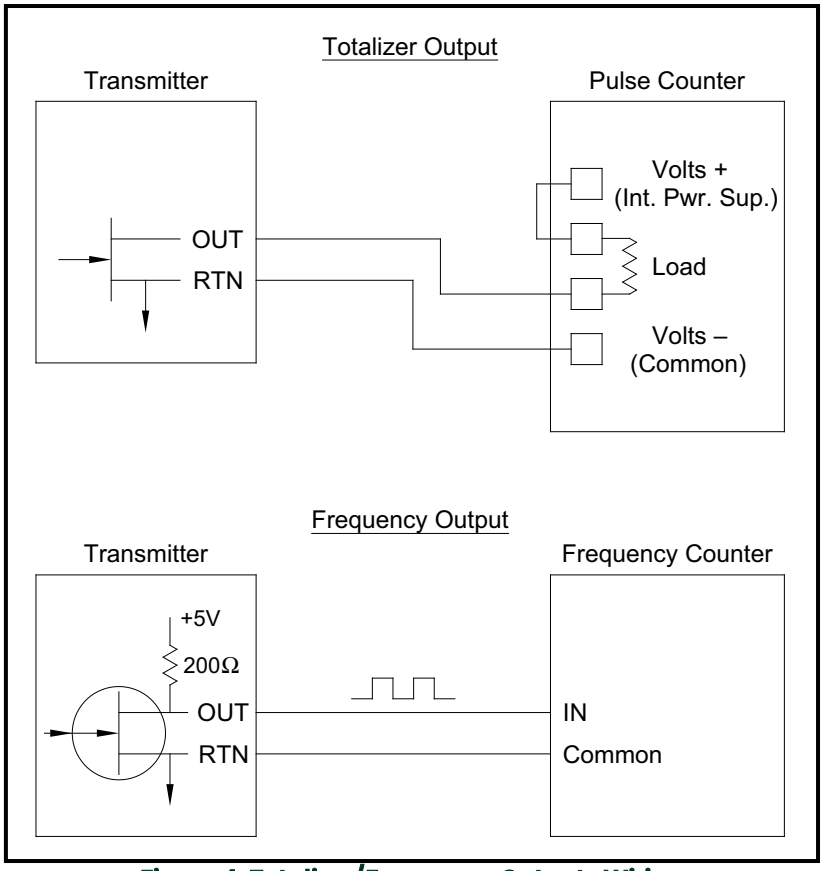


Figure 4: Totalizer/Frequency Outputs Wiring

1.7.5.4 Wiring an RTD Inputs Option Card

The XGF868i RTD (Resistance Temperature Device) inputs option card provides two or four direct RTD inputs (designated as A, B, C and D). Each RTD input requires three wires, and should be connected as shown on the label in the rear cover (see *Figure 2 on page 6* and *Figure 8 on page 20*).

Note: *Before making any connections, complete the steps in* Preparing for Wiring *on* page 12*.*

1.7.5.5 Wiring a 0/4-20 mA Analog Outputs Option Card

The analog outputs option card includes two isolated 0/4-20 mA outputs (designated as A and B). Connections to these outputs may be made with standard twisted-pair wiring, but the total current loop impedance for these circuits must not exceed 1000 ohms.

Before making any connections, complete the steps in *Preparing for Wiring* on *page 12*. Then, wire this option card with the connections shown on the label in the rear cover (see *Figure 2 on page 6* and *Figure 8 on page 20*).

1.7.5.6 A Specific Example

To illustrate the procedures described in the previous sections for wiring the option cards, a specific example may prove helpful. Assume that an XGF868i is equipped with an option card numbered *703-1223-08*. *Table 13* in Appendix C, *Data Records*, indicates that this option card includes two analog current inputs and two standard alarm relays.

1.7.5.7 Wiring the MODBUS/TCP Interface

Customers can also use a modified XGF868i that provides a MODBUS/TCP interface to communicate to an internal network. An optional MODBUS/TCP card with a unique MAC (IP) address (installed only in slot 2) includes an RJ45 connector. To connect the MODBUS/TCP-enabled XGF868i to the network, insert the jack of an RJ45 cable into the RJ45 connector, route the cable through one of the conduit holes using an appropriate cable clamp, and wire the other end of the cable to the Ethernet network according to the manufacturer's instructions (see Figure 11).

Note: *The MAC address for a specific XGF868i is included with customer documentation. For more information on setting up the MAC address, refer to Chapter 6 of the* Programming Manual.

1.7.5.8 Wiring the Ethernet Interface

A modified XGF868i can use the Ethernet interface to communicate to a local area network. An optional Ethernet card with a unique MAC (IP) address (installed only in slot 2) includes an RJ45 connector. To connect the Ethernet-enabled XGF868i to the network, insert the jack of an RJ45 cable into the RJ45 connector, route the cable through one of the conduit holes using an appropriate cable clamp, and wire the other end of the cable to the Ethernet network according to the manufacturer's instructions. An external connection is required between the Ethernet option card and the XGF868i RS232 connector, as shown in *Table 4* below and *Figure 11*.

Note: *The MAC address for a specific XGF868i is included with the customer documentation. For more information on setting up the MAC address, refer to Appendix C of the* Programming Manual.

Table 4: RS232 to Ethernet Interconnections

RS232 Terminal Block on Rear Board	TB1 Terminal Block on Ethernet Card
TX	Pin 1
RX	Pin 2
COM	Pin 3

1.7.5.9 Wiring the Foundation Fieldbus Interface

To connect the Foundation Fieldbus interface to the XGF868i, make the network connections at J8, pins 1 and 2, as shown in drawing Y of *Figure 11*. As an option, you can connect a shield to J8 pin 3, depending on the network wiring.

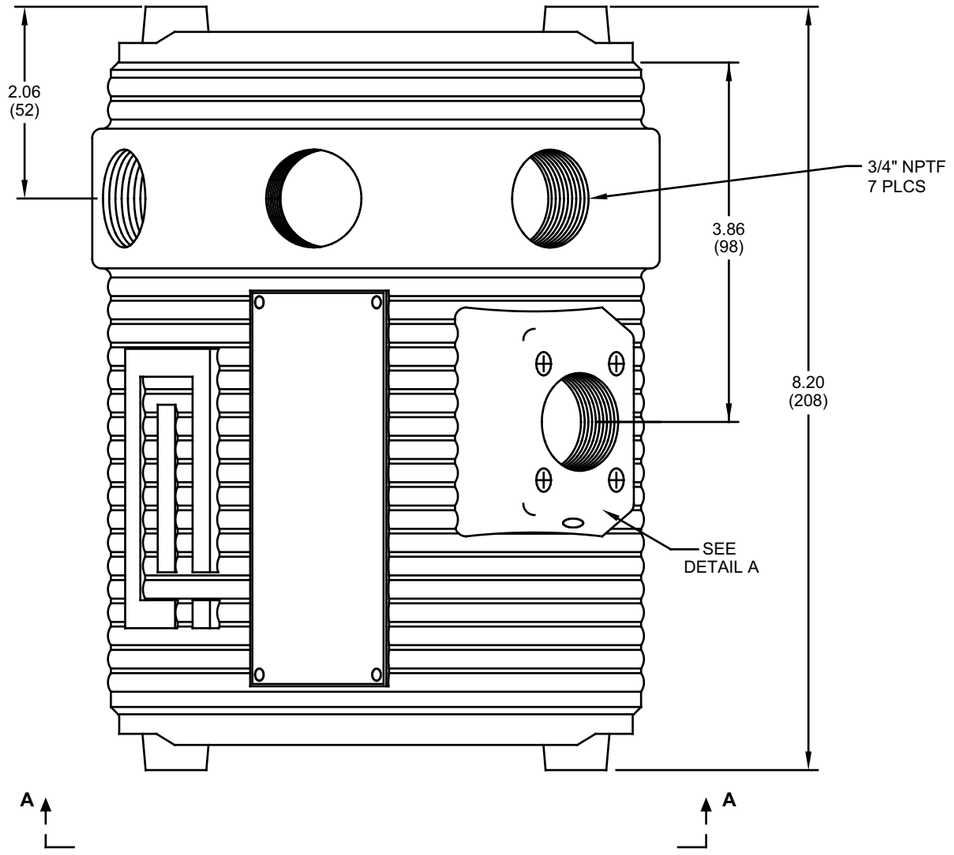
No connections are made to J9 under normal operation. If you need to reset the network board to factory defaults:

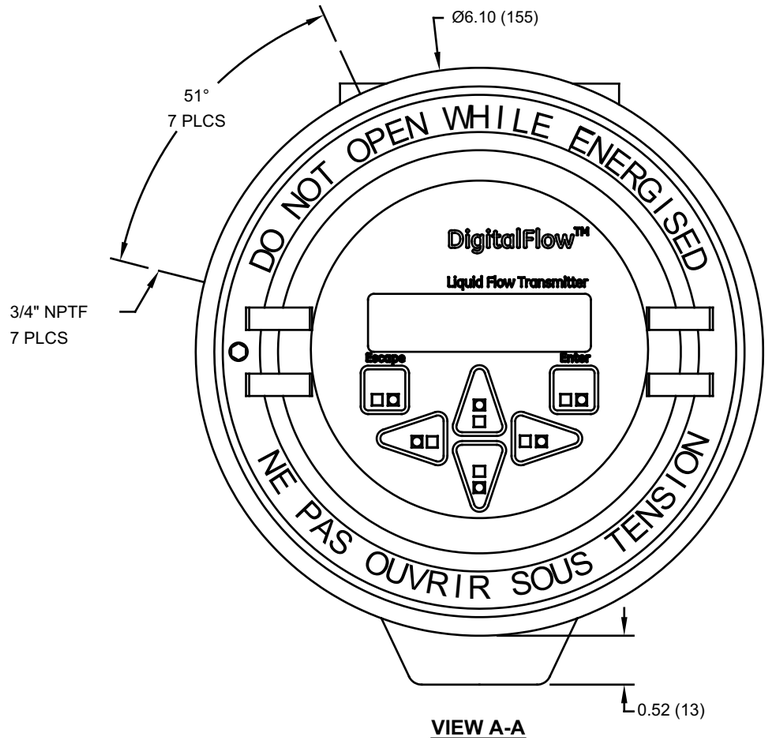
1. Connect a jumper between J9 pin 2 and J9 pin 3.
2. Power cycle (i.e., turn off and on) the XGF868i.
3. Ten seconds after the power has been restored to the XGF868i, remove the jumper to return the network board to normal operation.



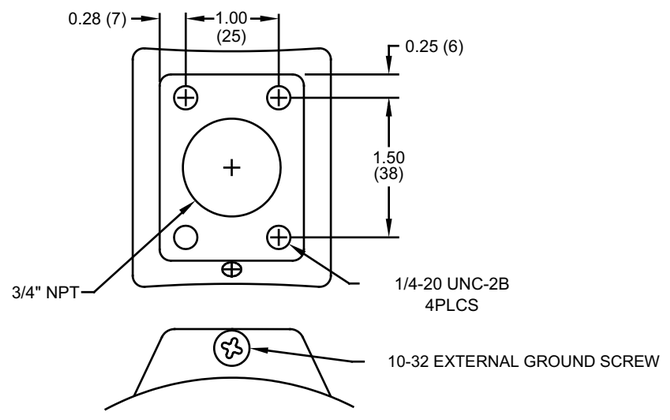
WARNING! **Make sure that both covers with the o-ring seals are installed and the set screws are tightened before applying power to the unit in a hazardous environment.**

[no content intended for this page]





VIEW A-A



DETAIL A

NOTES:

1. ALL DIMENSIONS ARE REFERENCE.

2. WEIGHT: 10 LB (4.5 KG) AL
   25 LB (11.5 KG) SS

3. DIMENSIONS ARE IN INCHES (MILLIMETERS).

Figure 5: Outline and Installation – Electronics Enclosure (ref. dwg #712-1318)

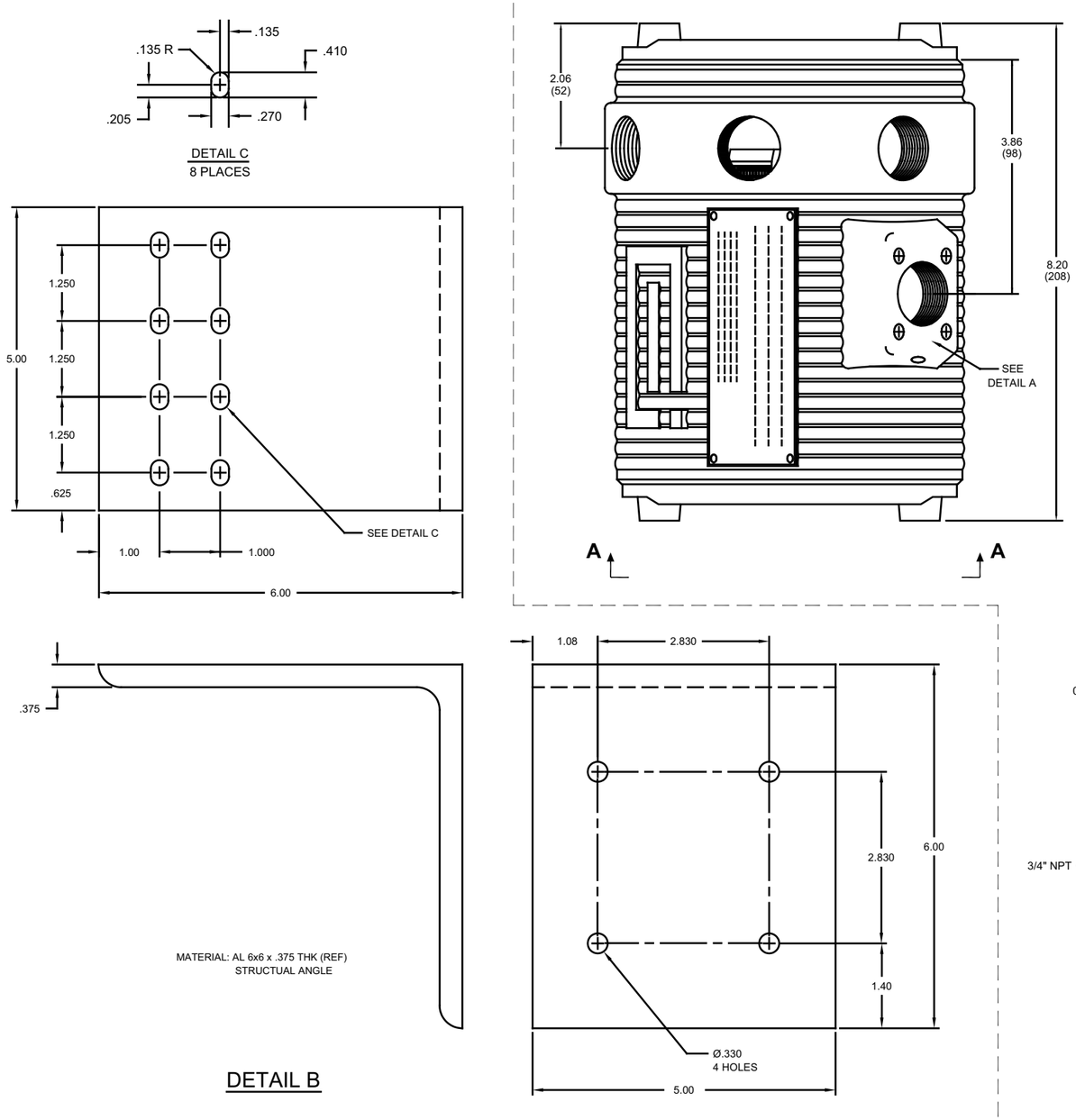


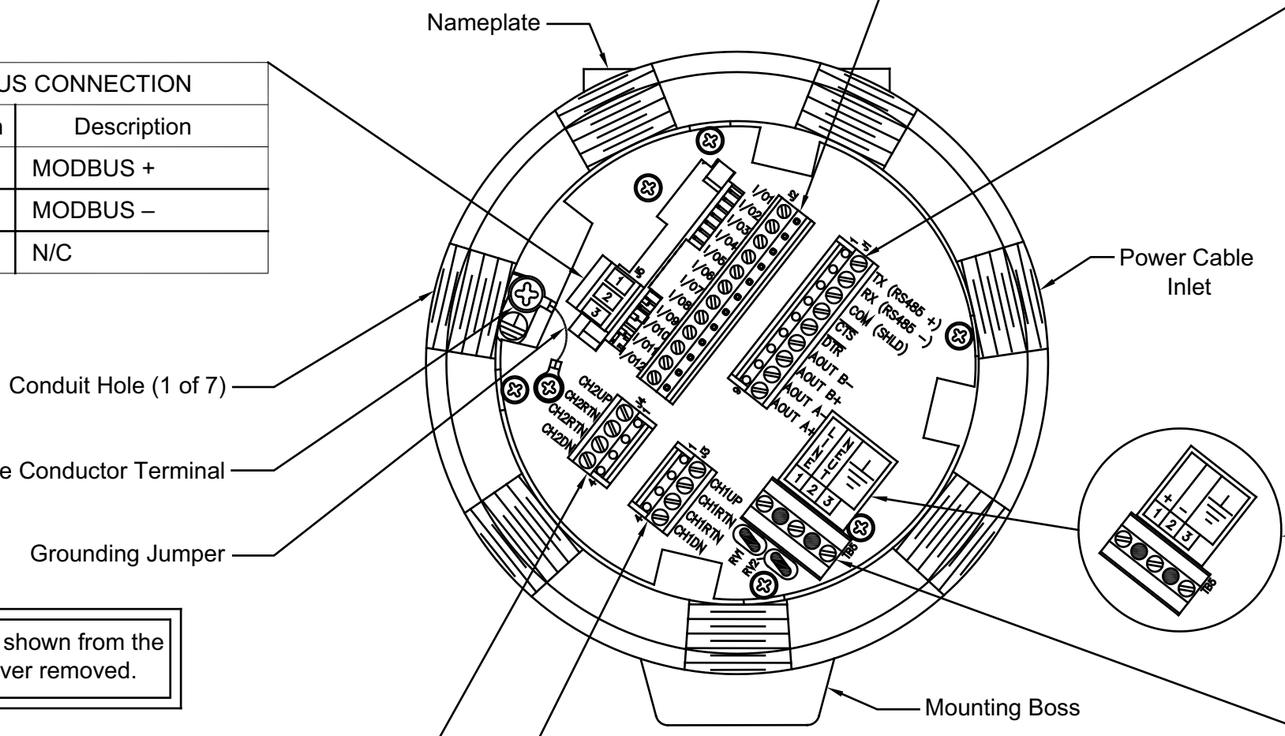
Figure 6: Right Angle Mounting Bracket - Electronics Enclosure (ref. dwg #712-1317)

NOTE: *For compliance with the EU Low Voltage Directive, this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible and located within 1.8 m (6 ft) of the unit.*

J2 - INPUT/OUTPUT CONNECTIONS*												
Pin #	1	2	3	4	5	6	7	8	9	10	11	12
Designation	I/O1	I/O2	I/O3	I/O4	I/O5	I/O6	I/O7	I/O8	I/O9	I/O10	I/O11	I/O12
Description	*See the wiring label inside the rear cover and Figure 9.											

J1 - RS232/ 4-20 OUTPUT		
Pin #	Designation	Description
1	TX	Transmit / +
2	RX	Receive / –
3	COM (SHLD)	Ground
4	$\overline{\text{CTS}}$	Clear To Send
5	$\overline{\text{DTR}}$	Data Terminal Ready
6	AOUT B–	4-20 Output 2 RTN
7	AOUT B+	4-20 Output 2 SIG
8	AOUT A–	4-20 Output 1 RTN
9	AOUT A+	4-20 Output 1 SIG

J5 - MODBUS CONNECTION		
Pin #	Designation	Description
1	+	MODBUS +
2	–	MODBUS –
3	N/C	N/C



NOTE: Enclosure is shown from the rear with the rear cover removed.

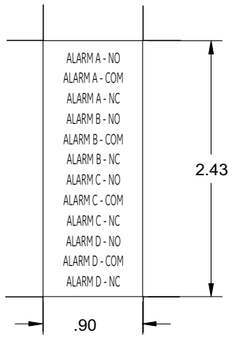
DC POWER INPUT	
Pin #	Description
1	Line Positive
2	Line Negative
3	No Connection

AC POWER INPUT	
Pin #	Description
1	Line Power
2	Line Neutral
3	Earth Ground

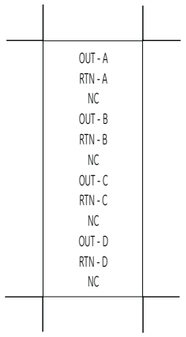
J4 - CH2 TRANSDUCER CONNECTION (optional)		
Pin #	Designation	Description
1	CH2UP	Upstream Transducer SIG(+)
2	CH2RTN	Upstream Transducer Analog RTN(-)
3	CH2RTN	Downstream Transducer Analog RTN(-)
4	CH2DN	Downstream Transducer SIG(+)

J3 - CH1 TRANSDUCER CONNECTION		
Pin #	Designation	Description
1	CH1UP	Upstream Transducer SIG(+)
2	CH1RTN	Upstream Transducer Analog RTN(–)
3	CH1RTN	Downstream Transducer Analog RTN(-)
4	CH1DN	Downstream Transducer SIG(+)

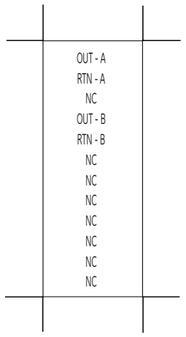
Figure 7: Wiring Diagram – Electronics Enclosure



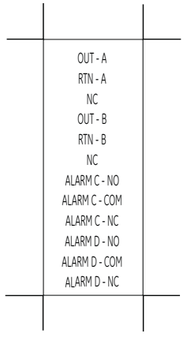
-01 (AA,HH)



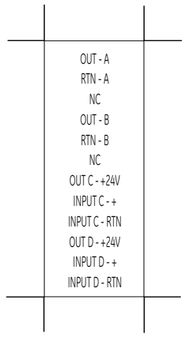
-02 (FF,TT,FT,CT,CF)



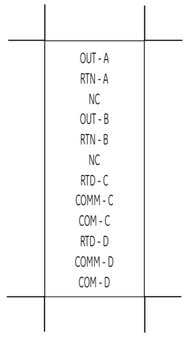
-03 (FO,TO,CO)



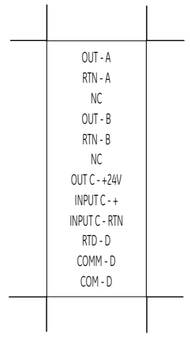
-04 (FA,FH,TA,TH,CA,CH)



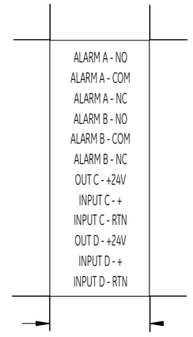
-05 (CI,TI,FI)



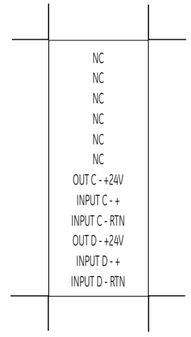
-06 (CR,FR,TR)



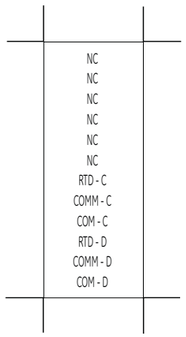
-07 (CIR)



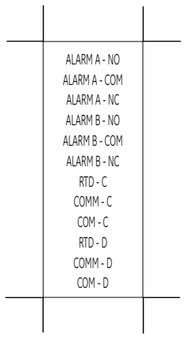
-08 (AI,HI)



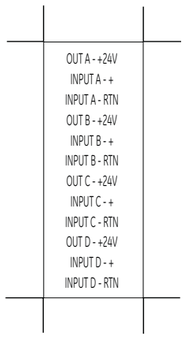
-09 (OI)



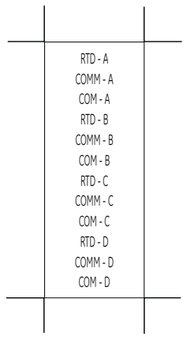
-10 (OR)



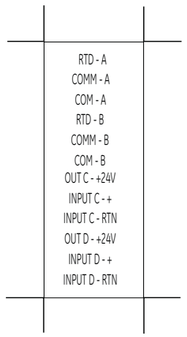
-11 (AR,HR)



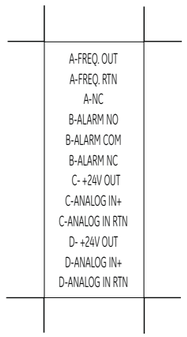
-12 (II)



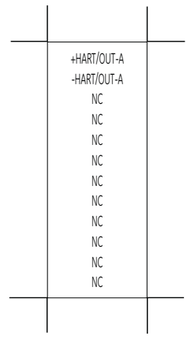
-13 (RR)



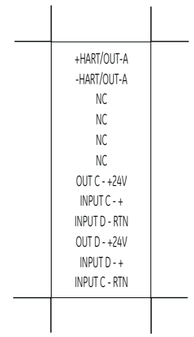
-14 (IR)



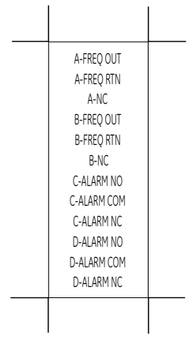
-15 (FHII)



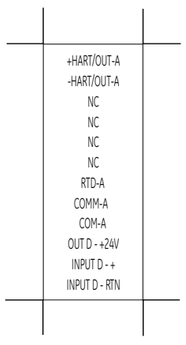
-16 (HART)



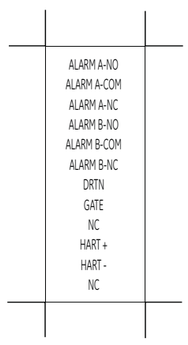
-17 (HART/OI)



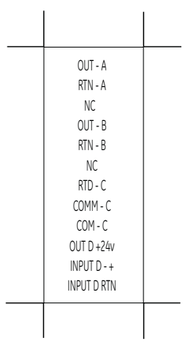
-18 (F(F)HH)



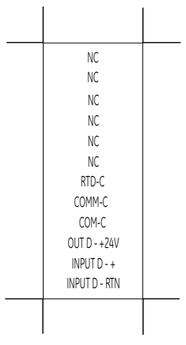
-19 (HART/RI)



-20 (A/GATE HART)



-21 (FRI)



-22 (ORI)

NOTES

1. MATERIAL: .003 THK (REF) MYLAR WITH REVERSE SCREENING, AND 3M #467MP (OR EQUIVALENT) ADHESIVE BACKING.
2. MARKINGS: BACKGROUND - WHITE. ALL MARKINGS PROCESS BLACK C.
3. ALL COLORS PER PANTONE MATCHING SYSTEM.
4. ALL DIMENSIONS PER -01.
5. ARTWORK CREATED IN ADOBE ILLUSTRATOR (FILE#: 442-615_N.AI)
6. ALL DIMENSIONS REFERENCE.

Figure 8: Option Card Connection Labels (ref. dwg #703-1473)

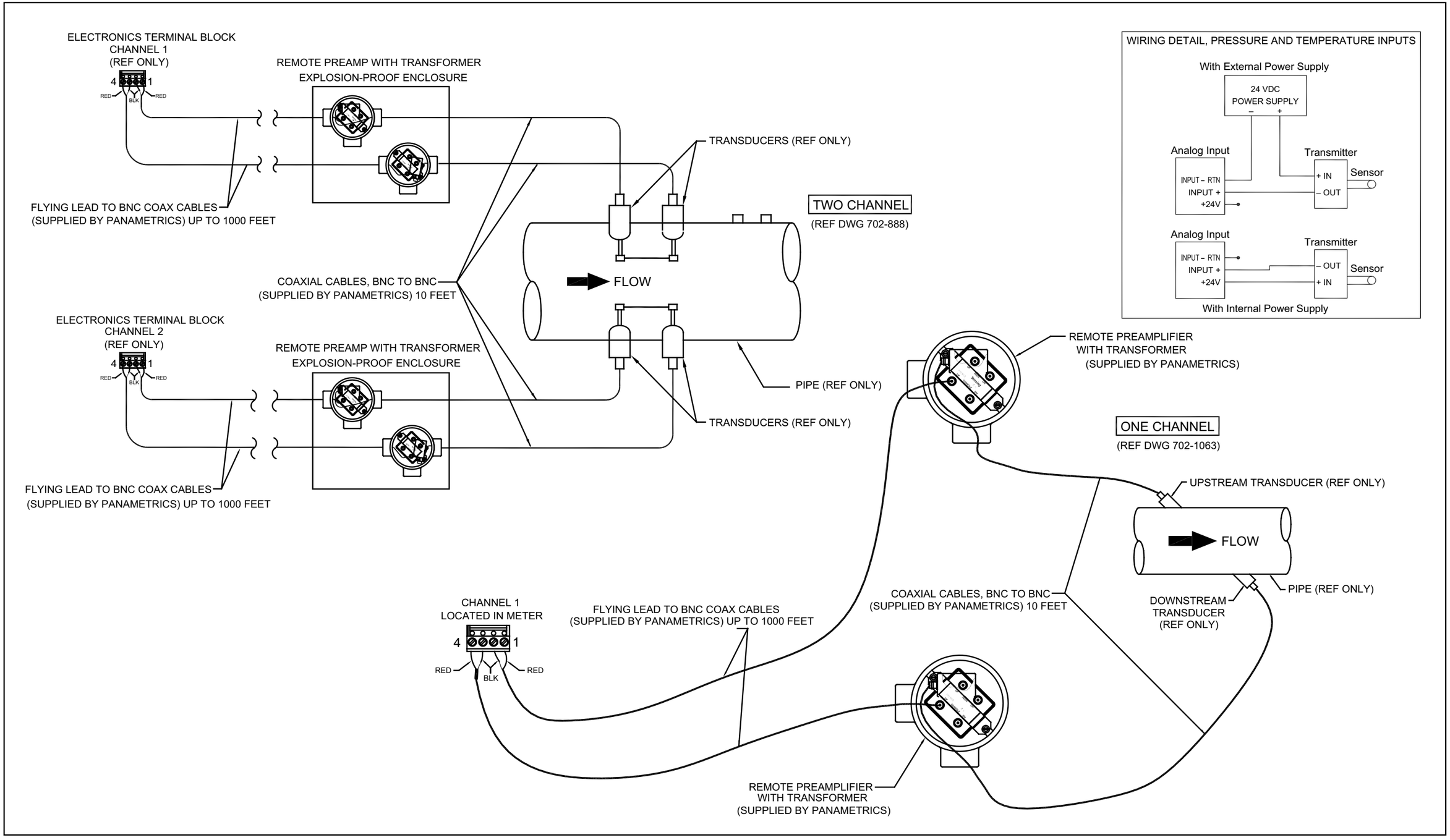


Figure 9: Wiring Diagram – Transducers with Remote Preamplifier (PRE868) and Transformer

[no content intended for this page]

Chapter 2. Initial Setup

2.1 Introduction

This chapter provides instructions for programming the minimum amount of data required to place the XGF868i flowmeter into operation. Before the XGF868i can begin taking measurements and displaying valid data, the current system and pipe parameters must be entered. In addition, a 2-Channel meter requires that each channel be activated prior to use. Additional programming options provide access to the more advanced features of the XGF868i, but this information is not required to begin taking measurements.

Refer to the *Programming Manual* for information on programming all other features. Be sure to record all programming data in Appendix B, *Data Records*.

As a guide in following the programming instructions in this chapter, the relevant portions of the XGF868i menu map have been reproduced in *Figure 11 on page 31*.

2.2 Programming Methods

Note: *See the* Programming Manual *for information on those* User Program *features not covered in this chapter.*

You can program the XGF868i via either the keypad on the lower part of the glass enclosure, or **PanaView™,** a Panametrics PC-based, non-resident software program that communicates with the XGF868i via its RS232 serial port. PanaView supplements basic XGF868i functions with several additional capabilities. With PanaView, you can:

- Load and save site file data
- Create and save graph and log files
- Display text output and graphs of live measurement data
- Create custom templates for displaying text, graph and log data
- Interface with multiple Panametrics instruments.

This chapter focuses on programming via the keypad. For information on programming the XGF868i via PanaView, refer to Appendix C of the *Programming Manual*.

2.3 The XGF868i Keypad

Keypad Program

Along with the 2-line, 16-character LCD, the XGF868i includes a 6-key magnetic keypad. The decal cutout for each key contains a hall effect sensor, pushbutton switch and visible red LED. The magnetic wand used to activate a magnetic key is found attached to the meter chassis below the front panel. An operator activates the key by pressing the magnetic wand up to the glass lid over the desired key. The LED will light indicating a successful key press.

Note: *The pushbutton switch will also act as a key press but is done with the glass lid open. Do not use the pushbutton switch in a hazardous area where the lid needs to be installed.*

Use the magnetic keypad to navigate through the user program. The menu map may be followed in sequence, or the four arrow keys may be used to scroll through the prompt screens. Figure 10 shows the front of the XGF868i, with magnetic keypad and magnetic wand.

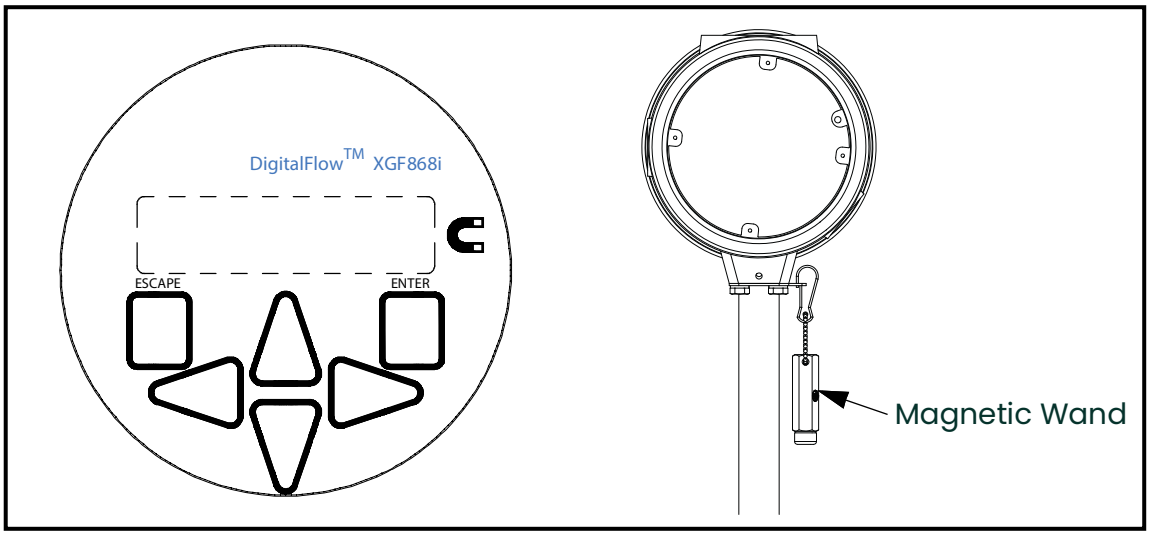


Figure 10: XGF868i Magnetic Keypad and Wand

IMPORTANT: The XGF868i keypad enables programming of the instrument through the glass faceplate without removing the cover. Thus, all programming procedures may be performed while the unit is installed in a hazardous area.

Six keys on the keypad enable users to program the XGF868i:

- [Enter] - confirms choice of a specific option and data entry within the option
- [Escape] - allows users to exit from a specific option without entering unconfirmed data
- [△] and [▽] - enable users to view a specific measurement in the Key display setting or to scroll through a list of options (letters and numbers 0-9 as well as the negative sign and decimal point) in a menu
- [◁] and [▷] - enable users to scroll to a specific option, among choices in an option, or to a character in a text entry.

When you power up the XGF868i, the display first shows the model and software version:

Panametrics
XGF868i Y4DF.STD

The meter then starts to display measured parameters.



To enter the *Keypad Program*, press the [Escape] key, followed by the [Enter] key, and the [Escape] key again. Each successive key must be entered within 10 seconds of the prior key.

As a guide in following the programming instructions in this chapter, the relevant portions of the Model XGF868i menu map have been reproduced in *Figure 11 on page 31.* Proceed to the following sections to enter data in the Channel or GLOBL menus.

IMPORTANT: If the keypad has not been pressed for 10 minutes, the XGF868i exits the Keypad Program and returns to displaying measurements. The meter retains any configuration changes that were confirmed with the [Enter] key, and restarts as if the operator had completed the programming cycle.

2.4 Entering Data in the GLOBL Menu

To begin programming your meter, you must select the system units from the **GLOBL** menu as discussed below. Refer to *Figure 11 on page 31* and remember to record all programming data in Appendix B, *Data Records*.

Note: *Refer to the* Programming Manual *for information on the other submenus in the GLOBL menu.*

2.4.1 Entering Global System Data

The GLOBL-SYSTM submenu is used to enter several general system parameters (e.g., English or metric units). For units with 2 channels, this menu is also used to compute parameters such as the sum, difference or average of the channel 1 and channel 2 signals. When calculating the **SUM**, **DIF** or **AVE** readouts, data from the **GLOBL-SYSTM** submenu is used. Any conflicting data entered in the **CHANNEL-SYSTM** submenu is overridden.

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to SYSTM and press [Enter].
4. Scroll to the desired *System Units* selection (either metric or English) and press [Enter]. The XGF868i will display all parameters and measurements in the designated units.
5. Scroll to the desired *Pressure Units* selection (absolute or gauge) and press [Enter].
6. Do one of the following:
   - If PSIa (absolute) was selected, proceed to Step 7.
   - If PSIg (gauge) was selected, enter the desired atmospheric pressure, press [Enter] and proceed to Step 7.
7. Do one of the following:
   - For a single-channel XGF868i, the program returns to the Global PROGRAM menu.
   - For a 2-channel meter, proceed to the next page.

2.4.1.1 Selecting Volumetric Units

1. Scroll to the desired *Volumetric Units* for the flow rate display and press [Enter]. *Table 5* below lists the available volumetric units.

Table 5: Available Volumetric/Totalizer Units

English	Metric
ACF = Actual Cubic Feet	ACM = Actual Cubic Meters
KACF = Thousands of ACF	KACM = Thousands of ACM
MMACF = Millions of ACF	MMACM = Millions of ACM
SCF = Standard Cubic Feet	SCM = Standard Cubic Meters
KSCF = Thousands of SCF	KSCM = Thousands of SCM
MMSCF = Millions of SCF	MMSCM = Millions of SCM

2. Scroll to the desired unit of *Volumetric Time* (from seconds to days), and press [Enter].
3. Scroll to the desired number of *Vol Decimal Digits* (digits to the right of the decimal point) in the volumetric flow display, and press [Enter].

2.4.1.2 Selecting Totalizer Units

4. Scroll to the desired *Totalizer Units* for the flow rate display and press [Enter]. Available units are listed in *Table 5* above.
5. Scroll to the desired number of *Tot Decimal Digits* (digits to the right of the decimal point in the totalized flow rate display) and press [Enter].
6. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting Mass Flow Units* on *page 26*.
   - If MASS FLOW is OFF, the meter returns to the Global PROGRAM window. Press [Escape] twice and proceed to Chapter 3, *Operation*, or the *Programming Manual*.

Note: *To activate mass flow, see* Activating Mass Flow *in Chapter 1 of the* Programming Manual. *The following prompts appear only if mass flow is activated for both channels.*

2.4.1.3 Selecting Mass Flow Units

1. Scroll to the desired *Mass Flow* units for the flow rate display and press [Enter]. The available units for this prompt, which are determined by the selection made at the *System Units* screen, are shown in *Table 6* below.

Table 6: Available Mass Flow Units

English	Metric
LB = Pounds	Kilograms
KLB = Thousands of LB	Metric Tons (1000 KG)
MMLB = Millions of LB	
Tons (2000 LB)	

2. Scroll to the desired *Mass Flow Time* units for the mass flow rate display (from seconds to days) and press [Enter].
3. Scroll to the desired number of *Mdot Dec. Digits* (digits to the right of the decimal point in the mass flow rate display) and press [Enter].
4. Scroll to the desired *Mass (Totalizer)* units for the totalized mass flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at the *System Units* prompt.
5. Scroll to the desired number of *Mass Dec. Digits* (digits to the right of the decimal point in the totalized mass flow rate display) and press [Enter].
6. Enter the *Molecular Weight (Mw)* and press [Enter].
7. After completing the above steps, the XGF868i returns to the Global PROGRAM window. Press [Escape] and scroll to CH1 or CH2 to continue setup programming.

2.5 Activating a Channel

The **ChannelX-ACTIV** submenu permits selection of the desired measurement method. In addition, it is used to activate/deactivate one or both of the channels in a 2-Channel XGF868i.

To access the ChannelX-ACTIV submenu:

1. From the *Keypad Program,* scroll to CH1 or CH2 and press [Enter].
2. In the Channel PROGRAM menu, scroll to ACTIV and press [Enter].
3. Scroll to *Burst* to activate the channel/path, and press [Enter].
4. Scroll to one of the measurement methods described below and press [Enter].
   - *Skan Only* is the preferred technique for locating the acoustic signal and for high velocity measurements. It is more robust in a noisy environment than the Measure technique.
   - *Skan/Measure* is the preferred technique to use for low velocity measurements.

If *Skan Only* is selected at the above prompt, the meter uses this technique exclusively. However, if *Skan/Measure* is selected, the meter uses *Skan Only* to find the acoustic signal and then tries to use the *Skan/Measure* technique for the actual measurement.

After completing the above step, the meter returns to the Channel PROGRAM window. Proceed to the next section to continue programming your meter.

2.6 Entering System Data for the Channel

The ChannelX-System submenu is used to enter system parameters for the channel.

2.6.1 Accessing the ChannelX-System Submenu

1. From the Channel PROGRAM menu, scroll to SYSTM and press [Enter].
2. The first prompt asks for the *Channel Label.*Use the four scrolling keys to enter the desired label (in any numeric or text combination up to five characters), and press [Enter].
3. The next prompt asks for the *Channel (Site) Message*. Enter the desired text in the same manner as the channel label with up to 15 characters, and press [Enter].

2.6.2 Selecting Volumetric Units

1. Scroll to the desired *Volumetric Units* for the flow rate display and press [Enter]. The available units are listed in *Table 7* below.
2. Scroll to the desired *Volumetric Time* units for the flow rate display (from seconds to days) and press [Enter].
3. Scroll to the desired number of *Vol Decimal Digits* (digits to the right of the decimal point in the volumetric flow rate display) and press [Enter].

Table 7: Available Volumetric/Totalizer Units

English	Metric
ACF = Actual Cubic Feet	ACM = Actual Cubic Meters
KACF = Thousands of ACF	KACM = Thousands of ACM
MMACF = Millions of ACF	MMACM = Millions of ACM
SCF = Standard Cubic Feet	SCM = Standard Cubic Meters
KSCF = Thousands of SCF	KSCM = Thousands of SCM
MMSCF = Millions of SCF	MMSCM = Millions of SCM

2.6.3 Selecting Totalizer Units

1. Scroll to the desired *Totalizer Units* for the totalized flow rate display and press [Enter]. Available units are listed in *Table 7* above.
2. Scroll to the desired number of *Tot Decimal Digits* (digits to the right of the decimal point in the totalized flow rate display) and press [Enter].

3. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting Mass Flow Units* on *page 28*.
   - If MASS FLOW is OFF, the meter returns to the **Channel PROGRAM** window. Proceed to *Entering Transducer and Pipe Parameters on page 28*.

Note: *To activate mass flow, see* Activating Mass Flow *in Chapter 1 of the* Programming Manual.

2.6.4 Selecting Mass Flow Units

1. Scroll to the desired *Mass Flow* units for the flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at the *System Units* prompt. See *Table 8* below.

Table 8: Available Mass Flow Units

English	Metric
LB = Pounds	Kilograms
KLB = Thousands of LB	Metric Tons (1000 KG)
MMLB = Millions of LB	
Tons (2000 LB)	

2. Scroll to the desired *Mass Flow Time* units for the mass flow rate display and press [Enter].
3. Scroll to the desired number of *Mdot Decimal Digits* (digits to the right of the decimal point in the mass flow rate display) and press [Enter].
4. Scroll to the desired *Mass (Totalizer)* units for the totalized mass flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at the *System Units* prompt.
5. Scroll to the desired number of *Mass Dec. Digits* (digits to the right of the decimal point in the totalized mass flow rate display) and press [Enter].

After completing the above steps, the XGF868i returns to the Channel PROGRAM window. Proceed to the next section to program transducer and pipe parameters.

2.7 Entering Transducer and Pipe Parameters

Enter the transducer and pipe parameters via the **PIPE** submenu.

1. From the Channel PROGRAM menu, scroll to the PIPE option and press [Enter].
2. The first prompt asks for the *Transducer Number.*
   - For a standard transducer, use the arrow keys to enter the number engraved on the transducer head, and press [Enter].
   - If there is no number engraved on the transducer head, press the right arrow key to scroll to the *STD* option, and use the up and down arrow keys to change to *SPEC*. Then use the arrow keys to enter an assigned number (from 91 to 99), and press [Enter].

IMPORTANT: Special transducers, which have no engraved number on the head, are rarely used. Examine the transducer head carefully for a number.

- If you entered the number for a standard transducer, proceed to the *Pipe OD* prompt in step 5.
- If you entered the number for a special transducer, proceed to step 3 on the next page.

2.7.1 Special Transducers

3. Scroll to the transducer *Frequency* (supplied by the factory) and press [Enter].

Note: *The frequency is required to transmit an excitation voltage at the transducer's natural frequency.*

4. Enter the special transducer *Tw* (time delay) value (supplied by the factory) and press [Enter].

   Tw is the time required for the transducer signal to travel through the transducer and its cable. This time delay must be subtracted from the transit times of the upstream and downstream transducers to ensure an accurate measurement.

2.7.2 Pipe Data

If either a standard or a special transducer is being used, the programming sequence should be rejoined at this point.

5. To select the appropriate *Pipe OD Unit* type from the list shown in *Table 9* below, scroll to the right side of the screen, and use the up and down arrow keys to step through the list. Press [Enter]. Then use the arrow keys to enter the known pipe outside diameter or circumference on the left side and press [Enter].

Obtain the required information by measuring either the pipe outside diameter (OD) or circumference at the transducer installation site. The data may also be obtained from standard pipe size tables found in *Sound Speeds and Pipe Size Data* (914-004).

Table 9: Available Pipe OD Units

English	Metric
inch	mm = millimeters
feet	m = meters
in/PI = pipe circumference in inches	mm/PI = pipe circumference in millimeters
ft/P I= pipe circumference in feet	m/PI = pipe circumference in meters

6. Use the arrow keys to enter the known *Pipe Wall Thickness* (in inches or mm) and press [Enter]. If the pipe wall thickness is not available, look up the value in a table of standard pipe size data which can be found in the *Sound Speeds and Pipe Size Data* manual (914-004).

2.7.3 Path and Axial Lengths

7. To enter the *Path Length*:

a. Use the [▷] arrow key to highlight the path length unit type at the right of the screen.Then use the [△] and [▽] arrow keys to scroll to the desired unit type.

b. Use the [◁] arrow key to return to the numeric entry on the left, and enter the path length of the ultrasonic signal. Press [Enter].

Note: *If a spoolpiece was ordered with the meter, the transducer signal path length* **(P)** *and the transducer signal axial length* **(L)** *are engraved on the flowcell and/or are included in the documentation supplied with the meter. For on-site transducer installations, refer to Appendix C,* Measuring P and L Dimensions.

8. In the same manner, enter the appropriate *Axial Length L* unit type and axial length of the ultrasonic signal, and press [Enter].

9. Scroll to the desired *Fluid Type* and press [Enter]. Then do one of the following:

- If **OTHER** was selected - proceed to Step 10.
- If **AIR** was selected - proceed to Step 11.

10. Use the arrow keys to enter the *Fluid Soundspeed* (in feet per second) in the gas to be measured and press [Enter].

11. Scroll to the appropriate choice to indicate whether you want *Reynolds Correction*, and press [Enter].

- If *Off* is selected, go to Step 12.
- If *On* is selected, the program asks for the *Kinematic Viscosity*. Use the arrow keys to enter the desired value, and press [Enter].

12. Use the arrow keys to enter a value for the flow *Calibration Factor* and press [Enter]. The default value is 1.00, but values between 0.50 and 2.0 may be entered.

2.7.3.1 Procedure Options

After completing the above steps, the XGF868i returns to the Channel PROGRAM window. Press [Escape] twice to return to the meter display. Then proceed to Chapter 3, *Operation*, for instructions on taking measurements, or refer to the *Programming Manual* for instructions on programming the XGF868i advanced features.

[no content intended for this page]

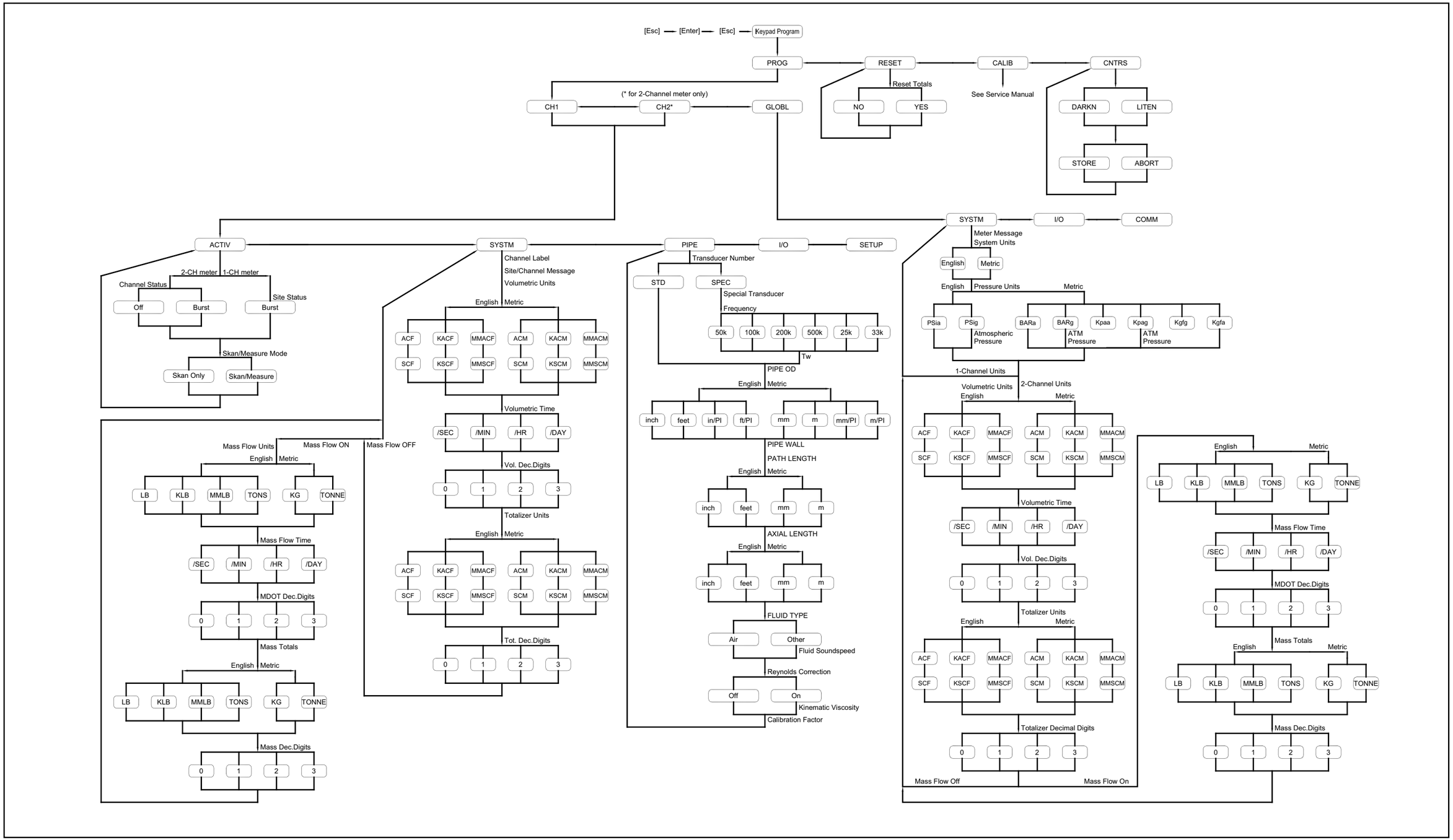


Figure 11: Model XGF868i Initial Setup Menu Map

[no content intended for this page]

Chapter 3. Operation

3.1 Introduction

See Chapter 1, *Installation*, and Chapter 2, *Initial Setup*, to prepare the XGF868i system for operation. When the meter is ready to take measurements, proceed with this chapter. The following specific topics are discussed:

- Powering Up
- Using the Display
- Taking Measurements
- Recording Diagnostics

Note: *All inputs and outputs of the XGF868i are calibrated at the factory, prior to shipment. If it becomes necessary to recalibrate any of the inputs and/or outputs, see Chapter 1,* Calibration*, of the* Service Manual *for instructions.*



WARNING! **To ensure the safe operation of the XGF868i, it must be installed and operated as described in this manual. In addition, be sure to follow all applicable local safety codes and regulations for the installation of electrical equipment.**

3.2 Powering Up

Because the XGF868i does **not** have an ON/OFF switch, it will power up as soon as the connected power source is energized.

IMPORTANT: For compliance with the EU Low Voltage Directive (2006/95/EC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.

There are three methods for obtaining readings from the XGF868i:

- Built-in LCD display
- PanaView software on a computer
- Device to read the XGF868i analog output

At least one of the above display options must be installed in order to obtain flow rate readings from the meter.

Immediately upon power up the software version display appears. Then, the meter performs a series of internal checks, which take about 45 seconds, prior to displaying the flow rate data.

Note: *If the XGF868i fails any of the internal checks (see Chapter 2,* Error Codes*, in the* Service Manual*), try disconnecting the power and then repowering the unit. If the meter continues to fail any of the internal checks, contact Panametrics for assistance.*

After successfully performing the internal checks, the XGF868i begins taking measurements and the software version display is replaced by a measurement mode display. Proceed to the appropriate section for instructions on using the LCD display and the PanaView display option.

Note: *As a minimum, the system and pipe parameters (for each installed channel of a 2-channel meter) must be entered before the XGF868i can display valid data. Refer to Chapter 2,* Initial Setup*, for instructions.*

3.3 The LCD Display

The components of the LCD display are shown in *Figure 12* below, along with a typical mass flow rate readout.

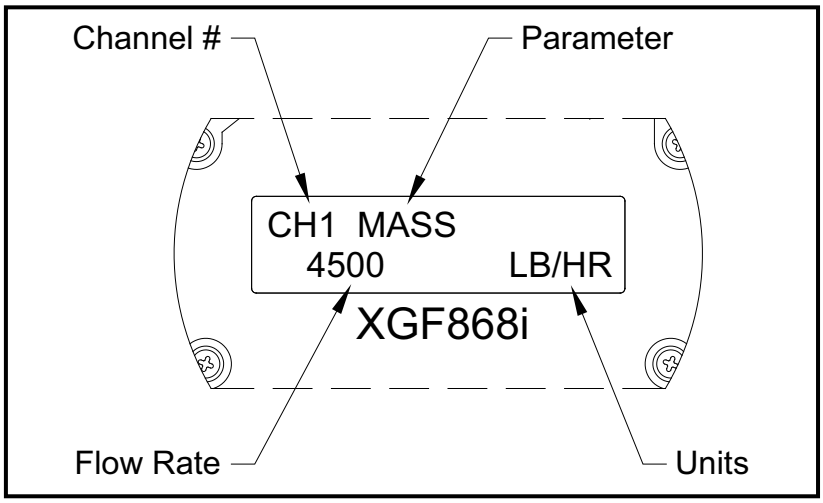


Figure 12: A Typical LCD Flow Rate Display

As shown in *Figure 12* above, the display screen includes the following information:

- Channel Number
- Flow Parameter
- Units of Measure
- Flow Rate Value

The example in *Figure 12* above uses the default display settings. However, the first three items in the list above may be reprogrammed to display a variety of alternative choices. See the *Programming Manual* for detailed instructions on programming these parameters.

Note: *The LCD backlight flashes to signal errors. If the backlight is off when an error is detected, the display is illuminated briefly; if the backlight is already on, the light is interrupted briefly. Error code messages may appear in the upper right corner of the LCD display. For information about these error codes and how to respond to them, refer to Chapter 2,* Error Codes*, in the* Service Manual.

Proceed to the *Taking Measurements* section to use the XGF868i.

3.4 The Optional PanaView Display

The components of the PanaView text display appear in *Figure 13* below, along with a typical flow rate readout.

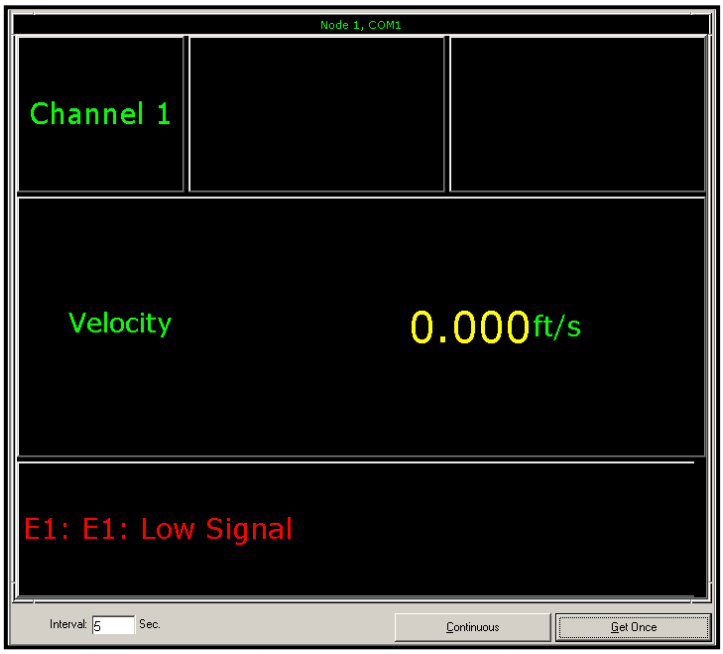


Figure 13: A Typical PanaView Text Display Pane

As shown in *Figure 13* above, the text pane includes the following information:

- Channel Number
- Flow Parameter
- Units of Measure
- Flow Rate Value

The example in *Figure 13* above is typical, but the first three items in the list above may be reprogrammed to display a variety of alternative choices. See the next section for detailed instructions on programming these parameters.

Note: *Error code messages may appear in the lower left corner of the PanaView text display window. For information about these error codes and how to respond to them, refer to Chapter 2,* Error Codes*, in the* Service Manual.

Proceed to the *Taking Measurements* section to use the XGF868i.

3.5 Taking Measurements

The XGF868i is capable of displaying several different variables in a variety of formats. However, this manual discusses only the basic measurement displays using the LCD display or the PanaView display. Refer to Chapter 2, *Displaying Data*, in the *Programming Manual* for instructions on setting up alternate choices. Also, refer to the *Programming Manual* and the *PanaView User's Manual* to use PanaView or the analog outputs to obtain the flow rate data.

3.5.1 Programming the LCD

Note: *When you first initialize the XGF868i, the number of LCD parameters is set to OFF. You must program the LCD to display any measured parameters.*

Through the *Keypad Program*, you can program the LCD display to display up to four variables in sequence. Complete the following steps to program the LCD display:

1. Power up the XGF868i and wait until it has initialized.
2. Press [Escape], [Enter], [Escape].
3. In the *Keypad Program* window, scroll to PROG and press [Enter].
4. In the PROG menu, scroll to GLOBL and press [Enter].
5. Scroll to I/O and press [Enter].
6. Scroll to LCD and press [Enter].
7. The window now asks for the *# of LCD Parameters*. Scroll to the desired number (from OFF through 1-4 and KEY) and press [Enter].

The OFF setting switches the measurement display off, while the KEY setting enables users to change the measurement display via the arrow keys, without accessing the *Keypad Program.* If you select KEY:

- To view a parameter other than the one currently displayed, press the [△] or [▽] keys to scroll through the various parameters.
- To scroll through the channel options on a two-channel XGF868i, press the [◁] and [▷] keys until you have reached the desired option.

8. Scroll to the desired *Channel option*, as listed in *Table 10* below.

Table 10: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

9. For each channel, select the desired *Measurement Parameter*, as shown in *Table 11* below.

Table 11: Available Measurement Parameters

Option Bar	Description	Good	Bad
VEL	Displays the flow velocity.	N.A.	N.A.
VOLUM	Displays the volumetric flow.	N.A.	N.A.
+TOTL	Displays the forward totalized volume flow.	N.A.	N.A.
-TOTL	Displays the reverse totalized volume flow.	N.A.	N.A.
TIME	Displays the total flow measurement time.	N.A.	N.A.
MDOT	Displays the mass flow.	N.A.	N.A.
+MASS	Displays the forward totalized mass flow.	N.A.	N.A.

Table 11: Available Measurement Parameters

Option Bar	Description	Good	Bad
-MASS	Displays the reverse totalized mass flow.	N.A.	N.A.
SS up	Displays the signal strength for the upstream transducer.	50–75	<50 or >75
SS do	Displays the signal strength for the downstream transducer.	50–75	<50 or >75
SNDSP	Displays the measured speed of sound in the gas.	N.A.	N.A.
Tup	Displays the upstream ultrasonic signal transit time.	N.A.	N.A.
Tdown	Displays the downstream ultrasonic signal transit time.	N.A.	N.A.
DELTA	Displays the transit time difference between the upstream and downstream signals.	N.A.	N.A.
Tot K	Displays the total K factor.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default).	N.A.	N.A.
Qup	Displays the signal quality for the upstream transducer.	≥1200	–400 to +400
Qdown	Displays the signal quality for the downstream transducer.	≥1200	–400 to +400
AMPup	Displays the value for the signal amplitude of the upstream transducer.	24 ± 5	<19 or >29
AMPdn	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29
CNTup	Displays the AGC DAC count for the upstream gain setting.	N.A.	N.A.
CNTdn	Displays the AGC DAC count for downstream gain setting.	N.A.	N.A.
P#up	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
P#dn	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
TEMP	Displays the gas temperature (from 0/4-20 mA input).	N.A.	N.A.
PRESR	Displays the gas pressure (from 0/4-20 mA input).	N.A.	N.A.
Mw	Displays the molecular weight.	N.A.	N.A.
z	Displays the compressibility.	N.A.	N.A.
AcVOL	Displays actual volumetric flow.	N.A.	N.A.
StVOL	Displays standard volumetric flow.	N.A.	N.A.
Tu S[1]	Displays Skan transit time upstream.	N.A.	N.A.
Td S[1]	Displays Skan transit time downstream.	N.A.	N.A.
DT S[1]	Displays Skan Delta T.	N.A.	N.A.
Tu M[1]	Displays Measure transit time upstream.	N.A.	N.A.
Td M[1]	Displays Measure transit time downstream.	N.A.	N.A.
DT M[1]	Displays Measure Delta T.	N.A.	N.A.
Vinst	Displays the instantaneous velocity.	N.A.	N.A.

[1]available only if Burst Mode = S/M

Note: *The measurement units that appear in these prompts are those selected in the* **GLOBL-SYSTM** *menu earlier in this section. Also, when differences in one channel's programming invalidate an output previously chosen for the other, the measurement defaults to the nearest selectable item in the parameter list.*

The previous two prompts repeat until all of the specified **# of LCD Parameters** have been set up. When all of the display parameters have been set up, the meter returns to the **Global I/O** window. To leave the *Keypad Program*, press the **[Escape]** key three times.

After leaving the *Keypad Program*, the XGF868i will reset itself and will begin to display the parameters specified in this section. If more than one parameter was set up, each of the parameters will be displayed in sequence, with a pause of several seconds between display changes.

3.5.2 Using the LCD Display

To use the programmed LCD display for obtaining flow rate data, simply power on the XGF868i as described earlier in this chapter. Then, read the flow rate directly from the display, as shown in *Figure 12 on page 34*.

Note: *See Chapter 2,* Displaying Data*, in the* Programming Manual *to customize the contents of the LCD display.*

3.5.3 PanaView Display

Power up PanaView, establish communications with the XGF868i and enter the **required startup parameters**, as described in Chapter 2, *Initial Setup*. Then, proceed as follows:

Note: *See Chapter 2,* Initial Setup*, in this manual and/or Chapter 1,* Programming Site Data*, in the* Programming Manual *for complete instructions on entering startup data via PanaView.*

1. In PanaView, pull down the *Output* menu, as shown in Figure 14 below, and click on the *Text Display* option.

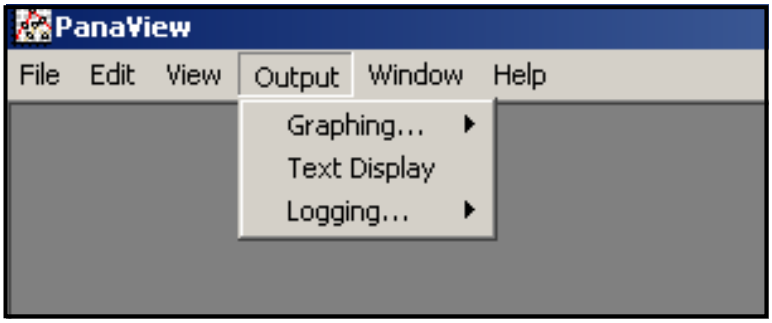


Figure 14: The Output Menu

Note: *The* Text Display *window that appears after Step 1 is actually stacked on top of any previously opened windows (such as the* Meter Browser *window).*

2. Using the *Window* menu, as described in the *PanaView User's Manual,* arrange the open windows in the desired format. For this discussion, *Figure 15* below shows the *Text Display* window in its maximized (full-screen) size.

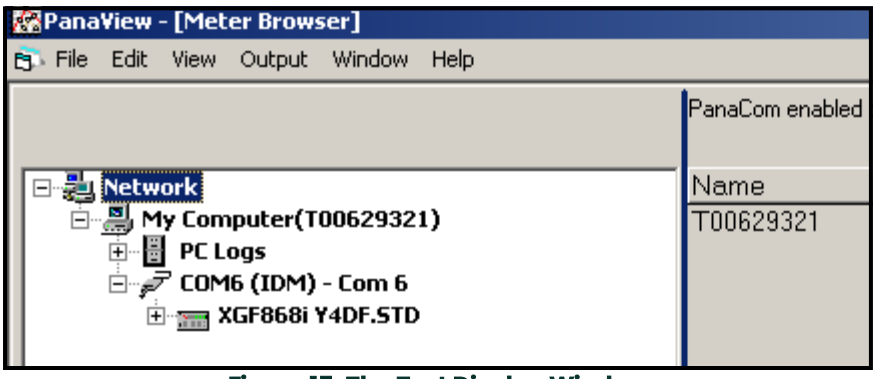


Figure 15: The Text Display Window

3. The left pane of the *Text Display* window contains the standard PanaView network tree. Expand the XGM branch, and double-click on the desired channel. (On 2-channel units, you can also display the SUM, DIFF or AVG parameters.)

4. From the expanded tree, double-click on the desired flow parameter to display it in the right pane of the window.
5. Before actual data values can be displayed in the text pane, activate one of the following data collection modes (see *Figure 15 on page 38*):
   - Click on the **[Get Once]** option button at the bottom of the right pane in the *Text Display* window. The current value of the selected process parameter, as specified in the PanaView network tree, is displayed in the right pane of the *Text Display* window.

or

   - Enter an *"interval"* in the text box at the bottom of the right pane in the *Text Display* window, or check the *"Max. Comm Rate"* box to collect readings as fast as the system allows (1 sec). Then, click on the **[Continuous]** option button to begin collecting data for display in the right pane of the *Text Display* window.

Note: *Any value entered in the* "Interval" *text box is overridden if the* "Max. Comm Rate" *box is checked.*

The right pane now appears similar to *Figure 13 on page 35*.

6. If the **[Continuous]** option was selected in Step 5, click on the **[Stop]** option button, which has replaced the original **[Continuous]** option button, to terminate data collection.

The *Text Display* window may be left open while other tasks are performed, or it may be closed by clicking on the lower **[X]** control button at the far right of the menu bar.

IMPORTANT: If you click on the upper **[X]** control button at the far right of the PanaView title bar, you will exit PanaView completely.

3.5.3.1 Displaying Multiple Process Parameters

The procedure for displaying a single process parameter in a text screen may be repeated to simultaneously display multiple process parameters. To do so, proceed as follows:

1. Display the first process parameter in a text screen, as described in the previous section.
2. Repeat Step 1 for any desired additional process parameters, by double clicking on them in the PanaView network tree. PanaView automatically tiles the multiple text screens in the right pane of the *Text Display* window, as shown in *Figure 16* below.

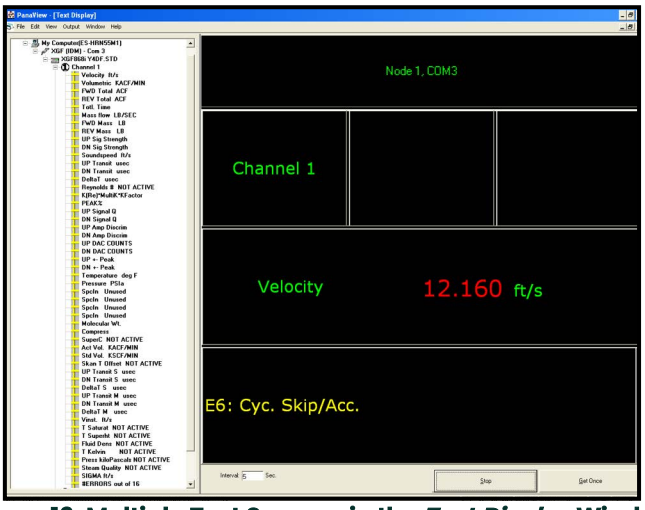


Figure 16: Multiple Text Screens in the *Text Display* Window

3. As in any standard Windows application, the multiple text screens may be resized by dragging their borders. Also, the individual panes within a parameter's text screen may be resized by dragging the borders within that text screen.
4. To close an open text screen, right click anywhere within that screen (except in the title bar or the error section) and click on the **[Remove]** option that pops up in the context menu.

Note: *After resizing or removing any of the multiple text screens, the default tiled layout may be restored by opening the* Window *menu (see the* PanaView User's Manual*) and clicking on the* Tile Output Displays *option.*

3.5.3.2 Displaying Multiple Text Windows

The procedures for displaying one or more process parameters in a single *Text Display* window may be repeated to open multiple *Text Display* windows. To do so, proceed as follows:

1. To open another *Text Display* window and display the desired process parameter(s) in the new window, repeat the steps in *PanaView Display*.
2. Arrange the multiple *Text Display* windows as desired via the *Window* menu (see the *PanaView User's Manual*).

3.5.4 Pausing Measurements

On occasion, it might become necessary for the XGF868i to stop taking measurements. Through PanaView, you can direct the XGF868i to pause measurements without cutting off the power from the meter.

1. From the meter tree in the *New Meter Browser*, click on the XGF868i entry.
2. Expand the *Edit Functions* option, and double-click on the *Pause Measurement* entry. A window opens similar to *Figure 17* below.

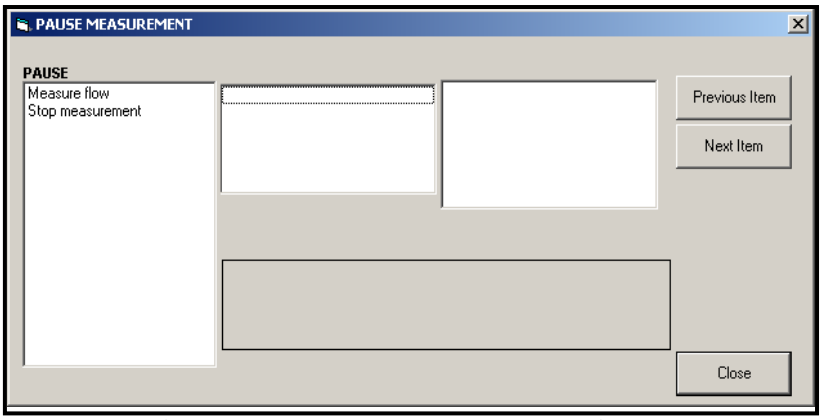


Figure 17: The *Pause Measurement* Window

3. To pause current measurements, double-click on the *Stop measurement* option. The window closes, and the XGF868i stops taking measurements.
4. To restart measurement, double-click on the *Pause Measurement* entry, and then on the *Measure flow* option. The XGF868i resumes flow measurement.

3.5.4.1 Procedure Options

The *Startup Guide* is intended to provide only those instructions necessary to get the XGF868i installed and operating. By following the instructions in this chapter, the XGF868i can be set up to display the desired channel option and the desired measurement parameter, using either the LCD display or PanaView. To utilize the more advanced capabilities of the XGF868i, refer to the *Programming Manual* and/or the *Service Manual* for the instrument. Also, refer to the *PanaView User's Manual* for instructions on using the PanaView software with the XGF868i.

[no content intended for this page]

Chapter 4. Specifications

4.1 Operation and Performance

4.1.1 Fluid Types

Flare and vent gases

4.1.2 Pipe Materials

All metals, fiberglass (Consult Panametrics for other materials)

4.1.3 Pipe Sizes

14 to 120 in. NB ANSI (350 to 3000 mm)

4.1.4 Flow Accuracy (Velocity)

4.1.4.1 High Flow Range: ±1.0 ft/s to ±394 ft/s (±0.3 to ±120 m/s)

One-Path: ±2.0%
Two-Path: ±1.5%
Note: For 4 to 12 in. NB pipe sizes, accuracy ranges from 1.5 to 4% (consult Panametrics for details). Accuracy to ±0.5% may be achieved with calibration.

4.1.4.2 Low Flow Range: ±0.1 ft/s to ±1.0 ft/s (±0.03 to ±0.3 m/s)

One-Path: ±0.008 f/s (±0.002 m/s)
Two-Path: ±0.0057 f/s (±0.0017 m/s)

Note: *Accuracies listed assume a fully developed flow profile. A minimum straight pipe run of 20 pipe diameters upstream and 5 pipe diameters downstream from the measurement point are recommended. Also, consult Panametrics for the accuracy of non-standard flow transducer types.*

4.1.5 Molecular Weight Accuracy

±1.8% of reading for hydrocarbon mixtures with molecular weights of 2 to 120 gr/gr mole

4.1.6 Mass Flow Accuracy

One-Path: ±2.7%
Two-Path: ±1.9%
Note: Dependent on the accuracy of the temperature and pressure inputs.

4.1.7 Repeatability

4.1.7.1 High Flow Range: ±1.0 ft/s to ±394 ft/s (±0.3 to ±120 m/s)

One-Path: ±0.5 to 1.0%
Two-Path: ±0.35 to 0.75%

4.1.7.2 Low Flow Range: ±0.1 ft/s to ±1.0 ft/s (±0.03 to ±0.3 m/s)

One-Path: ±5 to 6%
Two-Path: ±3.5 to 4.0

4.1.8 Rangeability (Overall)

4000:1

4.2 Electronics

4.2.1 Flow Measurement

Patented *Correlation Transit-Time* mode

4.2.2 Enclosures

Standard: Epoxy-coasted aluminum, Hazardous area ratings:
Explosion-proof: Class I, Division 1, Groups B, C, D
Flameproof:ISSeP 07ATEX015
II 2 G Ex d IIC T5 IP66
IECEx:FM G 0011x
II 2 G Ex IIC T6 Gb IP66

Optional: Stainless steel

4.2.3 Dimensions (l x d)

8.2 in. x 6.6 in. (208 mm x 168 mm)

4.2.4 Weight

Aluminum: 10 lb (4.5 kg)
Stainless steel: 30 lb (13.6 kg)

4.2.5 Channels

Standard: Two channels (for two-path averaging)

4.2.6 Display

2 line x 12 character backlit LCD display,
configurable to display up to four measurement parameters in sequence

4.2.7 Keypad

Built-in magnetic six-button keypad for full functionality operation

4.2.8 Power Supplies

Standard: 100 to 240 VAC, 50/60 Hz, ± 10%.
Optional: 12 to 28 VDC, ±5%.

4.2.9 Power Consumption

20 W maximum

4.2.10 Operating Temperature

–40°F to 140°F (–40°C to 60°C)

4.2.11 Storage Temperature

–67°F to 167°F (–55°C to 75°C)

4.2.12 Standard Inputs and Outputs

Two 0/4 to 20 mA isolated analog outputs, 600 Ω maximum load, and
Two 4 to 20 mA isolated analog inputs, 24 VDC loop power
or
One 4 to 20 mA isolated analog inputs, 24 VDC loop power, and
One direct three-wire RTD (temperature) input, -148°F to 662°F (-100°C to 350°C), 100 Ω platinum

4.2.13 Optional Inputs and Outputs

Two optically isolated frequency outputs, 3 A maximum, 100 VDC maximum,
1 W maximum, from DC to 10 kHz maximum

4.2.14 Digital Interfaces

Standard:RS232 (PanaView (PC software)

HART® protocol on 4-20 mA output

Optional:Modbus® TCP/IP
Ethernet
OPC Server

Foundation Fieldbus®

4.2.15 European Compliance

System: Directives EMC 2004/108/EC, LVD 2006/95/EC (Installation Category II, Pollution Degree 2)
Transducers: PED Directive 97/23/EC for DN<25
[See the *CE Declaration of Conformity* at the back of this manual.]

4.3 Wetted Ultrasonic Flow Transducers

4.3.1 Temperature Range

Overall: -364ºF to 536ºF (-220ºC to 280ºC)
Note: Transducer type selection is based on specific application review.

4.3.2 Pressure Range

Standard: 2 psig to 1500 psig (87.6 kPa to 10300 kPa)

4.3.3 Materials

Standard: Titanium

Optional: Monel® or Hastelloy® alloys

4.3.4 Process Connections

Flanged and compression fittings

4.3.5 Area Classifications

Standard: Epoxy-coasted aluminum, Hazardous area ratings:
Explosion-proof: Class I, Division 1, Groups C, D
Flameproof:II 2 G Ex d IIC T4, T3 or T2 Gb
IECEx: Ex d IIC T4, T3 or T2 Gb

Optional: Class I, Division 1, Group B

4.4 Insertion Mechanism

4.4.1 Standard Range

3 in. (76 mm) flange-mounted packing gland and valve with equal mounting angles upstream and downstream

4.4.2 Extended Velocity Range

3 in. (76 mm) flange-mounted packing gland and valve with *Recovery Angle* in downstream assembly

4.5 Preamplifier

4.5.1 Physical

In-line, powered preamplifier with transformer and BNC connections. One preamplifier with transformer is required per transducer per channel.

4.5.2 Gain

Standard: 20
Optional: 2, 10, 40 (factory selected)

4.5.3 Temperature Range

–40°F to 60°F (–40°C to 140°C)

4.5.4 Enclosure

Explosion-proof: Class I, Division 1, Groups C, D (*Optional*: Group B upon request)
ATEX Flameproof: II 2 G Ex d IIC T4, T3 or T2 Gb
IECEx Flameproof: Ex d IIC T4, T3 or T2 Gb

4.6 Transducer Cables

4.6.1 Standard (per Transducer pair)

- One pair of coaxial cables for transducer to preamplifier connections (if required), type RG62A/U, length 3m (10 ft)
- One pair of coaxial cables for preamplifier to XGF868i electronics, type RG62A/U, length 10 ft (3 m) to 1000 ft (330 m) maximum

4.6.2 Optional

flame retardant, armored cable; cable glands

4.7 Options

4.7.1 PanaView™ PC-Resident Interface Software

Using the *PanaView* software, the *DigitalFlow™ XGF868i* flow transmitter communicates with a PC running a *Windows®* operating system through a serial interface. Features include *site files*, *logs* and other operations.

4.7.2 Installation Flowcells

Flanged or plain-end spoolpiece, with hot tap or cold tap transducer connections
Note: Consult with Panametrics for the availability of transducers and flowcells for specific applications.

4.7.3 Pressure and Temperature Transducers

Available upon request.

Appendix A. CE Mark Compliance

A.1 Introduction

For CE Mark compliance, the XGF868i flow transmitter must be wired in accordance with the instructions in this appendix.

IMPORTANT: *CE Mark compliance is required for all units intended for use in EU countries.*

A.2 Wiring

The XGF868i must be wired with the recommended cable, and all connections must be properly shielded and grounded. Refer to *Table 12* below for the specific requirements. All interconnecting cables shall comply with IEC/EN 60079-14.

Table 12: Wiring Requirements

Connection	Cable Type	Ground Termination
Transducer	Armored RG62 a/U	Grounded via cable gland.
Input/Output	Armored 22 AWG shielded (e.g. Baystate #78-1197) with armored material added to outside of jacket	Grounded via cable gland.
Power	Armored 14 AWG 3 conductor	Grounded via cable gland.



WARNING! To ensure safe and reliable operation of the XGF868i, be sure to install and tighten all cable glands in accordance with the gland manufacturer's instructions.

Note: *If the XGF868i is wired as described in this appendix, the unit will comply with the EMC Directive 2004/108/EC.*

[no content intended for this page]

Appendix B. Certification and Safety Statements

B.1 Certification & Safety Statements for Panametrics Ultrasonic Flow Transmitters

When installing this apparatus, the following requirements must be met:

- Field wiring shall be rated at least 10°C above 70°C.
- Connecting cables shall be mounted securely and protected from mechanical damage, pulling and twisting.
- Cable entries are ¾" NPT.
- Cable glands of an approved flameproof design are required. These must be installed according to the manufacturer's instructions. Where the cable glands are provided by Panametrics, the manufacturer's instructions, as supplied, to Panametrics, will be included in the documentation.
- Unused cable entries must be sealed using a certified threaded plug.
- Modifications to the flameproof enclosure are not permitted.
- The apparatus should be de-energized before opening.
- Installation should comply with IEC/EN 60079-14.
- Equipment is of type flameproof "d" design and complies with: EN 60079-0:2009, EN 60079-1:2007, EN 60529:1991 +A1:2000, IEC 60079-0:2011, IEC 60079-1:2007, IEC 60529:2001.
- The product contains no exposed parts which produce surface temperature infrared, electromagnetic ionizing, or
non-electrical dangers.
- The product must not be subjected to mechanical or thermal stresses in excess of those permitted in the certification documentation and the instruction manual.
- The product cannot be repaired by the user; it must be replaced by an equivalent certified product. Repairs should only be carried out by the manufacturer or by an approved repairer.
- Only trained, competent personnel may install, operate and maintain the equipment
- The product is an electrical apparatus and must be installed in the hazardous area in accordance with the requirements of the EC Type Examination Certificate. The installation must be carried out in accordance with all the appropriate international, national and local standard codes and practices and site regulations for flameproof apparatus and in accordance with the instructions contained in the manual. Access to the circuitry must not be made during operation.

Special Conditions for Safe Use: Consult the manufacturer if dimensional information on the flameproof joints is necessary.

Markings: Markings shall appear on the product as shown below:

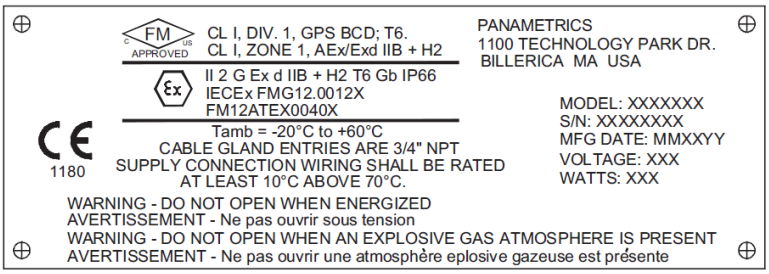
When installing this apparatus, the following requirements must be met:

- Field wiring shall be rated at least 10°C above 70°C.
- Connecting cables shall be mounted securely and protected from mechanical damage, pulling and twisting.
- Cable entries are ¾" NPT.
- Cable glands of an approved flameproof design are required. These must be installed according to the manufacturer's instructions. Where the cable glands are provided by Panametrics, the manufacturer's instructions, as supplied, to Panametrics, will be included in the documentation.
- Unused cable entries must be sealed using a certified threaded plug.
- Modifications to the flameproof enclosure are not permitted.
- The apparatus should be de-energized before opening.
- Installation should comply with IEC/EN 60079-14.
- Equipment is of type flameproof "d" design and complies with: EN 60079-0:2009, EN 60079-1:2007, EN 60529:1991 +A1:2000, IEC 60079-0:2011, IEC 60079-1:2007, IEC 60529:2001.

- The product contains no exposed parts which produce surface temperature infrared, electromagnetic ionizing, or
non-electrical dangers.
- The product must not be subjected to mechanical or thermal stresses in excess of those permitted in the certification documentation and the instruction manual.
- The product cannot be repaired by the user; it must be replaced by an equivalent certified product. Repairs should only be carried out by the manufacturer or by an approved repairer.
- Only trained, competent personnel may install, operate and maintain the equipment
- The product is an electrical apparatus and must be installed in the hazardous area in accordance with the requirements of the EC Type Examination Certificate. The installation must be carried out in accordance with all the appropriate international, national and local standard codes and practices and site regulations for flameproof apparatus and in accordance with the instructions contained in the manual. Access to the circuitry must not be made during operation.

Special Conditions for Safe Use: Consult the manufacturer if dimensional information on the flameproof joints is necessary.

Markings: Markings shall appear on the product as shown below:



ATEX/IECEx

Specific Conditions of Use:

- The 868i and 878 series transmitter shall only be mounted in such an orientation that the mounting base is pointed downwards with the cylindrical enclosure in a horizontal position. (See clause 26.5.1.1 of IEC 60079-0).
- Contact the manufacturer if dimensional information of flameproof joints is needed. (See clause 5.1 of IEC 60079-1).
- Field connections to the 868i and 878 series transmitter (e.g. ultrasonic transducers, accessories or similar peripherals) shall be appropriately certified for the location and installed in accordance with wiring method requirements of the local electrical code as applicable

US/Canada:

Specific Conditions of Use:

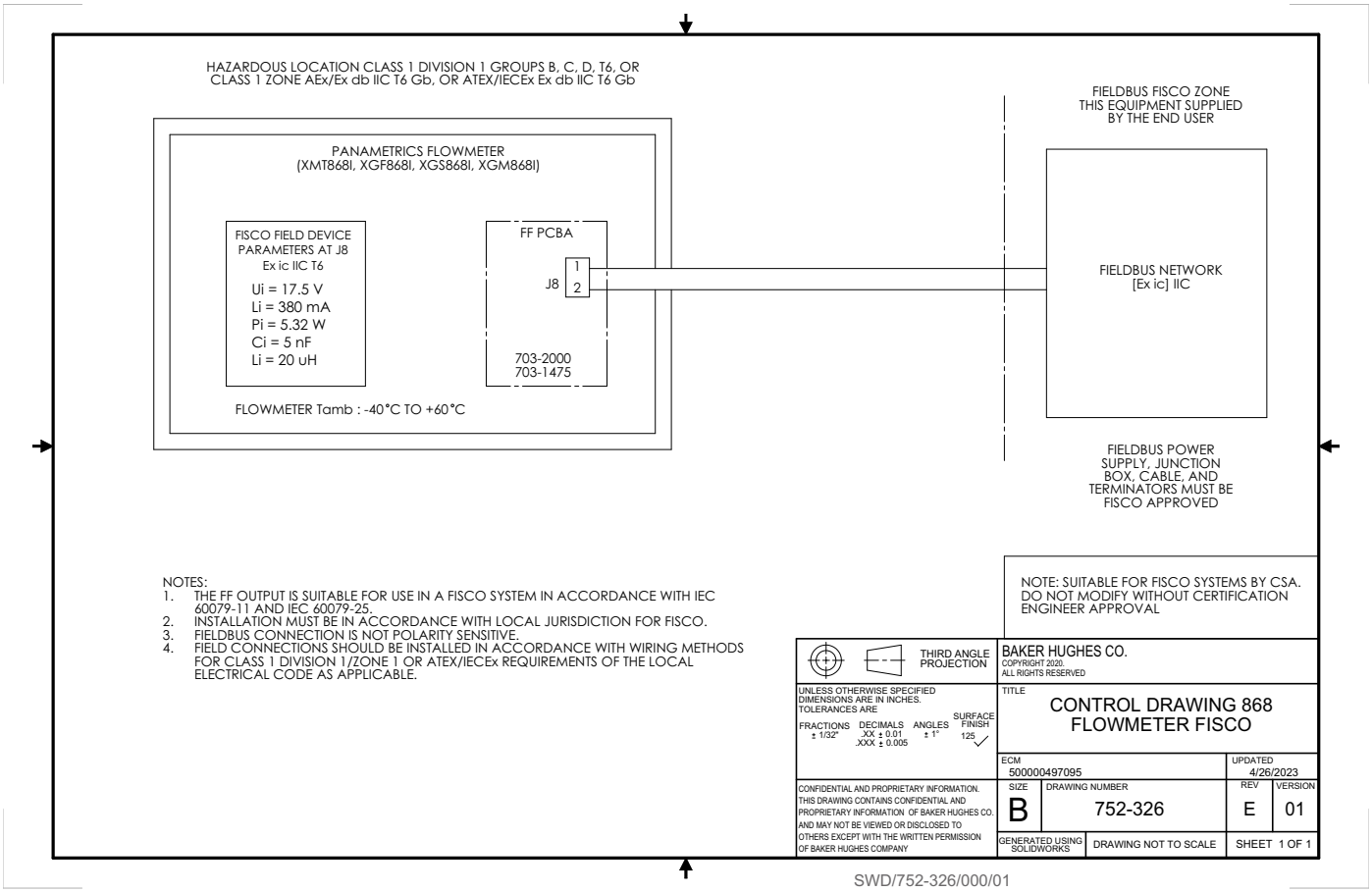
- The 868i and 878 series model designation may include additional suffixes denoting dimensions and details for construction. (See drawing 752-111)
- The above models are permanently (conduit) connected, intended for continuous operation in extended environmental conditions as specified. Equipment Class I, Overvoltage Category II, Pollution Degree 2.
- The DC version is intended to be supplied by Class 2, SELV or equivalent power source.
- The 868i and 878 series Transmitter shall only be mounted in such an orientation that the mounting base is pointed downwards with the cylindrical enclosure in a horizontal position.
- Contact the manufacturer if dimensional information of flameproof joints is necessary.
- Field connections to the 868i and 878 series Transmitter (e.g. ultrasonic transducers, accessories or similar peripherals) shall be appropriately certified for the location and installed in accordance with wiring method requirements of the local electrical code as applicable.

- The 868i and 878 series Transmitter have non-conducting coating which may generate an ignition-capable level of electrostatic charge under certain extreme conditions. The user shall take the necessary precautions to minimize the risk from electrostatic discharge. For example, controlling the environmental humidity where installed in order to minimize generation of static electricity, with the equipment protected from direct airflow which could cause a transfer of charge to the surface of the equipment. Cleaning should be done only with a damp cloth.

USA/Can/ATEX/IECEx FISCO:

Specific Conditions of Use:

- The 868i and 878 series model code variables shown as an asterisk (*) above may be replaced by alpha numeric characters without affecting certification status.
- The 868i and 878 series model designation may include additional suffixes denoting dimensions and details for construction. (See drawing 752-111)
- The above models are permanently (conduit) connected, intended for continuous operation in extended environmental conditions as specified, supplied by Class 2, SELV or equivalent power source. Equipment Class III, Overvoltage Category I, Pollution Degree 2.
- Field connections to the 868i and 878 series Transmitter (e.g. ultrasonic transducers, accessories or similar peripherals) shall be appropriately certified for the location and installed in accordance with wiring method requirements of the local electrical code as applicable.



SWD/752-326/000/01

B.2 Installing Panametrics Ultrasonic Flow Transmitters in a Potentially Hazardous Area

When installing this apparatus in a potentially hazardous area, the following requirements must be met:

- The installation shall comply with IEC 60079-14.
- Apparatus Markings:
  Ex d IIC T6 Gb
- Supply connection wiring shall be rated at least 10°C above rated ambient temperature of 60°C. Cable entries are 3/4" NPT.
- Certificate Number: IECExFMG12.0011X
  Complies with IEC 60079-0: 2011 and IEC 60079-1: 2007
  Manufacturer: Panametrics, Billerica, MA.
- The certification covers the following Panametrics product types — XMT868, XMT868i, XGF868, XGF868i, XGN868, XGN868i, XGS868, XGS868i, XGM868, XGM868i, IGM878 &: IGM878i.
- This apparatus is equipment category 2 and may be employed in Zones 1 and 2. It may not be employed in a Zone 0 area. This apparatus is certified for gas hazards only.
- Enclosure Material: Si=95, Mg=0.35%, Mn=0.5%, Al = remainder.
- This apparatus must be securely mounted using the mounting fixtures provided on the enclosure.
- All covers are fitted with a locking device. This device must be tightened after the cover is replaced so as to preserve the protection offered by the enclosure.
- Modifications to the flameproof enclosure are not permitted.
- Cable glands of an approved flameproof design are required. These must be installed according to the manufacturer's instructions. Where the cable glands are provided by Panametrics, the manufacturer's instructions, as supplied to Panametrics, will be included in the documentation.
- Connecting cable shall be mounted securely and protected from mechanical damage, pulling and twisting.
- Unused entries must be sealed using a certified threaded plug.
- The apparatus should be de-energized before opening.
- If live working is necessary, the apparatus may only be opened when the surrounding atmosphere is known to be safe. Measures must be taken to ensure that it remains safe while the unit is open, such as a system of hot work permits.
- The apparatus uses standard printed circuit assemblies. Always quote the apparatus serial number when ordering spares.
- This flameproof apparatus is only designed to be installed in a potentially hazardous area. This apparatus has not been designed for use in a safe area, where it would be subject to CD 2006/95/EC (LVD). For a safe area installation, an external mains disconnect must be provided close to this apparatus. If in doubt, consult Panametrics.

Appendix C. Data Records

C.1 Available Option Cards

The XGF868i can hold one option card in Slot 1 and one in Slot 2. The available configurations are listed in *Table 13* below.

Table 13: Option Card Configurations

Card #	Slot #	Configuration
1473-02	1	OI - 2 Current Inputs
1473-14		OR - 1 RTD Input/1 Current Input
1473-06		FI - 2 Current Inputs/2 Frequency Outputs
1473-15		FR - FRI- 2 Frequency Outputs/1 RTD Input/1 Current Input
1345-04	2	Modbus Communications Protocol
1658		HART Communication
1477-03		MODBUS/TCP/IP
1477-01		Ethernet
1475-01		Foundation Fieldbus

[no content intended for this page]

Appendix D. Measuring P and L Dimensions

D.1 Introduction

When programming the PIPE menu in the XGF868i *User Program*, the *path length* (P) and the *axial dimension* (L) must be entered. These parameters are determined by measurements on the actual transducer installation, with P equal to the face-to-face distance between the transducers and L equal to the axial distance between the centers of the transducer faces.

The accuracy of the programmed P and L values is critical to precise flow rate measurements. If Panametrics supplies the flowcell for the system, the correct values will be included in the documentation supplied with the system. For transducers installed on an existing pipe (see Figure 18 on page 56), P and L must be measured at the site. This appendix provides instructions for properly determining these dimensions.

D.2 Measuring P and L

Whenever possible, physically measure the face-to-face distance (P) and the axial distance (L) between the centers of the flat faces of the transducers. Refer to *Figure 18 on page 56* for an illustration of the proper distances to measure, in a typical installation.

In some situations only one of the required distances can be directly measured. When this happens, a knowledge of the installation angle (θ) of the transducers, permits the second distance to be calculated from *Equation C-1* below.

$$\cos\theta = \frac{L}{P}$$

As an example, assume that the transducer installation angle is known to be 45° and the L distance is measured to be 10.00 inches. Then, the P distance is calculated to be P = 10.00/0.707 = 14.14 inches.

With a Bias 90° transducer installation, it sometimes happens that the only known parameters are the transducer angle (θ) and the centerline distance between the transducer bodies (CL). In these cases, it is still possible to calculate P and L by combining *Equation C-1* above with the additional *Equation C-2* below (see *Figure 18 on page 56*):

$$P = CL - 1.2$$

Standard Panametrics 90° transducers have the face offset from the centerline of the body by 0.6 inches. Thus, a pair of transducers has a total offset of 1.2 inches, as indicated in Equation C-2. For example, suppose that the transducer installation angle is 30° and CL is measured to be 12.00 inches. Then, P = 12.00 – 1.2 = 10.80 inches and L = 10.80 x 0.866 = 9.35 inches.

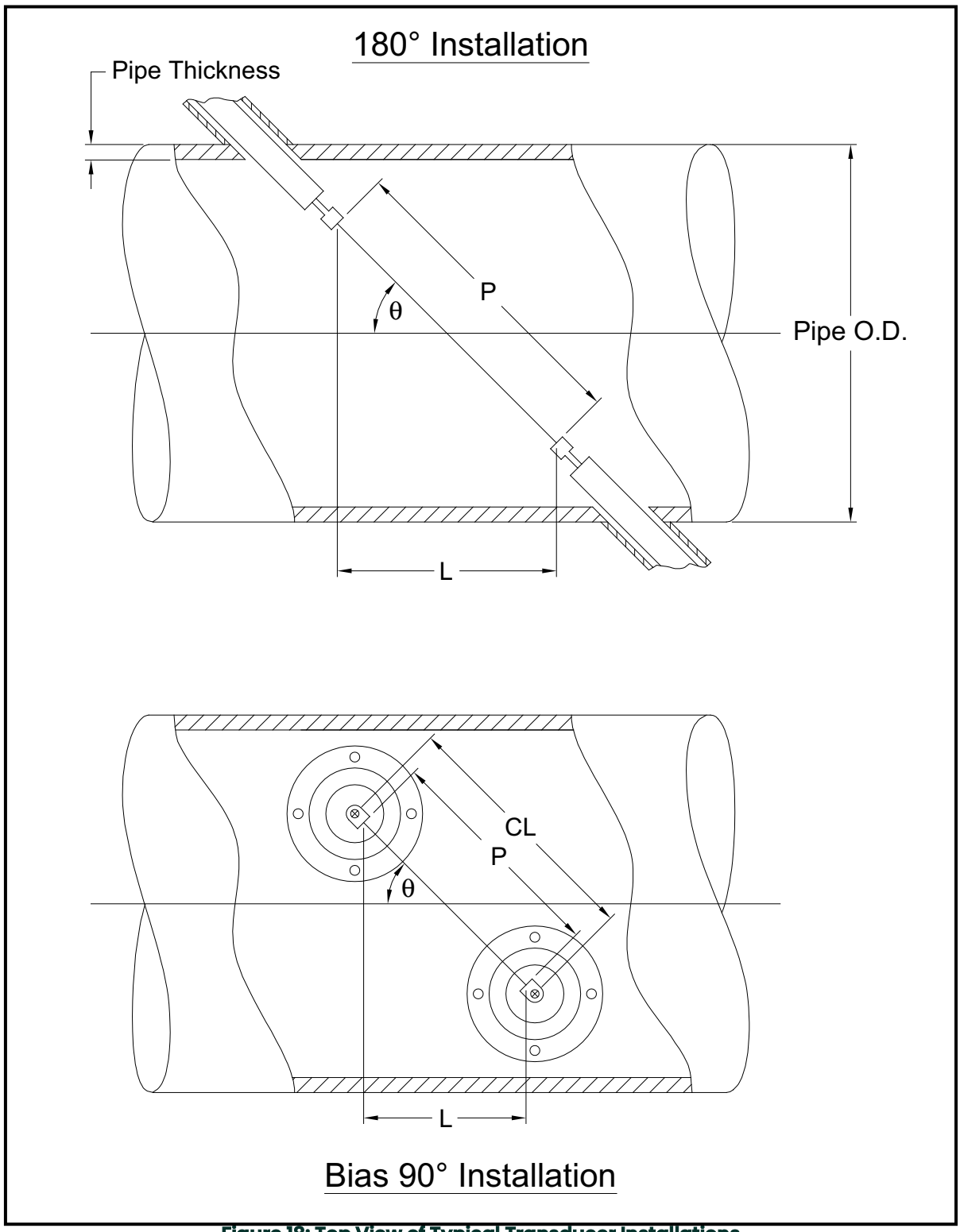


Figure 18: Top View of Typical Transducer Installations

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Warranty

Each instrument manufactured by Panametrics is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of Panametrics. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics determines that the equipment was defective, the warranty period is:

- One year from delivery for electronic or mechanical failures
- One year from delivery for sensor shelf life

If Panametrics determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Panametrics, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a Panametrics instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify Panametrics, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, Panametrics will issue a RETURN MATERIAL AUTHORIZATION (RMA), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, Panametrics will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If Panametrics determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

[no content intended for this page]

Customer Support Centers

U.S.A.
The Boston Center
1100 Technology Park Drive
Billerica, MA 01821
U.S.A.
Tel: 800 833 9438 (toll-free)
978 437 1000
E-mail: panametricstechsupport@bakerhughes.com

Ireland
Sensing House
Shannon Free Zone East
Shannon, County Clare
Ireland
Tel: +353 (0)61 470200
E-mail: panametricstechsupport@bakerhughes.com

Scan here for Panametrics support and service information

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Panametrics

DigitalFlow™ XGF868i

Panametrics Flare Gas Flow Transmitter

Programming Manual



panametrics.com

BH060C31 EN D

Panametrics

DigitalFlow™ XGF868i

Panametrics Flare Gas Flow Transmitter

Programming Manual

BH060C31 EN D
April 2024

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Services

Panametrics provides customers with an experienced staff of customer support personnel ready to respond to technical inquiries, as well as other remote and on-site support needs. To complement our broad portfolio of industry-leading solutions, we offer several types of flexible and scalable support services including: Training, Product Repairs, Service Agreements and more.

Please visit https://www.bakerhughes.com/panametrics/panametrics-services for more details.

Typographical Convention

Note: *These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.*

IMPORTANT: These paragraphs provide information emphasizing instructions which are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.



WARNING! **Indicates a potentially hazardous situation which can result in serious personal injury or death, if it is not avoided.**



CAUTION! **Indicates a potentially hazardous situation which can result in minor or moderate injury to personnel or damage to the equipment, if it is not avoided.**



HIGH VOLTAGE! **This symbol indicates the presence of high voltage. It calls your attention to situations or operations that could be dangerous to you and other persons operating the equipment. Read these messages and follow the instructions carefully.**

Safety Issues



WARNING! **It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.**

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area



WARNING! **Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.**



WARNING! **Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on the equipment.**

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

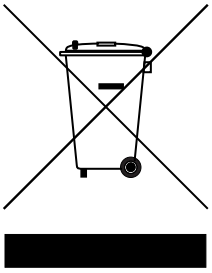
Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

Panametrics is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2012/19/EU.



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

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Chapter 1. Programming Site Data

1.1 Introduction

The XGF868i flow transmitter must be properly installed and programmed, as described in the *Startup Guide*, before it can provide accurate flow rate measurements. After completing the installation and initial setup, use this chapter to program the advanced features of the XGF868i *Keypad Program*.

Step-by-step programming instructions are presented in this chapter. Also, as a programming aid, a complete set of menu maps for the **XGF868i** are included in Appendix A, *Menu Maps*. The specific figure numbers will be referenced throughout this chapter, as required.

Refer to the appropriate section for a discussion of the following *Keypad Program* features:

- **ChannelX-ACTIV** - activate one or both channels and Scroll to the desired measurement method.
- **ChannelX-SYSTM** - enter the individual channel parameters.
- **ChannelX-PIPE -** enter the pipe geometry and other parameters.
- **ChannelX-I/O** - set up the inputs and outputs.
- **ChannelX-SETUP** - set the signal limits, response times and mass flow status.
- **Global-SYSTM** - scroll to system units (English or metric).
- **Global-I/O** - set up error handling, option cards and the display.
- **Global-COMM** - set the serial port parameters.

Note: *The "x" in CHx represents the channel number.*

To get the XGF868i up and running as quickly as possible you must, as a minimum, activate the channel(s), enter the channel and global system data and the pipe parameters. The *Procedure Options* section at the end of each menu will help you in programming the required (quick startup) and optional data.

Note: *In this manual, only the programming of Channel 1 will be described. To program Channel 2 of a 2-channel meter, simply repeat the same procedure presented for Channel 1.*

1.2 Programming Methods

You can program the XGF868i via either the keypad on the lower part of the glass window, or **PanaView™,** a PC-based, non-resident software program that communicates with the XGF868i via its RS232 serial port. PanaView supplements basic XGF868i functions with several additional capabilities. With PanaView, you can:

- Load and save site file data
- Create and save graph and log files
- Display text output and graphs of live measurement data
- Create custom templates for displaying text, graph and log data
- Interface with multiple Panametrics instruments.

Although the actual displays differ somewhat, the general procedures are the same for all three programming methods. This chapter provides detailed programming instructions for use with the magnetic keypad. If you are using PanaView™, see Appendix C, *Programming the XGF868i via PanaView™,* and/or the *PanaView™ User's Manual* (910-211) for detailed instructions.

IMPORTANT: This manual is for instruments using software version Y4AM or later.

1.3 The XGF868i Keypad

Keypad Program

Along with the 2-line, 16-character LCD, the XGF868i includes a 6-key magnetic keypad. The decal cutout for each key contains a hall effect sensor, pushbutton switch and visible red LED. The magnetic wand used to activate a magnetic key is found attached to the meter chassis below the front panel. An operator activates the key by pressing the magnetic wand up to the glass lid over the desired key. The LED will light indicating a successful key press.

Note: *The pushbutton switch will also act as a key press but is done with the glass lid open. Do not use the pushbutton switch in a hazardous area where the lid needs to be installed.*

Use the magnetic keypad to navigate through the user program. The menu map may be followed in sequence, or the four arrow keys may be used to scroll through the prompt screens. Figure 1 shows the front of the XGF868i, with magnetic keypad and magnetic wand.

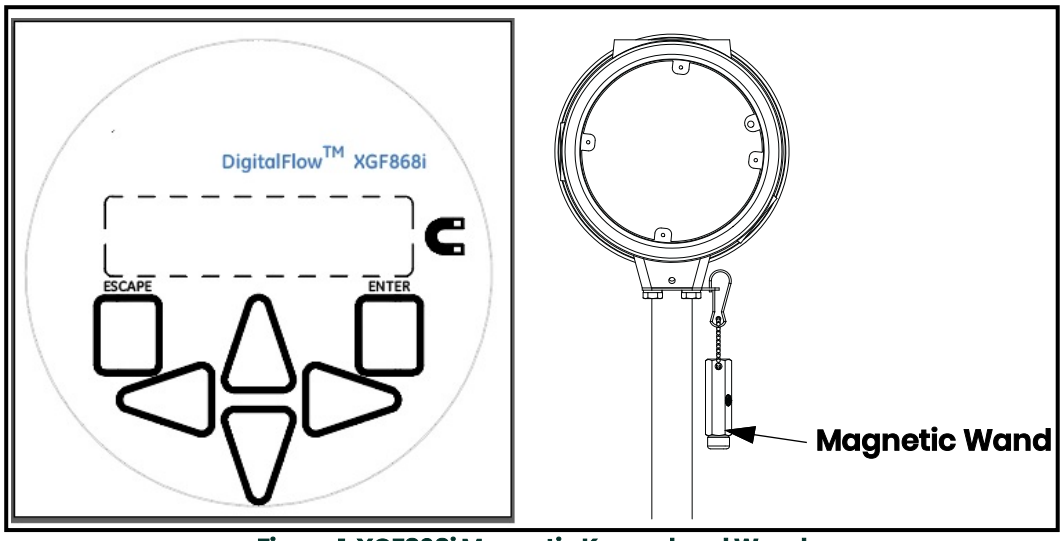


Figure 1: XGF868i Magnetic Keypad and Wand

IMPORTANT: The XGF868i keypad enables programming of the instrument through the glass faceplate without removing the cover. Thus, all programming procedures may be performed while the unit is installed in a hazardous area.

Six keys on the keypad enable users to program the XGF868i:

- [Enter] - confirms choice of a specific option and data entry within the option
- [Escape] - allows users to exit from a specific option without entering unconfirmed data
- [△] and [▽] - enable users to highlight a specific window in the display option or to scroll through a list of options (parameters, letters, and numbers 0-9 as well as the negative sign and decimal point) in a menu
- [◁] and [▷] - enable users to scroll to a specific option, among choices in an option, or to a character in a text entry.

When you power up the XGF868i, the display first shows the model and software version:

Panametrics
XGF868i Y4DF.STD

The meter then starts to display measured parameters.



To enter the *Keypad Program*, press the [Escape] key, followed by the [Enter] key, and the [Escape] key again. Each successive key must be entered within 10 seconds of the prior key.

As a guide in following the programming instructions in this chapter, the relevant portions of the XGF868i menu map have been reproduced in *Figure 28 on page 61* and *Figure 29 on page 62*. Proceed to the following sections to enter data in the Channel or GLOBL menus.

IMPORTANT: If the keypad has not been pressed for 10 minutes, the XGF868i exits the Keypad Program and returns to displaying measurements. The meter retains any configuration changes that were confirmed with the [Enter] key, and restarts as if the operator had completed the programming cycle.

1.4 Activating a Channel

The **ChannelX-ACTIV** submenu permits selection of the desired measurement method. In addition, it is used to activate/deactivate one or both of the channels in a 2-Channel XGF868i.

While following the programming instructions, refer to *Figure 28 on page 61*. To access the ChannelX-ACTIV submenu:

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to ACTIV and press [Enter].
4. Scroll to *Burst* to activate the channel/path, and press [Enter].
5. Scroll to one of the measurement methods described below and press [Enter].
   - Skan Only is the preferred technique for locating the acoustic signal and for high velocity measurements. It is more robust in a noisy environment than the Measure technique.
   - Skan/Measure is the preferred technique to use for low velocity measurements.

If Skan Only is selected at the above prompt, the meter uses this technique exclusively. However, if Skan/Measure is selected, the meter uses Skan Only to find the acoustic signal and then tries to use the Skan/Measure technique for the actual measurement.

Note: *To change the Skan Only and Skan/Measure parameters, see the* **Signal** *submenu section on* page 12 *of this chapter.*

Procedure Options

After completing the above step, the XGF868i returns to the Channel PROGRAM window. Do one of the following:

- To continue entering “quick startup” data, proceed to Step 3 in the following section.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] twice.

1.5 Entering System Data for the Channel

The ChannelX-System submenu is used to enter system parameters for the channel. While following the programming instructions, refer to *Figure 28 on page 61*.

1.5.1 Accessing the ChannelX-System Submenu

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to SYSTM and press [Enter].
4. Use the arrow keys to enter the desired *Channel Label* (up to 5 characters) and press [Enter].
5. Use the arrow keys to enter the desired *Site/Channel Message* (up to 21 characters) and press [Enter].

1.5.2 Selecting Volumetric Units

1. Scroll to the desired *Volumetric Units* for the flow rate display and press [Enter]. Table 1 lists available units.
2. Scroll to the desired *Volumetric Time* units for the flow rate display and press [Enter].
3. Scroll to the desired number of *Vol. Decimal Digits* (digits to the right of the decimal point in the volumetric flow rate display) and press [Enter].

Table 1: Available Volumetric/Totalizer Units

English	Metric
ACF = Actual Cubic Feet	ACM = Actual Cubic Meters
KACF = Thousands of ACF	KACM = Thousands of ACM
MMACF = Millions of ACF	MMACM = Millions of ACM
SCF = Standard Cubic Feet	SCM = Standard Cubic Meters
KSCF = Thousands of SCF	KSCM = Thousands of SCM
MMSCF = Millions of SCF	MMSCM = Millions of SCM

1.5.3 Selecting Totalizer Units

1. Scroll to the desired *Totalizer Units* for a totalized flow rate display and press [Enter]. *Table 1* above lists available units.
2. Scroll to the desired number of *Tot Decimal Digits* (digits to the right of the decimal point in the totalized flow rate display) and press [Enter].
3. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting the Mass Flow Units* on the following page.
   - If MASS FLOW is OFF, the meter returns to the Channel PROGRAM. Go to *Procedure Options* on the next page.

Note: *To activate mass flow, refer to* page 17.

1.5.4 Selecting Mass Flow Units

1. Scroll to the desired *Mass Flow* units for the flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at System Units (see *Table 2* below).

Table 2: Available Mass Flow Units

English	Metric
Pounds	Kilograms
Thousands of LB	Metric Tons (1,000 KG)
Millions of LB	
Tons (2,000 LB)	

2. Scroll to the desired *Mass Flow Time* units for the mass flow rate display and press [Enter].
3. Scroll to the desired number of *Mdot Decimal Digits* (digits to the right of the decimal point in the mass flow rate display) and press [Enter].
4. Scroll to the desired *Mass (Totalizer)* units for the totalized mass flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at the *System Units* prompt.
5. Scroll to the desired number of *Mass Decimal Digits* (digits to the right of the decimal point in the totalized mass flow rate display) and press [Enter].

Procedure Options

After completing the steps on the previous page, the XGF868i returns to the Channel PROGRAM window. Do one of the following:

- To continue entering “quick startup” data, continue to Step 1 in *Entering Transducer and Pipe Parameters* on the next page.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] twice.

1.6 Entering Transducer and Pipe Parameters

Enter the transducer and pipe parameters via the **PIPE** submenu. While following the programming instructions, refer to *Figure 28 on page 61*.

1. From the Channel PROGRAM menu, scroll to the PIPE option and press [Enter].
2. The first prompt asks for the *Transducer Number.*
   - For a standard transducer, use the arrow keys to enter the number engraved on the transducer head, and press [Enter].
   - If there is no number engraved on the transducer head, press the right arrow key to scroll to the *STD* option, and use the up and down arrow keys to change to *SPEC*. Then use the arrow keys to enter an assigned number (from 91 to 99), and press [Enter].

IMPORTANT: Special transducers have no engraved number on the head and are rarely used. Examine the transducer head carefully for a number.

- If you entered the number for a standard transducer, proceed to the *Pipe OD* prompt in step 5.
- If you entered the number for a special transducer, proceed to step 3 below.

1.6.1 Special Transducers

Note: *For special transducers, Panametrics supplies a transducer data sheet with programming information.*

3. Scroll to the transducer *Frequency* (supplied by the factory) and press [Enter].

Note: *The frequency is required to transmit an excitation voltage at the transducer's natural frequency.*

4. Enter the special transducer *Tw* (time delay) value (supplied by the factory) and press [Enter].

   Tw is the time required for the transducer signal to travel through the transducer and its cable. This time delay must be subtracted from the transit times of the upstream and downstream transducers to ensure an accurate flow rate measurement.

1.6.2 Pipe Data

If either a standard or a special transducer is being used, the programming sequence should be rejoined at this point.

1. To select the appropriate *Pipe OD Unit* type from the list shown in Table 3, scroll to the right side of the screen, and use the up and down arrow keys to step through the list. Press [Enter]. Then use the arrow keys to enter the known pipe outside diameter or circumference on the left side and press [Enter].

   Obtain the required information by measuring either the pipe outside diameter (OD) or circumference at the transducer installation site. The data may also be obtained from standard pipe size tables found in *Sound Speeds and Pipe Size Data* (914-004).

Table 3: Available Pipe Size Units

English	Metric
inches	mm = millimeters
feet	m = meters
in/PI = pipe circumference in inches	mm/PI = pipe circumference in millimeters
ft/PI= pipe circumference in feet	m/PI = pipe circumference in meters

2. Use the arrow keys to enter the known *Pipe Wall Thickness* (in inches or mm) and press [Enter]. If the pipe wall thickness is not available, look up the value in a table of standard pipe size data which can be found in the *Sound Speeds and Pipe Size Data* manual (914-004)

IMPORTANT: Because the units cannot be independently chosen for this parameter, the value must be entered in the same units used for the pipe OD/Circumference.

1.6.2.1 Path and Axial Lengths

1. To enter the *Path Length:*

a. Use the [▷] arrow key to highlight the path length unit type at the right of the screen.Then use the [△] and [▽] arrow keys to scroll to the desired unit type.

b. Use the [◁] arrow key to return to the numeric entry on the left, and enter the path length of the ultrasonic signal. Press [Enter].

Note: *If a spoolpiece was ordered with the meter, the transducer signal path length* **(P)** *and the transducer signal axial length* **(L)** *are engraved on the flowcell and/or are included in the documentation supplied with the meter. For on-site transducer installations, refer to Appendix C,* Measuring P and L Dimensions*, in the* Startup Guide.

2. In the same manner, enter the appropriate *Axial Length L* unit type and axial length of the ultrasonic signal, and press [Enter].
3. Scroll to the desired *Fluid Type* and press [Enter]. Then do one of the following:
   - If **OTHER** was selected - proceed to Step 10.
   - If **AIR** was selected - proceed to Step 11.
4. Use the arrow keys to enter the *Fluid Soundspeed* (in feet per second) in the gas to be measured and press [Enter].
5. Scroll to the appropriate choice to indicate whether you want *Reynolds Correction*, and press [Enter].
   - If *Off* is selected, go to Step 12.
   - If *On* is selected, the program asks for the *Kinematic Viscosity*. Use the arrow keys to enter the desired value, and press [Enter].
6. Use the arrow keys to enter a value for the flow *Calibration Factor* and press [Enter]. The default value is 1.00, but values between 0.50 and 2.0 may be entered.

Procedure Options

After entering the **Calibration Factor**, the XGF868i returns to the **Channel PROGRAM**. Do one of the following:

- To continue entering "*quick startup*" data, press [**Escape] once and proceed to Step 1 in Entering Global System Data** on *page 18*.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press the **[Escape]** key twice.

1.7 Entering Zero Cutoff and Setting Up Inputs

Enter the zero cutoff value and set up the temperature and pressure inputs via the **I/O** submenu. While programming these parameters, refer to *Figure 28 on page 61*.

IMPORTANT: If an option card in **Slot 1** fails to appear in this menu, it may be turned **Off**. See the **Global-I/O-Options** section on page 21 for setup instructions.

1.7.1 Zero Cutoff Value

Near a zero flow rate, the XGF868i's readings may fluctuate due to small offsets caused by thermal drift or similar factors. To force a zero display reading when there is minimal flow, enter a *zero cutoff value* as described below.

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to I/O and press [Enter].
4. Enter a value from 0 to 1 ft/sec (0 to 0.30 m/sec) for the *Zero Cutoff* and press [Enter]. The recommended setting is 0.0200 ft/sec (0.0009 m/sec).

1.7.2 Temperature Input

The XGF868i can use either a fixed temperature value or a live temperature input to calculate the density for the mass flow rate display.

1. Scroll to a *Fixed* temperature value or to set up the option card in *Slot 1* that will supply the live temperature input and press [Enter].

Note: *If Slot 1 contains an activated option card with an analog input assigned to* **Temperature** *or an* **RTD** *input, Slot 1 appears as an option at the above prompt. If the process temperature is stable, a fixed value may be used, but most applications require a live temperature input. If there is no active option card for temperature, the meter assumes you are using a fixed temperature.*

2. Proceed to one of the following sections:
   - If you selected *Fixed* - proceed to Step 3.
   - If you selected *Slot 1* - proceed to Step 4.
3. Enter the known *Fixed Temp.* (process temperature) and press [Enter]. The meter will accept values from –328° to 1832°F (–200° to 1000°C). Proceed to *Base Temperature* on the next page.
4. Scroll to *Input A* or *Input B* and press [Enter]. The inputs were labeled during setup.

Note: *The set up of Input A is used as an example. Identical procedures would be used to set up Input B.*

1.7.3 Base Temperature

1. Use the arrow keys to enter the *Base Temperature* and press [Enter]. The ratio of this value to the actual temperature is used to calculate the standard mass flow rate.
2. Do one of the following:
   - If you selected Pressure as the Input Type, proceed to *Pressure Input* below.
   - If you selected Temperature as the Input Type, proceed to *Base Pressure* below.

1.7.4 Pressure Input

1. Scroll to a *Fixed* pressure value or to set up the option card in *Slot 1* that will supply the live pressure input and press [Enter].

Note: *If Slot 1 contains an activated option card with an input assigned to* **Pressure, Slot 1** *appears as an option at the above prompt. If the process pressure is stable, a fixed value may be used, but most applications require a live pressure input. If there is no active option card for pressure, the meter assumes you are using a fixed pressure.*

2. Proceed to one of the following steps:
   - If you selected Fixed - proceed to Step 3.
   - If you selected Slot 1 - proceed to Step 4.
3. Enter the known *Fixed* process *Pressure* and press [Enter]. The meter will only accept values from 0 to 5,000 psia. Proceed to *Base Pressure* below.
4. Scroll to *Input A* or *Input B* and press [Enter]. The inputs were labeled during setup.

Note: *The set up of Input A is used as an example. Identical procedures would be used to set up Input B.*

1.7.5 Base Pressure

1. Enter the *Base Pressure* and press [Enter]. The ratio of this value to the actual pressure is used to calculate the standard mass flow rate.

1.7.6 Low Pressure Switch

1. Scroll to *Yes* or *No* to activate or deactivate the *Low Pressure Switch* software function and press [Enter].
2. Proceed to one of the following steps:
   - If you selected Yes - proceed to Step 3.
   - If you selected No - go to *Procedure Options* below.
3. Enter the *Pressure Limit*, the low pressure switch set point, and press [Enter]. The acceptable range is 0 to 5000 psia. The meter will stop taking readings if the pressure drops below this value.

Procedure Options

After completing the above steps, the XGF868i returns to the Channel PROGRAM window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

1.8 Entering Setup Data

The signal limits, response times, mass flow and multiple K factors for the XGF868i are specified via the **Setup** submenu. The following four submenus are included in this section:

- **Signal** - set the parameters related to the transducer signal (see below).
- **Default Setup** - reset all parameters to default values (*page 15*).
- **V averaging** - specify the response of the meter to step changes (*page 15*).
- **Advanced Features** - enable mass flow and enter K factors (*page 16*).

While following the programming instructions, refer to *Figure 29 on page 62*. Record all programmed data in Appendix B, *Data Records*.

1.8.1 Setting Transducer Signal Parameters

Use this option to set the limits for the incoming signal and other parameters affecting the transducer signal. For example, the programmed signal strength low limit may be used to determine the trigger point for an alarm.



CAUTION! **The Signal default settings are suitable for most applications. Consult with Panametrics before changing any of these parameters.**

Only after consulting the factory, complete the following steps to program the signal parameters:

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to Setup and press [Enter].
4. Scroll to SIGNL and press [Enter].
5. Use *Table 4 on page 13* to choose the desired values. Use the arrow keys to enter a value (or scroll to a value for a parameter with menu options) and press [Enter].

Procedure Options

After completing the above steps, the XGF868i returns to the Channel SET UP window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

Table 4: Transducer Signal Settings

Transducer Signal Parameters	Range	Default Value	Description
Signal Low Limit	-20 to 100	20	The E1:LOW SIGNAL error message appears when the signal strength falls below the programmed SIGNAL LOW LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Correlation Peak Limit	0 to 500	100	The **E4: SIGNAL QUALITY** error message appears when the signal quality falls below the programmed **COR. PEAK LIMIT** value. See Chapter 2 in the Service Manual for a discussion of error codes
Soundspeed+ - Limit	1 to 50%	20%	The E2:SOUNDSPEED error message appears when the calculated fluid sound speed differs from the fluid sound speed entered in the Channelx-System menu by more than the programmed SOUNDSPEED +– LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Velocity Low Limit	-500 to 500 ft/sec (-150 to 150 m/sec)	-150 ft/sec (-46 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity is less than the programmed VELOCITY LOW LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Velocity High Limit	-500 to 500 ft/sec (-150 to 150 m/sec)	150 ft/sec (46 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity exceeds the programmed VELOCITY HIGH LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Acceleration Limit	0 to 250 ft/s (0 to 76 m/s)	15 ft/s (5 m/s)	The **E6: CYCLE SKIP** error message appears when the calculated fluid velocity changes by more than the programmed **ACCELERATION LIMIT** value from one reading to the next. See Chapter 2 in the Service Manual for a discussion of error codes.
Amplitude Discriminator Low	0 to 100	14	The amplitude discriminator measures the transducer signal received by the Model XGF868i. The default value for the above parameter is 14, and values from 0 to 100 are acceptable. The **E5: AMPLITUDE** error message appears when the amplitude discriminator falls below the programmed **AMP. DISCRIM LOW** value. See Chapter 2 in the Service Manual for a discussion of error codes.
Amplitude Discriminator High	0 to 100	34	The amplitude discriminator measures the transducer signal received by the Model XGF868i. The default value for the above parameter is 34, and values from 0 to 100 are acceptable. The **E5: AMPLITUDE** error message appears when the amplitude discriminator exceeds the programmed **AMP. DISCRIM HIGH** value. See Chapter 2 in the Service Manual for a discussion of error codes.
Delta T Offset	-1000 to 1000 µsec	0 µsec	An offset between the upstream and downstream transit times is specified at this prompt.
Skan T Offset	–500 to 500 µsec	58 µsec	At this prompt, specify a time measurement offset that compensates for any shift resulting from cross-correlation. Set to 0 for active Skan T Offset.
% of Peak	1 to 100%	50%	The percentage of peak used to calculate the transit times and Delta T is specified at this prompt.

Table 4: Transducer Signal Settings (cont.)

Transducer Signal Parameters	Range	Default Value	Description
M>S Switch	0 to 250 µsec	50 µsec	If the burst mode is set to Skan/Measure (S/M), the meter switches from Skan to Measure Mode when Delta T is less than the **M>S_Switch** value. **DO NOT** change this value unless advised to do so by the factory.
# Shifts	0 to 10	3	The number of shifts corresponds to the actual number of transmits per cycle (number of signals added together in one direction to produce an averaged signal for one interrogation of the fluid) and need only be changed if the environment is very noisy or the acoustic signal is weak.
A Divisor	0.1 to 10	2.5	**A Divisor** is used to calculate the Measure Mode integrated threshold level and is not normally changed.
# Transmit Pulses	1 to 16	4	**# Transmit Pulses** specifies the number of pulses in a burst. For difficult conditions (i.e. long paths, high velocity or high temperature), settings as high as 16 may be necessary.
T Window (cycles)	0 to 1000	0	The XGF868i calculates the size of the transmit window based on pipe size and fluid sound speed. However, for diagnostic purposes, the window size may be reset.
R Window (cycles)	10 to 128	10	The XGF868i calculates the size of the receive window based on pipe size and fluid soundspeed. However, for diagnostic purposes, the window size may be reset.

1.8.2 Initializing Setup Parameters - Default Setup

Use this option to initialize (reset) all of the parameters within the **Setup** menu to their default values. Complete the following steps to reset all of the parameters:

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to Setup and press [Enter].
4. Scroll to INIT. Press [Enter].
5. Scroll to Yes to initialize default parameters or No to abort this command. Press [Enter].

Procedure Options

After completing the above steps, the XGF868i returns to the Channel Set up window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] four times.

1.8.3 Setting Response Time - V Averaging

Use this option to specify the number of readings that occur before the meter will respond to a step change in flow rate. In general, the smaller the number of readings, the less steady the display will appear. Complete the following steps to set the response time:

IMPORTANT: Do not change this number unless instructed to do so by Panametrics personnel.

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to Setup and press [Enter].
4. Scroll to AVRG and press [Enter].
5. Scroll to the *Response Time* (in number of readings) from the pull-down menu and press [Enter]. For best results, select a value of 30 to ensure the most stable signal.

Procedure Options

After completing the above steps, the XGF868i returns to the Channel SET UP window. Do one of the following:

- To continue programming, refer to Appendix A, M*enu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] four times.

1.8.4 Using Advanced Features

This option enables you to access the more advanced features of the meter. In this option you can do the following:

- *Enter a table of K factors* - to compensate for non-linear flow rates (see below).
- *Enable mass flow* - calculated for static fluid density (see the next page).

1.8.4.1 Entering K Factors

Use this option to enter a table of K factors. K factors are used to create a curve for the flow range (based on velocity) that compensates for non-linear flow rates. The meter accepts from 2 to 20 data pairs. Complete the following steps to enter multiple K factors for velocity values:

Note: *The K factors are supplied by the factory. Without them the K factor table cannot be edited.*

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to Setup and press [Enter].
4. Scroll to ADVAN. Press [Enter].
5. Scroll to MULTK, and press [Enter].
6. Scroll to *Yes* to activate, or to *No* to deactivate multiple K factors, and press [Enter].

Note: *If you selected No, go to* Procedure Options *below.*

7. Scroll to the *Custom Type* of K factor desired: CstV (velocity) or CstR (Reynolds). Press [Enter].
8. Scroll to *Yes* to *Edit Table,* or to *No* to retain the current values, and press [Enter].

Note: *If you scroll to No, go to* Procedure Options *on the next page.*

1.8.4.2 Editing K Factors

1. Use the arrow keys to enter the number of K factors (2 to 20) in the table and press [Enter].
2. Enter the velocity (or Reynolds) value for K factor number "X" and press [Enter].

Note: *When editing the K factor table, the velocities must be entered in increasing order.*

3. Enter the K factor corresponding to velocity number "X" (0.333 to 3.0) and press [Enter].
4. Repeat Steps 2 and 3 for each pair of values.

Procedure Options

After completing the previous steps, the XGF868i returns to the Advanced Features window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] five times.

1.8.4.3 Activating Mass Flow

Use this option to calculate mass flow from a static fluid density. Complete the following steps to enter the static density of the fluid:

IMPORTANT: The XGF868i can use a static density from either a single value of density (Rho), or from the live or fixed temperature and pressure inputs, as programmed in the I/O menu, along with a single entered value of Molecular Weight (MW). This is done by setting the Mass flow calculation prompt to Yes **and following the prompts below to calculate mass flow.**

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to Setup and press [Enter].
4. Scroll to ADVAN. Press [Enter].
5. Scroll to MASS, and press [Enter].
6. Scroll to *Yes* to activate, or to *No* to deactivate *Static Density*, and press [Enter].

Note: *If you scroll to No, go to* Procedure Options *below.*

7. Scroll to the *Density Type* (molecular weight (Mw)) and press [Enter].
8. Do one of the following:
   - If you selected Rho - proceed to Step 9.
   - If you selected Mw - proceed to Step 11.
9. Scroll to the type of volumetric units (standard - StVOL or actual- AcVOL) for the measurement data display and press [Enter].
10. Enter the *Fluid Density* (0.00001 to 0.100 lb/ft^3 or 0.00001 to 123.18 kg/m^3) and press [Enter]. Go to *Procedure Options* below.
11. Enter the *Molecular Weight* and press [Enter].

Procedure Options

After completing the steps on the previous page, the XGF868i returns to the Advanced Features window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] five times.

1.9 Entering Global Data

The **Global** menu is used to enter information that is not specific to either of the individual channels. Information programmed via this menu is used to compute parameters such as the sum, difference or average of the channel 1 and channel 2 signals (for a 2-Channel meter). In addition, several general system parameters may be entered in the **Global** menu.

IMPORTANT: When calculating the **sum**, **difference** or **average** readouts, data from the **Global-System** submenu is used. Any conflicting data entered in the **ChannelX-System** submenu is overridden.

The following submenus are included in the **Global** menu:

- **SYSTM** - use to specify the units of measure used in calculations (see the next page).
- **I/O** - used to set up error handling and to configure analog inputs and outputs (see page 20).
- **COMM**- used to set up the serial communications port (see page 26).

Based on the selection made above, proceed to the appropriate section of this chapter for instructions. While following the programming instructions, refer to *Figure 30 on page 63*. Remember to record all programmed data in Appendix B, *Data Records*.

1.9.1 Entering Global System Data

This menu enables you to select the system units that the XGF868i will use when channel data is added, subtracted or averaged together.

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to SYSTM and press [Enter].
4. At the *System Units* prompt, scroll to *Eng* to display measurements in English units or to *Metrc* for metric units and press [Enter].
5. Scroll to the desired *Pressure Units* (absolute or gauge) and press [Enter].
6. Do one of the following:
   - If absolute was selected, proceed immediately to Step 7.
   - If gauge was selected, enter the desired *Atmospheric Pressure*, press [Enter] and proceed to the next step.

1.9.1.1 Selecting Volumetric Units

1. Scroll to the desired *Volumetric Units* for the flow rate display and press [Enter]. Available units are listed in *Table 5* below.

Table 5: Available Volumetric/Totalizer Units

English	Metric
ACF = Actual Cubic Feet	ACM = Actual Cubic Meters
KACF = Thousands of ACF	KACM = Thousands of ACM
MMACF = Millions of ACF	MMACM = Millions of ACM
SCF = Standard Cubic Feet	SCM = Standard Cubic Meters
KSCF = Thousands of SCF	KSCM = Thousands of SCM
MMSCF = Millions of SCF	MMSCM = Millions of SCM

2. Scroll to the desired *Time* units for the flow rate display and press [Enter].
3. Scroll to the desired number of *Vol Decimal Digits* (digits to the right of the decimal point in the volumetric flow rate display) and press [Enter].

1.9.1.2 Selecting Totalizer Units

1. Scroll to the desired *Totalizer Units* for the totalized flow rate display and press [Enter]. Available units are listed in *Table 5*.
2. Scroll to the desired number of *Tot Decimal Digits* (digits to the right of the decimal point in the totalized flow rate display) and press [Enter].
3. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting the Mass Flow Units* below.
   - If MASS FLOW is OFF, the meter returns to the Channel PROGRAM window. Go to *Procedure Options* on the following page.

Note: *To activate mass flow, refer to* page 17. *The following prompts will only appear if mass flow is activated for both channels.*

1.9.1.3 Selecting Mass Flow Units

1. Scroll to the desired *Mass Flow* units for the flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at System Units (see *Table 6* below).

Table 6: Available Mass Flow Units

English	Metric
LB = Pounds	KG = Kilograms
KLB = Thousands of LB	Tonne = Metric Tons (1,000 KG)
MMLB = Millions of LB	
Tons (2,000 LB)	

2. Scroll to the desired *Mass Flow Time* units for the mass flow rate display and press [Enter].
3. Scroll to the desired number of *Mdot Decimal Digits* (digits to the right of the decimal point in the mass flow rate display) and press [Enter].
4. Scroll to the desired *Mass (Totalizer)* units for the totalized mass flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at the *System Units* prompt.
5. Scroll to the desired number of *Mass Decimal Digits* (digits to the right of the decimal point in the totalized mass flow rate display) and press [Enter].

Procedure Options

After completing the previous steps, the XGF868i returns to the Global PROGRAM window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] twice.

1.9.2 Setting Up Inputs and Outputs

Set up the XGF868i inputs and outputs via the **I/O** submenu. While following the programming instructions, refer to *Figure 30 on page 63* and *Figure 31 on page 64*. The following three submenus are included in this section:

- **ERROR** - program the meter's response during an error condition (see below)
- **OPTN** - set up any option cards and the **Slot 0** analog outputs (*page 21*)
- **LCD** - set up the LCD display. Refer to Chapter 2, *Displaying Data.*

Note: *In this section,* **Slot 1** *appears as an option only if a suitable option card is installed in Slot 1.*

Proceed to the appropriate section to program the option selection made at the above prompt. Remember to record all programmed data in Appendix B, *Data Records*.

1.9.2.1 Selecting Error Handling

This menu option permits programming of the manner in which the XGF868i outputs respond during an error condition. See Chapter 2, *Error Codes*, in the *Service Manual* for a discussion of the built-in error codes. To access this submenu:

Note: *The 2-Channel meters have an additional option for error handling.*

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to I/O and press [Enter].
4. Scroll to ERROR and press [Enter].
5. Scroll to the desired option for error handling and press [Enter]. If you select Error Level in mA, proceed to Step 6 on the next page. (See *Table 7 on page 20* for a description of error handling options available and how the totalizers and analog outputs respond to them.)

Note: *The error responses listed in* Table 7 below *apply only to the* **Channelx** *measurement mode and to the* **Sum/Difference** *measurement modes, if either or both channels are in error. Error handling in the* **Average** *measurement mode is set in Step 7 on* page 20.

Table 7: Error Response Options

Option	Output Response	Totalizer Response
HOLD	Holds the last "good" reading.	Continues to totalize, based on last "good" flow reading.
LOW	Forces outputs to the low set point.	Stops totalizing.
HIGH	Forces outputs to the high set point.	Stops totalizing.
HHIGH	Forces outputs ≈10% above the high set point.	Stops totalizing.
OTHER	Forces outputs to the entered mA level.	Stops totalizing during critical errors.

6. Use the arrow keys to enter a specific current that will signify meter errors and press [Enter].
7. Scroll to *Yes* or *No* to enable or disable 2-path error handling. Specific responses of the display and the totalizer are listed in *Table 8* below. The **2-path error handling** option is intended for applications where two sets of transducers are installed in the same location in the same pipe to improve accuracy and the meter is operated in **AVE** mode. With this function enabled, the Model XGF868i performs error handling only if both channels are in error. If this function is disabled, error handling occurs when either channel goes into error.

Table 8: 2-Path Error Response Options

Option	Display Response	Totalizer Response
No	Displays the average of **Channel 1** and **Channel 2**, regardless of the error state of either channel.	Outputs the average of Channel 1 and Channel 2 totals, regardless of the error state of either channel.
Yes	1. If one channel is in error, the other channel's value is displayed as the average. 2. If both channels are in error, the last average reading is held.	1. If one channel is in error, totalizing continues. 2. If both channels are in error, totalizing stops.

Procedure Options

After completing the above steps, the XGF868i returns to the **Global I/O** window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] four times.

1.9.2.2 Setting Up Slot 0 and Slot 1 Inputs/Outputs

The XGF868i has two built-in analog outputs, which are assigned to **Slot 0**. Also, a variety of input/output option cards may be installed in **Slot 1**. See Chapter 1, *Installation*, of the *Startup Guide* for a complete description of the available option cards.

To set up option cards, refer to one of the following sections:

- Analog Outputs - see *Section 1.9.2.3* below.
- Analog Inputs - see *Section 1.9.2.4 on page 23*
- RTD - see *Section 1.9.2.5 on page 24*
- Frequency Outputs - see *Section 1.9.2.6 on page 25*

1.9.2.3 Analog Outputs

While following the programming instructions, refer to *Figure 31 on page 64*.

Accessing the Output

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to I/O and press [Enter].
4. Scroll to OPTN and press [Enter].
5. Scroll to Slot 0 or Slot 1, depending on which output you want to set up.
6. Scroll to the desired *Output* and press [Enter].

Note: *Output letters (A, B, etc.) correspond to the output wiring terminal numbers from top to bottom. For example, Output A corresponds to pins 1,2 and 3; Output B corresponds to pins 4, 5 and 6; etc.*

Setting Up the Output Scale

1. Scroll to the desired output scale and press [Enter].
2. If you selected *Off*, the XGF868i returns to the I/O window. Go to *Procedure Options* on *page 23*.
3. Scroll to the desired *Channel* option (CH1, CH2, SUM, DIF or AVE) and press [Enter].
4. Scroll to the desired *Measurement Parameter* and press [Enter]. See Table 9 below for a description of the available options.
5. At Zero, enter a value for the low end of the analog output range and press [Enter].
6. At Full, enter a value for the high end of the analog output range and press [Enter].

Table 9: Available Measurement Parameters

Option Bar	Description	Good	Bad
VEL	Displays the flow velocity.	N.A.	N.A.
VOLUM	Displays the volumetric flow.	N.A.	N.A.
+TOTL	Displays the forward totalized volume flow.	N.A.	N.A.
-TOTL	Displays the reverse totalized volume flow.	N.A.	N.A.
TIME	Displays the total flow measurement time.	N.A.	N.A.
MDOT	Displays the mass flow.	N.A.	N.A.
+MASS	Displays the forward totalized mass flow.	N.A.	N.A.
-MASS	Displays the reverse totalized mass flow.	N.A.	N.A.
SS up	Displays the signal strength for the upstream transducer.	50–75	<50 or >75
SS do	Displays the signal strength for the downstream transducer.	50–75	<50 or >75
SNDSP	Displays the measured speed of sound in the gas.	N.A.	N.A.
Tup	Displays the upstream ultrasonic signal transit time.	N.A.	N.A.
Tdown	Displays the downstream ultrasonic signal transit time.	N.A.	N.A.
DELTA	Displays the transit time difference between the upstream and downstream signals.	N.A.	N.A.
Tot K	K factor, based on the Reynolds number.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default).	N.A.	N.A.
Qup	Displays the signal quality for the upstream transducer.	≥1200	–400 to +400
Qdown	Displays the signal quality for the downstream transducer.	≥1200	–400 to +400
AMPup	Displays the value for the signal amplitude of the upstream transducer.	24 ± 5	<19 or >29
AMPdn	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29

Table 9: Available Measurement Parameters

Option Bar	Description	Good	Bad
CNTup	Displays the AGC DAC count for the upstream gain setting.	N.A.	N.A.
CNTdn	Displays the AGC DAC count for the downstream gain setting.	N.A.	N.A.
P#up	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
P#dn	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
TEMP	Displays the gas temperature (from 0/4-20 mA input).	N.A.	N.A.
PRESR	Displays the gas pressure (from 0/4-20 mA input).	N.A.	N.A.
Mw	Displays the molecular weight.	N.A.	N.A.
z	Displays the compressibility.	N.A.	N.A.
AcVOL	Displays actual volumetric flow.	N.A.	N.A.
StVOL	Displays standard volumetric flow.	N.A.	N.A.
Tu S[1]	Displays Skan transit time upstream.	N.A.	N.A.
Td S[1]	Displays Skan transit time downstream.	N.A.	N.A.
DT S[1]	Displays Skan Delta T.	N.A.	N.A.
Tu M[1]	Displays Measure transit time upstream.	N.A.	N.A.
Td M[1]	Displays Measure transit time downstream.	N.A.	N.A.
DT M[1]	Displays Measure Delta T.	N.A.	N.A.
Vinst	Displays the instantaneous velocity.	N.A.	N.A.
[1]available only if Burst Mode = S/M			

Note: *The measurement units that appear in these prompts are those selected in the* **Global-System** *window earlier in this section.*

Procedure Options

After completing the above steps, the XGF868i returns to the I/O window. Do one of the following:

- To continue programming, refer to Appendix A, M*enu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

1.9.2.4 Analog Inputs

Refer to *Figure 31 on page 64*, and complete the following steps to set up the analog inputs of an option card installed in **Slot 1**:

Accessing the Input

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to I/O and press [Enter].
4. Scroll to OPTN and press [Enter].
5. Scroll to Slot 1 and press [Enter].
6. Scroll to the desired *Input* and press [Enter].

Note: *Input letters (A, B, etc.) correspond to input wiring terminal numbers from top to bottom (e.g. Input A corresponds to pins 1,2 and 3; Input B corresponds to pins 4, 5 and 6; etc.).*

Setting Up the Input

1. Enter a *Label* of up to eight characters for input and press [Enter].
2. Scroll to the desired input *Measurement* and press [Enter]. Do one of the following:
   - If **Off** was selected, go to *Procedure Options* below.
   - If **Pressure** or **Temperature** was selected, proceed to Step 5.
   - If **Special** was selected to set up the input as a live special input, proceed to the next step.
3. Use the arrow keys to enter a *Name* for the input and press [Enter].
4. Use the arrow keys to enter a *Unit* of measurement for the input and press [Enter].
5. Use the arrow keys to enter a value (a temperature value for special inputs) for the low end of the analog input range and press [Enter].
6. Use the arrow keys to enter a value (a temperature value for special inputs) for the high end of the analog input range and press [Enter].

Procedure Options

After completing the above steps, the XGF868i returns to the I/O window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

1.9.2.5 RTD Inputs

Option cards with RTD inputs have a temperature range of –148 to 662°F (–100 to 350°C). While following the programming instructions, refer to Figure 31 on page 64, and complete the following steps to set up the RTD inputs of an option card installed in Slot 1.

Accessing the Input

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to I/O and press [Enter].
4. Scroll to OPTN and press [Enter].
5. Scroll to Slot 1 and press [Enter].
6. Scroll to the desired *Input* and press [Enter].

Note: *Input letters (A, B, etc.) correspond to input wiring terminal numbers from top to bottom (e.g. Input A corresponds to pins 1,2 and 3; Input B corresponds to pins 4, 5 and 6; etc.).*

Setting Up the RTD Input

1. Enter a *Label* for the RTD input and press [Enter].
2. Scroll to the desired input type and press [Enter]. Do one of the following:
   - If **Off** was selected, go to *Procedure Options* below.
   - If **Temperature** was selected, proceed to the next step.
3. Enter a temperature value for the *Low* end of the analog input range and press [Enter].
4. Enter a temperature value for the *High* end of the analog input range and press [Enter].

Procedure Options

After completing the above steps, the XGF868i returns to the I/O window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] four times.

1.9.2.6 Frequency Outputs

The frequency output issues a continuous signal with a frequency proportional to the selected measurement. Refer to *Figure 31 on page 64*, and complete the following steps to set up the totalizer outputs of an option card installed in **SLOT 1**:

Accessing the Frequency Output

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to I/O and press [Enter].
4. Scroll to OPTN and press [Enter].
5. Scroll to Slot 1 and press [Enter].
6. Scroll to the desired *Output* and press [Enter].
7. If you selected *Off*, the XGF868i returns to the Input/Output window. Go to *Procedure Options* on the following page.

Note: *Output letters (A, B, etc.) correspond to the output wiring terminal numbers from top to bottom (e.g. Output A corresponds to pins 1,2 and 3; Output B corresponds to pins 4, 5 and 6; etc.).*

Setting Up the Frequency

1. Scroll to the desired *Channel* option and press [Enter].
2. Scroll to the desired *Measurement* parameter and press [Enter]. See *Table 9* for a description of the available options. Refer to the *Service Manual* for a description of diagnostic parameters.

Note: *The measurement units that appear in these prompts are those selected in the* **Global-System** *window earlier in this section.*

3. Use the arrow keys to enter a value for the *Low* end of the frequency output range and press [Enter].

Note: *A complete pulse consists of equal amounts of* ON *and* OFF *times. Choose a value that is compatible with the frequency counter to be used.*

4. Use the arrow keys to enter a value for the *High* end of the frequency output range and press [Enter].
5. Use the arrow keys to enter a value between 1 and 10,000 for the *Frequency* at full scale and press [Enter].

Procedure Options

After completing the above steps, the XGF868i returns to the I/O window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

1.9.3 Configuring the Communications Port

The XGF868i flowmeter is equipped with an RS232 serial interface. The meter can be configured with a MODBUS option card for MODBUS communications, a Foundation Fieldbus option card for Foundation Fieldbus communications, an Ethernet option card for Ethernet communications, or with a MODBUS/TCP option card for MODBUS communication over the Ethernet, if desired.

Note: *To set Fieldbus communications parameters, see Appendix E,* Foundation Fieldbus Communications.

The serial port is used to transmit stored data and displayed readings to a personal computer by connecting the meter's serial interface to the serial port of the PC. In addition, the XGF868i can receive and execute remote commands, using *PanaView* software via this link.

Use the **COMM** submenu to set the communications port and MODBUS parameters. While programming the meter, refer to *Figure 30 on page 63*.

1.9.3.1 Setting Up the Serial Port

Use the steps below to configure the communications port:

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to COMM and press [Enter].
4. Enter a *Meter Address* (between 1 and 127) and press [Enter]. (The default address is 1.)

A meter address is necessary for communication with the Panametrics *PanaView* software. See Appendix C, *Programming the XGF868i with PanaView™*, or the *PanaView™ User's Manual* (910-211) for more information.

IMPORTANT: If the meter address or baud rate is changed, communication with PanaView must be re-established with the new parameters.

5. Scroll to the desired *Baud Rate* and press [Enter]. (Available baud rates extend from 300 to 19200.)
6. If you have the standard RS232 serial interface, go to *Procedure Options* on the next page.

1.9.3.2 Setting Up MODBUS Communications

When equipped with an optional MODBUS output card, the XGF868i can transmit flow data serially to a flow computer, or SCADA, using a Gould-type RTU protocol. Thus only the MODBUS function command, 3 (read multiple registers), 6 (write multiple registers) is valid. The XGF868i uses the following format for the data exchange:

- The *Send* command (initiated by the host flow computer or controller) comes in the form:
  [time delimiter]<Addr><3><First Register MSB>
  <First Register LSB> <Register Count MSB>
  <Register Count LSB><CRC Low><CRC High>[time delimiter]
- The *Response* (initiated by the host flow computer or controller) comes in the form:
  [time delimiter]<Addr><3><Byte count><Data.....>
  <CRC Low><CRC High>[time delimiter]

The format for the returned data types is:

- Integer (16 bit Integer) <MSB><LSB>
  1 Register - 16 bit integer
- Integer (32 bit IntegerI) <MSB><LSB><LSB><LSB>
  2 Register - 32 bit integer
- Floating Point (FP)<EXP><MAN><MAN><MAN>
  2 Registers - 32 bit IEEE floating point number

Use the steps below to configure MODBUS communications:

IMPORTANT: The XGF868i MODBUS communications settings chosen in the next four steps must match those of the MODBUS control system.

1. Scroll to the desired *MODBUS Baud Rate* and press [Enter].
2. Scroll to the *MODBUS Parity* and press [Enter].
3. Scroll to the *MODBUS Stop Bits* and press [Enter].
4. Enter a MODBUS *Meter Address* (between 1 and 254) and press [Enter]. (The default address is 1.)

IMPORTANT: You must reboot the XGF868i to load the new settings.

Procedure Options

After completing the above steps, the XGF868i returns to the Global PROGRAM window. Do one of the following:

- Refer to the section *Requesting Parameters Using MODBUS* on the following page to retrieve data from the XGF868i using MODBUS.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

1.9.4 Requesting Parameters Using MODBUS

To request specific parameters from the XGF868i via the MODBUS, the control system must enter the appropriate register number. Only registers 1 through 90 are available for MODBUS communications, while registers 508 through 512 are used by the XGF868i to store the MODBUS parameters. For details, see *Table 10* below.

Table 10: MODBUS Registers for a 2-Channel XGF868i

MODBUS Reg #	DPR Hex Addr	Description	Scaling (decimal places)	Size in Bytes
1	0	1"Clear Ch1 Totalizers"	--	2 (16 bit signed)
2	2	1"Clear Ch2 Totalizers"	--	2 (16 bit signed)
3	4	Ch1 Velocity	2	4 (2 16-bit int)
5	8	Ch1 Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)
7	C	Ch1 Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)
9	10	Ch1 Fwd Totals	#T DIGITS	4 (2 16 bit int)
11	14	Ch1 Rev Totals	#T DIGITS	4 (2 16 bit int)
13	18	Ch1 #Tot Digits	0	2
14	1A	Ch1 Mass Flow	#M DIGITS	4 (IEEE 32 bit)
16	1E	Ch1 Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)
18	22	Ch1 Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)
20	26	Ch1 #Mass Tot Digits	0	2
21	28	Ch1 Timer	2	4 (2 16-bit int)
23	2C	Ch1 Error Code	0	2
24	2E	Ch1 Sound Speed	3	4 (2 16-bit int)
26	32	Ch1 Molecular Weight	4	4 (2 16-bit int)
28	36	Ch1 Sig Strength Upstream	1	4 (2 16-bit int)
30	3A	Ch1 Sig Strength Downstream	1	4 (2 16-bit int)
32	3E	Ch1 Temperature	2	4 (2 16-bit int)
34	42	Ch1 Pressure	3	4 (2 16-bit int)
36	46	Ch2 Velocity	2	4 (2 16-bit int)
38	4A	Ch2 Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)
40	4E	Ch2 Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)
42	52	Ch2 Fwd Totals	#T DIGITS	4 (2 16 bit int)
44	56	Ch2 Rev Totals	#T DIGITS	4 (2 16 bit int)
46	5A	Ch2 #Tot Digits	0	2
47	5C	Ch2 Mass Flow	#M DIGITS	4 (IEEE 32 bit)
49	60	Ch2 Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)
51	64	Ch2 Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)
53	68	Ch2 #Mass Tot Digits	0	2
MODBUS Reg #	DPR Hex Addr	Description	Scaling (decimal places)	Size in Bytes
54	6A	Ch2 Timer	2	4 (2 16-bit int)
56	6E	Ch2 Error Code	0	2
57	70	Ch2 Sound Speed	3	4 (2 16-bit int)
59	74	Ch2 Molecular Weight	4	4 (2 16-bit int)

Table 10: MODBUS Registers for a 2-Channel XGF868i

61	78	Ch2 Sig Strength Upstream	1	4 (2 16-bit int)
63	7C	Ch2 Sig Strength Downstream	1	4 (2 16-bit int)
65	80	Ch2 Temperature	2	4 (2 16-bit int)
67	84	Ch2 Pressure	3	4 (2 16-bit int)
69	88	Avg Velocity	2	4 (2 16-bit int)
71	8C	Avg Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)
73	90	Avg Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)
75	94	Avg Fwd Totals	#T DIGITS	4 (2 16 bit int)
77	98	Avg Rev Totals	#T DIGITS	4 (2 16 bit int)
79	9C	Avg #Tot Digits	0	2
80	9E	Avg Mass Flow	#M DIGITS	4 (IEEE 32 bit)
82	A2	Avg Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)
84	A6	Avg Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)
86	AA	Avg #Mass Tot Digits	0	2
87	AC	Avg Timer	2	4 (2 16-bit int)
89	B0	[5]Avg Error Code	0	2
90	B2	Avg Sound Speed	3	4 (2 16-bit int)
508	3F6	[2]MODBUS baud rate	0	2
509	3F8	[3]MODBUS parity	0	2
510	3FA	[4]MODBUS stop bits	0	2
511	3FC	MODBUS meter addr	0	2
512	3FE	RESERVED	---	---

1. **Clear Totalizers:**
   Flag from the 8051 to clear either the Channel 1 or Channel 2 totalizers.
2. **MODBUS baud rate:**
   5 = 2400, 6 = 4800, 7 = 9600
3. **MODBUS parity:**
   0 = none, 1 = odd, 2 = even
4. **MODBUS stop bits:**
   1 = 1 stop bit, 2 = 2 stop bits
5. **AVG Error Code:**
   0=Both Ch1 and Ch2 are in error.
   1=Ch1 only is in error
   2=Ch2 only is in error
   3=Both channels are error free.

1.9.5 Activating Security

In order to prevent unauthorized tampering with the flowmeter's programming, the XGF868i is equipped with a security feature that locks all the keys except [PROG] (which, when pressed, requires the password).

When the system is locked, access to the menus will be denied unless the correct password is entered. The XGF868i is shipped with a default password (2719 and three spaces). For increased security, the default password should be changed.

IMPORTANT: Once the system has been locked, it can only be unlocked by entering the password, because access to the SECUR submenu is restricted.

While following the programming instructions, refer to the menu map in Figure 30 on page 63.

IMPORTANT: It is recommended that all program parameters be recorded before changing the password. (This information should be recorded in Appendix B, Data Records, as a matter of routine.) If the password is lost, the site data is not retrievable and will have to be re-entered.

1. In the *Keypad Program*, scroll to **PROG** and press **[Enter]**.
2. From the **PROGRAM** menu, scroll to **GLOBL** and press **[Enter]**.
3. Scroll to **SECUR** and press **[Enter]**.
4. At the Lock Out prompt, scroll to **UNlck** to unlock the system and return to the initial **PROGRAM** menu, or scroll to **LOCK** to lock the system.

Note: *If the system was unlocked at the above prompt, the following steps do not appear.*

5. Enter the current or default Password and press **[Enter]**.
6. At the Edit Password prompt, scroll to **NO** and press **[Enter]** to leave the password unchanged, or scroll to **YES** to enter a new password.

IMPORTANT: Since the default password is printed in this manual, a new password should be entered. If the password is ever lost, contact the factory for assistance.

7. Enter the New Password and press **[Enter]**. Any combination of letters and numbers up to a total of 7 characters may be used as a password.
8. Verify the New Password by entering it again and press **[Enter]**. Be sure to record the new password in a safe place.

1.10 Exiting the User Program

After completing the **COMM** option, the XGF868i returns to the **Global PROGRAM** prompt. Press **[Escape]** twice to return to the *Keypad Program,* and a third time to return to the meter display. Then proceed to Chapter 3, *Operation*, of the *Startup Guide* for instructions on taking measurements, or refer to the appropriate chapters of this manual for detailed instructions on using the other features of the XGF868i flow transmitter.

Chapter 2. Displaying Data

2.1 Introduction

This chapter explains how to display measurement data using either of the available methods:

- **LCD Display** - show data on the built-in display
- **PanaView** - display data on a computer terminal using the optional PanaView software

2.2 Displaying Data with the LCD

When equipped with the Liquid Crystal Display (LCD), the XGF868i may be programmed to display up to four variables in sequence. In addition, the contrast of the LCD may be adjusted for optimum viewing. Proceed to the appropriate section for instructions, and refer to *Figure 30 on page 63* of Appendix A, *Menu Maps.*

2.2.1 Adjusting LCD Contrast

The LCD contrast may be adjusted through the *Keypad Program* to suit individual needs.

1. Press [Escape]. [Enter], [Escape].
2. In the *Keypad Program* window, scroll to CNTRS and press [Enter].
3. Scroll to *DARKN* or *LITEN* and press [Enter] until the screen shows the desired contrast.
4. When you have achieved the desired contrast, scroll to *STORE* to retain the setting, or to *ABORT* to leave the menu without changing the setting. In either case, the XGF868i returns to the *Keypad Program.*
5. Then press [Escape] to return to the display screen.

2.2.2 Programming the LCD

Note: *When you first initialize the XGF868i, the number of LCD parameters is set to OFF. You must program the LCD to display any measured parameters.*

Through the *Keypad Program*, you can program the LCD display to display up to four variables in sequence. Complete the following steps to program the LCD display:

1. Power up the XGF868i and wait until it has initialized.
2. Press [Escape], [Enter], [Escape].
3. In the *Keypad Program* window, scroll to PROG and press [Enter].
4. In the PROG menu, scroll to GLOBL and press [Enter].
5. Scroll to I/O and press [Enter].
6. Scroll to LCD and press [Enter].
7. The window now asks for the *# of LCD Parameters*. Scroll to the desired number (from OFF through 1-4 and KEY) and press [Enter].

The OFF setting switches the measurement display off, while the KEY setting enables users to change the measurement display via the arrow keys, without accessing the *Keypad Program*. If you select KEY:

- To view a different parameter, press the [v] or [w] keys to scroll through the various parameters.
- To scroll through the channel options on a two-channel XGF868i, press the [r] or [s] keys until you have reached the desired option.

2.2.2 Programming the LCD (cont.)

8. Scroll to the desired *Channel option*, as listed in *Table 11* below.

Table 11: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

9. For each channel, select the desired *Measurement Parameter*, as shown in Table 9.

Note: *The measurement units that appear in these prompts are those selected in the* **GLOBL-SYSTM** *menu earlier in this manual. Also, when differences in one channel's programming invalidate an output previously chosen for the other, the measurement defaults to the nearest selectable item in the parameter list.*

The previous two prompts repeat until all of the specified **# of LCD Parameters** have been set up. When all of the display parameters have been set up, the meter returns to the **Global I/O** window. To leave the *Keypad Program*, press the **[Escape]** key three times.

After leaving the *Keypad Program*, the XGF868i will reset itself and will begin to display the parameters specified in this section. If more than one parameter was set up, each of the parameters will be displayed in sequence, with a pause of several seconds between display changes.

2.3 Displaying Data on a Computer Terminal

The flow rate data collected by the XGF868i may be displayed in various formats on a remote computer terminal via the meter's RS232 serial port. This requires the use of the optional PanaView software. Refer to the instructions below to display data via PanaView.

2.3.1 Preparing for PanaView Programming

Before you attempt to communicate with the XGF868i, be sure you have linked your PC to the XGF868i via an RS232 interface. For details on wiring the interface, refer to *Wiring the Serial Port* in the *Startup Guide*, and to the document *EIA-RS Serial Communications* (916-054). You must also install PanaView, as discussed in the *PanaView User's Manual* (910-211), and in Appendix C, *Programming the XGF868i via PanaView™*.

1. Power up the XGF868i and wait until it has initialized.
2. Launch PanaView and wait until it initializes the XGF868i and displays the basic PanaView window.
3. As described in Appendix C, open the *Meter Browser* window and highlight the meter to be used.

At this time, any of PanaView's comprehensive data handling capabilities may be used. These include:

- Collecting and displaying live data in text format
- Collecting and displaying live data in graphical format
- Collecting and logging live data
- Displaying a log file in text format
- Displaying a log file in graphical format

To access PanaView's data handling options, pull down the *Output* menu, as shown in *Figure 2* below.

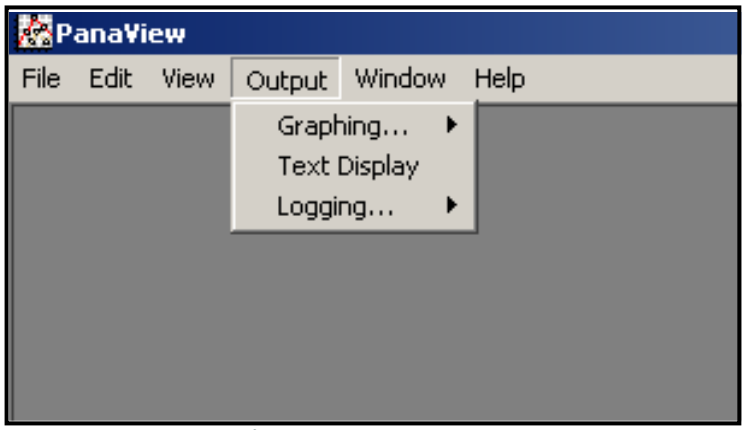


Figure 2: Output Menu

Proceed directly to the appropriate section for instructions on either of the following output options:

- *Text Display* output, discussed below
- *Graphing* output on *page 37*

Note: *For information on the* Logging *output, see Chapter 3,* Logging Data.

2.3.2 The Text Display Output

To collect data from the instrument and display it on a text screen, complete the following steps:

1. Complete Steps 1-3 on the previous page.
2. Pull down the *Output* menu and click on the *Text Display* option (see *Figure 2 on page 34*).

Note: *The* Text Display *window that appears after Step 2 is actually stacked on top of any previously opened windows (such as the* Meter Browser *window).*

3. Using the *Window* menu, arrange the open windows in the desired format. For this discussion, *Figure 3* below shows the *Text Display* window in its maximized (full-screen) size.

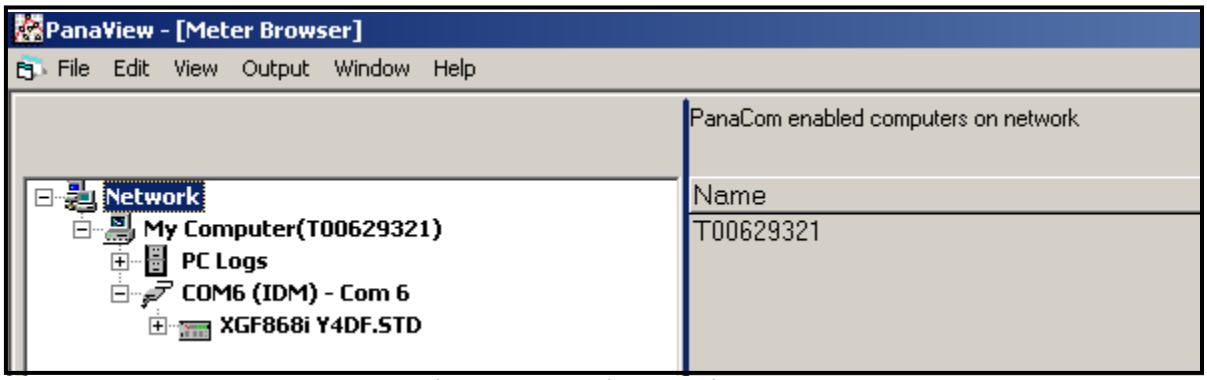


Figure 3: Text Display Window

Note: Figure 3 *above has been compressed both vertically and horizontally for improved clarity.*

4. The left pane of the *Text Display* window contains the standard PanaView network tree. Expand this tree as far as necessary, and double click on the desired process parameter to display it in the right pane of the window.
5. Before actual data values can be displayed in the text pane, activate one of the following data collection modes (refer to *Figure 3 on page 35*):
   - Click on the **[Get Once]** option button at the bottom of the right pane in the *Text Display* window. The current value of the selected process parameter, as specified in the PanaView network tree, is displayed in the right pane of the *Text Display* window.

or

   - Enter an *interval* in the text box at the bottom of the right pane in the *Text Display* window, or check the *Max. Comm Rate* box to collect readings as fast as the system allows (1 sec). Then, click on the **[Continuous]** option button to begin collecting data for display in the right pane of the *Text Display* window.

Note: *Any value entered in the* Interval *text box is overridden if the* Max. Comm Rate *box is checked.*

6. If the **[Continuous]** option was selected in Step 5 above, click on the **[Stop]** option button, which has replaced the original **[Continuous]** option button, to terminate data collection.

The *Text Display* window may be left open while other tasks are performed, or it may be closed by clicking on the lower **[X]** control button at the far right of the menu bar.

IMPORTANT: If you click on the upper **[X]** control button at the far right of the PanaView title bar, you will exit PanaView completely.

2.3.2.1 Displaying Multiple Process Parameters

The procedure for displaying a single process parameter in a text screen may be repeated to simultaneously display multiple process parameters. To do so, proceed as follows:

1. Display the first process parameter in a text screen, as described in the previous section.
2. Repeat Step 1 for any desired additional process parameters, by double clicking on them in the PanaView network tree. PanaView automatically tiles the multiple text screens in the right pane of the *Text Display* window.
3. As in any standard Windows application, the multiple text screens may be resized by dragging their borders. Also, the individual panes within a parameter's text screen may be resized by dragging the borders within that text screen.
4. To close an open text screen, right click anywhere within that screen (except in the title bar or the error section) and click on the **[Remove]** option that pops up in the context menu.

Note: *After resizing or removing any of the multiple text screens, the default tiled layout may be restored by opening the* "Window" *menu (see the* PanaView User's Manual*) and clicking on the* "Tile Output Displays" *option.*

2.3.2.2 Displaying Multiple Text Windows

The procedures for displaying one or more process parameters in a single *Text Display* window may be repeated to open multiple *Text Display* windows. To do so, proceed as follows:

1. To open another *Text Display* window, repeat the steps on *page 35* and *page 36*.
2. To display the desired process parameter(s) in the new window, repeat Steps 1-4 on *page 36*.
3. Arrange the multiple *Text Display* windows as desired via the *Window* menu.

2.3.3 Graphing the Output

To collect data from the instrument and display it graphically in a new format, complete the following steps:

2.3.3.1 Setting Up a Graph

1. Perform Steps 1-3 on *page 32*.
2. Pull down the *Output* menu and click on the *Graphing - New* option (see *Figure 2 on page 34*).

Note: *The* Graph *window is stacked on top of any previously opened windows (such as the* Meter Browser *window).*

3. Using the *Window* menu, arrange the open windows in the desired format. For this discussion, *Figure 4* below shows the *Graph* window in its maximized (full-screen) size.

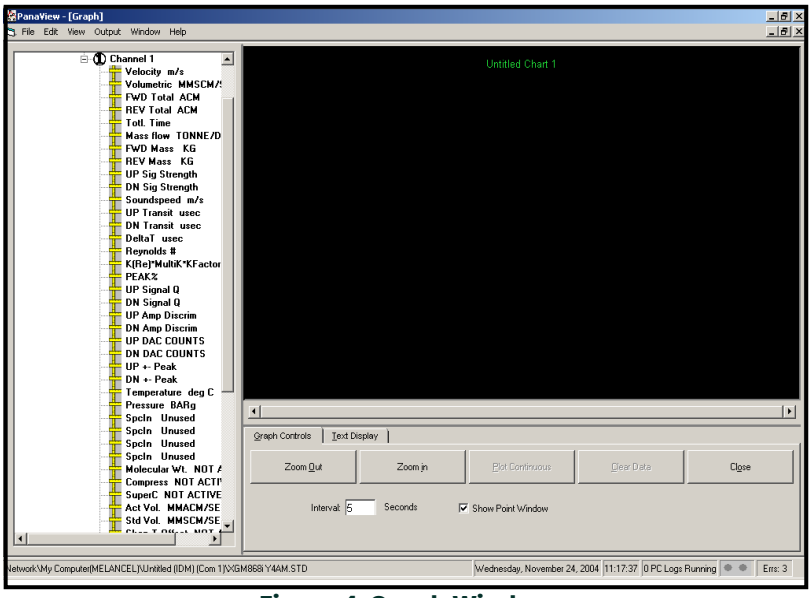


Figure 4: Graph Window

The *Graph* window shown above consists of three panes:

- *left pane* - PanaView network tree
- *top right pane* - graph with default chart style
- *bottom right pane* - graph controls or text display

Note: *The three panes of the* Graph *window may be resized by simply dragging their borders.*

2.3.3.2 Graphing Data

The PanaView network tree has already been described, and the display pane shows only a graph in the default style with no data points. The bottom right pane enables you to set up the graph. To begin graphing your data, proceed as follows:

1. Expand the network tree as far as necessary and double click on the process parameter to be graphed. The grid for the selected graph appears in the display pane, with *Time* as the x-axis and the parameter *Value* as the y-axis. In addition, a *legend* appears above the graph, which indicates the name, data point shape and line color for that parameter.
2. If desired, a second parameter may be added to the graph by repeating Step 1. In this case, the parameter "*Value*" is shown as a *right* y-axis (Y2).

Note: *Although only two parameters may be graphed for any one meter channel, the same two parameters may also be graphed for any other active meter channels.*

3. To begin plotting data for the selected parameter(s), enter a time *Interval* for data sampling in the text box provided (the default value is 5 seconds).
4. Click on the **[Plot Continuous]** control button to begin graphing the selected process parameter(s) as a function of time, at the interval specified in Step 3.
5. While PanaView is graphing the data, the following actions may be taken from the control pane:
   - change the sampling interval by entering a new value
   - click on the **[Zoom Out]** control button to increase the size of the intervals shown on the x-axis
   - click on the **[Zoom In]** control button to decrease the size of the intervals shown on the x-axis

Note: *The zoom buttons may be clicked multiple times to enhance the effect.*

   - click on the *Text Display* tab to view the data being graphed in the text format described in the previous section

When you have finished graphing your data, click on the **[Stop]** control button, which has replaced the original **[Plot Continuous]** control button.

For further information on setting up graph properties, refer to Chapter 5, *Displaying Data,* of the *PanaView User's Manual*.

2.3.4 Displaying Transducer Signals

Along with flow rate data, PanaView enables XGF868i users to read and plot transducer signals from the XGF868i.

1. From the *New Meter Browser*, highlight the XGF868i.
2. Right-click on the highlighted XGF868i and click on the *Properties* option, as shown in *Figure 5* below.

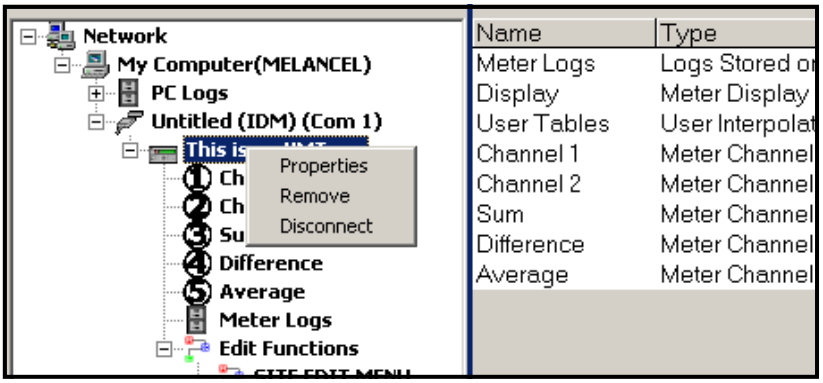


Figure 5: *Properties* Option in the *New Meter Browser*

The *Properties* window opens, as shown in *Figure 6* below.

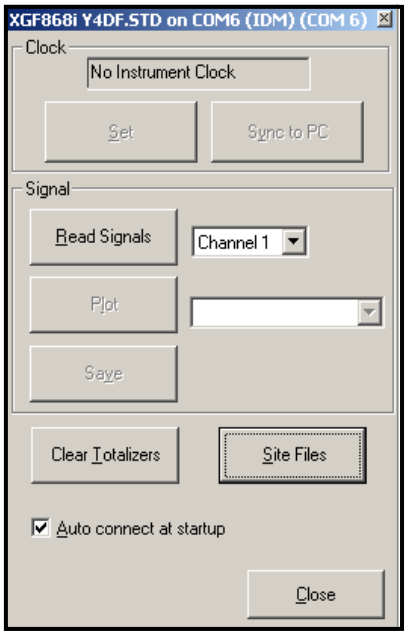


Figure 6: *Properties* Window

2.3.4.1 Reading Transducer Signals

3. To read a signal from the meter, click on the [Read Signals] button. (If the meter is a multi-channel instrument, open the Channel drop-down menu and click on the desired channel.) After a moment, the *Properties* window appears similar to *Figure 7* below.

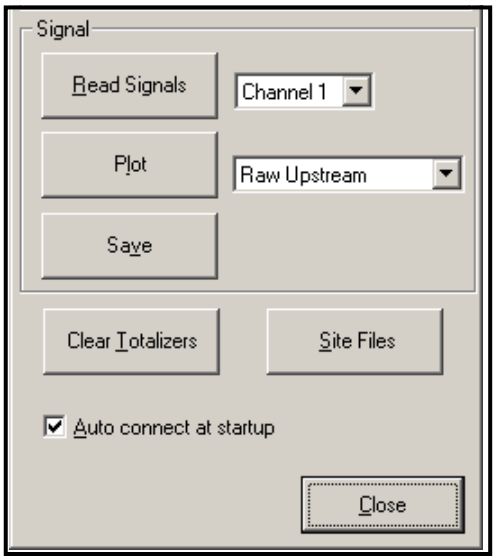


Figure 7: Active Signal Options

4. To select a different signal type, open the signal menu at the right (shown here with *Raw Upstream* highlighted) and click on the desired signal.

2.3.4.2 Plotting Transducer Signals

To plot the selected signal, click on [Plot]. A graphical window opens, as shown in *Figure 8* below.

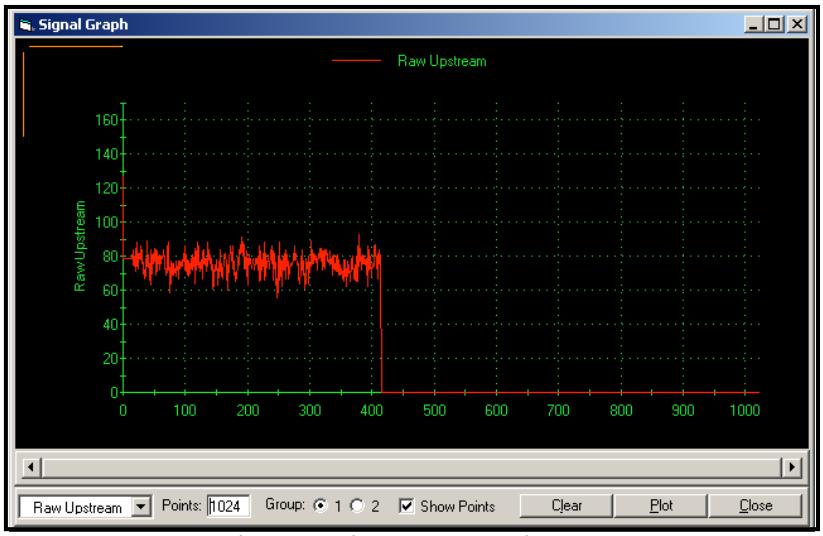


Figure 8: *Signal Graph* Window

2.3.4.3 Saving Transducer Signals

To save the raw signal, click on [Save]. A window opens similar to *Figure 9* below. Enter the desired name, and click on [Save] to save the signal as a text file.

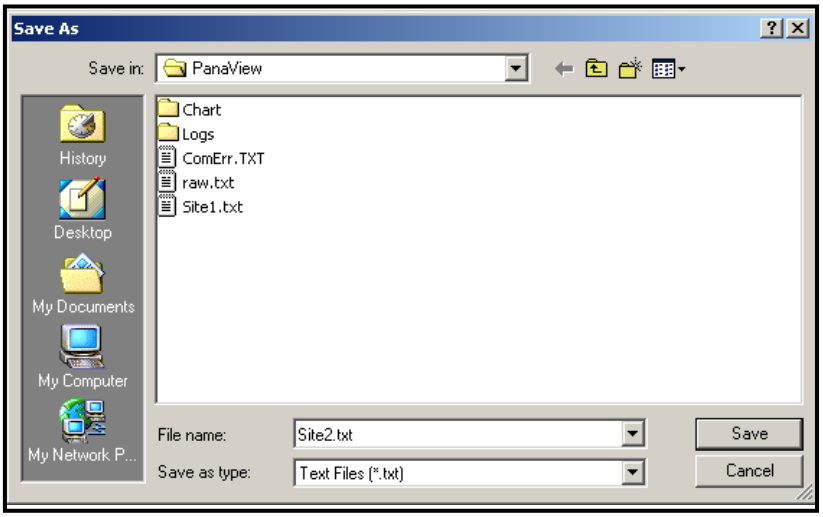


Figure 9: *Save As* Window

[no content intended for this page]

Chapter 3. Logging Data

3.1 Introduction

PanaView can create *PC log files* for the XGF868i for storage on the PC's hard drive.

This chapter explains how to use the XGF868i data logging capability with PanaView.

3.2 Logging with PanaView

PanaView is capable of creating and viewing log files of the following types:

- **meter logs** - log files stored in the XGF868i memory, as discussed above
- **PC logs** - log files stored on your PC's hard drive (see *page 46*)

To create or view logs of the above types, proceed to the appropriate section of this chapter.

3.3 Creating Meter Logs

To create a new meter log, complete the following steps:

1. From the *New Meter Browser* in PanaView, expand the network tree and open the *Edit Functions* option (described in Appendix C, *Programming the XGF868i via PanaView*). The menu will appear similar to *Figure 10* Below.

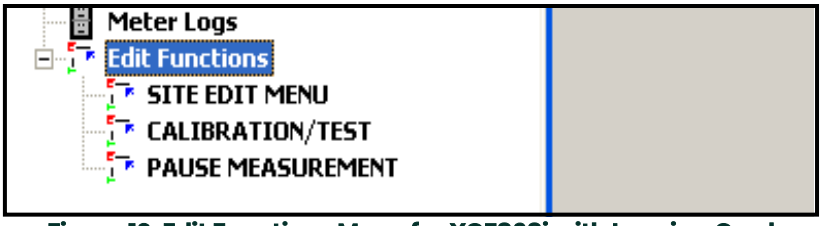


Figure 10: Edit Functions Menu for XGF868i with Logging Card

2. Double-click on the *Log Edit Menu*, as shown in *Figure 10* above. The window appears similar to *Figure 11* below.

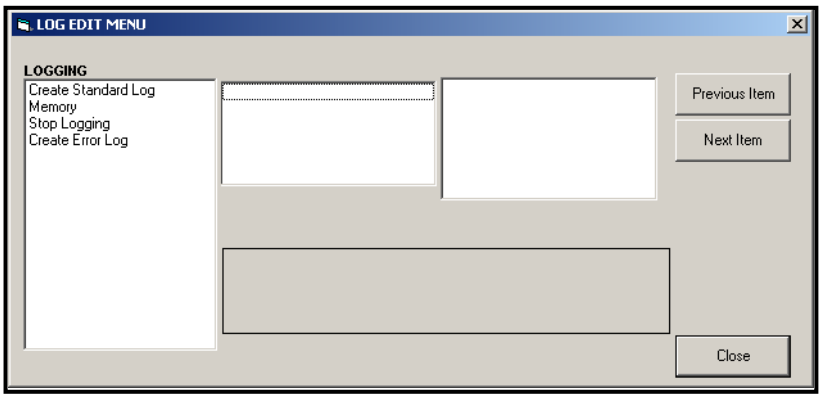


Figure 11: *Log Edit Menu* Window

3.3.1 Creating a Standard Meter Log

3. To create a standard meter log, complete the following steps:

a. Double-click on the *Create Standard Log* option.The window now appears similar to *Figure 12* below.

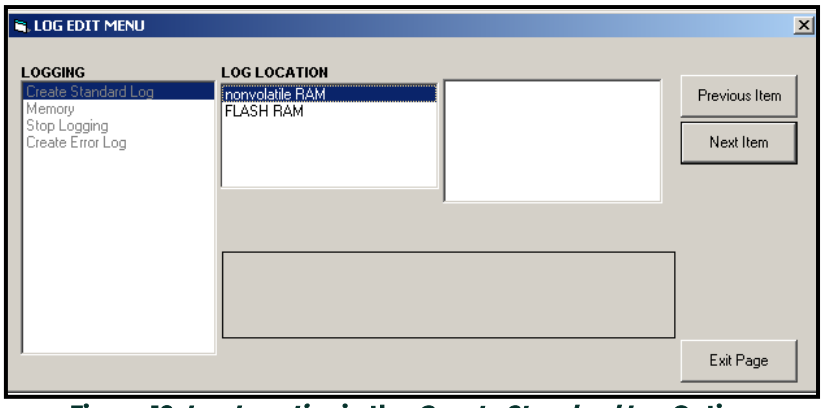


Figure 12: *Log Location* in the *Create Standard Log* Option

b. PanaView first asks for the *Log Location,* either flash or non-volatile RAM. Double-click on the desired location.

c. Now type the desired *Log Name* in the right window, and click **[Next Item]**.

d. Type the desired *Log Message* in the right window, and click **[Next Item]**.

e. PanaView now asks for the *Number of Variables* you wish to log. Type in the desired number (from 1 to 6), and click **[Next Item]**.

f. Double-click on the desired *Channel* for the first variable.

g. Scroll to and double-click on the desired *Measurement* to be logged.

h. Repeat steps f and g for the specified number of variables.

Note: *If you select a forward or reverse total, PanaView asks if you want to Reset Totals to 0? Double-click on Yes or No.*

i. PanaView indicates a given *StartTime*. Double-click on OK to agree to the given time, on *Now* to start the log immediately, or on *Edit* to change the starting time.

j. If you select *Edit,* PanaView asks first for the desired *Hour*, then for the *Minute*, and finally for the *Second*. For each parameter, type the desired number in the right window, and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

k. PanaView indicates a given *StartDate*. Double-click on *OK* to agree to the given day, on *Today* to start the log that day, or on *Edit* to change the starting date.

- If you select *Edit,* PanaView asks first for the desired *Year*, then for the *Month,* and finally for the *Day*. For each parameter, type the desired number in the right window, (or scroll to and click on the desired month) and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

l. PanaView indicates a given *End Time*. Double-click on OK to agree to the given time, on *Now* to start the log immediately, or on *Timed* to indicate a specific duration.

- If you select *Edit,* PanaView asks first for the desired *Hour*, then for the *Minute*, and finally for the *Second*. For each parameter, type the desired number in the right window, and click **[Next Item]** (or simply click **[Next Item] to step through the parameters).**
- If you select *Timed*, PanaView asks for the *Log Time* (duration). Scroll to and double-click on the desired length of time (from 10 minutes to 24 hours.) Then go to step m.

m. PanaView indicates a given *End Date*. Double-click on *OK* to agree to the given day, on *Today* to start the log that day, or on *Edit* to change the starting date.

- If you select *Edit,* PanaView asks first for the desired *Year*, then for the *Month,* and finally for the *Day*. For each parameter, type the desired number in the right window, (or scroll to and click on the desired month) and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

n. Scroll to and double-click on the desired *Time Increment* (from 5 seconds to 24 hours). PanaView indicates that the log has been created, and returns to the *Log Edit Menu.*

If an erroneous value has been entered, PanaView displays a *Log Creation Error* message. Otherwise, the program indicates that the log has been created, and returns to the *Log Edit Menu.*

3.3.2 Creating an Error Log

To create an error meter log, complete the following steps:

1. Double-click on the *Create Error Log* option.

a. PanaView first asks for the *Log Location,* either flash or non-volatile RAM. Double-click on the desired location.

b. Now type the desired *Log Name* in the right window, and click **[Next Item]**.

c. Type the desired *Log Message* in the right window, and click **[Next Item]**.

d. PanaView now asks for the *Number of Variables* you wish to log. Type in the desired number (from 1 to 6), and click **[Next Item]**.

e. Double-click on the desired *Channel* for the first variable.

f. Scroll to and double-click on the desired *Measurement*.

g. Repeat steps e and f for the specified number of variables.

- If you select a forward or reverse total, PanaView asks if you want to *Reset Totals to 0*? Double-click on *Yes* or *No*.

h. PanaView asks, *Is Log Circular?* Double-click on *Yes* or *No.*

i. PanaView indicates a given *StartTime*. Double-click on OK to agree to the given time, on *Now* to start the log immediately, or on *Edit* to change the starting time.

- If you select *Edit,* PanaView asks first for the desired *Hour*, then for the *Minute*, and finally for the *Second*. For each parameter, type the desired number in the right window, and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

j. PanaView indicates a given *StartDate*. Double-click on *OK* to agree to the given day, on *Today* to start the log that day, or on *Edit* to change the starting date.

- If you select *Edit,* PanaView asks first for the desired *Year*, then for the *Month,* and finally for the *Day*. For each parameter, type the desired number in the right window, (or scroll to and click on the desired month) and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

Note: *If you have selected a circular log, PanaView now indicates that the log has been created, and returns to the* Log Edit Menu.

k. PanaView indicates a given *End Time*. Double-click on OK to agree to the given time, on *Now* to start the log immediately, or on *Timed* to indicate a specific duration.

- If you select *Edit,* PanaView asks first for the desired *Hour*, then for the *Minute*, and finally for the *Second*. For each parameter, type the desired number in the right window, and click **[Next Item]** (or simply click **[Next Item] to step through the parameters).**
- If you select *Timed*, PanaView asks for the *Log Time* (duration). Scroll to and double-click on the desired length of time (from 10 minutes to 24 hours.) Then go to step m.

l. PanaView indicates a given *End Date*. Double-click on *OK* to agree to the given day, on *Today* to start the log that day, or on *Edit* to change the starting date.

- If you select *Edit,* PanaView asks first for the desired *Year*, then for the *Month,* and finally for the *Day*. For each parameter, type the desired number in the right window, (or scroll to and click on the desired month) and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

m. Scroll to and double-click on the desired *Time Increment* (from 5 seconds to 24 hours). PanaView indicates that the log has been created, and returns to the *Log Edit Menu.*

If an erroneous value has been entered, PanaView displays a *Log Creation Error* message. Otherwise, the program indicates that the log has been created, and returns to the *Log Edit Menu.*

3.3.2.1 Checking Log Memory

To check on the amount of log memory available, double-click on the *Memory* option in the *Log Edit Menu.* The right window indicates the number of bytes available in both NVR and Flash memory.

3.3.2.2 Stop Logging

To manually terminate logging, double-click on the *Stop Logging* option in the *Log Edit Menu.* PanaView displays the name of the currently active logs. Double-click on your choice, and then click on *Yes* when the program asks if you wish to stop logging.

3.4 Creating PC Logs

PC logs are created in a different menu from the meter logs described in the last section. To create a new PC log:

1. Open the *Output* menu (see *Figure 13* below), and click on the *Logging* option.

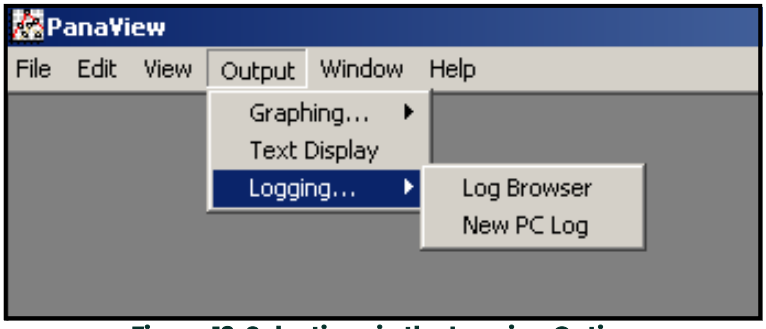


Figure 13: Selections in the Logging Option

You have two choices:

- Click on the *New PC Log* option and proceed to step 5, or
- Click on the *Log Browser* option. The dialog box shown in *Figure 14* below appears.

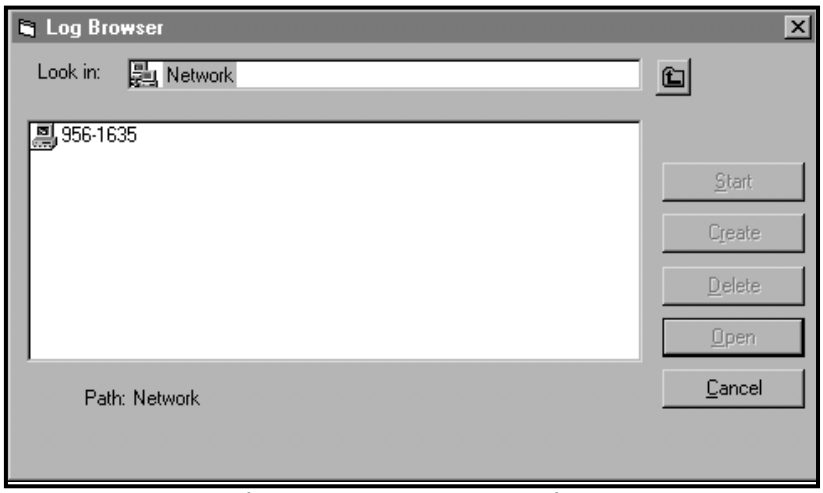


Figure 14: Computer Selection

Note: *If no log files have yet been created or if a log file has not yet been selected from the list, all of the option buttons (except for* **[Cancel]***) in the* Log Browser *dialog box are unavailable.*

2. Double click on the *computer name* to advance to the dialog box shown in *Figure 15* below.

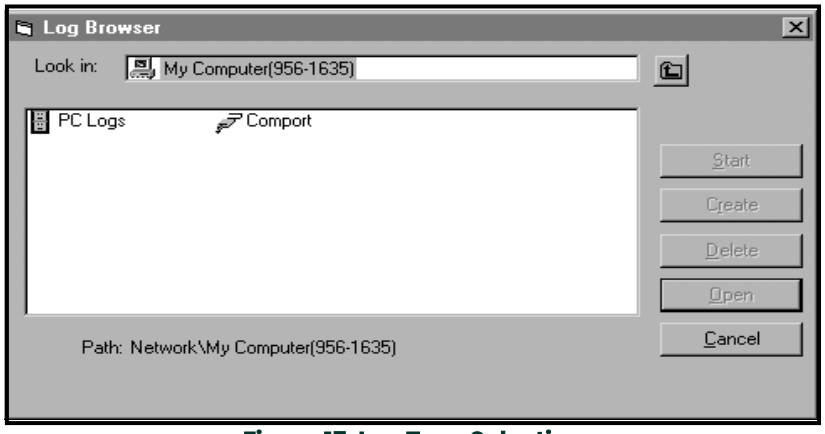


Figure 15: Log Type Selection

3. Double click on *PC Logs* to advance to the dialog box shown in *Figure 16*. below

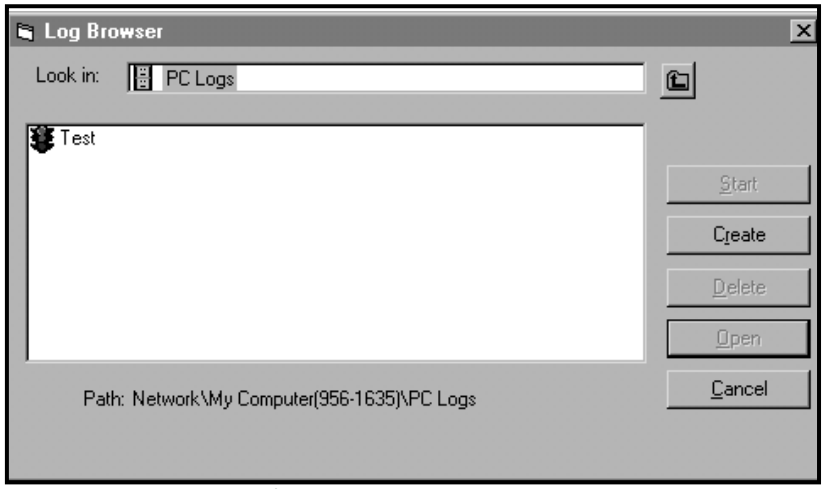


Figure 16: Create a PC Log

4. At the dialog box shown in *Figure 16* above, click on the **[Create]** option button to create a new meter log.

5. Enter a log *file name* (“*Sample*” in this case) in the dialog box shown in *Figure 17* below. Click on the **[OK]** option button.

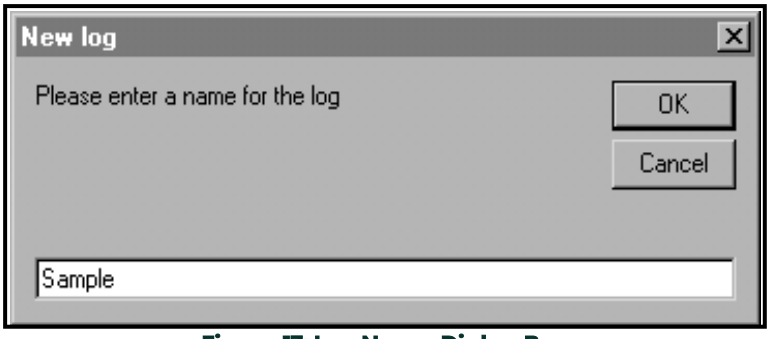


Figure 17: Log Name Dialog Box

6. At the resulting *PC Log* window shown in *Figure 18* below, place a check mark in the text box to create a *circular log*, or leave this box empty to create a linear log.

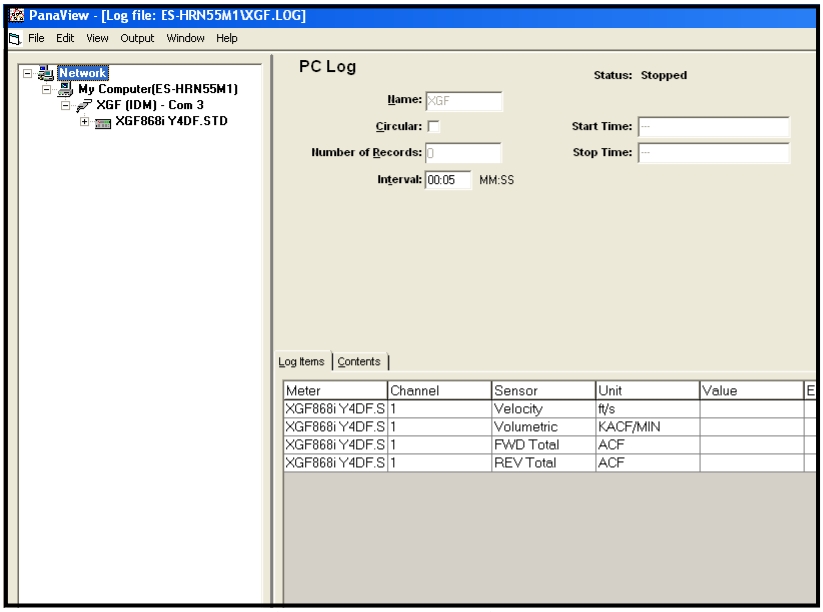


Figure 18: PC Log Window

7. Enter a sampling *interval* in the text box shown in *Figure 18* above.

Note: Start Time *and* Stop Time *cannot be specified for PC logs. These options are inactive in the* PC Log *window.*

8. Expand the network tree as far as necessary and double click on the process parameter(s) to be logged. As they are selected, the parameters are listed in the lower right pane of the *PC Log* window (make sure that the *Log Items* tab in this pane is selected).

Note: *To add all the channel parameters to a given log, right-click on the desired channel. A pop-up button, "Add Group to Log," appears. Click on the button to add the entire set of channel parameters to the log.*

9. Click on the **[Apply]** option button to record the log setup information, and then click on the **[Start]** option button to begin logging data immediately. (The *Start Time* automatically appears in the *PC Log* window.)

3.5 Viewing Meter Log Files

After one or more meter log files have been created, the logs may be viewed by using the *New Meter Browser*:

1. From the *New Meter Browser* in PanaView, expand the network tree and click on the *Meter Logs* option. If you have created one or more logs, the tree will appear similar to *Figure 19* below.

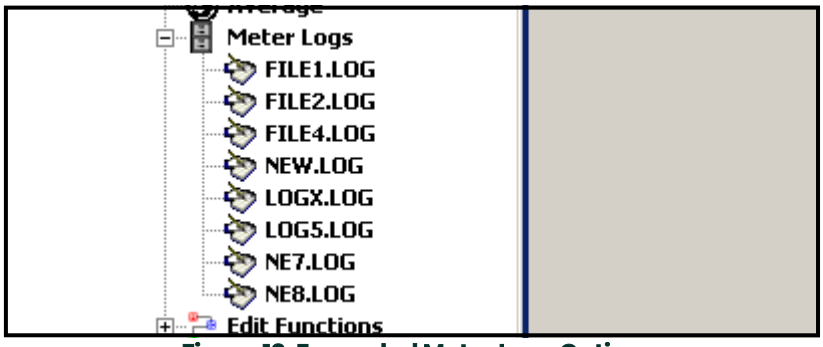


Figure 19: Expanded Meter Logs Option

2. Double-click on the desired log. A window opens for the individual log, as shown in *Figure 20* below.

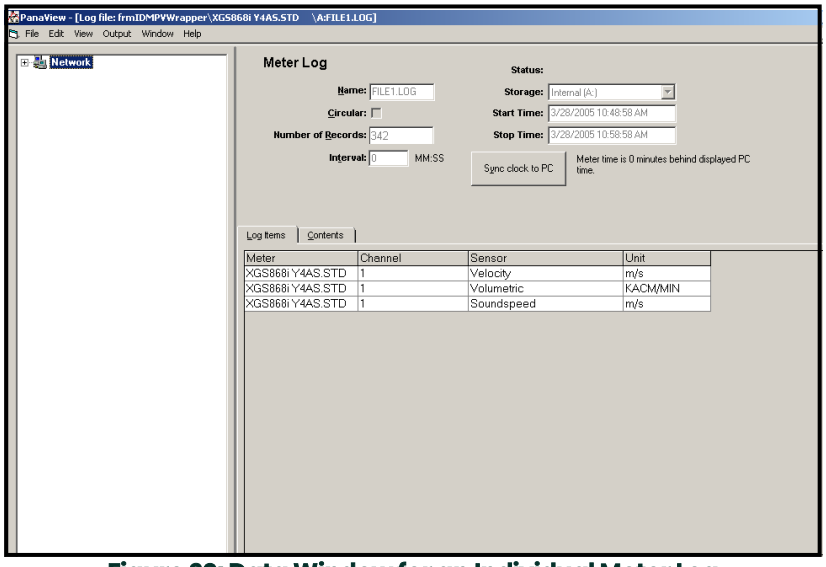


Figure 20: Data Window for an Individual Meter Log

- Click on the *Log Items* tab (see *Figure 20* above) for a list of the parameters specified for logging.
- Click on the *Contents* tab (see *Figure 21 on page 49*) for a list of all the data points logged to date for the parameter currently highlighted on the *Log Items* tab.
- Click on the **[Graph]** option button to display a graphical representation of the data logged to date.

Note: *The graph is displayed in its own window, which is opened on top of the* Meter Log *window. For instructions on using the* Graph Log *window, refer to the* Graphing Output *section in Chapter 2 of the PanaView User's Manual.*

Remember that only two parameters per channel may be graphed, and that the same two parameters must be graphed for each channel of a multi-channel graph display. When you have finished viewing the graph, click on the **[Close]** option button to close the Graph window and leave the log running.To review log details, click on the *Contents* tab. The window now appears similar to *Figure 21* below.

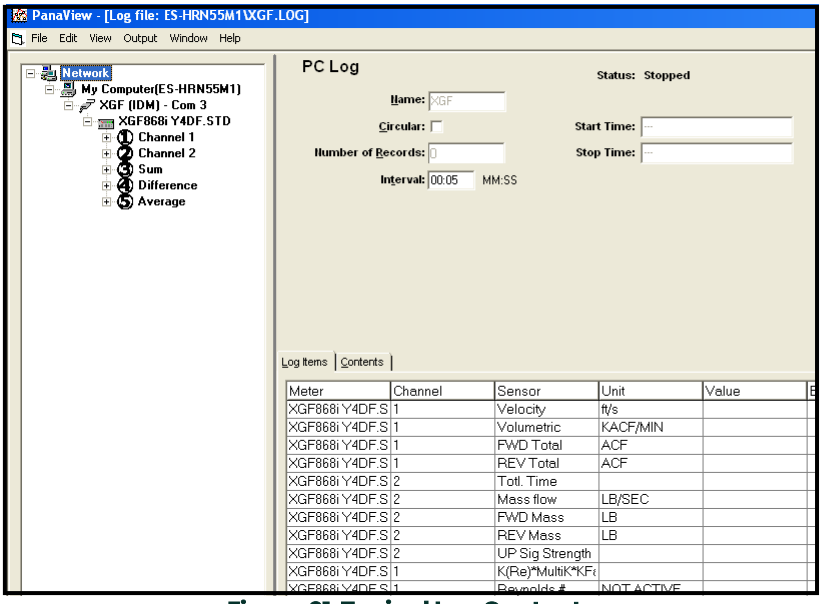


Figure 21: Typical Log Contents

3.6 Viewing PC Log Files

After one or more PC log files have been created, the logs may be viewed by using PanaView as follows:

1. You can access PC logs in two ways:
   - From the *New Meter Browser* in PanaView, expand the network tree and click on the *PC Logs* option. If you have created one or more logs, the tree will appear similar to Figure 22 below. Double-click on the log name to open the log, or
   - Pull down the *Output* menu (see *Figure 13 on page 46*), and click on the *Log Browser* option. Advance to the *PC Logs* dialog box as described in previous sections. A screen similar to that shown in Figure 23 appears.

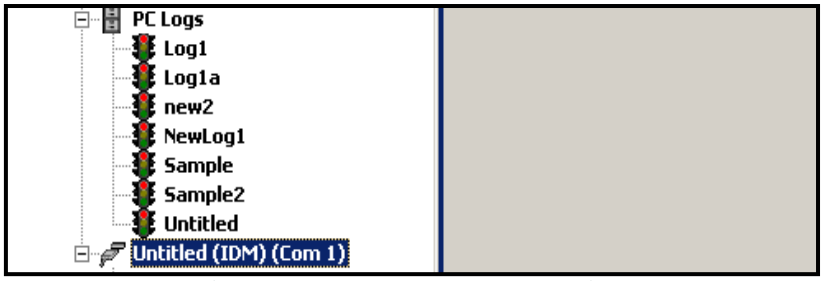


Figure 22: Expanded PC Logs Option

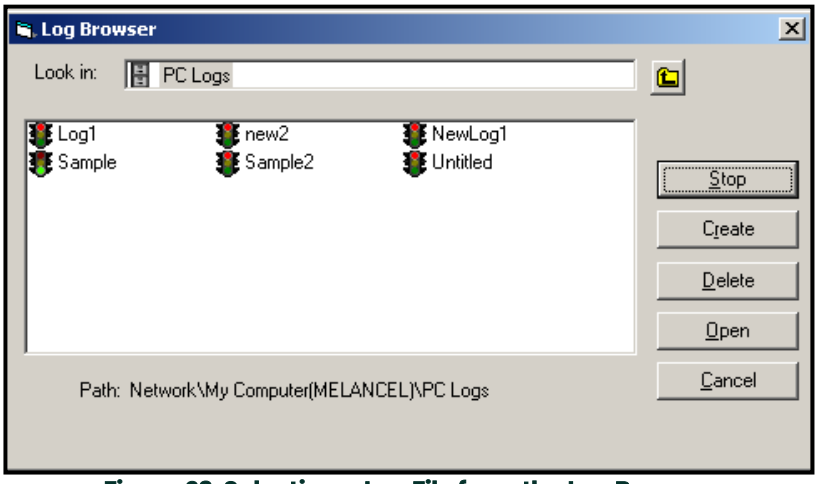


Figure 23: Selecting a Log File from the Log Browser

Notice that each of the log files in *Figure 22* and *Figure 23* has a traffic light icon next to its name. These icons indicate the current status of the log as follows:

- *Red light* - log has not run to its specified stop time but has been manually stopped
- *Green light* - log is currently running but is not yet complete

2. In the *Log Browser*, after you highlight the name of the desired log file, the following option buttons become available:
   - **[Start]** - resumes logging if the log is currently stopped, or

     [Stop] - stops logging, if the log is currently running
   - **[Delete]** - permanently deletes the log file
   - **[Open]** - opens the log in the *PC Log* window
3. Click on one of the option buttons listed in Step 2 above.

You can monitor the progress of an ongoing log in several ways:

- Click on the *Log Items* tab (see *Figure 21 on page 49*) for a list of the parameters specified for logging.
- Click on the *Contents* tab (see *Figure 21 on page 49*) for a list of all the data points logged to date for the parameter currently highlighted on the *Log Items* tab.
- Click on the **[Graph]** option button to display a graphical representation of the data logged to date.

Note: *The graph is displayed in its own window, which is opened on top of the* PC Log *window. For instructions on using the* Graph Log *window, refer to the* Graphing Output *section in Chapter 2 of the PanaView User's Manual.*

- Click on the **[Refresh]** option button to update the information shown on the *Contents* tab and in the *Graph Log* window. Any data logged since the last use of the **[Refresh]** option button is added to the list and to the graph.

Remember that only two parameters per channel may be graphed, and that the same two parameters must be graphed for each channel of a multi-channel graph display. When you have finished viewing the graph, click on the **[Close]** option button to close the *Graph* window and leave the log running.

4. To terminate the logging process, simply click on the **[Stop]** option button, which has replaced the original **[Start]** option button. (The *Stop Time* automatically appears in the *PC Log* window.)

Because a PC log has no specific *"Stop Time,"* the log will continue to run until it is manually stopped (unless the PC is turned off or you run out of hard drive space).

[no content intended for this page]

Chapter 4. Printing Data

4.1 Data Types for Printing

The XGF868i flowmeter has no ability to print any of its data directly. However, any of the data stored in its memory may be printed via the built-in RS232 communications port, using a computer terminal. In order to use the capability, the XGF868i must be linked to the computer terminal with the optional *PanaView* software.

Note: *See Chapter 1,* Installation, *of the* Startup Guide *for instructions on wiring the RS232 serial port. For additional information, refer to the* EIA-RS Serial Communications *Manual (916-054).*

After making the hardware connections and installing PanaView software, the following data may be output to a printer connected to the personal computer:

- Live data in numeric or graphical format
- Log file in numeric or graphical format
- Site file in tabular format
- Transducer signal array data in tabular format

For detailed instructions on printing any of the data types listed above, consult the *PanaView User's Manual.*

[no content intended for this page]

Chapter 5. Clearing Data

5.1 Introduction

This chapter explains how to purge totalized measurements, site data and/or log files from the XGF868i memory.

Note: *For detailed information on creating a log file, see Chapter 3,* Logging Data. *For detailed information on programming site data, see Chapter 1,* Programming Site Data.

IMPORTANT: None of the clearing procedures described in this chapter can be undone. Be very sure that the exact consequences of a selected option are thoroughly understood before proceeding.

5.2 Clearing the XGF868i Memory

If the XGF868i available memory becomes nearly full, it may be necessary to purge some or all of the existing data from memory, before any additional data can be stored. In order to accomplish this task, proceed to the appropriate section for step-by-step instructions.

Note: *Depending on the current configuration of the XGF868i, it may be possible to add additional memory by installing an option card in* **Slot 2**. *See Chapter 4,* Parts Replacement, *of the* Service Manual *for details.*

5.2.1 Clearing Site Data

This feature has not yet been implemented, because the XGF868i currently has no capability to store site files in its own memory.

5.2.2 Clearing Log Files

To clear log files from the XGF868i or from the PC's memory, complete the following steps:

1. From PanaView, click on the *Logging* option in the *Output* menu. Then click on the *Log Browser* option, as shown in *Figure 24* below.

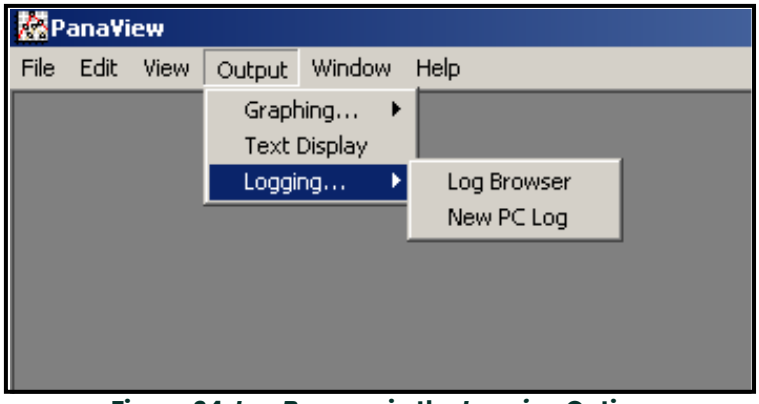


Figure 24: *Log Browser* in the *Logging* Option

2. Double-click on the *computer name* to move to the network level.
3. Double-click on *PC Logs* to access the stored PC logs, or on the *communication port* name and the *meter* name to access the stored meter logs. In either case, the *Log Browser* appears similar to *Figure 25* below.

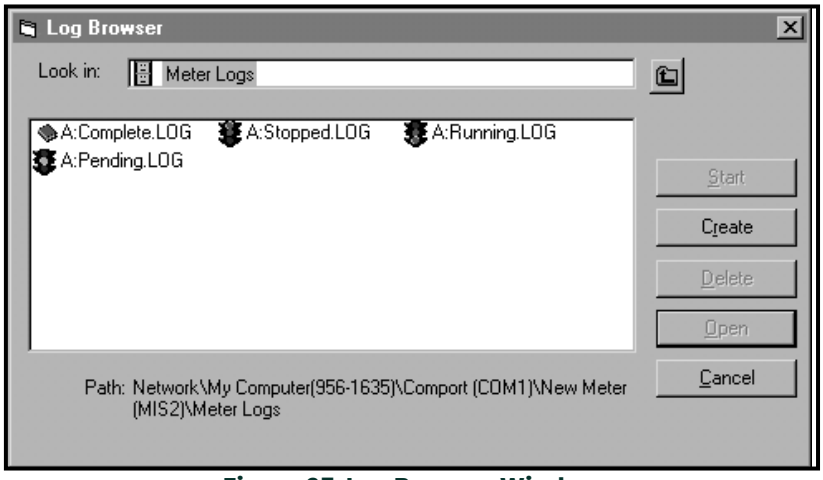


Figure 25: Log Browser Window

4. Highlight the log you wish to delete, and click on the [Delete] option button.

5.2.3 Clearing the Totalizers

You can clear the XGF868i totalizers (i.e., reset specified totalized flow rates to zero) from either the LCD display or from PanaView. (Refer to *Figures A-1, A-2, A-3 or A-4* in Appendix A.) To reset totals from the display, complete the following steps:

1. Press [Escape], [Enter], [Escape].
2. In the *Keypad Program*, scroll to RESET and press [Enter].
3. The XGF868i asks *Reset Totals?* Scroll to *NO* or *YES* (2) and press [Enter] at the desired choice.

The XGF868i totalizers are reset to 0, and the meter returns to the *Keypad Program*. Press [Escape] to return to the data display.

To reset the totals from PanaView:

1. From the *New Meter Browser* in PanaView, highlight the XGF868i.
2. Open the *Edit* menu and select the *Properties* option, as shown in *Figure 26* below.

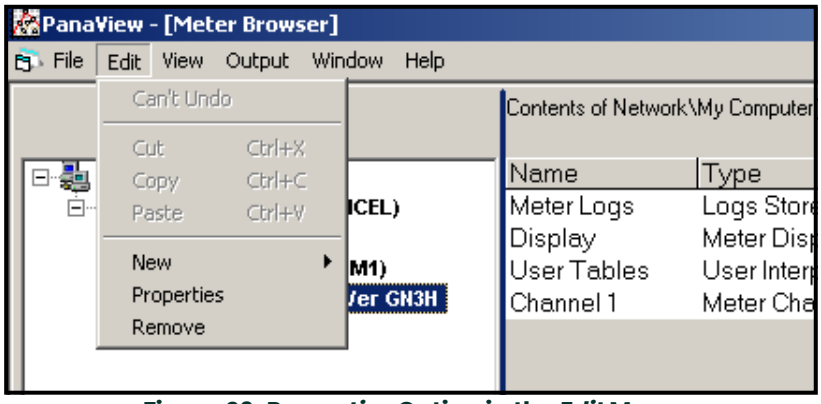


Figure 26: *Properties* Option in the *Edit* Menu

3. The *Properties* window appears similar to *Figure 27* below. To clear the XGF868i totalizers, click on the [Clear Totalizers] button. The XGF868i totalizers are reset to 0.

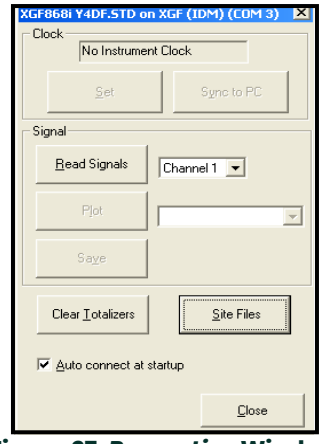


Figure 27: *Properties* Window

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Appendix A. Menu Maps

The following *Menu Maps* are included in this appendix:

- Figure 28, “PROG > CHx > ACTIV, SYSTM, PIPE & I/O Menus,” on page 61
- Figure 29, “PROG > CHx > SETUP Menu,” on page 62
- Figure 30, “PROG > GLOBL > SYSTM, I/O & COMM Menus,” on page 63

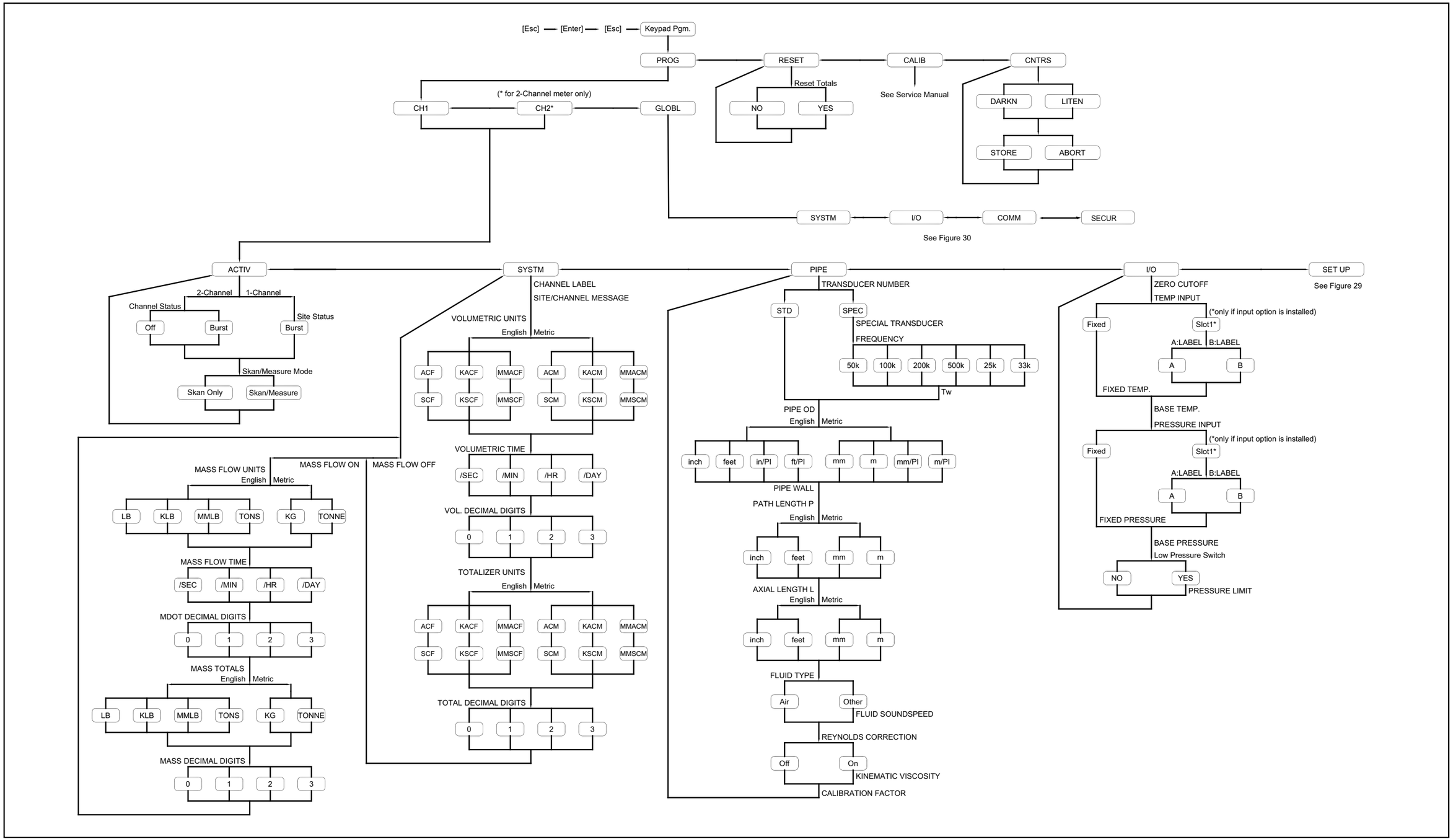


Figure 28: PROG > CHx > ACTIV, SYSTM, PIPE & I/O Menus

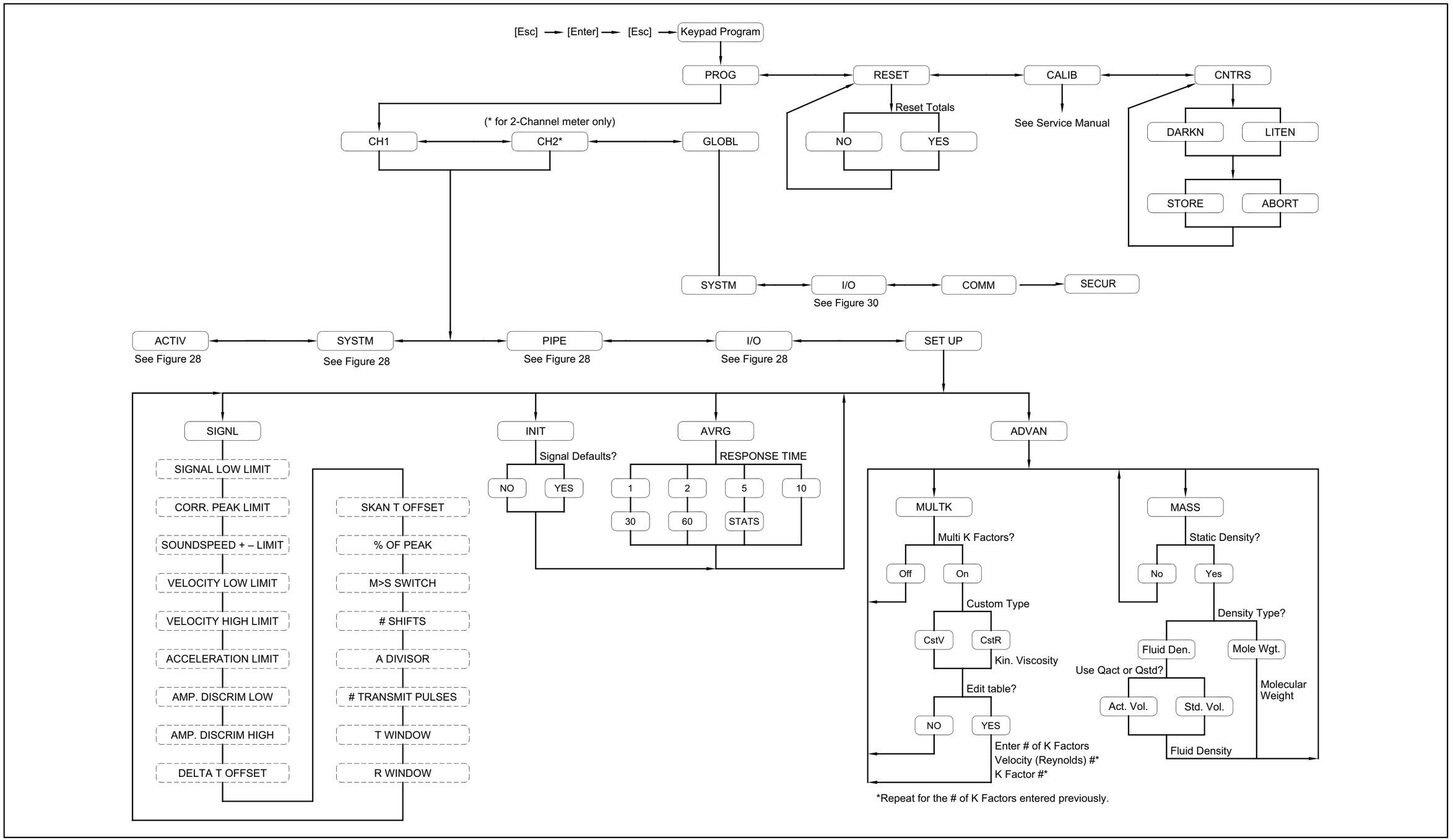


Figure 29: PROG > CHx > SETUP Menu

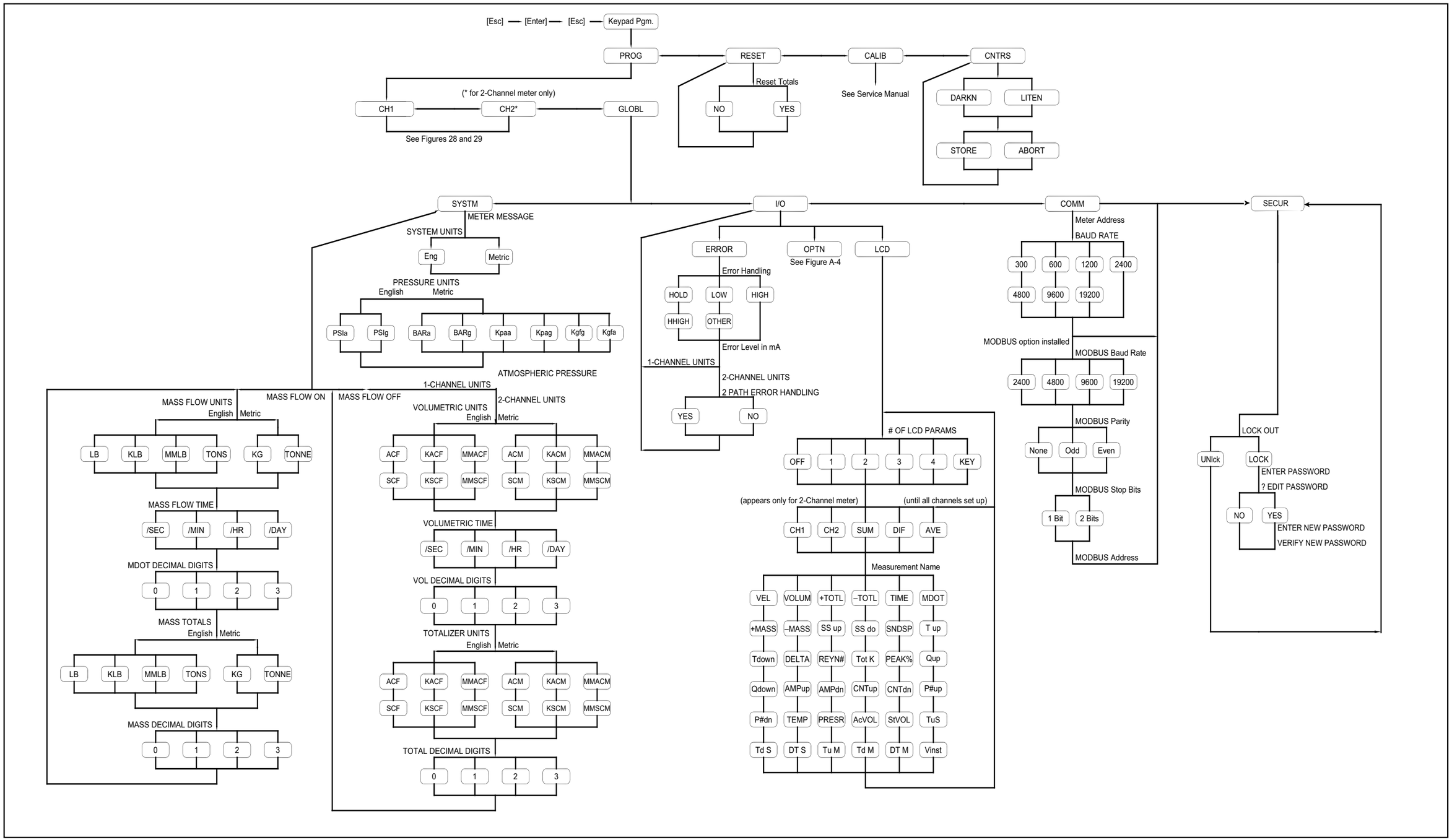


Figure 30: PROG > GLOBL > SYSTM, I/O & COMM Menus

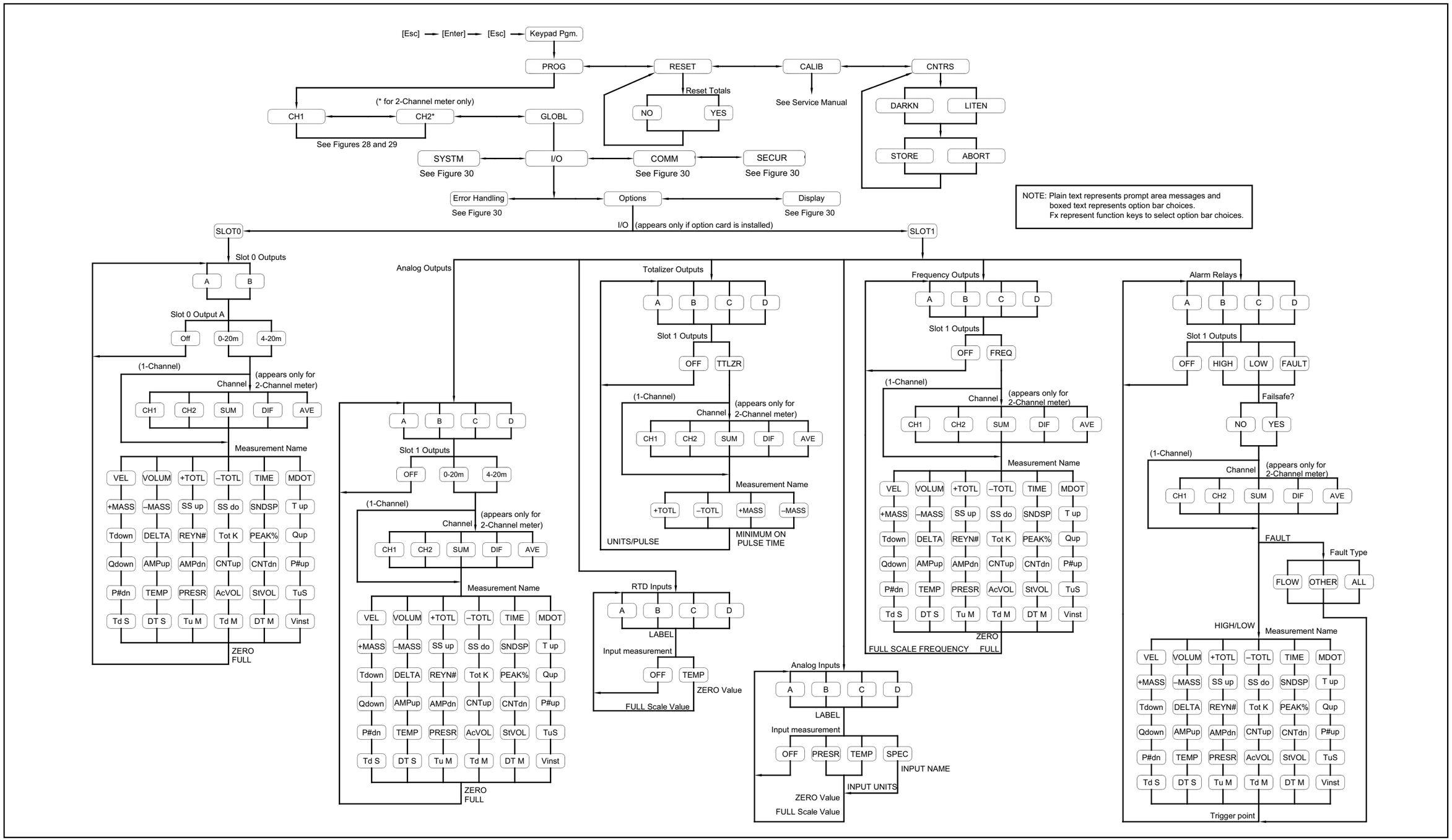


Figure 31: PROG > GLOBL > I/O > OPTIONS Menu

Appendix B. Data Records

B.1 Available Option Cards

The XGF868i can hold one option card in Slot 1 and one in Slot 2. The available configurations are listed in *Table 12* below.

Table 12: Option Cards Configuration

Card #	Slot #	Configuration
1473-02	1	OI - 2 Current Inputs
1473-14		ORI - 1 RTD Input/1 Current Input
1473-06		FI - 2 Current Inputs/2 Frequency Outputs
1473-15		FRI - 2 Frequency Outputs/1 RTD Input/1 Current Input
1345-04		Modbus Communications Protocol
1385		HART Communication
1477-03	2	MODBUS/TCP/IP
1477-01		Ethernet
1475-01		Foundation Fieldbus

B.2 Option Cards Installed

Whenever an option card is installed or changed in the XGF868i flow transmitter, record the type of card and any additional setup information in the appropriate row of *Table 13* below.

Table 13: Option Cards Installed

Slot #	Type of Option Card	Additional Setup Information
0	Analog Outputs (A, B)	
1		
2		

B.3 Setup Data

After the XGF868i flow transmitter has been installed, setup data must be entered via the *User Program* prior to operation. Record that information in *Table 14* below.

Table 14: Setup Data

General Information						
Model #				Serial #		
Software Version				Setup Date		
Channel - Status						
Channel 1				Channel 2		
Channel Status	Off	Burst		Channel Status	Off	Burst
Measure Mode	Skan	S/M		Measure Mode	Skan	S/M
Channel - System						
Channel Label				Channel Label		
Site/Channel Msg.				Channel Message		
Vol. Units				Vol. Units		
Vol. Time Units				Vol. Time Units		
Vol. Dec. Digits				Vol. Dec. Digits		
Totalizer Units				Totalizer Units		
Tot. Dec. Digits				Tot. Dec. Digits		
Mass Flow				Mass Flow		
Mass Flow Time				Mass Flow Time		
MDOT Dec. Digits				MDOT Dec. Digits		
Mass Totalizer				Mass Totalizer		
Mass Dec. Digits				Mass Dec. Digits		
Molecular Weight				Molecular Weight		

Table 14: Setup Data

Channel - Pipe Parameters						
Channel 1				Channel 2		
Transducer Type	STD	SPEC		Transducer Type	STD	SPEC
Transducer #				Transducer #		
Spec. Trans. Freq.				Spec. Trans. Freq.		
Spec. Trans. Tw				Spec. Trans. Tw		
Pipe O.D.				Pipe O.D.		
Pipe Wall				Pipe Wall		
Path Length (P)				Path Length (P)		
Axial Length (L)				Axial Length (L)		
Fluid Type	Air	Other		Fluid Type	Air	Other
Other/Sndspd				Other/Sndspd		
Calibration Factor				Calibration Factor		
Channel - Input/Output						
Zero Cutoff				Zero Cutoff		
Temp. Input				Temp. Input		
Base Temp.				Base Temp.		
Pressure Input				Pressure Input		
Base Pressure				Base Pressure		
Low Press. Switch	No	Yes		Low Press. Switch	No	Yes
Pressure Limit				Pressure Limit		
Channel - SETUP - V Averaging						
Response Time				Response Time		
Channel - SETUP - Advanced Features - Multi K Factors						
K-Factor #	Velocity	K-Factor		K Factor #	Velocity	K-Factor
1				1		
2				2		
3				3		
4				4		
5				5		
6				6		
7				7		
8				8		
9				9		
10				10		

Table 14: Setup Data

Channel - SETUP - Advanced Features - Multi K Factors (cont.)						
K-Factor #	Velocity	K-Factor		K Factor #	Velocity	K-Factor
11				11		
12				12		
13				13		
14				14		
15				15		
16				16		
17				17		
18				18		
19				19		
20				20		
Channel - SETUP - Advanced Features - Mass Flow Calculation						
Mass Flow	Yes	No		Mass Flow	Yes	No
Density Type	Fluid Dens.	Mol. Wt.		Density Type	Fluid Dens.	Mol. Wt.
Q_{act} or Q_{std}?	Actual	Standard		Q_{act} or Q_{std}?	Actual	Standard
Fluid Density				Fluid Density		
Mole. Weight				Mole. Weight		
Global - System						
Meter Message				Totalizer Units		
System Units	English	Metric		Tot. Dec. Digits		
Pressure Units				Mass Flow		
Atmos. Pressure				Mass Flow Time		
Vol. Units				MDOT Dec. Digit		
Vol. Time Units				Mass Totals		
Vol. Dec. Digits				Mass Dec. Digits		
Global - Input/Output - Error Handling						
Error Handling				2-Path Error	No	Yes
Global - Communications Port						
Meter Address				MOD. Parity		
Baud Rate				MOD. Stop Bits		
MOD. Baud Rate				MOD. Address		

[no content intended for this page]

Appendix C. Programming the XGF868i With PanaView™

C.1 Introduction

The XGF868i flow transmitter must be properly installed and programmed, as described in the *Startup Guide*, before it can provide accurate flow rate measurements. After completing the installation and initial setup, use this chapter to program the advanced features of the Model XGF868i's via the PanaView™ software program. Refer to the appropriate section for a discussion of the following menu features:

- Channel-Status - activate one or both channels and select the desired measurement method
- Channel-System - enter the individual channel parameters
- Channel-Pipe - enter the pipe parameters
- Channel-I/O - set up the inputs and outputs
- Channel-Setup - set the signal limits, response times and activating mass flow.
- Global-System - enter the system units
- Global-I/O - set up error handling, option cards and display
- Global-Comm - set the serial port and MODBUS parameters

As a programming aid, a complete set of menu maps for the PROG menu is included in Appendix D, *PanaView Menu Maps*. The specific figure numbers will be referenced throughout this chapter, as required.

C.2 Programming With PanaView™

You can program the XGF868i with PanaView™, a Panametrics PC-based, non-resident software program that communicates with the XGF868i via its RS232 serial port.

C.2.1 Preparing for PanaView Programming

Before you attempt to communicate with the XGF868i, be sure you have linked your PC to the XGF868i via an RS232 interface. For details on wiring the interface, refer to *Wiring the Serial Port* in the *Startup Guide,* and to the document *EIA-RS Serial Communications* (916-054). You must also install PanaView, as described in the *PanaView User's Manual* (910-211).

C.2.2 Setting Up the Communications Port

Use the steps below to establish PanaView communications with the XGF868i.

1. Launch PanaView, as discussed in Chapter 3, *Initial Setup*, of the *PanaView User's Manual*.
2. Open the *New Meter Browser* window in the *File* menu and expand the network tree. Then, highlight the *My Computer (Name)* branch by clicking on it.
3. Pull down the *Edit* menu by clicking on it in the menu bar.
4. Click on the *New* menu option to select it, and a submenu opens with two choices on it (see *Figure 32* below).

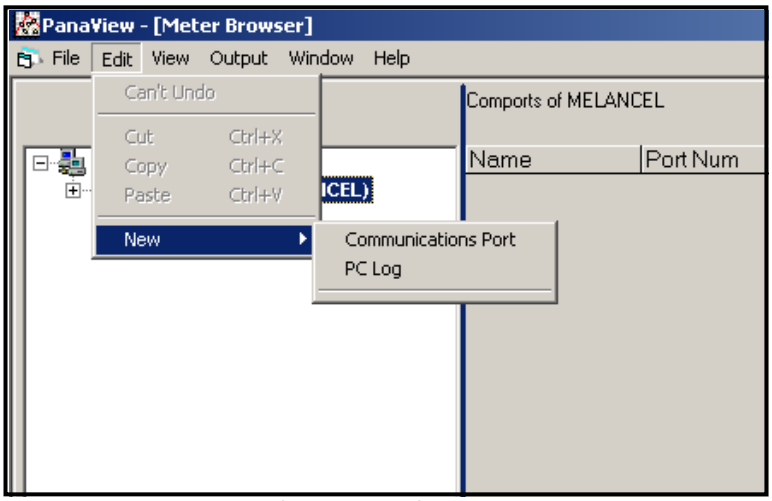


Figure 32: Edit Menu

5. Click on the *Communications Port* option to select it. The *Setup Communications* screen appears similar to *Figure 33* below.

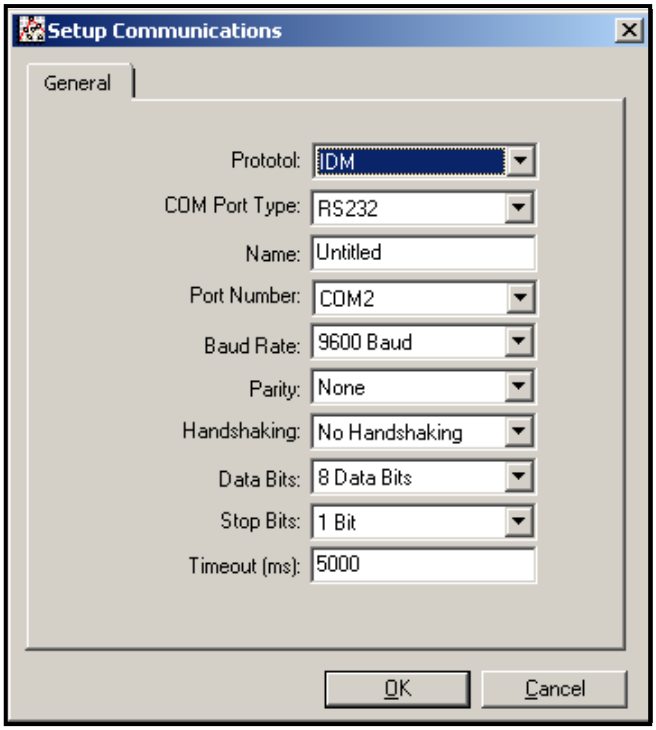


Figure 33: *Setup Communications* Screen

6. Open the Protocol menu (the first of the drop-down menus) and click on *IDM*.

7. Open the COM Port Type menu and click on the desired type (or on *TCP/IP*, if the XGF868i is using an Ethernet connection).

Note: *If you select TCP/IP, the menu changes. Proceed to the next page.*

8. Select any suitable available baud rate. A baud rate of 19200 is appropriate for almost all applications. However, if you experience periodic communication reliability problems, you may wish to consider lowering the baud rate on your instrument and in PanaView.

IMPORTANT: *Be sure all the communications port settings match those made in setting up the meter's serial port.*

9. Click on [OK] to complete data entry.

C.2.3 Setting up Ethernet Communications

If you have selected TCP/IP in step 6 on the previous page, the Setup Communications window appears similar to *Figure 34* below.

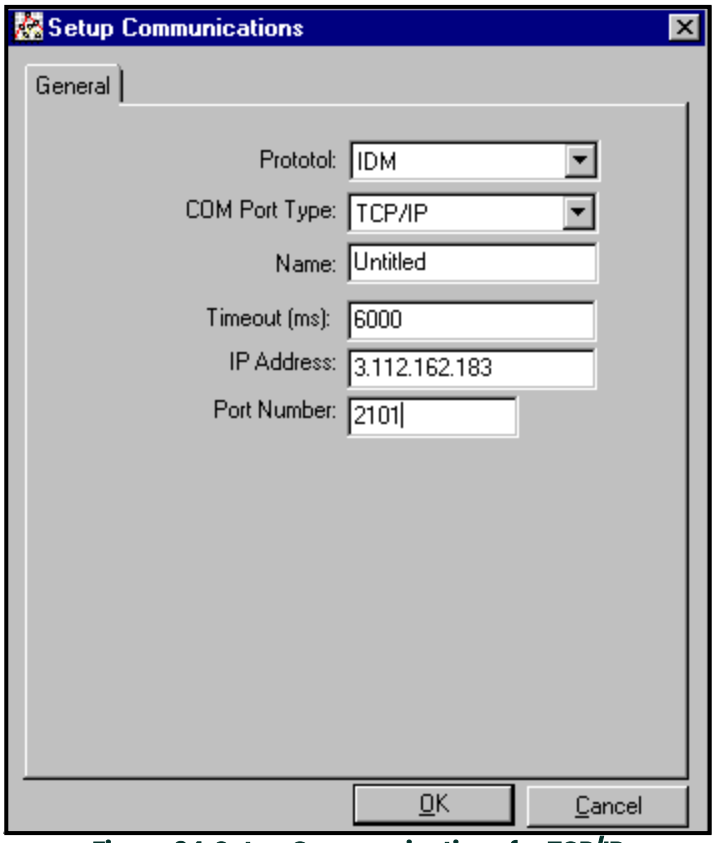


Figure 34: Setup Communications for TCP/IP

1. Type in the desired *Name* and *Timeout* (in milliseconds).
2. In the *IP Address* text box, enter the IP address. If the IP address is unknown, run the Device Discovery software utility. All units found will be identified by their MAC address and the assigned IP address. In the *Port Number* box, enter 2101 (the default value).
3. Click [OK] to complete data entry.

IMPORTANT: *If you are using Ethernet communications, be sure the XGF868i is set up with the default communications parameters: 9600 baud, no parity, no handshaking, 8 data bits and 1 stop bit. The port number must match the "Enable Raw TCP access using TCP Port" assignment shown under the* Device Discovery *"TCP Server Settings" menu* (Configuration>Serial Ports>Port).

C.2.4 Modifying Ethernet Parameters

To establish Ethernet communications with the XGF868i or to modify its IP parameters, you will need to install the Ethernet Device Discovery software utility (available with your XGF868i) on a PC connected to the LAN. Once installed and running, the software displays all Ethernet devices currently connected to the subnet. You can identify the XGF868i by its MAC address, supplied as part of customer documentation. The default IP Port is 2101.

The default IP addressing for the XGF868i is DHCP (dynamic). If you need to assign a static IP address to the XGF868i, complete the following steps:

IMPORTANT: *To assign a static IP address, the XGF868i must be connected to an Ethernet network with a dynamic address assignment mechanism (DHCP) first.*

1. Run Ethernet Device Discovery software, and identify the XGF868i's current IP address.
2. Open your Internet browser (Internet Explorer, Netscape, or other) and type the XGF868i IP address in the Address box.
3. The Connect ME Configuration and Management window opens. Two text boxes ask for the user name and password.
   a. In the Username text box, type root.
   b. In the Password text box, type dbps.
4. At the left of the window, click on Network.
5. The IP Settings window opens. In the text boxes for IP Address, Subnet Mask, and Default Gateway, type in the new information.
   4. Click Apply. The software applies the new address.

C.3 Adding the XGF868i

To add the XGF868i on the IDM-configured communications port, complete the following steps:

1. Highlight the communication port to which the meter will be added by clicking on it, and then open the *Edit* menu on the menu bar (if the communication port is not highlighted first, the *New Meter* option is not active in the *Edit* menu).
2. Click on the *New* option in the *Edit* menu (see *Figure 35* below).

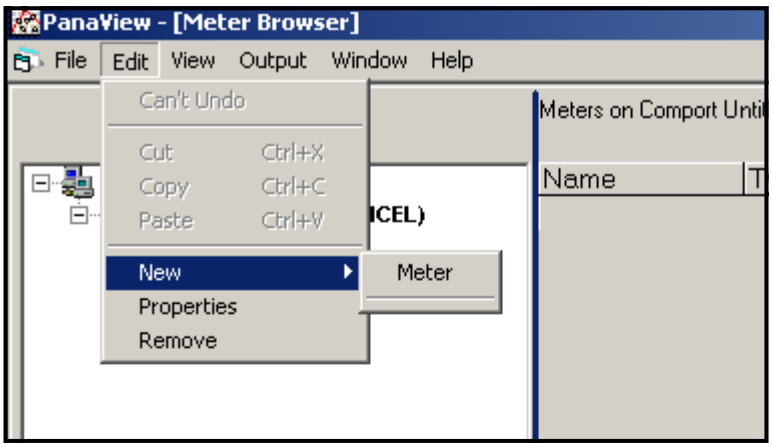


Figure 35: *New* Option in the *Edit* Menu

3. After clicking on the *New* option, the *Meter* menu option appears. Click on this option to select it.
4. The *New IDM Meter* screen (see *Figure 36* below) opens. Enter the Network ID number for the meter, and click [OK].

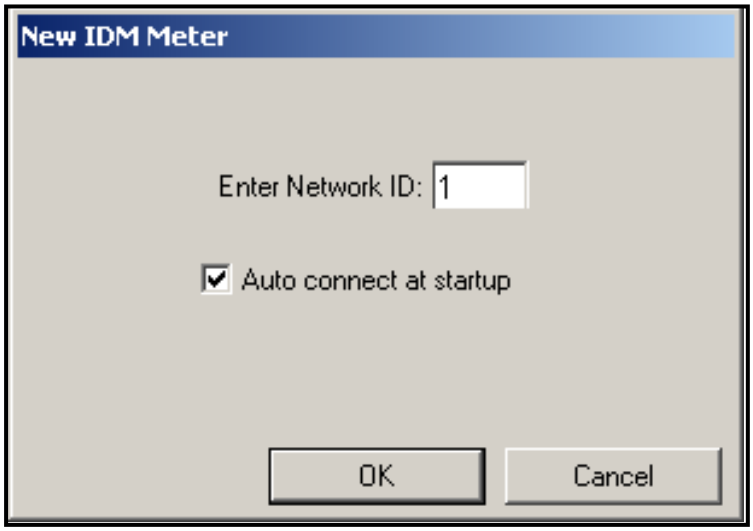


Figure 36: New IDM Meter Screen

IMPORTANT: *The Network ID number must match the Network ID programmed in the meter's Communications menu.*

If the initialization is successful, the *Meter Browser* shows a listing similar to *Figure 37* below.

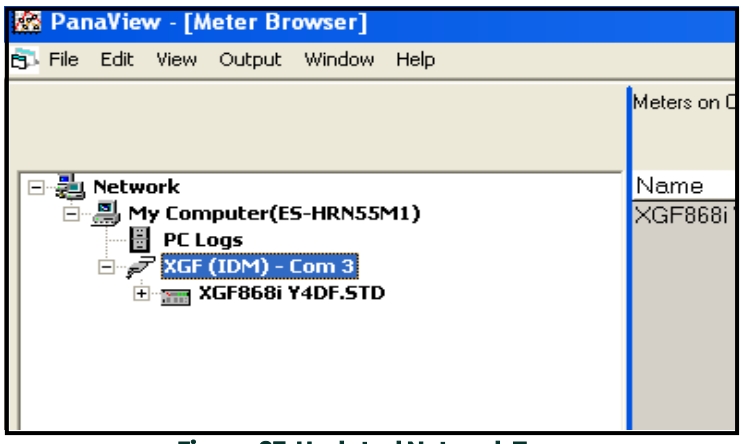


Figure 37: Updated Network Tree

However, if the settings do not match, or there is some other difficulty, a screen appears similar to *Figure 38* below.

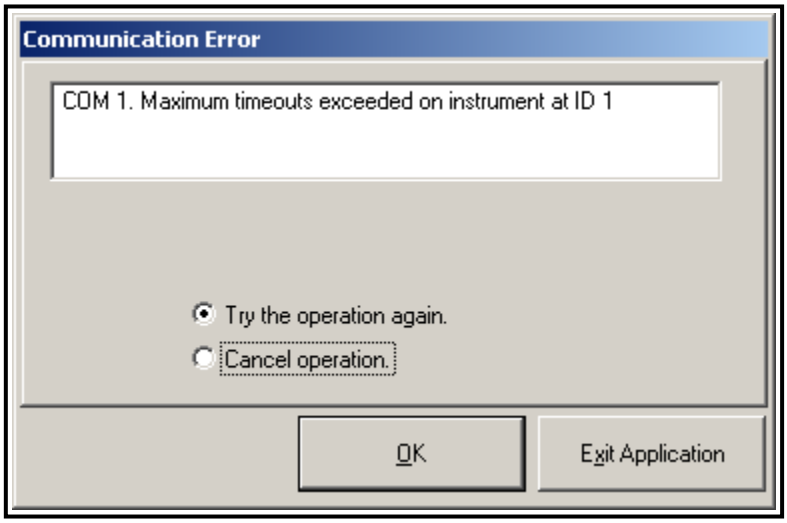


Figure 38: Communication Error Screen

The screen offers the options of trying again or of canceling the operation. Click on the desired choice, and then on [OK] to confirm the choice or on [Exit Application] to close PanaView.

C.4 Entering the User Program Using PanaView

Note: *Be sure to record all the programming data entered in this chapter in Appendix B,* Data Records.

Programming of the Status, System, and Pipe submenus of the Channel menu and the Global-System menu are required for basic operation of the XGF868i. Failure to accurately enter all of the necessary information will result in unreliable flow rate data. Therefore, be sure to complete at least the sections of this chapter pertaining to those three submenus. Except for those three submenus, it is not necessary to program the XGF868i flowmeter in any particular order. Therefore, the sections of this chapter need not be completed in sequence. Enter the user program as described below and proceed immediately to any section of interest.

To begin entering data into the XGF868i via PanaView:

1. From the meter tree in the *New Meter Browser* (see *Figure 37 on page 75*), click on the XGF entry. The screen now appears similar to *Figure 39* below.

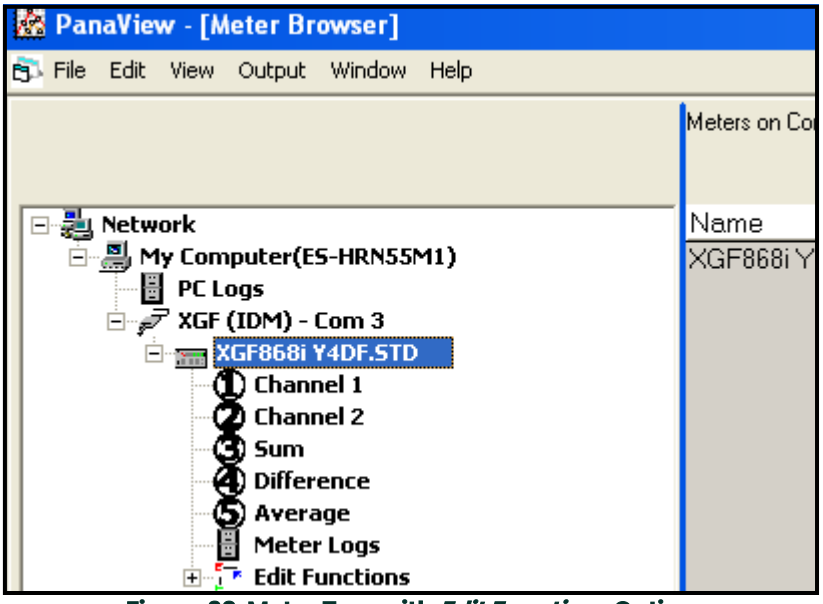


Figure 39: Meter Tree with *Edit Functions* Option

2. Expand the *Edit Functions* option. The window now appears similar to that shown in *Figure 40 on page 78*.

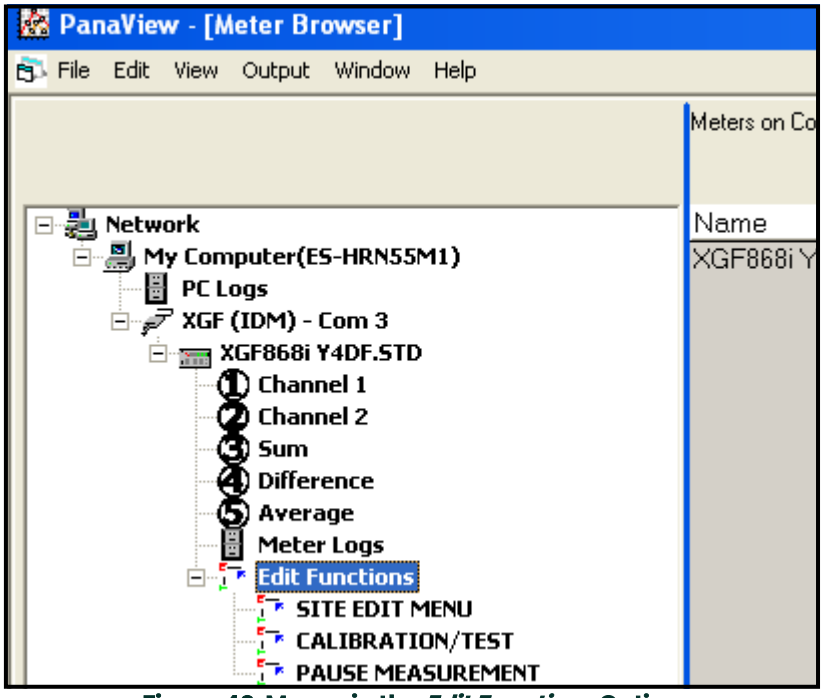


Figure 40: Menus in the *Edit Functions* Option

3. To enter data into the user program, double-click on the *Site Edit Menu*. The window appears similar to *Figure 41* below.

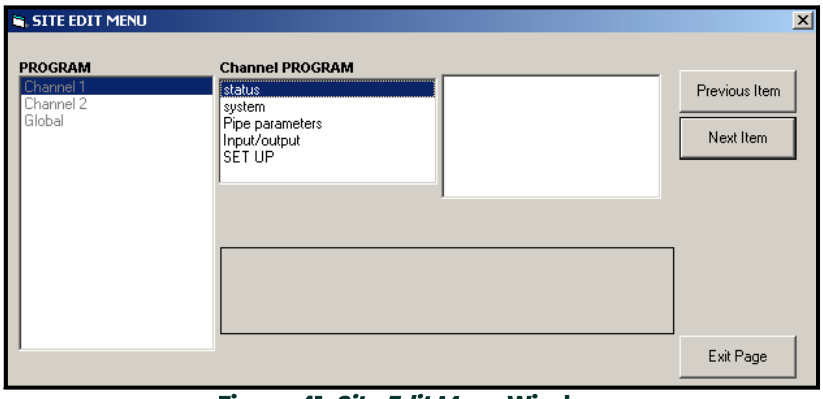


Figure 41: *Site Edit Menu* Window

4. To enter the Channel 1, Channel 2, or Global menu, highlight and double-click on the desired menu in the left pane. For example, clicking on Channel 1 in *Figure 41* above opens the list of options shown in the center pane.
5. To enter a particular option:
   a. Highlight and double-click on the desired option in the center pane. *Figure 42 on page 79* shows the first entry (Transducer Number) in the *Pipe Parameters* option. The title above the center pane lists the current entry, while the center pane displays the available selections for that entry.

   b. Click on the desired choice. If the entry requires a numeric or text value, change the value displayed in the right pane.

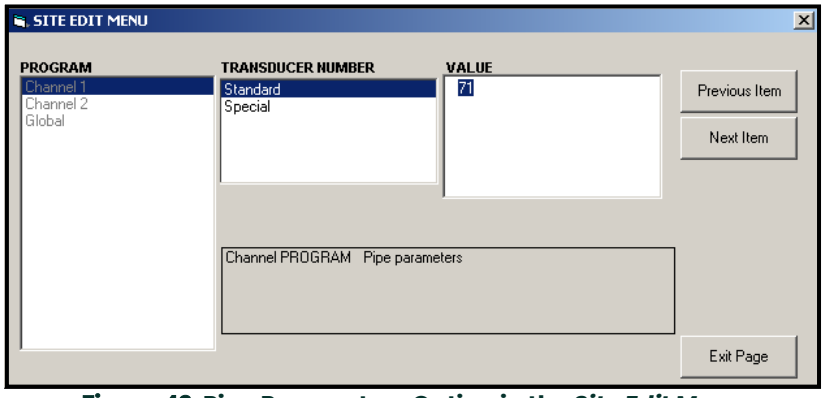


Figure 42: Pipe Parameters Option in the *Site Edit Menu*

c. Do one of the following:

Click on [Next Item] to proceed to the next menu item,
or
Click on [Previous Item] to return back through the menu to a previous item.

Note: *If you click on either [Next Item] or [Previous Item] without changing the settings, the current settings remain unchanged.*

As you step through the menu, the bottom panel lists the current settings you have modified or left unchanged, as shown in *Figure 43* below. If you modify or step through more than five items, a scroll bar at the right of the panel lets you review the earlier settings.

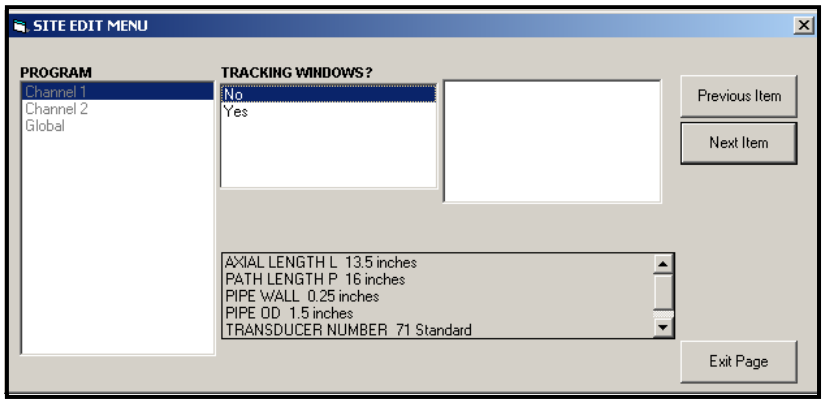


Figure 43: *Site Edit Menu* with Current Settings

6. When you have completed entering parameters in a given option, click [Exit Page] to close the option. You can then double-click on another option, or click [Close] to close the window.

You can double-click on another menu to modify its settings, or return to the *New Meter Browser*. Proceed to the following sections to enter data in the Channel or Global menus.

C.5 Entering Data in the Channel Menu

The Channel menu is used to enter data specific to each channel. Refer to Figures D-1 through D-3 in Appendix D, *PanaView Menu Maps*, and remember to record all programming data in Appendix B, *Data Records*.

Note: *In this manual, only the programming of Channel 1 is described. To program Channel 2 of a 2-Channel meter, simply repeat the same procedures presented for Channel 1.*

C.5.1 Selecting the Channel Measurement Method

The Status submenu permits selection of the desired measurement method.

1. In the *Site Data Menu*, double-click on the desired channel.
2. Highlight and double-click on the Status option in the center pane. The window now appears similar to *Figure 44* below.

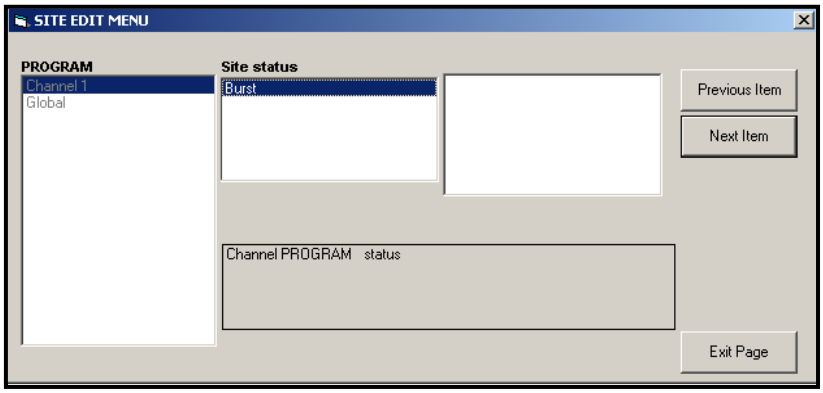


Figure 44: *Status* Option in the Channel Menu

3. Double-click on *Burst* to activate the channel/path.
4. Double-click on one of the measurement methods described below.
   - Skan Only is the preferred technique for locating the acoustic signal and for high velocity measurements. It is more robust in a noisy environment than the Measure technique.
   - Skan/Measure is the preferred technique to use for low velocity measurements.

If Skan Only is selected at the above prompt, the meter uses this technique exclusively. However, if Skan/Measure is selected, the meter uses Skan Only to find the acoustic signal and then tries to use the Skan/Measure technique for the actual measurement.

Note: *To change the Skan Only and Skan/Measure parameters, see the* Signal *submenu section on* page 12.

PanaView returns to the Channel PROGRAM menu (see *Figure 41 on page 78*). Proceed to the System option.

C.5.2 Entering Data in the Channel System Option

1. From the Channel PROGRAM menu, highlight and double-click on the System option in the center pane.
2. The first prompt asks for the *Channel Label*. Enter the desired label (in any numeric or text combination up to five characters) in the right pane, and click [Next Item].
3. Enter the desired *Channel Message*, and click [Next Item].
4. Double-click on the desired V*olumetric Units* (from the list shown in *Table 15* below).

Note: *Refer to the System option of the* Global *menu to choose between English or metric measurements.*

Table 15: Available Volumetric/Totalizer Units

English	Metric
Actual Cubic Feet	Actual Cubic Meters
Thousands of ACF	Thousands of ACM
Millions of ACF	Millions of ACM
Standard Cubic Feet	Standard Cubic Meters
Thousands of SCF	Thousands of SCM
Millions of SCF	Millions of SCM

5. Double-click on the desired unit of *Volumetric Time* (from seconds to days) in the volumetric flow display.
6. Double-click on the desired number of *Decimal Digits* (digits to the right of the decimal point) in the volumetric flow display.
7. Double-click on the desired *Totalizer Units* for the totalized flow rate display (listed in *Table 15* above).
8. Double-click on the desired number of *Decimal Digits* (digits to the right of the decimal point) in the totalized flow rate display.

The program now varies, depending on whether you have activated MASS FLOW (see *Chapter 1* for details).

- If you have activated MASS FLOW, continue to step 1 on the next page.
- If you are not using MASS FLOW, PanaView returns to the Channel PROGRAM window shown in *Figure 41 on page 78*. Proceed to the Pipe option.

C.5.2.1 Programming the Mass Flow Option

1. Double-click on the desired *Mass Flow* units for flow rate display (listed in *Table 16* below).

Table 16: Available Mass Flow Units

English	Metric
Pounds	Kilograms
KiloPounds = Thousands of Pounds	Tonnes = Metric Tons (1000 KG)
MillionPounds	
TONS (2000 LB)	

2. Double-click on the desired *Mass Flow Time* units.
3. Double-click on the desired number of *MDOT Decimal Digits* (digits to the right of the decimal point) in the mass flow rate display.
4. Double-click on the desired *Mass Totalizer* units for the totalized mass flow rate display (listed in *Table 16* above).
5. Double-click on the desired number of *Mass Decimal Digits* (digits to the right of the decimal point) in the totalized mass flow rate display.

PanaView returns to the Channel PROGRAM window shown in *Figure 41 on page 78*. Proceed to the Pipe option on the next page.

C.5.3 Entering Pipe Parameters

Enter the transducer and pipe parameters via the Pipe submenu. While following the programming instructions, see *Figure 55 on page 109* of Appendix D, *PanaView Menu Maps.*

1. From the Channel PROGRAM menu, highlight and double-click on the Pipe Parameters option in the center pane.
2. The first prompt asks for the *Transducer Number.*
   - For a standard transducer, double-click on the *Standard* option in the center pane. Then enter the number engraved on the transducer head in the right pane, and click [Next Item].
   - If there is no number engraved on the transducer head, double-click on the *Special* option, enter an assigned number (from 91 to 99), and click [Next Item].

IMPORTANT: *Special transducers, which have no engraved number on the head, are rarely used. Examine the transducer head carefully for a number.*

The menu now varies, depending on your selection in step 2.

- If you entered the number for a standard transducer, proceed to the *Pipe OD* prompt in step 4.
- If you entered the number for a special transducer, proceed to step 3 below.

C.5.3.1 Special Transducers

1. For special transducers:

Note: *Panametrics supplies the information required for steps a and b with the transducers.*

   a. Double-click on the appropriate *Frequency* (from 25 kHz to 500 kHz).The frequency is required to transmit an excitation voltage at the transducer's natural frequency.

   b. Enter the *Time Delay (Tw)* value supplied by Panametrics and click [Next Item].

Tw is the time required for the transducer signal to travel through the transducer and its cable. This time delay must be subtracted from the transit times of the upstream and downstream transducers to ensure an accurate measurement.

C.5.3.2 Pipe OD

1. Click on the appropriate *Pipe OD Unit* type in the center pane from the list shown in *Table 17* below. Then enter the known pipe outside diameter or circumference in the right pane and click [Next Item].

Obtain the required information by measuring either the pipe outside diameter (OD) or circumference at the transducer installation site. The data may also be obtained from standard pipe size tables found in *Sound Speeds and Pipe Size Data* (914-004).

Table 17: Available Pipe OD Units

English	Metric
inch	mm
feet	meters
circum.in = pipe circumference in inches	circum.mm = pipe circumference in millimeters
circum.ft = pipe circumference in feet	circum.m = pipe circumference in meters

2. Enter the known *Pipe Wall Thickness* (in inches or mm) in the right pane and click [Next Item].

C.5.3.3 Path and Axial Lengths

1. Click on the appropriate *Path Length* unit type in the center pane. Then enter the path length of the ultrasonic signal in the right pane and click [Next Item].

Note: *If a spoolpiece was ordered with the meter, the transducer signal path length* (P) *and the transducer signal axial length* (L) *are engraved on the flowcell and/or are included in the documentation supplied with the meter. For on-site transducer installations, refer to Appendix C,* Measuring P and L Dimensions, *in the* Startup Guide *for instructions.*

2. Click on the appropriate *Axial Length* unit type in the center pane. Then enter the axial length of the ultrasonic signal in the right pane and click [Next Item].

C.5.3.4 Fluid Type

3. Double-click on the appropriate *Fluid Type*, either *Air* or *Other*.
   - If you select *Other*, PanaView asks for the *Fluid Soundspeed*. Enter the appropriate soundspeed (in ft/sec) and click [Next Item].

C.5.3.5 Reynolds Correction

1. Double-click on the appropriate choice to indicate whether you want *Reynolds Correction*.
   - If *Off* is selected, enter the *Calibration Factor* and click on [Next Item].
   - If *On* is selected, enter the *Kinematic Viscosity* and click [Next Item]. Then enter the *Calibration Factor* and click [Next Item].

PanaView returns to the Channel PROGRAM menu. You have completed entering pipe parameters.

C.5.4 Entering Input/Output Parameters

Enter the zero cutoff value and set up the temperature, pressure and quality inputs via the Input/Output submenu. While programming these parameters, refer to *Figure 55 on page 109* of Appendix D, *PanaView Menu Maps*.

IMPORTANT: *If an option card in* Slot 1 *fails to appear in this menu, it may be turned* OFF. *See the* Global-I/O-Options *section on* page 91 *for setup instructions.*

C.5.4.1 Zero Cutoff Value

Near a zero flow rate, the XGF868i readings may fluctuate due to small offsets caused by thermal drift or similar factors. To force a zero display reading when there is minimal flow, enter a *zero cutoff value* as described in the following steps:

1. From the Channel menu, highlight and double-click on the Input/Output option in the center pane.
2. The program asks for the *Zero Cutoff*. Enter a value from 0 to 1 ft/sec (0 to 0.30 m/sec) for the zero cutoff and click [Next Item]. The recommended setting is 0.1 ft/sec (0.03 m/sec).

C.5.4.2 Temperature Input

The XGF868i can use either a fixed temperature value or a live temperature input to calculate the density for the mass flow rate display.

1. Double-click on a *Fixed* temperature value or to set up the option card in *Slot 1* that will supply the live temperature input and press [Next Item].

Note: *If Slot 1 contains an activated option card with an analog input assigned to* Temperature *or an* RTD *input, Slot 1 appears as an option at the above prompt. If the process temperature is stable, a fixed value may be used, but most applications require a live temperature input. If there is no active option card for temperature, the meter assumes you are using a fixed temperature.*

2. Proceed to one of the following sections:
   - If you selected *Fixed* - proceed to Step 3.
   - If you selected *Slot 1* - proceed to Step 4.
3. Enter the known *Fixed Temp.* (process temperature) and click [Next Item]. The meter will accept values from −328 to 1832°F (−200 to 1000°C). Proceed to *Base Temperature* on the next page.
4. Select *Input A* or *Input B* and click [Next Item]. The inputs were labeled during setup.

Note: *The set up of Input A is used as an example. Identical procedures would be used to set up Input B.*

C.5.4.3 Base Temperature

1. Enter the *Base Temperature* and click [Next Item]. The ratio of this value to the actual temperature is used to calculate the standard mass flow rate.
2. Do one of the following:
   - If you selected Pressure as the Input Type, proceed to *Pressure Input* below.
   - If you selected Temperature as the Input Type, proceed to *Base Pressure* below.

C.5.4.4 Pressure Input

1. Double-click on a *Fixed* pressure value or to set up the option card in *Slot 1* that will supply the live pressure input.

Note: *If Slot 1 contains an activated option card with an input assigned to* Pressure, Slot 1 *appears as an option at the above prompt. If the process pressure is stable, a fixed value may be used, but most applications require a live pressure input. If there is no active option card for pressure, the meter assumes you are using a fixed pressure.*

2. Proceed to one of the following steps:
   - If you selected Fixed - proceed to Step 3.
   - If you selected Slot 1 - proceed to Step 4.
3. Enter the known *Fixed* process *Pressure* and click [Next Item]. The meter will only accept values from 0 to 5000 psia. Proceed to *Base Pressure* below.
4. Double-click on *Input A* or *Input B*. The inputs were labeled during setup.

Note: *The set up of Input A is used as an example. Identical procedures would be used to set up Input B.*

C.5.4.5 Base Pressure

1. Enter the *Base Pressure* and click [Next Item]. The ratio of this value to the actual pressure is used to calculate the standard mass flow rate.

C.5.4.6 Low Pressure Switch

1. Click on *Yes* or *No* to activate or deactivate the *Low Pressure Switch* software function and click [Next Item].
   - If you selected Yes, enter the *Pressure Limit*, the low pressure switch set point, and click [Next Item]. The acceptable range is 0 to 5000 psia. The meter will stop taking readings if the pressure drops below this value.

PanaView returns to the Channel PROGRAM menu. You have completed entering input/output parameters.

C.5.5 Entering Setup Parameters

The signal limits and response times for the XGF868i are specified via the SETUP submenu. While following the programming instructions, refer to *Figure 57 on page 111* of Appendix D, *PanaView Menu Maps*. This submenu includes four options:

- Signal - set the parameters related to the transducer signal
- V Averaging - specify the response of the meter to step changes
- Default Setup - initialize all parameters to default values
- *Advanced Features* - enable mass flow or activate K factors.

To enter the Set Up submenu, highlight and double-click on the *Set Up* option in the center pane of the Channel menu. Remember to record all programmed data in Appendix B, *Data Records*.

C.5.5.1 The Signal Option

Use this option to set the limits for the incoming signal and other parameters affecting the transducer signal. For example, the programmed signal strength low limit may be used to determine the trigger point for an alarm.

IMPORTANT: *The Signal default settings are suitable for most applications. Consult with Panametrics before changing any of these parameters.*

1. From the Set Up option menu, highlight and double-click on *Signal* in the center pane.
2. For each parameter, click [Next Item] to accept the current value or enter a new value and click [Next Item]. *Table 18 below* lists ranges and default parameters for each parameter.

Table 18: Transducer Signal Settings

Transducer Signal Parameters	Range	Default Value	Description
Signal Low Limit	-20 to 100	20	The E1:LOW SIGNAL error message appears when the signal strength falls below the programmed SIGNAL LOW LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Correlation Peak Limit	0 to 500	100	The E4: SIGNAL QUALITY error message appears when the signal quality falls below the programmed COR. PEAK LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes
Soundspeed+ - Limit	1 to 50%	20%	The E2:SOUNDSPEED error message appears when the calculated fluid sound speed differs from the fluid sound speed entered in the Channelx- System menu by more than the programmed SOUNDSPEED +- LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Velocity Low Limit	-500 to 500 ft/sec (-150 to 150 m/sec)	-150 ft/sec (-46 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity is less than the programmed VELOCITY LOW LIMIT value.See Chapter 2 in the Service Manual for a discussion of error codes.

Table 18: Transducer Signal Settings (cont.)

Transducer Signal Parameters	Range	Default Value	Description
Velocity High Limit	-500 to 500 ft/sec (-150 to 150 m/sec)	150 ft/sec (46 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity exceeds the programmed VELOCITY HIGH LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Acceleration Limit	0 to 250 ft/s (0 to 76 m/s)	15 ft/s (5 m/s)	The E6: CYCLE SKIP error message appears when the calculated fluid velocity changes by more than the programmed ACCELERATION LIMIT value from one reading to the next. See Chapter 2 in the Service Manual for a discussion of error codes.
Amplitude Discriminator Low	0 to 100	14	The amplitude discriminator measures the transducer signal received by the Model XGF868i. The default value for the above parameter is 14, and values from 0 to 100 are acceptable. The E5: AMPLITUDE error message appears when the amplitude discriminator falls below the programmed AMP. DISCRIM LOW value. See Chapter 2 in the Service Manual for a discussion of error codes.
Amplitude Discriminator High	0 to 100	34	The amplitude discriminator measures the transducer signal received by the Model XGF868i. The default value for the above parameter is 34, and values from 0 to 100 are acceptable. The E5: AMPLITUDE error message appears when the amplitude discriminator exceeds the programmed AMP. DISCRIM HIGH value. See Service Manual, Chapter 2 for a discussion of error codes.
Delta T Offset	-1000 to 1000 µsec	0 µsec	An offset between the upstream and downstream transit times is specified at this prompt.
Skan T Offset	–500 to 500 µsec	58 µsec	At this prompt, specify a time measurement offset that compensates for any shift resulting from cross-correlation. Set to 0 for active Skan T Offset.
% of Peak	1 to 100%	50%	The percentage of peak used to calculate the transit times and Delta T is specified at this prompt.
M>S Switch	0 to 250 µsec	50 µsec	If the burst mode is set to Skan/Measure (S/M), the meter switches from Skan to Measure Mode when Delta T is less than the M>S_Switch value. **DO NOT** change this value unless advised to do so by the factory.
# Shifts	0 to 10	3	The number of shifts corresponds to the actual number of transmits per cycle (number of signals added together in one direction to produce an averaged signal for one interrogation of the fluid) and need only be changed if the environment is very noisy or the acoustic signal is weak.
A Divisor	0.1 to 10	2.5	A Divisor is used to calculate the Measure Mode integrated threshold level and is not normally changed.
# Transmit Pulses	1 to 16	4	# Transmit Pulses specifies the number of pulses in a burst. For difficult conditions (i.e. long paths, high velocity or high temperature), settings as high as 16 may be necessary.
T Window (cycles)	0 to 1000	0	The XGF868i calculates the size of the transmit window based on pipe size and fluid sound speed. However, for diagnostic purposes, the window size may be reset.
R Window (cycles)	10 to 128	10	The XGF868i calculates the size of the receive window based on pipe size and fluid soundspeed. However, for diagnostic purposes, the window size may be reset.

After responding to the above prompt, the meter returns to the SET UP option window.

C.5.5.2 The Default Setup Option

Use this option to initialize (reset) all of the parameters within the Set Up Signal menu back to their default values. Complete the following steps to reset all of the parameters:

1. From the Set Up option menu, highlight and double-click on *Default Setup* in the center pane.
2. Double-click on *No* to keep the current values or on *Yes* to reset all values to their default settings.

After responding to the above prompt, the meter returns to the Set Up option window.

C.5.5.3 The V Averaging Option

Use this option to specify the number of readings that occur before the meter will respond to a step change in flow rate. In general, the smaller the number of readings, the less steady the display will appear. Complete the following steps to set the response time:

1. From the Set Up option menu, highlight and double-click on *V Averaging* in the center pane.
2. Double-click on the desired *Response Time* (from 1 to 60 sec).

For best results, select the STATS (statistics) option, as this increases the response time under steady flow conditions while still allowing a rapid response to changes in flow rate.

After responding to the above prompt, the meter returns to the Set Up option window.

C.5.5.4 The Advanced Features Option

This option enables you to enable the more advanced features of the meter. In this option you can do the following:

- enter a table of K-factors (based on velocity or reynolds number) that compensates for non-linear flow rates
- enable mass flow (calculated for static fluid density)

The Multiple K Factors Option

Use this option to enter a table of K-factors. K-factors are used to create a curve for the flow range (based on velocity or reynolds number) that compensates for non-linear flow rates. The meter accepts from 2 to 20 pairs. Complete the following steps to enter multiple K factors for velocity or reynolds values:

1. From the *Advanced Features* option menu, highlight and double-click on *Multiple K Factors* in the center pane.
2. Double-click on *Yes* to *Activate Multi K Factors* or on *No* to disable this option.

   If NO was selected, the meter returns to the *Advanced Features* window. If YES was selected, proceed to Step 3.
3. Double-click on the desired *Custom Type* (velocity or reynolds).
4. Double-click on *Yes* to *Edit* the K-factor *Table* or on *No* to retain the current K-factor table (and return to the *Advanced Features* window).

   If NO was selected, the meter returns to the *Advanced Features* window. If YES was selected, proceed to Step 5.

Note: *If the necessary velocity/reynolds vs. K-factor data was not provided with the XGF868i's documentation, the K-factor table cannot be edited.*

5. Enter the *Number Of K-factors* (from 2 to 20) to be entered into the table, and click [Next Item].

Note: *When editing the K-factor table, the velocities must be entered in increasing order.*

6. Enter the *Velocity/Reynolds Value* for K-factor number "X" and click [Next Item].
7. Enter the *K-factor* corresponding to velocity/reynolds number "X" (0.333 to 3.0) and click [Next Item].

The *Velocity #* and *K Factor #* prompts repeat for each pair. After entering all the pairs, the meter returns to the *Advanced Features* window.

The Mass Flow Option

Use this option to calculate mass flow from a static fluid density. Complete the following steps to enter the static density of the fluid:

1. From the *Advanced Features* option menu, highlight and double-click on *Mass flow calculation* in the center pane.
2. Double-click on *Yes* to activate *Static Density* or on *No* to disable this option. (If you select No, PanaView returns to the *Advanced Features* window.)
3. Double-click the *Density Type* (fluid density (Rho) or molecular weight (Mw)) and click [Next Item].
4. Do one of the following:
   - If you selected Rho - proceed to Step 5.
   - If you selected Mw - proceed to Step 7.
5. Double-click the type of volumetric units (standard - StVOL or actual-AcVOL) for the measurement data display and click [Next Item].
6. Enter the *Fluid Density* (0.00001 to 0.100 lb/ft^3 or 0.00001 to 123.18 kg/m^3) and click [Next Item]. PanaView returns to the *Advanced Features* window.
7. Enter the *Molecular Weight* and click [Next Item].

After responding to the above prompt, the meter returns to the *Advanced Features* window. Click [Exit Page] three times to return to the *Site Edit Menu.*

C.6 Entering Data in the Global Menu

The Global menu is used to enter information that is not specific to any of the individual channels. Information programmed via this menu is used to enter several general system parameters (e.g., English or metric units). For meters with 2 channels, this menu is also used to compute parameters such as the sum, difference or average of the channel 1 and channel 2 signals. When calculating the SUM, DIF or AVE readouts, data from the Global-System submenu is used. Any conflicting data entered in the Channel-System submenu is overridden.

The following submenus are included in the Global menu:

- System - use to specify the units of measure used in calculations
- Input/Output - used to set up error handling and to configure analog inputs and outputs
- Comm port - used to set up the serial communications port and MODBUS parameters

To enter the Global menu, double-click on the Global entry in the left pane of the *Site Edit Menu* window. Then proceed to the appropriate section of this chapter for instructions. See *Figure 58 on page 112* in Appendix D, *PanaView Menu Maps,* and remember to record all programming data in Appendix B, *Data Records*.

C.6.1 Entering Global-System Data

While completing these instructions, refer to *Figure 58 on page 112* in Appendix D, *PanaView Menu Maps*.

1. In the *Site Data Menu*, double-click on the Global entry.
2. Highlight and double-click on the *System* option in the center pane. The window now appears similar to *Figure 45* below.

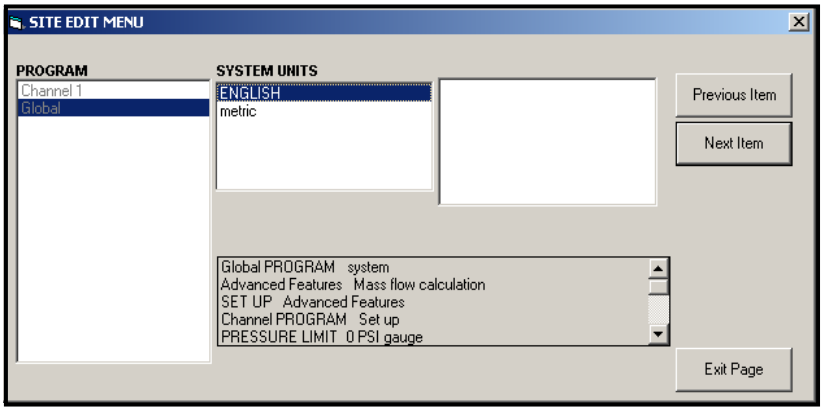


Figure 45: System Option in the Global Menu

3. Double-click on the desired *System Units* selection (either metric or English). The XGF868i will display all parameters and measurements in the designated units.
4. Double-click on the desired *Pressure Units* (absolute or gauge) and click [Next Item].
   a. If gauge was selected, enter the desired *Atmospheric Pressure*, and click [Next Item].

- Proceed to step 1 on the next page.

C.6.1.1 Volumetric Units

1. Double-click on the desired *Volumetric Units* for the flow rate display. *Table 19* below lists the available units.

Table 19: Available Volumetric/Totalizer Units

English	Metric
Actual Cubic Feet	Actual Cubic Meters
Thousands of ACF	Thousands of ACM
Millions of ACF	Millions of ACM
Standard Cubic Feet	Standard Cubic Meters
Thousands of SCF	Thousands of SCM
Millions of SCF	Millions of SCM

2. Double-click on the desired *Time* units for the flow rate display.
3. Double-click on the desired number of *Vol Decimal Digits* (digits to the right of the decimal point in the volumetric flow rate display).

C.6.1.2 Selecting Totalizer Units

1. Double-click on the desired *Totalizer Units* for the totalized flow rate display. Available units are listed in *Table 19* above.
2. Double-click on the desired number of *Tot Decimal Digits* (digits to the right of the decimal point in the totalized flow rate display).
3. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting the Mass Flow Units* on the next page.
   - If MASS FLOW is OFF, the meter returns to the Global PROGRAM window. Click [Exit Page] to return to the *Site Edit Menu*.

Note: *To activate mass flow, refer to* page 89. *The following prompts will appear only if mass flow is activated for both channels.*

C.6.1.3 Programming Mass Flow Data

1. Double-click on the desired *Mass Flow* units for flow rate display. The options are listed in *Table 20* below.

Table 20: Available Mass Flow Units

English	Metric
Pounds	Kilograms
KiloPounds (Thousands of Pounds)	Tonne = Metric Tons (1000 KG)
MillionPounds	
TONS (2000 LB)	

2. Double-click on the desired *Mass Flow Time* units (from seconds to days).
3. Double-click on the desired number of *MDOT Dec.Digits* (digits to the right of the decimal point) in the mass flow rate display.
4. Double-click on the desired *Mass Totalizer Units* The available units for the totalized mass flow rate display are listed in *Table 20*.
5. Double-click on the desired number of *Mass Decimal Digits* (digits to the right of the decimal point) in the totalized mass flow rate display.

The XGF868i returns to the Global PROGRAM window. Click [Exit Page] to return to the *Site Edit Menu*.

You have completed entering selections in this option.The program returns to the Global PROGRAM menu.

C.6.2 Setting Up Inputs and Outputs

Set up the XGF868i inputs and outputs via the I/O submenu. While following the programming instructions, see *Figure 58 on page 112* in Appendix D, *PanaView Menu Maps*. Remember to record all programmed data in Appendix B, *Data Records*.The I/O submenu consists of the following options:

- Error Handling - program the meter's response during an error condition
- Options - set up any option cards and the Slot 0 analog outputs
- Display - set up the LCD display.

To enter the I/O submenu:

1. In the *Site Data Menu*, double-click on the Global entry.
2. Highlight and double-click on the *Input/Output* option in the center pane.

Note: *In this section,* Slot 1 *appears as an option only if a suitable option card is installed in Slot 1.*

C.6.2.1 Setting Up Error Handling

This menu option lets you set how the XGF868i will handle the outputs for measurements and average (two-path) measurements during an error condition. See Chapter 2, *Error Codes*, in the *Service Manual* for a discussion of the built-in error codes.

1. From the Input/Output option, highlight and double-click on the *Error Handling* option in the center pane.
2. Double-click on the desired *Error Handling* selection (as shown in *Table 21* and *Table 22* below).
   a. If you selected *Error Level in mA*, enter the *4-20 mA Error Level* (the number of milliamps the analog output will put out during a fault condition). Enter a whole number between 0 and 22, and click [Next Item].

See *Table 21* and *Table 22* below for a description of the error handling options available and how the totalizers and display respond to them for a single and two-channel meter.

Table 21: Error Options and Responses for a One-Channel Meter

Option	Output Response	Totalizer Response
Hold Last Value	Holds the last "good" reading	Holds the last "good" reading and continues to totalize, based on that reading
Force Low	Forces the outputs to the low set point	Stops totalizing
Force High	Forces the outputs to the high set point	Stops totalizing
Force High High	Forces the outputs ≈10% above the high set point	Stops totalizing
Error Level in mA	Allows user to enter 4-20 mA error level in mA.	Sends analog outputs to entered mA level when a fault occurs.

Table 22: Error Options and Responses for a Two-Channel Meter

When Measuring	Display Response	Totalizer Response When Error Handling is	
		HOLD	LOW, HIGH, HHIGH
CH1 or CH2 (vel, vol, etc.)	Holds last "good" reading.	Holds last "good" reading and continues to totalize based on that "good" reading.	Stops totalizing.
SUM	Adds two channels using the last "good" reading.	Holds last "good" reading and continues to totalize based on two channels.	Stops totalizing if either or both channels go into error.
DIF	Subtracts two channels using last "good" reading.	Holds last "good" reading and continues to totalize based on two channels.	Stops totalizing if either or both channels go into error.
AVE	See *Error Handling for Average Measurements* below.		

C.6.2.2 The Error Option

Note: *The* 2PATH ERROR HANDLING *option is intended for applications where two sets of transducers are installed in the same location in the same pipe to improve accuracy and the meter is operated in* AVE *mode. With this function enabled, the XGF868i performs error handling only if both channels are in error. If this function is disabled, error handling occurs when either channel goes into error.*

For a one-channel meter, after responding to the previous prompt, the meter returns to the Global I/O prompt shown on the previous page. For a two-channel meter, proceed to step 3 below.

3. Double-click *Yes* to enable *Two-path Error Handling,* or on *No* to disable this function.

Specific responses of the display and the totalizer to the two-path error handling option available at the above prompt are listed in *Table 23* below.

Table 23: 2-Path Error Response Options

Option	Display Response	Totalizer Response
NO	Displays the average of CH1 and CH2, regardless of the error state of either channel.	Outputs the average of CH1 and CH2 totals, regardless of the error state of either channel.
YES	1. If one channel is in error, the other channel's value is displayed as the average. 2. If both channels are in error, the last average reading is held.	1. If one channel is in error, totalizing continues. 2. If both channels are in error, totalizing stops.

After responding to the above prompt, the meter returns to the Input/Output option menu.

C.6.2.3 Setting Up Option Cards

The XGF868i has two built-in analog outputs, which are assigned to Slot 0. Also, a variety of input/output option cards may be installed in Slot 1. See Chapter 1, *Installation*, of the *Startup Guide* for a complete description of the available option cards.

To access this submenu, double-click on the *Options* entry in the Input/Output submenu. This menu option is used to set up and/or scale the inputs and outputs. To accomplish this, complete the following steps:

- Double-click on the desired *I/O Slot* to program the I/O functions in that slot.

Note: *If an option card is not installed in Slot 1, the* Slot1 *option does not appear at the above prompt.*

Proceed to the appropriate section for programming instructions specific to the type of input or output selected above.

Analog Outputs

Complete the following steps to set up the analog outputs for any slot (refer to *Figure 58 on page 112*):

1. Double-click on the desired *Output* (A or B).

Note: *The set up of output A is used here as an example. Identical procedures would be used to set up output B.*

2. Double-click on *Off* to disable Output A and return to step 1, or on *0-20 mA* or *4-20 mA* to specify the desired range for output A.
3. Double-click on the desired *Channel* option. See *Table 24* below for a description of the channel options available.

Table 24: Channel Options

Option	Description
Channel 1	Channel 1
Channel 2	Channel 2
Add Channels	CH1+CH2

Table 24: Channel Options

Option	Description
Subtract Channels	CH1-CH2
Average Channels	(CH1+CH2)/2

4. Double-click on the desired *Measurement Name*. (Table 25 on next page) provides a description of the available parameters.)

Note: *All the options shown below will appear only if Mass Flow is activated.*

Table 25: Available Measurement Parameters

Option Bar	Description	Good	Bad
Velocity	Displays the flow velocity.	N.A.	N.A.
Volumetric	Displays the volumetric flow.	N.A.	N.A.
FWD Total	Displays the forward totalized volume flow.	N.A.	N.A.
REV Total	Displays the reverse totalized volume flow.	N.A.	N.A.
Time	Displays the total flow measurement time.	N.A.	N.A.
Mass Flow	Displays the mass flow.	N.A.	N.A.
FWD Mass	Displays the forward totalized mass flow.	N.A.	N.A.
REV Mass	Displays the reverse totalized mass flow.	N.A.	N.A.
Mw	Displays the molecular weight.	N.A.	N.A.
UP Sig Strength	Displays the signal strength for the upstream transducer.	50–75	<50 or >75
DN Sig Strength	Displays the signal strength for the downstream transducer.	50–75	<50 or >75
Soundspeed	Displays the measured speed of sound in the gas.	N.A.	N.A.
UP Transit	Displays the upstream ultrasonic signal transit time.	N.A.	N.A.
DN Transit	Displays the downstream ultrasonic signal transit time.	N.A.	N.A.
Delta T	Displays the transit time difference between the upstream and downstream signals.	N.A.	N.A.
K(Re)*Multi K*K Factor	K factor, based on the Reynolds number.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default).	N.A.	N.A.
UP Signal Q	Displays the signal quality for the upstream transducer.	≥1200	–400 to +400
DN Signal Q	Displays the signal quality for the downstream transducer.	≥1200	–400 to +400
UP Amp Discrim	Displays the value for the signal amplitude of the upstream transducer.	24 ± 5	<19 or >29
DN Amp Discrim	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29
UP DAC COUNTS	Displays the AGC DAC count for the upstream gain setting.	N.A.	N.A.
DN DAC COUNTS	Displays the AGC DAC count for the downstream gain setting.	N.A.	N.A.
UP +–Peak	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
DN +– Peak	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
Temperature	Displays the gas temperature (from 0/4-20 mA input).	N.A.	N.A.
Pressure	Displays the gas pressure (from 0/4-20 mA input).	N.A.	N.A.
Act Vol.	Displays actual volumetric flow.	N.A.	N.A.
Std Vol.	Displays standard volumetric flow.	N.A.	N.A.

Table 25: Available Measurement Parameters

Option Bar	Description	Good	Bad
Up Transit S[1]	Displays Skan transit time upstream.	N.A.	N.A.
Dn Transit S[1]	Displays Skan transit time downstream.	N.A.	N.A.
Delta T S[1]	Displays Skan Delta T.	N.A.	N.A.
Up Transit M[1]	Displays Measure transit time upstream.	N.A.	N.A.
Dn Transit M[1]	Displays Measure transit time downstream.	N.A.	N.A.
Delta T M[1]	Displays Measure Delta T.	N.A.	N.A.
Vinst	Displays the instantaneous velocity.	N.A.	N.A.
[1]available only if Burst Mode = S/M			

Note: *The measurement units that appear in these prompts are those selected in the* Global-System *menu earlier in this section.*

5. Enter a flow rate value for the *Zero* (low) end of the analog output range and click [Next Item].
6. Enter a flow rate value for the *Full* (high) end of the analog output range and click [Next Item].

After responding to the above prompt, the meter returns to step 1. Click [Exit Page] to proceed to another menu or option.

Option Card Analog Inputs

Complete the following steps to set up the analog inputs of an option card installed in Slot 1 (refer to *Figure 58 on page 112*):

1. Double-click on the desired *Input* (A, B, C or D).

Note: *The setup of input A is used as an example. Identical procedures would be used to set up the remaining inputs.*

2. Enter a *Label* of up to eight characters for input A and click on [Next Item].
3. Double-click on *Off* to disable Input A and return to step 1, or on *Temp* or *Spec* to designate it as a temperature or special input.

- OFF

If OFF was selected to disable input A, the meter returns to the *Input* prompt in step 1. Double-click on another input, or click [Exit Page] to move to another menu.

- TEMP or PRESR

If TEMP or PRESR was selected to set up input A as a live temperature or pressure input, complete steps 4 and 5 below:

4. Enter a value for the *Base* (low) end of the analog input range and click [Next Item].
5. Enter a value for the *Full Scale* (high) end of the analog input range and click [Next Item].

After responding to the above prompt, the meter returns to step 1. Click [Exit Page] to proceed to another menu or option.

- SPEC

If SPEC was selected to set up input A as a live special input, complete steps 6 through 9 below:

6. Enter a *Name* for input A and click [Next Item].
7. Enter the *Units* of measurement for input A and click [Next Item].
8. Enter a temperature value for the *Base* (low) end of the analog input range and click [Next Item].
9. Enter a temperature value for the *Full Scale* (high) end of the analog input range and click [Next Item].

After responding to the above prompt, the meter returns to step 1. Click [Exit Page] to proceed to another menu or option.

Option Card RTD Inputs

Option cards with RTD inputs have a temperature range of -148° to 660°F (–100° to 350°C). Complete the following steps to set up the RTD inputs of an option card installed in Slot 1 (refer to *Figure 58 on page 112*):

1. Double-click on the desired *Input* (A, B, C or D).

Note: *The setup of RTD input A is used here as an example. Identical procedures would be used to set up the remaining RTD inputs.*

2. Enter a *Label* of up to eight characters for input A and click [Next Item].
3. Double-click on *Off* to disable Input A and return to step 1, or on *Temp* to enable input A as a live temperature input.
4. Enter a temperature value for the *Zero* (low) end of the analog input range and click [Next Item].
5. Enter a temperature value for the *Full Scale* (high) end of the analog input range and click [Next Item].

After responding to the above prompt, the meter returns to step 1. Click [Exit Page] to proceed to another menu or option.

Option Card Frequency Outputs

This type of output produces a frequency pulse that is proportional to the output measurement. Complete the following steps to set up the frequency outputs of an option card installed in Slot 1 (see *Figure 58 on page 112*):

1. Double-click on the desired *Output* (A, B, C or D).

Note: *The set up of output A is used as an example. Identical procedures would be used to set up the other outputs.*

2. Double-click on *Off* to disable Output A and return to step 1, or on *Frequency* to set up output A as a frequency output.
3. Double-click on the desired *Channel* option.See *Table 26* for a description of the channel options available at the above prompt.
4. Double-click on the desired *Measurement Name*. (*Table 25* provides a description of the available parameters.)

Note: *The measurement units that appear in these prompts are those selected in the* Global-System *menu earlier in this section.*

5. Enter a flow rate value for the *Zero* (low) end of the frequency output range and click [Next Item].
6. Enter a flow rate value for the *Full* (high) end of the frequency output range and click [Next Item].
7. Enter a value between 1 and 10,000 for the *Full Scale Frequency* and click [Next Item].

After responding to the above prompt, the meter returns to step 1. Click [Exit Page]:

- once to return to the Global I/O option:
- twice to return to the Global PROGRAM option:
- three times to return to the *Site Edit Menu*:
- four times to exit the *Site Edit Menu*.

C.6.2.4 Programming the LCD

Through PanaView, you can program the LCD display to display up to four variables in sequence. Complete the following steps to program the LCD display:

Note: *When you first initialize the XGF868i, the number of LCD parameters is set to OFF. You must program the LCD to display any measured parameters.*

1. From the Input/Output option, highlight and double-click on the *Display* option in the center pane.
2. The first prompt asks for the *# of LCD Parameters*. Double-click on the desired number (from OFF through 1-4 and KEY).
   The OFF setting switches the measurement display off, while the KEY setting enables users to change the measurement display via the arrow keys, without accessing the *Keypad Program*. If you select KEY:
   - To view a parameter other than the one currently displayed, press the [△] or [▽] keys to scroll through the various parameters.
   - To scroll through the channel options on a two-channel XGF868i, press the [◁] and [▷] keys until you have reached the desired option.
3. Scroll to the desired *Channel option*, as listed in *Table 26* below.

Table 26: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

4. For each channel, select the desired *Measurement Parameter*, as shown in *Table 25*.
5. Repeat steps 3 and 4 for each parameter. PanaView returns to the Global I/O menu.

C.6.3 Entering Communications Data

The XGF868i flowmeter is equipped with an RS232 serial interface. The serial port is used to transmit stored data and displayed readings to a personal computer by connecting the meter's serial interface to the serial port of the PC. In addition, the XGF868i can receive and execute remote commands, using *PanaView* software, via this link.

Use the Comm port submenu to set the communications port and MODBUS parameters. While following the programming instructions, refer to *Figure 57 on page 111* of Appendix D, *PanaView Menu Maps*.

C.6.3.1 Setting Up the Serial Port

1. To enter this submenu from the Global menu, highlight and double-click on the *Comm port* option in the center pane.
2. Enter a *Meter Address* number between 1 and 254 and click [Next Item]. The default number is 1.
   A meter address is only necessary for communication with the Panametrics *PanaView* software. See the *PanaView User's Manual* for more information.

IMPORTANT: *If the meter address or baud rate is changed, communication with PanaView must be re-established with the new address number.*

3. Double-click on the desired *Baud Rate* (from 300 to 19200).

If you have the MODBUS option, proceed to step 4 below. If you have the standard RS232 serial interface, the meter exits the Comm port submenu and returns to the Global PROGRAM prompt.

Note: *The XGF868i MODBUS communication settings chosen in the next four steps must match those of the MODBUS control system.*

4. Double-click on the desired *MODBUS Baud Rate* (from 2400 to 9600).
5. Double-click on the desired *MODBUS Parity* (None, Odd or Even).

6. Double-click on the desired *MODBUS Stop Bits* (1 or 2).
7. Enter the desired *MODBUS Address*.

The meter exits the Comm port submenu and returns to the Global window. Click [Exit Page] once to return to the *Site Edit Menu*, and [Close] to exit the *Site Edit Menu*.

IMPORTANT: *You must reboot the XGF868i to load the new settings.*

Refer to the section *Requesting Parameters Using MODBUS* on the following page to retrieve data from the XGF868i using MODBUS.

C.6.3.2 Requesting Parameters Using MODBUS

To request specific parameters from the XGF868i via the MODBUS, the control system must access the appropriate register number, as shown in *Table 27* below. Only registers 1–84 are available with the XGF868i for MODBUS communications. Registers 508–512 are used by the XGF868i to store the MODBUS parameters.

Table 27: MODBUS Registers

MODBUS Reg #	DPR Hex Addr	Description	Scaling (decimal places)	Size in Bytes	MODBUS Reg #
1	0	1"Clear Ch1 Totalizers"	--	2 (16 bit signed)	1
2	2	1"Clear Ch2 Totalizers"	--	2 (16 bit signed)	2
3	4	Ch1 Velocity	2	4 (2 16-bit int)	3
5	8	Ch1 Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)	5
7	C	Ch1 Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)	7
9	10	Ch1 Fwd Totals	#T DIGITS	4 (2 16 bit int)	9
11	14	Ch1 Rev Totals	#T DIGITS	4 (2 16 bit int)	11
13	18	Ch1 #Tot Digits	0	2	13
14	1A	Ch1 Mass Flow	#M DIGITS	4 (IEEE 32 bit)	14
16	1E	Ch1 Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)	16
18	22	Ch1 Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)	18
20	26	Ch1 #Mass Tot Digits	0	2	20
21	28	Ch1 Timer	2	4 (2 16-bit int)	21
23	2C	Ch1 Error Code	0	2	23
24	2E	Ch1 Sound Speed	3	4 (2 16-bit int)	24
26	32	Ch1 Molecular Weight	4	4 (2 16-bit int)	26
28	36	Ch1 Sig Strength Upstream	1	4 (2 16-bit int)	28
30	3A	Ch1 Sig Strength Downstream	1	4 (2 16-bit int)	30
32	3E	Ch1 Temperature	2	4 (2 16-bit int)	32
34	42	Ch1 Pressure	3	4 (2 16-bit int)	34
36	46	Ch2 Velocity	2	4 (2 16-bit int)	36
38	4A	Ch2 Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)	38
40	4E	Ch2 Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)	40
42	52	Ch2 Fwd Totals	#T DIGITS	4 (2 16 bit int)	42
44	56	Ch2 Rev Totals	#T DIGITS	4 (2 16 bit int)	44
46	5A	Ch2 #Tot Digits	0	2	46
47	5C	Ch2 Mass Flow	#M DIGITS	4 (IEEE 32 bit)	47
49	60	Ch2 Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)	49
51	64	Ch2 Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)	51

Table 27: MODBUS Registers

MODBUS Reg #	DPR Hex Addr	Description	Scaling (decimal places)	Size in Bytes	MODBUS Reg #
53	68	Ch2 #Mass Tot Digits	0	2	53
54	6A	Ch2 Timer	2	4 (2 16-bit int)	54
56	6E	Ch2 Error Code	0	2	56
57	70	Ch2 Sound Speed	3	4 (2 16-bit int)	57
59	74	Ch2 Molecular Weight	4	4 (2 16-bit int)	59
61	78	Ch2 Sig Strength Upstream	1	4 (2 16-bit int)	61
63	7C	Ch2 Sig Strength Downstream	1	4 (2 16-bit int)	63
65	80	Ch2 Temperature	2	4 (2 16-bit int)	65
67	84	Ch2 Pressure	3	4 (2 16-bit int)	67
69	88	Avg Velocity	2	4 (2 16-bit int)	69
71	8C	Avg Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)	71
73	90	Avg Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)	73
75	94	Avg Fwd Totals	#T DIGITS	4 (2 16 bit int)	75
77	98	Avg Rev Totals	#T DIGITS	4 (2 16 bit int)	77
79	9C	Avg #Tot Digits	0	2	79
80	9E	Avg Mass Flow	#M DIGITS	4 (IEEE 32 bit)	80
82	A2	Avg Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)	82
84	A6	Avg Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)	84
86	AA	Avg #Mass Tot Digits	0	2	86
87	AC	Avg Timer	2	4 (2 16-bit int)	87
89	B0	[5]Avg Error Code	0	2	89
90	B2	Avg Sound Speed	3	4 (2 16-bit int)	90
508	3F6	[2]MODBUS baud rate	0	2	508

Notes:

1. **Clear Totalizers:** flag from the 8051 to clear totalizers in the 68332 memory.
2. **Error Value:** see table in XGF868i manual for error codes
3. **Average:**
   average of channel 1 and channel 2 if both channels out of error,
   channel 1 value if channel 2 is in error,
   channel 2 value if channel 1 is in error,
   zero if both channels in error.
4. **Average Error Status:**
   0 = both in error
   1 = chan 2 in error,
   2 = chan 1 in error,
   3 = both ok
5. **MODBUS baud rate:**
   5 = 2400, 6 = 4800, 7 = 9600
6. **MODBUS parity:**
   0 = none, 1 = odd, 2 = even
7. **MODBUS stop bits:**
   1 = 1 stop bit, 2 = 2 stop bits

8. General:
   Registers are written if corresponding functions are actuated by the user. Registers for unactuated functions are initialized to zero at startup.

C.7 Exiting the Site Edit Menu

After leaving the Global submenu, PanaView returns to the *Site Edit Menu*. Click [Close] to exit the *Site Edit Menu.* Then proceed to Chapter 3, *Operation*, of the *Startup Guide* for instructions on taking measurements, or refer to the appropriate chapters of this manual for detailed instructions on using the other features of the XGF868i flow transmitter.

C.7.0.1 Activating Security in the Global Menu

In order to prevent unauthorized tampering with the flowmeter's programming, the XGF868i is equipped with a security feature that locks all the keys except [PROG] (which, when pressed, requires the password).

When the system is locked, access to the menus will be denied unless the correct password is entered. The XGF868i is shipped with a default password (2719 and three spaces). For increased security, the default password should be changed.

Note: *Once the system has been locked, it can only be unlocked by entering the password, because access to the SECUR submenu is restricted.*

While completing these instructions, refer to the menu map in Figure 57 on page 111.

1. In the *Site Data Menu*, double-click on the Global entry. If the system is unlocked, the window appears similar to Figure 46 below. Highlight and double-click on the Security option in the center pane.

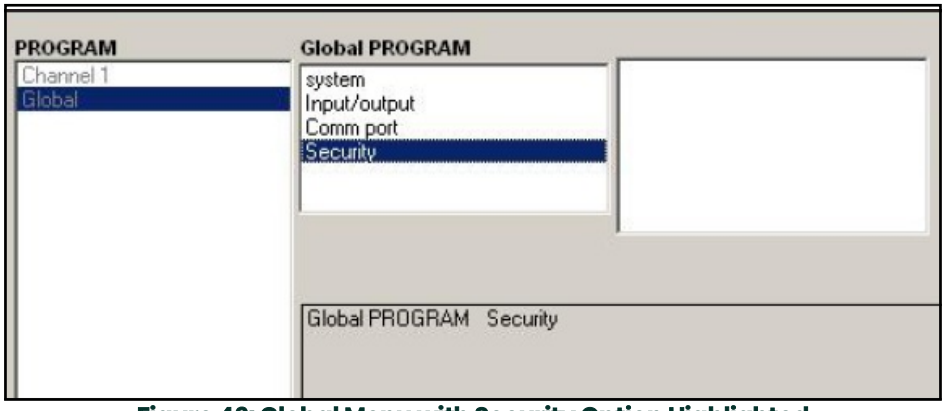


Figure 46: Global Menu with Security Option Highlighted

2. If the system is locked, the window is similar to Figure 47 below.

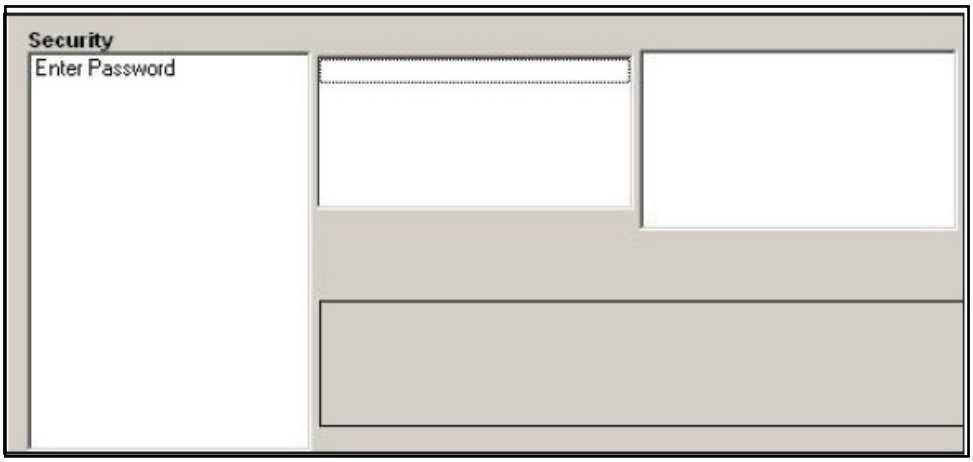


Figure 47: Password Window

3. Enter the current or default Password and click [Next Item].

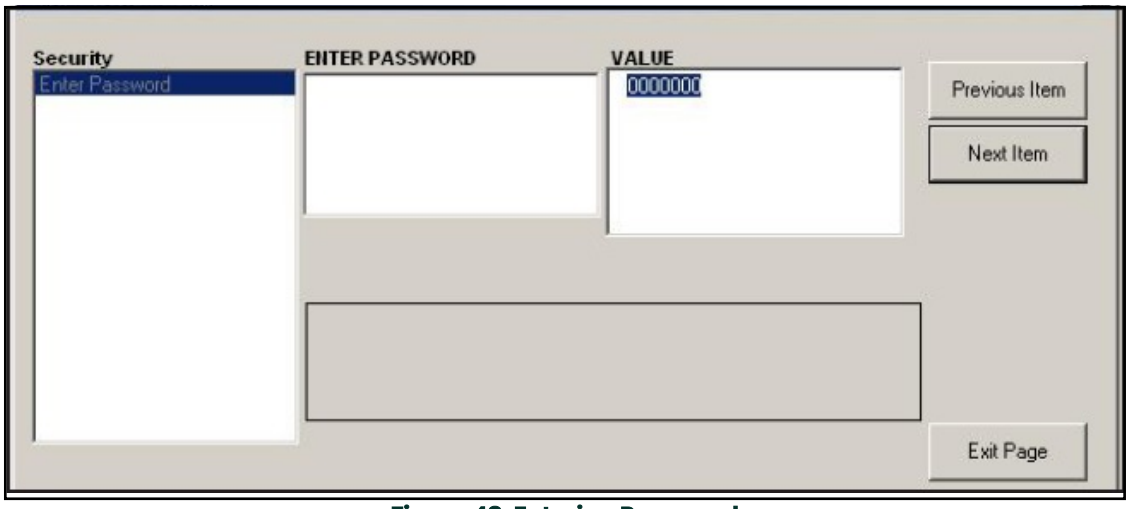


Figure 48: Entering Password

4. At the Lock Out prompt, click UNlck to unlock the system and return to the initial PROGRAM menu, or click LOCK to lock the system.
5. At the Edit Password prompt, click No to leave the password unchanged, or click YES to enter a new password.

IMPORTANT: *Since the default password is printed in this manual, a new password should be entered. If the password is ever lost, contact the factory for assistance.*

6. Enter the New Password and click Yes. Any combination of letters and numbers up to a total of 7 characters may be used as a password.
7. Verify the New Password by re-entering it and click Yes. Be sure to record the new password in a safe place.

C.8 Exiting the Site Edit Menu

After leaving the Global submenu, PanaView returns to the *Site Edit Menu*. Click [Close] to exit the *Site Edit Menu.* Then proceed to Chapter 3, *Operation*, of the *Startup Guide* for instructions on taking measurements, or refer to the appropriate chapters of this manual for detailed instructions on using the other features of the XGF868i flow transmitter.

C.9 Saving Site Data

The XGF868i holds setup parameters for a single internal site, called *Working*. Through PanaView, users can store site file data in a PC and reload it into the XGF868i. To save or reload site data via PanaView:

1. In the *New Meter Browser*, highlight the XGF868i.
2. Right-click on the highlighted XGF868i and select the *Properties* option, as shown in *Figure 49* below.

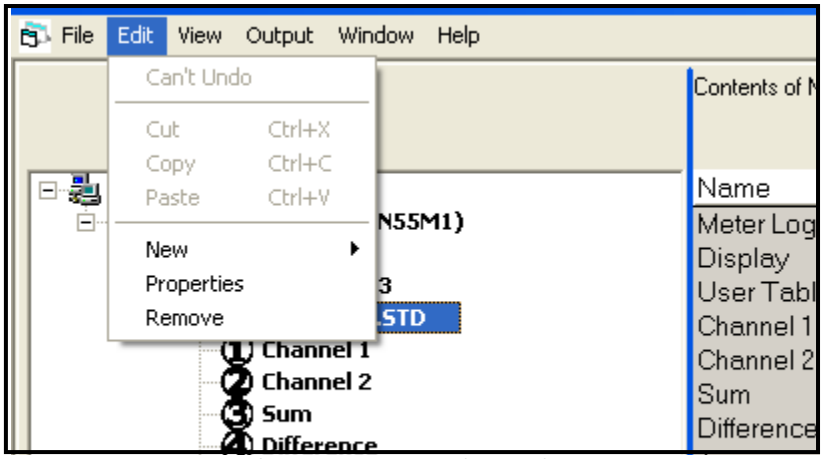


Figure 49: *Properties* Option

The window now appears similar to *Figure 50* below.

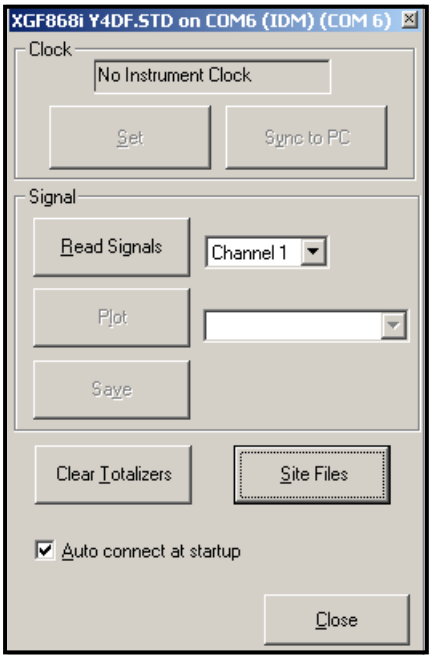


Figure 50: Properties Window

3. Click on the [Site Files] button. The *Site File Operations* window, as shown in *Figure 51* below, opens.

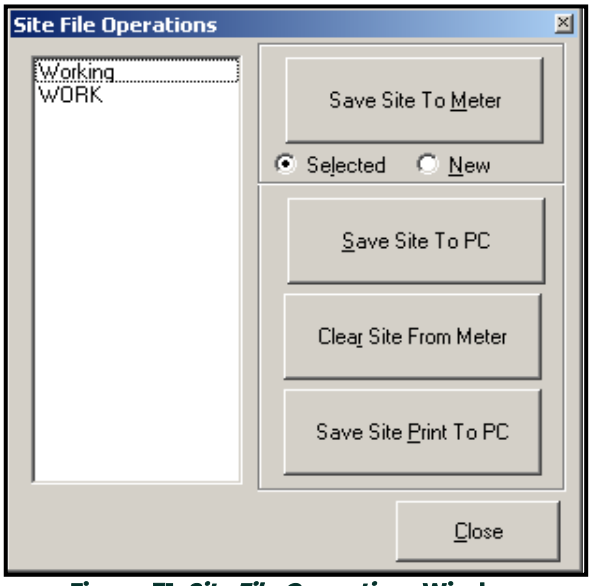


Figure 51: *Site File Operations* Window

C.9.1 Saving Current Site Data to the Meter

To save existing site data to the meter:

1. Select the radio button for *Selected* and highlight an existing site in the left pane.
2. Then click on the [Save Site to Meter] button. A screen similar to *Figure 52* below opens.

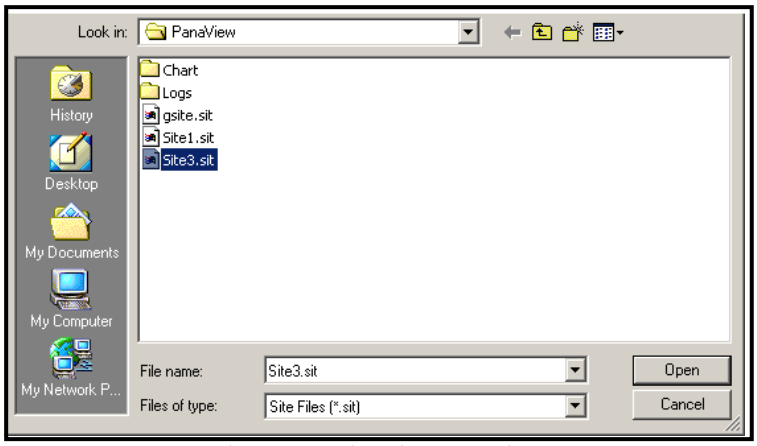


Figure 52: Site File Selection

3. Highlight the desired site and click [Open]. PanaView sends the site to the meter.

C.9.2 Saving New Site Data to the XGF868i

To save new site data to the meter:

1. Select the radio button for *New* and click on the [Save Site to Meter] button.
2. A window similar to *Figure 53* below opens. Enter the desired name, and click [OK].

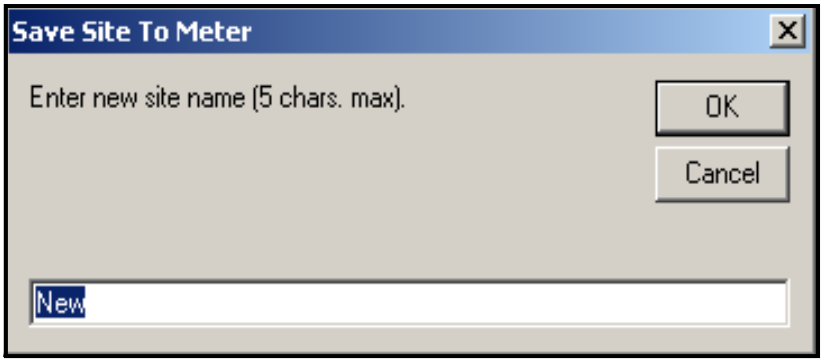


Figure 53: Site Name Entry Window

5. The *Site File Selection* window (*Figure 52 on page 103*) opens. Highlight a site file with the desired settings, and click [Open]. The site file becomes the *Working* site in the meter with the desired settings.

C.9.3 Saving a Site to the PC

To save a site to the PC:

1. Highlight the desired site in the left pane. (See *Figure 51 on page 103.*)
2. Click [Save Site to PC]. A window similar to *Figure 52 on page 103* opens.
3. Enter the desired site name and click [Save]. PanaView saves the site in the PanaView folder unless otherwise specified.

Note: *If you have created a site on the meter after opening the* Site File Operations *window, you must close and reopen the window to click on the new site.*

C.9.4 Clearing a Site from the Meter

As the XGF868i has only one site loaded (*Working)* at any time, it is not possible to remove this site. To change site parameters, first save a site to the PC (as discussed in *Saving a Site to the PC* on the previous page), and then save the site to the XGF868i (as discussed in *Saving New Site Data to the XGF868i* on the previous page).

C.9.5 Saving Site Data in Text Form

To store the data from a site file as a text file for display or printout:

1. Highlight the site in the left pane. (see *Figure 52 on page 103.*)
2. Click on [Save Site Print to PC].
3. The *Site File Selection* window (shown in *Figure 52 on page 103*) opens. Enter the desired site name (now with a .prt suffix) and click on [Save]. PanaView displays a text version of the site, as shown in *Figure 54* below.

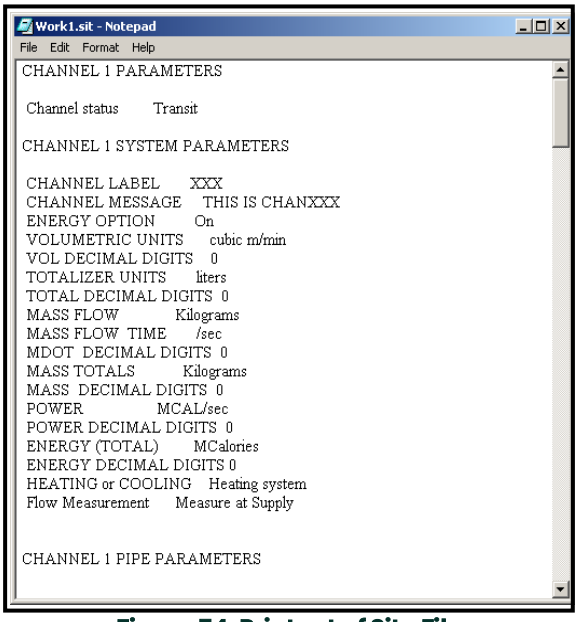


Figure 54: Printout of Site File

4. Click [Close] once to close the *Site File Operations* window, and a second time to close the *Properties* window and return to the *Meter Browser*.

[no content intended for this page]

Appendix D. PanaView Menu Maps for the XGF868i

The following *PanaView Menu Maps* are included in this appendix:

- Figure 55, “PanaView PROG > CHx > ACTIV, SYSTM, PIPE & I/O Menus,” on page 109
- Figure 56, “PanaView PROG > CHx > SETUP Menu,” on page 110
- Figure 57, “PanaView PROG > GLOBL > SYSTM, I/O & COMM Menus,” on page 111

[no content intended for this page]

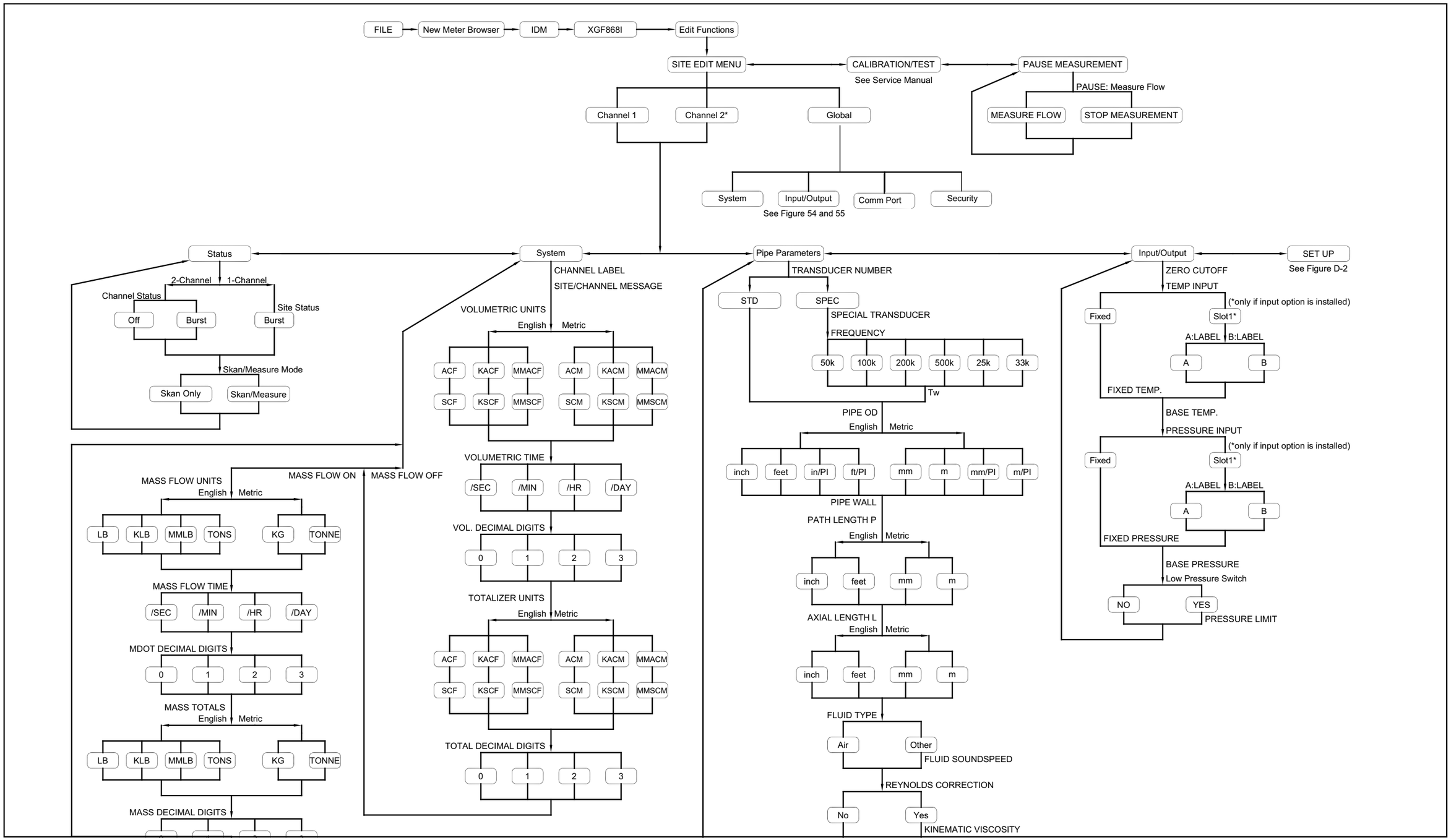


Figure 55: PanaView PROG > CHx> ACTIV, SYSTM, PIPE & I/O Menus

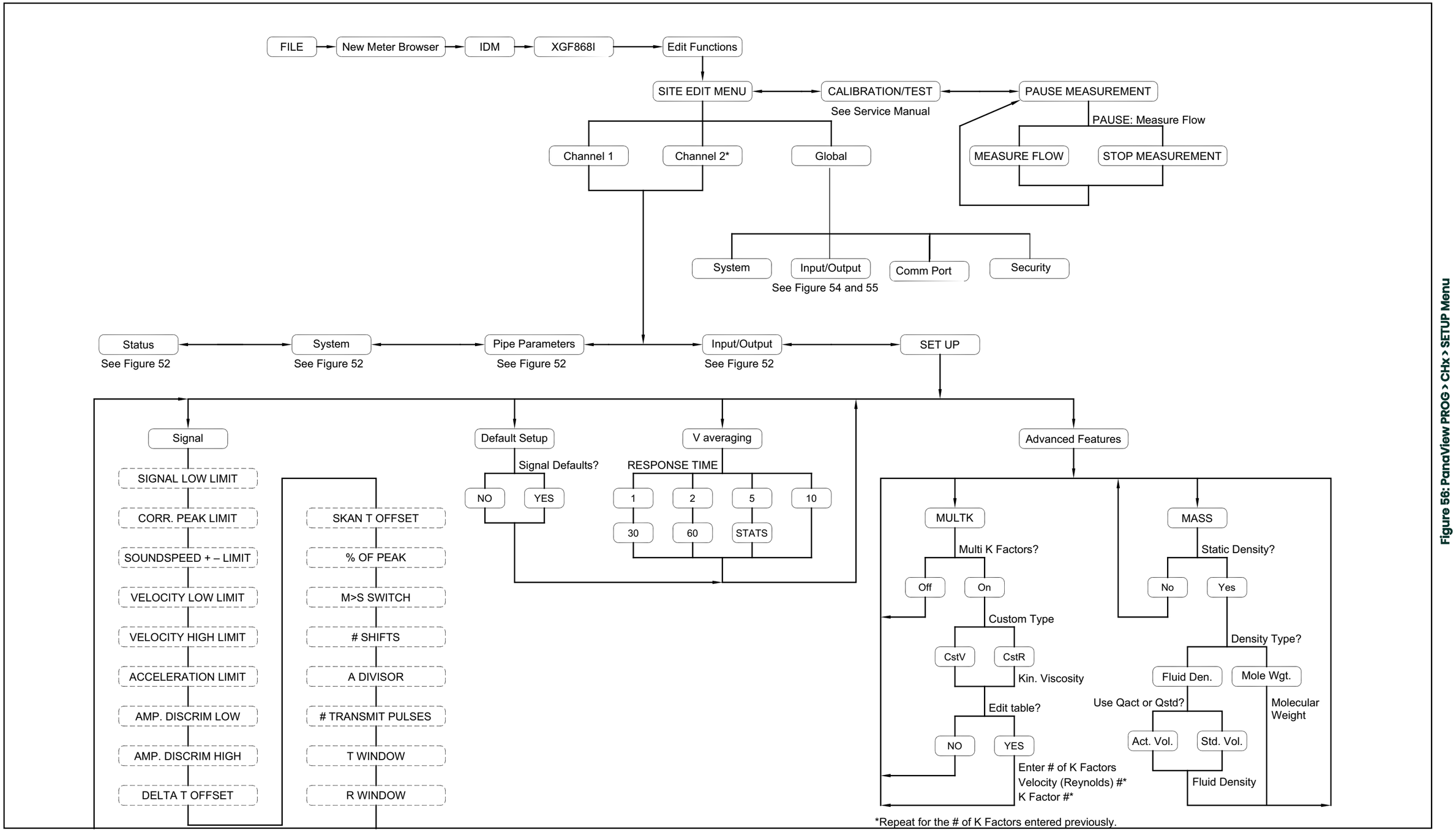


Figure 56: PanaView PROG > CHx > SETUP Menu

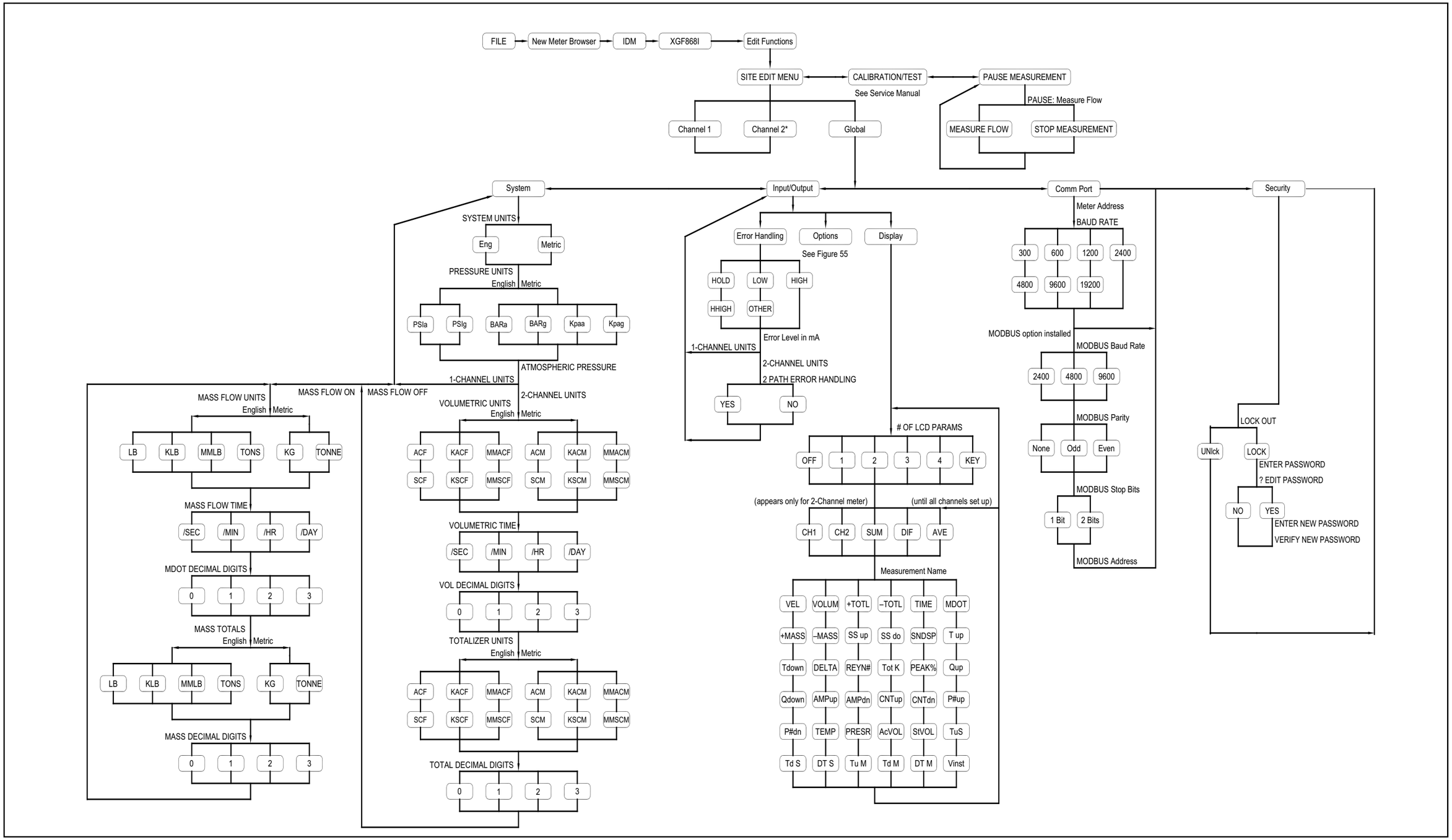


Figure 57: PanaView PROG > GLOBL > SYSTM, I/O & COMM Menus

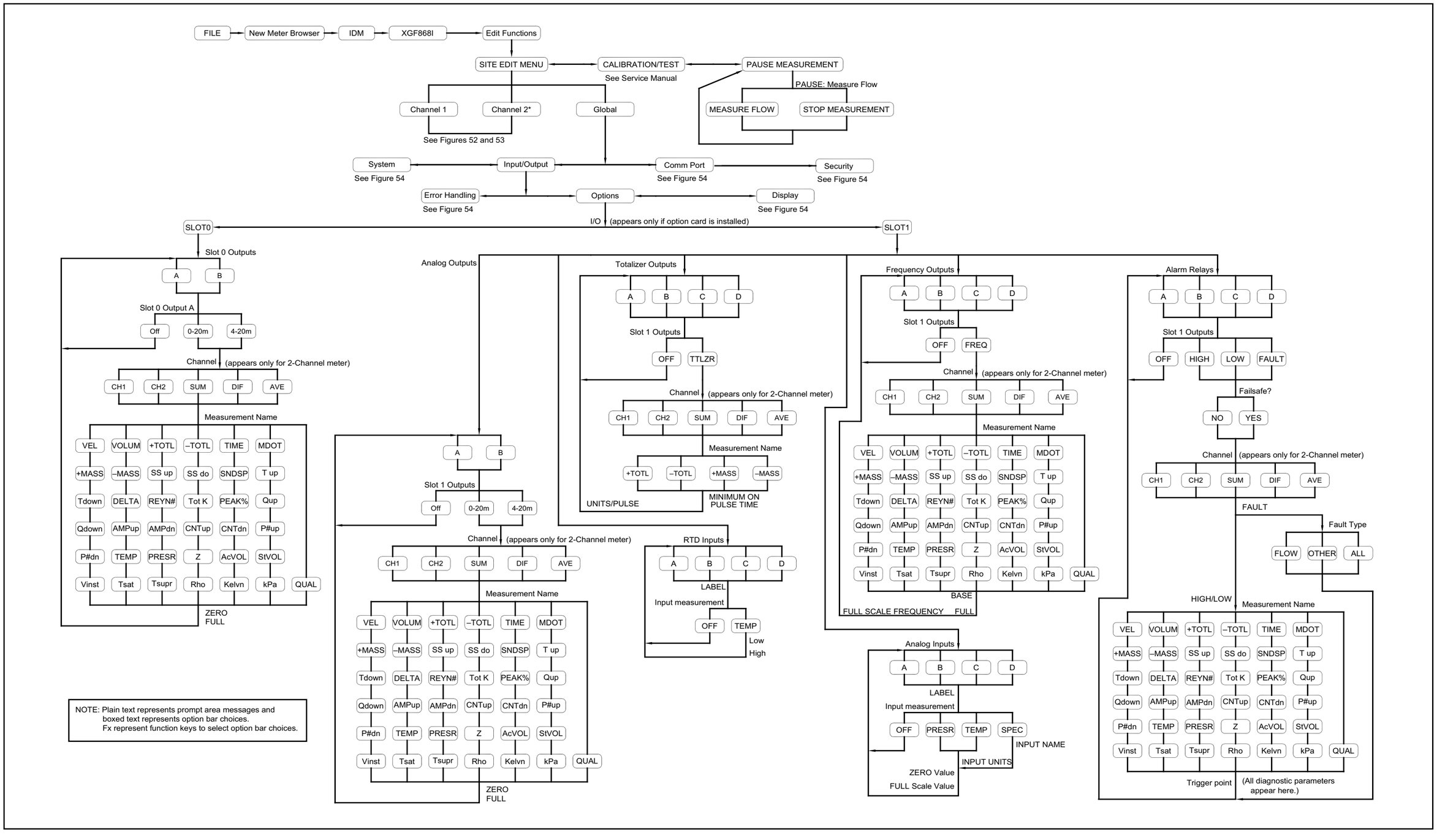


Figure 58: PanaView PROG > GLOBL > I/O > OPTIONS Menu

Appendix E. Foundation Fieldbus Communications

E.1 Introduction

Foundation Fieldbus provides a means of communicating with the flowmeter. The patent numbers which apply are 5,909,363 and 6,424,872. This Foundation Fieldbus device supports six Analog Input (AI) blocks, which can be configured to supply the network measurements shown in *Table 28* below.

Table 28: Available Measurements for the XGF868i

Channel 1	Units	Channel 2	Units	Ave. (CH1+CH2)/2	Units
Ch1 Velocity	ft/s or m/s*	Ch2 Velocity	ft/s or m/s*	Avg Velocity	ft/s or m/s*
Ch1 Act Volumetric	VOL_U	Ch2 Act Volumetric	VOL_U	Avg Act Volumetric	VOL_U
Ch1 Std Volumetric	VOL_U	Ch2 Std Volumetric	VOL_U	Avg Std Volumetric	VOL_U
Ch1 Fwd Totals	TOT_U	Ch2 Fwd Totals	TOT_U	Avg Fwd Totals	TOT_U
Ch1 Rev Totals	TOT_U	Ch2 Rev Totals	TOT_U	Avg Rev Totals	TOT_U
Ch1 #Tot Digits**	none	Ch2 #Tot Digits**	none	Avg #Tot Digits	none
Ch1 Mass Flow	MASS_U	Ch2 Mass Flow	MASS_U	Avg Mass Flow	MASS_U
Ch1 Fwd Mass Totals	MTOT_U	Ch2 Fwd Mass Totals	MTOT_U	Avg Fwd Mass Totals	MTOT_U
Ch1 Rev Mass Totals	MTOT_U	Ch2 Rev Mass Totals	MTOT_U	Avg Rev Mass Totals	MTOT_U
Ch1 #Mass Tot Digits	none	Ch2 #Mass Tot Digits	none	Avg #Mass Tot Digits	none
Ch1 Molecular Weight		Ch2 Molecular Weight		Avg Molecular Weight	
Ch1 Timer	sec	Ch2 Timer	sec	Avg Timer	sec
Ch1 Error Code	none	Ch2 Error Code	none	Avg Error Code	none
Ch1 SSUP	none	Ch2 SSUP	none	Avg SSUP	none
Ch1 SSDN	none	Ch2 SSDN	none	Avg SSDN	none
Ch1 Sound Speed	ft/s or m/s*	Ch2 Sound Speed	ft/s or m/s*	Avg Sound Speed	ft/s or m/s*
Ch1 Density***	see note	Ch2 Density***	see note		
Ch1 Temperature	Deg F or C*	Ch2 Temperature	Deg F or C*		
Ch1 Pressure	PRESS_U	Ch2 Pressure	PRESS_U		

*Metric or English units are determined by the setup of the flowmeter.

**Totalizer digits are available for informational purposes only. Respective totals are automatically scaled by the Tot Digits value selected in the flowmeter setup.

***If the meter is outputting Mole Weight, the unit is “mw”, otherwise it is the programmed pressure unit.

VOL_U, TOT_U, MASS_U, MTOT_U and PRESS_U are determined by the units chosen for these measurements in the flowmeter setup. See the instrument User's Manual for the setup of these parameters.

E.2 Configuration Utility Setup

The following is an *example* setup using National Instruments Configuration Utility v3.1.

Figure 59 below shows the Configuration Utility with a flowmeter on the network (Panametrics Flow-XGF).

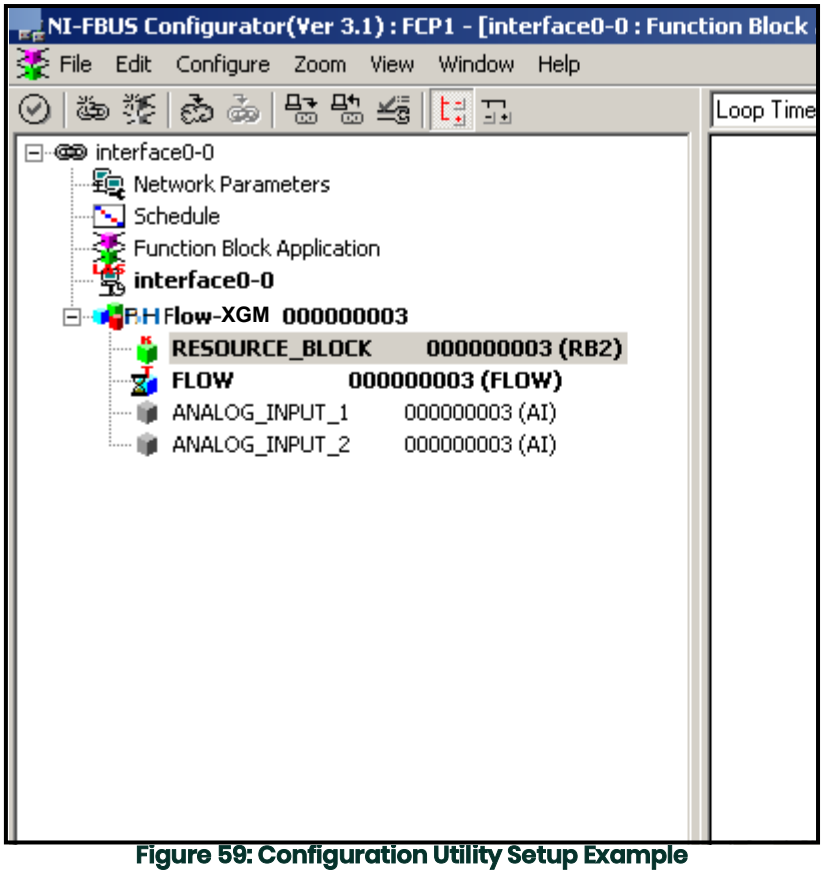


Figure 59: Configuration Utility Setup Example

Note: *The following procedures assume that the device has been placed in the OOS (out-of-service) mode before executing.*

E.3 Selecting the Desired Measurements

To set the measurement unit for each AI:

1. Double click on the FLOW Transducer Block (in the tree under BHFlow-XGF).
2. Select the **Others** tab and open the drop down list for the PRIMARY_SELECTOR and SECONDARY_SELECTOR (refer to *Figure 60 on page 115*).
3. Choose the unit from the list (see *Figure 60 on page 115*).

This unit will correspond to the unit that is available in the AI block for network connection. The PRIMARY_SELECTOR unit will correspond to ANALOG_INPUT_1 and the SECONDARY_SELECTOR will correspond to ANALOG_INPUT_2.

1. After the desired measurements have been selected for the PRIMARY and SECONDARY SELECTOR, choose the unit system (UNIT_SELECTOR above the PRIMARY_SELECTOR) that was programmed in the flowmeter (English or SI), as shown in *Figure 60* below.

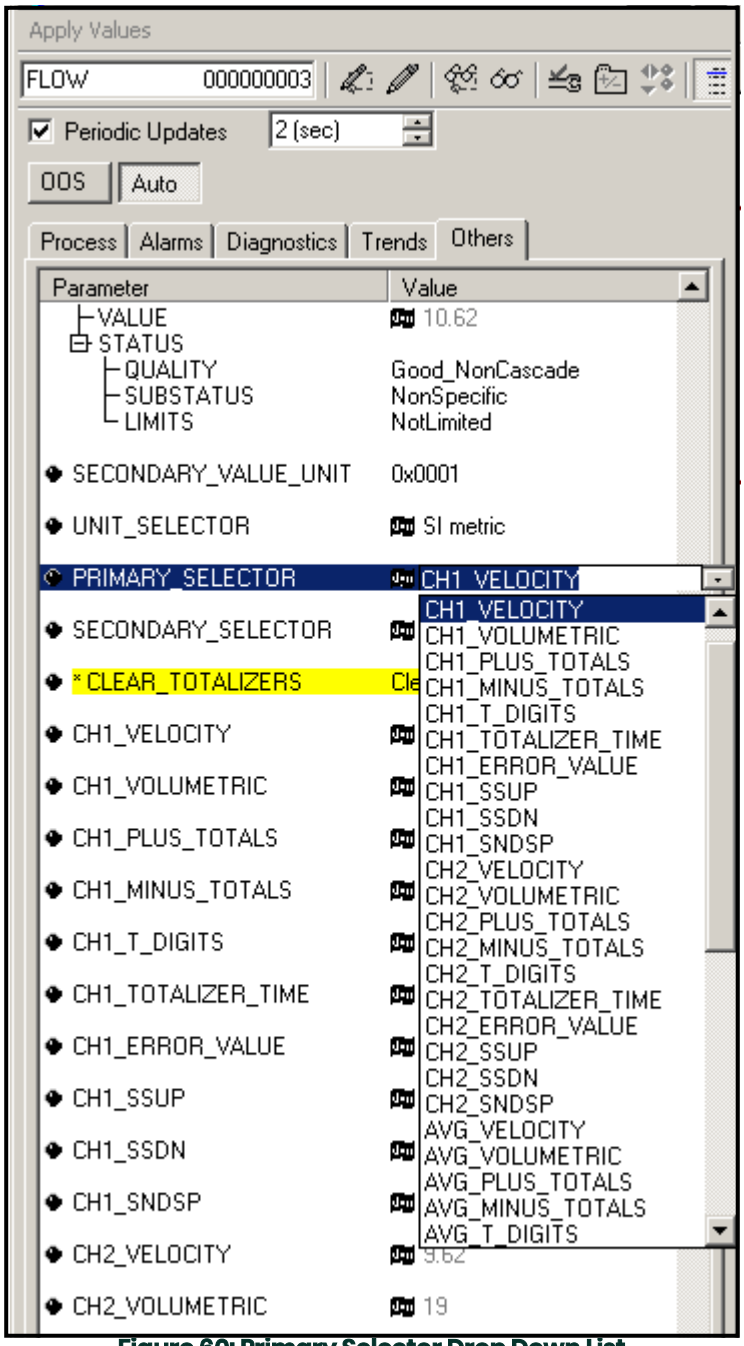


Figure 60: Primary Selector Drop Down List

E.4 Selecting Units for AI Blocks

To select the units for the individual AI blocks:

1. Double click on the AI block for which you wish to set the units (ANALOG_INPUT_1 or ANALOG_INPUT_2 in the tree under GEFlow-XGF; see *Figure 59 on page 114*).
2. Select the **Scaling** tab and set the unit for the measurement based on the flowmeter settings.

For example, if the flowmeter was set to use the metric unit system and the PRIMARY_SELECTOR was set to use VELOCITY you would choose **m/s** for the unit as shown in *Figure 61* below.

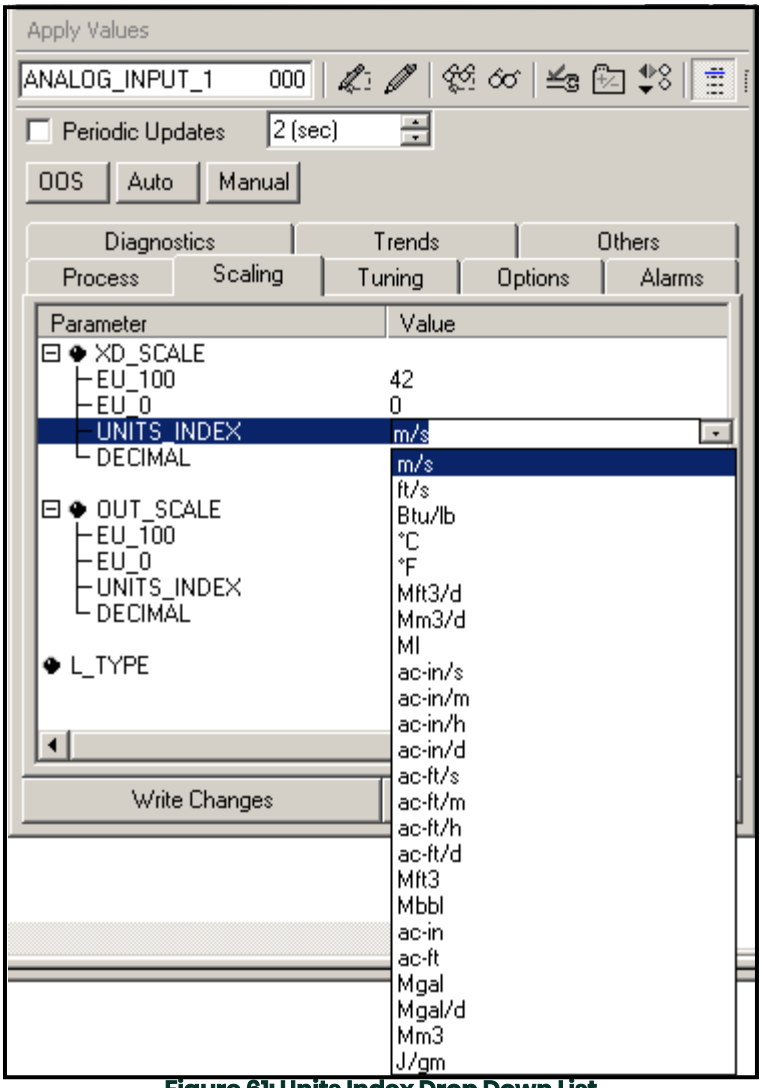


Figure 61: Units Index Drop Down List

E.5 Resetting Instrument Totalizers

To reset the instrument totalizers:

1. Double click on the FLOW transducer block (in the tree under GEFlow-XGF; see *Figure 59 on page 114*).
2. Select the **Others** tab and scroll down to the CLEAR_TOTALIZERS listing.
3. Select **Clear** from the drop down list box (see *Figure 62* below).
4. After the totals have been reset, select **Normal** from the drop down list box to resume total accumulation.

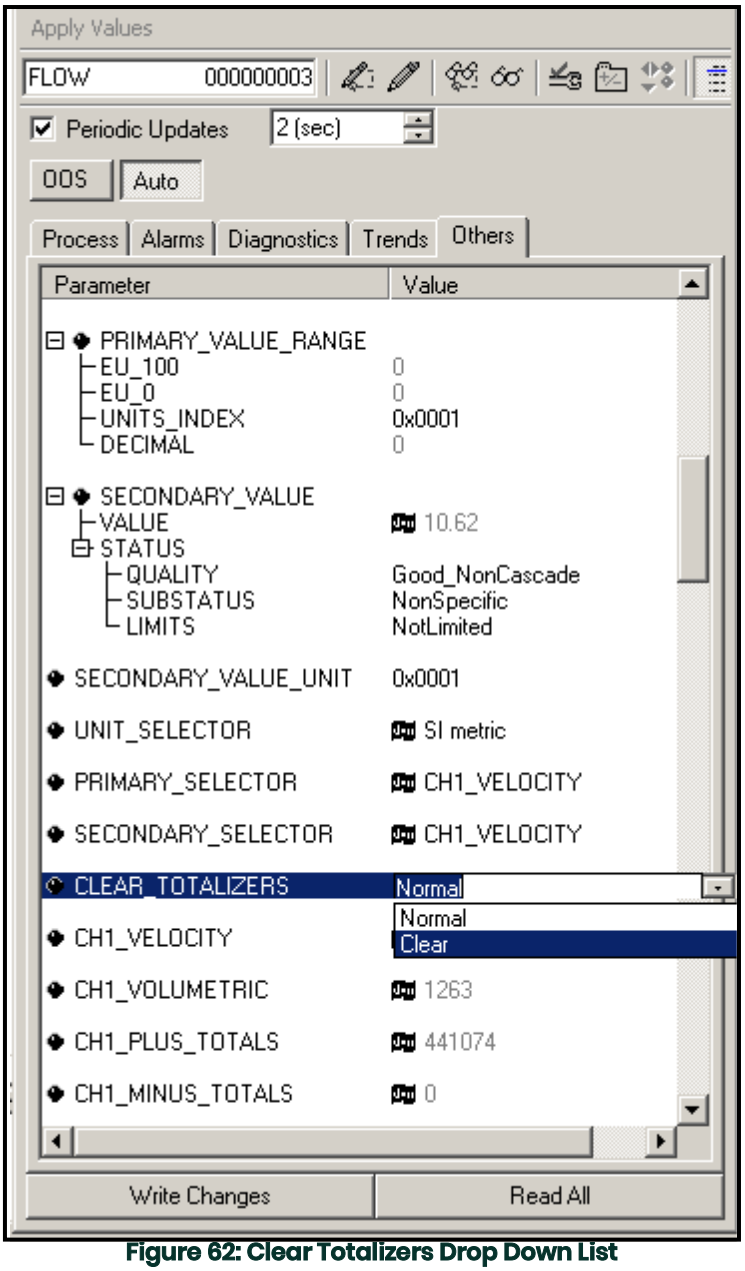


Figure 62: Clear Totalizers Drop Down List

E.6 Function Block Application

Figure 63 below is an example setup using the Function Block Application editor. The flowmeter AI blocks, along with the AO and PID of another device on the network, are displayed. We have connected the AI_1 OUT of the flowmeter to the CAS IN of the AO block. We have also connected the AI_2 OUT of the flowmeter to the CAS IN of the PID block.

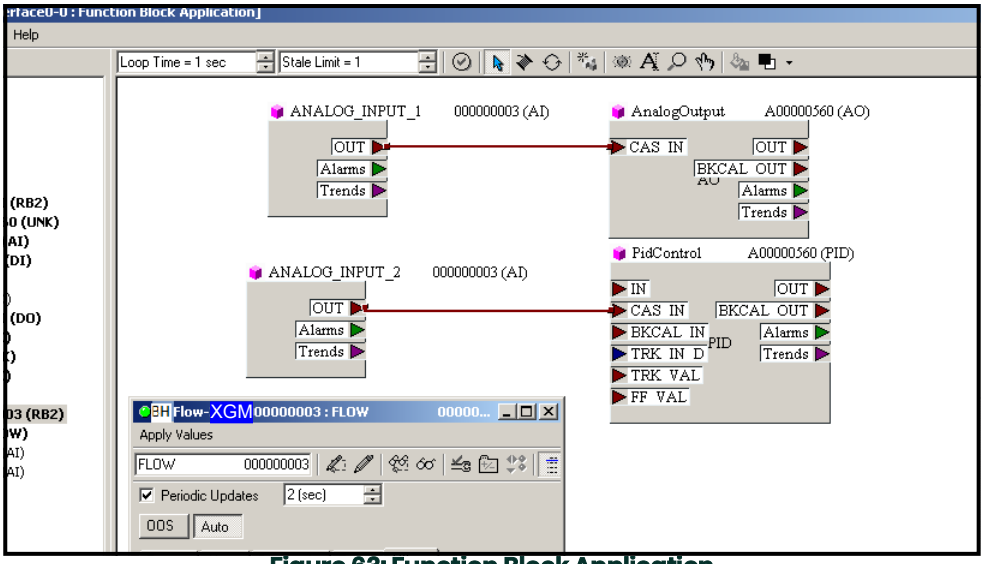


Figure 63: Function Block Application

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+TOTL 22

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Warranty

Each instrument manufactured by Panametrics is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of Panametrics. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics determines that the equipment was defective, the warranty period is:

- one year from delivery for electronic or mechanical failures
- one year from delivery for sensor shelf life

If Panametrics determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Panametrics, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a Panametrics instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify Panametrics, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, Panametrics will issue a RETURN MATERIAL AUTHORIZATION (RMA), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, Panametrics will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If Panametrics determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

[no content intended for this page]

Customer Support Centers

U.S.A.
The Boston Center
1100 Technology Park Drive
Billerica, MA 01821
U.S.A.
Tel: 800 833 9438 (toll-free)
978 437 1000
E-mail: mstechsupport@bakerhughes.com

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Sensing House
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Shannon, County Clare
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Tel: +353 (0)61 470200
E-mail: mstechsupport@bakerhughes.com

Scan here for Panametrics support and service information

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DigitalFlow™ XGF868i

Panametrics Flare Gas Flow Transmitter

Service Manual



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Panametrics Flare Gas Flow Transmitter

Service Manual

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Services

Panametrics provides customers with an experienced staff of customer support personnel ready to respond to technical inquiries, as well as other remote and on-site support needs. To complement our broad portfolio of industry-leading solutions, we offer several types of flexible and scalable support services including: Training, Product Repairs, Service Agreements and more.

Please visit https://www.bakerhughes.com/panametrics/panametrics-services for more details.

Typographical Conventions

Note: *These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.*

IMPORTANT: These paragraphs provide information that emphasizes instructions that are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.

CAUTION! **This symbol indicates a risk of potential minor personal injury and/or severe damage to the equipment, unless these instructions are followed carefully.**

WARNING! **This symbol indicates a risk of potential serious personal injury, unless these instructions are followed carefully.**

Safety Issues

WARNING! **It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.**

Attention European Customers!To meet CE Mark requirements for all units intended for use in the EU, all electrical cables must be installed as described in this manual.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area

WARNING! **Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.**

WARNING! **Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on this equipment.**

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

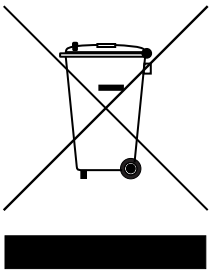
Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

Panametrics is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2012/19/EU.



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end of life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Please visit www.bakerhughesds.com/health-safety-and-environment-hse for take-back instructions and more information about this initiative.

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Chapter 1. Calibration

1.1 Introduction

Calibrating the XGF868i analog outputs and inputs is explained in this chapter. In addition, testing the optional totalizer, frequency and alarm relay outputs is discussed. The chapter includes the following specific topics:

- Calibrating the **Slot 0** and Slot 1 analog outputs - *page 2*.
- Calibrating option card analog inputs - *page 4*.
- Calibrating option card RTD inputs - *page 6*.
- Testing option card frequency outputs - *page 6*.

Note: *Convention in this manual identifies any expansion slot as* **Slot x**, *where* **x** *is a number from 0-2.* **Slot 2** *is used only for data logging, MODBUS or HART option cards.*

See Chapter 1, *Installation*, and Appendix B, *Data Records*, in the *Startup Guide* for a complete description of the available option cards and the procedures for wiring them.

1.2 Accessing the Calibration Menu

The *Calibration* menu is accessible through the *Keypad Program*, as well as through PanaView™ software. (If you are using PanaView to calibrate the XGF868i, refer to Appendix B.) Use this menu to calibrate and test the **Slot 0** analog outputs, as well as to calibrate and/or test any option cards that are installed in expansion **Slot 1**. Refer to the menu maps in *Figure 3 on page 9* as a guide in following the calibration instructions.

1. Power up the XGF868i and wait until it has initialized.
2. Press the [Escape], [Enter], [Escape] keys. The *Keypad Program* appears on the screen.
3. Press the right arrow key to scroll to the *CALIB* menu. Press [Enter]. The *Cal* window opens.

Proceed to the appropriate sections of this chapter to calibrate and/or test any of the installed inputs and/or outputs.

Note: *The Calibration menu never returns to the* Keypad Program. *Pressing* [Escape] *to exit the menu causes the XGF868i to restart.*

1.3 Calibrating and Testing the Analog Outputs

Every XGF868i flowmeter includes two built-in analog outputs (A and B) at terminal block **J1**, which is designated as **Slot 0**. Additional analog outputs may be added to the Model XGF868i by installing an appropriate option card in **Slot 1**. This option card contains two analog outputs, which are also designated as A and B.

Before beginning calibration, an ammeter must be connected to the desired analog output. Both the zero-point and full-scale values for all of these outputs must be calibrated. After calibrating the outputs, which have a resolution of 5.0 μA (0.03% full scale), their linearity should be tested.

Note: *The zero point of the analog output may be set at either 0 mA or 4 mA. However, the calibration always uses the 4 mA point, as the meter extrapolates this value to obtain the 0 mA point.*

1.3.1 Preparing for Calibration

Prepare for calibration by inserting an ammeter in series with the load on the desired output. Refer to *Figure 1* below and *Figure 4 on page 10* to identify the **OUT(+)** and **RTN(-)** pins for the desired output.

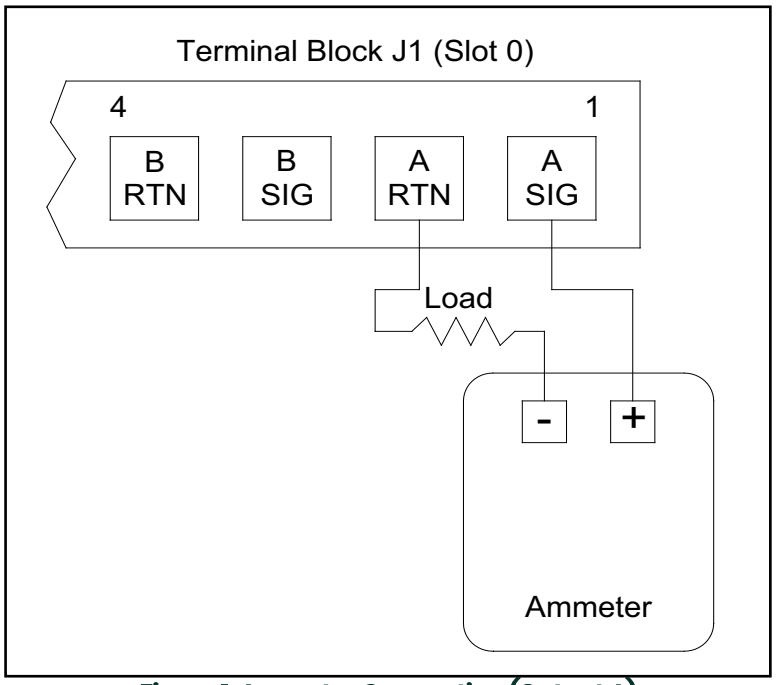


Figure 1: Ammeter Connection (Output A)

1.3.2 Calibrating the Low End of the Output Range

1. From the *Keypad Program*, press the right arrow key to scroll to the *CALIB* menu. Press [Enter].
2. In the *Cal* menu, scroll to the *Slot 0 or Slot 1* option, and press [Enter].

Note: *The* **Slot 1** *option only appears in the menu if an option card has been installed in this slot.*

3. Scroll to either *Output A* or *Output B* to open the *Analog Output* menu. (**Output A** will be used as an example in this manual.) Press [Enter].

IMPORTANT: The procedure for calibrating **Output B** is identical to that for calibrating **Output A**. However, when calibrating **Output B**, be sure to reconnect the ammeter on terminal block **J1**. See Figure 1 on page 2 for the correct pin numbers.

4. Scroll to *4 mA* to calibrate the low end of the output range. Press [Enter].
5. Scroll to *UP* or *DOWN* to adjust the ammeter reading **UP** or **DOWN**, until a 4 mA reading is achieved,
   or
   Scroll to *Numer,* and directly enter the mA reading. In either case, press [Enter] to confirm the entry.
6. Once you have achieved a 4 mA reading, scroll to either *STORE* to store the calibration, or to *ABORT* to exit the menu without storing the calibration. In either case, press [Enter].

Note: *If the ammeter reading cannot be adjusted within 5.0 μA of the 4 or 20 mA setting, contact the factory for assistance.*

1.3.3 Calibrating the High End of the Output Range

7. The XGF868i returns to the *Analog Output* window. Scroll to *20 mA*, and repeat steps 4 and 5 to calibrate the high end of the output range.

Note: *Skip the following prompt, if linearity testing of the output will not be performed at this time.*

1.3.4 Testing Output Linearity

8. Scroll to *TEST* to **test** the linearity of the currently selected analog output. Press [Enter].
9. Check the ammeter reading at *50% Full Scale*. Then, use the arrow keys to enter a different *% Full Scale* (0-100%). Press [Enter] when done.

Table 1 below lists the expected ammeter readings at various *% Full Scale* settings, for both 4-20 mA and 0-20 mA scales. Refer to this table to verify the accuracy of the ammeter readings taken above.

Table 1: Expected Ammeter Readings

% Full Scale	4-20 mA Scale*	0-20 mA Scale*
0	4.000	0.000
10	5.600	2.000
20	7.200	4.000
30	8.800	6.000
40	10.400	8.000
50	12.000	10.000
60	13.600	12.000
70	15.200	14.000
80	16.800	16.000
90	18.400	18.000
100	20.000	20.000
* all ammeter readings should be ±0.005 mA		

If the linearity test readings are not within 5 μA of the values listed in Table 1, check the accuracy and wiring of the ammeter. Then, repeat the low and high end calibrations. If the analog output still does not pass the linearity test, contact the factory for assistance.

10. Scroll to *EXIT* and press [Enter] to return to the *Cal* menu. Then choose another output to calibrate or press [Escape] to leave the *CALIB* menu.

This completes calibration of the **Slot 0** analog outputs. Proceed to the appropriate section to calibrate additional inputs/outputs.

1.4 Calibrating the Analog Inputs

Analog inputs may be added to the XGF868i by installing an appropriate option card in **Slot 1**. This option card contains two or four analog inputs, which are designated as A, B, C and D. Both the zero-point and full-scale values for each input must be calibrated.

Calibration of the analog inputs requires the use of a calibrated current source. If an independent calibrated current source is not available, one of the **Slot 0** analog outputs may be used for the calibration. During the analog input calibration, the **Slot 0** analog output will supply the low reference, high reference, 4 mA and 20 mA signals at the appropriate times.

IMPORTANT: If a **Slot 0** analog output will be used to calibrate the analog inputs, the **Slot 0** analog output calibration procedure must be completed first.

1.4.1 Preparing for Calibration

Prepare for the calibration procedure by connecting a **Slot 0** analog output (or an independent calibrated current source) to the desired input on the option card. See *Figure 4 on page 10* to identify the IN**(+)** and **RTN(–)** pins for the desired input on terminal block J2.

Note: *The zero point of the analog input may be set for either 0 mA or 4 mA. However, the calibration always uses the 4 mA point, as the meter extrapolates this value to obtain the 0 mA point.*

1.4.2 Accessing the Calibration/Test Menu

1. From the *Keypad Program*, press the right arrow key to scroll to the *CALIB* menu. Press [Enter].
2. In the *Cal* window, scroll to *Slot 1*. Press [Enter].
3. Scroll to the desired *Input* to open the *ANALOG INPUT* menu. (**Input A** will be used as an example in this manual.) Press [Enter].

IMPORTANT: Calibrating **Input B, C or D** is identical to calibrating **Input A**. However, be sure to reconnect the current source on terminal block **J2**. Refer to Figure 4 on page 10 for the correct pin numbers.

4. Scroll to the appropriate option to select the reference point to be calibrated. Press [Enter].

IMPORTANT: The procedure for calibrating all the inputs is the same. However, when calibrating a different input, be sure to reconnect the current source at terminal block **J2**. See Figure 4 on page 10 for the correct pin numbers.

5. Do one of the following:
   - Proceed to the *"4 mA Option" on page 5*.
   - Proceed to the *"20 mA Option" on page 5*.

1.4.2.1 4 mA Option

Set the calibrated current source to 4 mA.

- If you selected the *4 mA* option in the *ANALOG INPUT* menu, scroll to *STORE* to accept the current 4 mA value or on *ABORT* to cancel the entry. Press [Enter]. In either case, the XGF868i returns to the **Analog Input** window.

1.4.2.2 20 mA Option

Set the calibrated current source to 20 mA.

- If you selected the *20 mA* option in the *ANALOG INPUT* option, scroll *STORE* to accept the current 20 mA value or to *ABORT* to cancel the entry. Press [Enter]. In either case, the XGF868i returns to the **ANALOG INPUT** window.
- Press [Escape] to return to the *Slot 1* window and calibrate additional inputs/outputs, or press [Escape] again to close the *CALIB* menu.

1.5 Calibrating the RTD Inputs

RTD analog inputs may be added to the XGF868i by installing an appropriate option card in **Slot 1**. The option card contains two or four RTD inputs that are designated as A, B, C and D. Both the set point and slope point values for each input must be specified prior to use.

1.5.1 Preparing for Calibration

Prepare for the calibration procedure by connecting the RTD temperature transmitter to the desired input (A, B, C or D) on the option card. See *Figure 4 on page 10* to identify the **RTD(+)** and **COM(-)** pins for the desired input on terminal block J2.

1.5.2 Accessing the Calibration/Test Menu

1. From the *Keypad Program*, press the right arrow key to scroll to the *CALIB* menu. Press [Enter].
2. In the *Cal* window, scroll to *Slot 1*. Press [Enter].

Note: *The* **Slot 1** *option only appears at the above prompt if an option card is installed in this slot.*

3. Scroll to the desired *Input*. (**Input A** will be used as an example in this manual.) Press [Enter].

IMPORTANT: When calibrating the other inputs, be sure to reconnect the current source at terminal block **J2**. See Figure 4 on page 10 for the correct pins.

1.5.3 Entering the Set Point

1. Before proceeding, place the RTD in a temperature bath and allow it to stabilize at the desired set point temperature.
2. Scroll to *Set* to program the RTD set point. Press [Enter].
3. Use the arrow keys to enter the desired set point temperature and press [Enter].
4. Scroll to *STORE* to accept the new set point value or *ABORT* to cancel the entry. Press [Enter].

1.5.4 Entering the Slope

1. Scroll to *Slope* to program the RTD slope point. Press [Enter].
2. Use the arrow keys to enter the desired slope point temperature and press [Enter].
3. Press *STORE* to accept the new slope point value or *ABORT* to cancel the entry. Press [Enter].

Note: *If an error message appears, verify that the RTD is at the programmed temperature. Also, if you replace the set/slope range with a different range, be sure to recalibrate the set and slope points.*

Procedure Options

This completes calibration of the **Slot 1** RTD input. Do one of the following:

- To calibrate or test another input, press [Escape] and return to Step 3 in *Accessing the Calibration/Test Menu* above.
- To leave the *Keypad Program*, press [Escape] twice.

1.6 Testing the Frequency Outputs

Frequency outputs may be added to the XGF868i by installing an appropriate option card in **Slot 1**. This option card contains two or four frequency outputs, which are designated A, B, C and D.

1.6.1 Preparing for Testing

Prepare for the testing procedure by connecting a frequency counter to the desired output on the option card. See *Figure 2* below for frequency output wiring, and *Figure 4 on page 10* to identify the **OUT(+)** and **RTN(-)** pins for the desired output on terminal block J2.

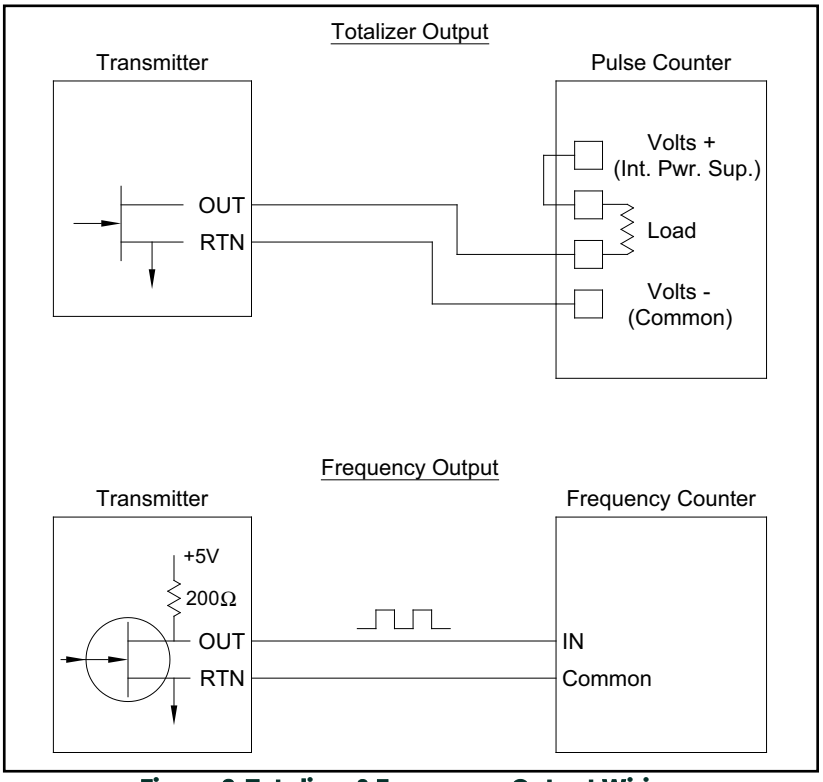


Figure 2: Totalizer & Frequency Output Wiring

1.6.2 Testing the Output

1. From the *Keypad Program*, press the right arrow key to scroll to the *CALIB* menu. Press [Enter].
2. In the *Cal* window, scroll to *Slot 1*. Press [Enter].

Note: *The* **Slot 1** *option only appears at the above prompt if an option card is installed in this slot.*

3. Scroll to the desired *Output*. (**Output A** will be used as an example in this manual.) Press [Enter].

IMPORTANT: The procedure for testing all the outputs is the same. However, when testing another output, be sure to reconnect the frequency counter at terminal block **J2**. See Figure 4 on page 10 for the correct pins.

4. Enter a frequency (between 1 and 10,000 Hz) and press [Enter].
5. Verify that the frequency counter reads the correct value.

Procedure Options

This completes testing of the **Slot 1** frequency outputs. Do one of the following:

- To test another of the available frequency outputs, return to Step 3 in *Testing the Output* above. If any of the frequency outputs fails the test, contact the factory for assistance.
- To calibrate/test additional inputs/outputs, proceed to the appropriate section.
- To leave the *Keypad Program*, press **[Escape]** twice.

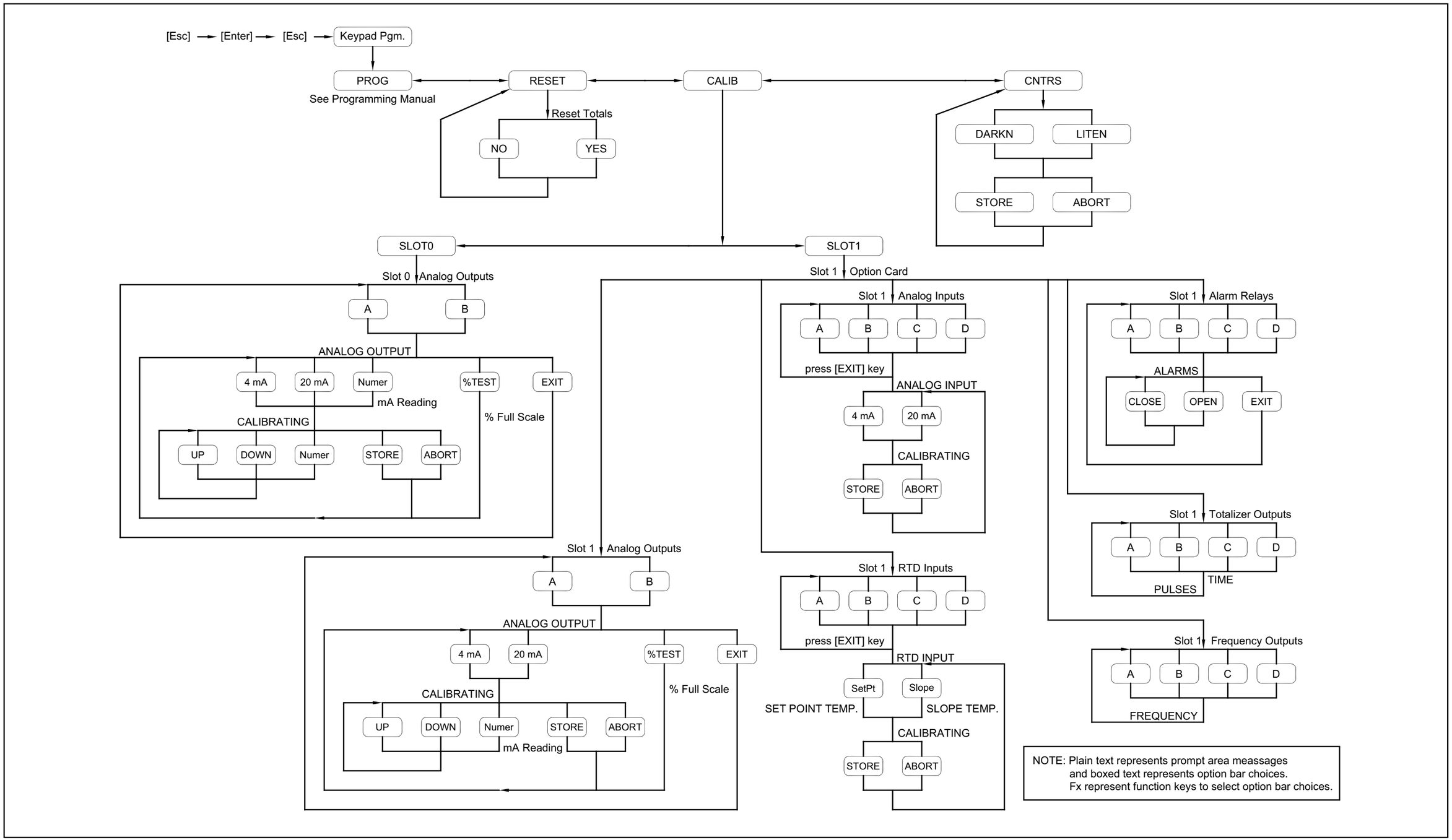
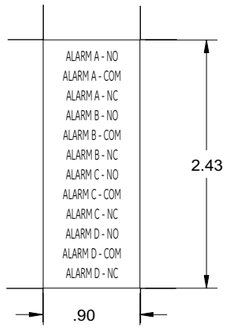
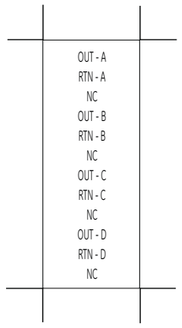


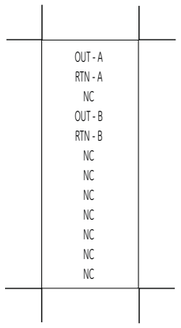
Figure 3: Calibration Menu Map



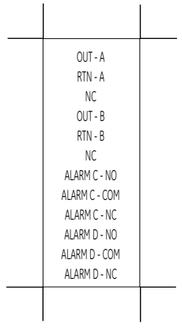
-01 (AA,HH)



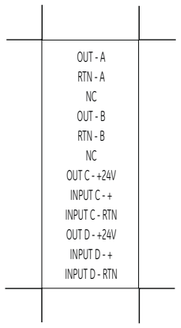
-02 (FF,TT,FT,CT,CF)



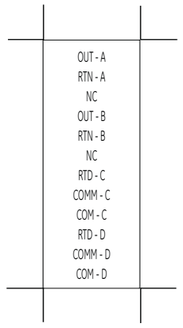
-03 (FO,TO,CO)



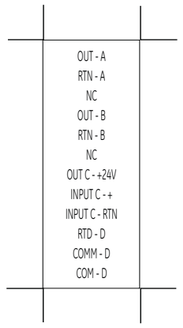
-04 (FA,FH,TA,TH,CA,CH)



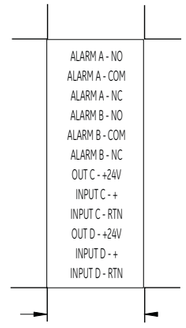
-05 (CI,TI,FI)



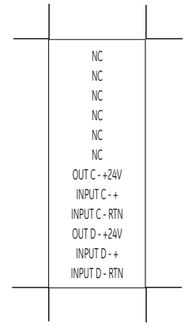
-06 (CR,FR,TR)



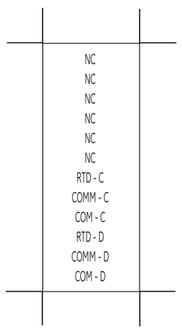
-07 (CIR)



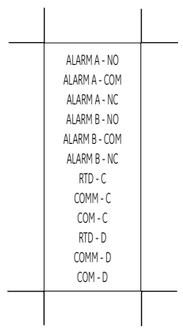
-08 (AI,HI)



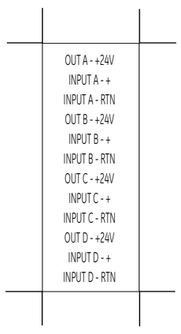
-09 (OI)



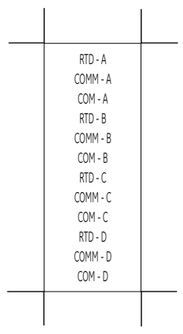
-10 (OR)



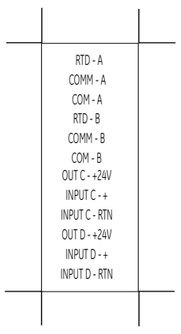
-11 (AR,HR)



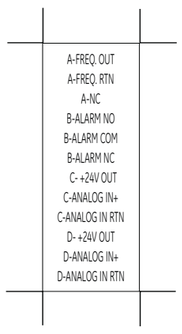
-12 (II)



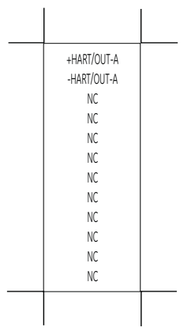
-13 (RR)



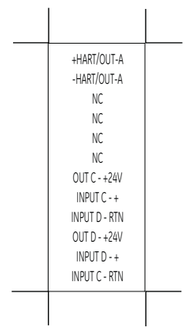
-14 (IR)



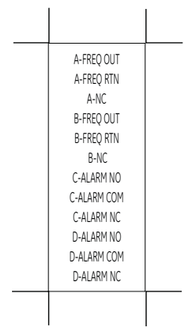
-15 (FHII)



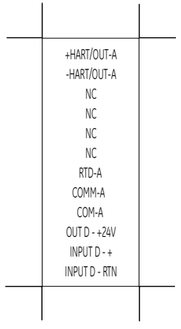
-16 (HART)



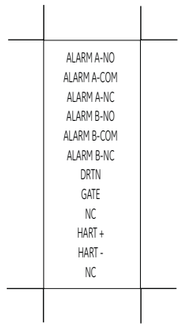
-17 (HART/OI)



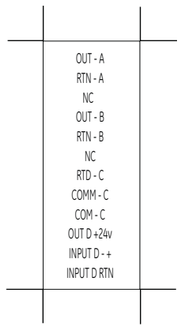
-18 (F(F)HH)



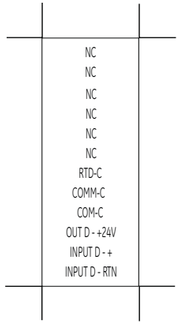
-19 (HART/RI)



-20 (A/GATE HART)



-21 (FRI)



-22 (ORI)

NOTES

1. MATERIAL: .003 THK (REF) MYLAR WITH REVERSE SCREENING, AND 3M #467MP (OR EQUIVALENT) ADHESIVE BACKING.
2. MARKINGS: BACKGROUND - WHITE. ALL MARKINGS PROCESS BLACK C.
3. ALL COLORS PER PANTONE MATCHING SYSTEM.
4. ALL DIMENSIONS PER -01.
5. ARTWORK CREATED IN ADOBE ILLUSTRATOR (FILE#: 442-615_N.AI)
6. ALL DIMENSIONS REFERENCE.

Figure 4: Option Card I/O Connections

Chapter 2. Error Codes

2.1 Introduction

The XGF868i ultrasonic flow transmitter is a reliable, easy to maintain instrument. When properly installed and operated, as described in the *Startup Guide*, the meter provides accurate flow rate measurements with minimal user intervention. However, if a problem should arise with the electronics enclosure, the transducers or the flowcell, a built-in error code message system greatly simplifies the troubleshooting process.

All of the possible XGF868i error code messages are discussed in this chapter, along with the possible causes and the recommended actions. When an error code is generated, it will appear on the LCD as shown in *Figure 5* below.

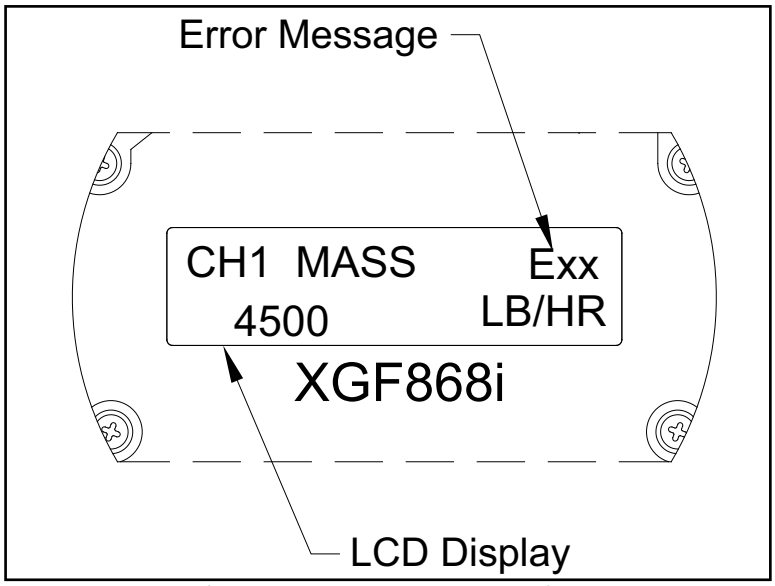


Figure 5: Error Message Location

If an error message appears during normal operation of the Model XGF868i, refer to the appropriate section of this chapter for instructions on how to proceed.

E0: No Error

Problem: No error condition currently exists.

Cause: This message appears briefly to confirm that the response to another error message has corrected the problem.

Action: No action is required.

E1: Low Signal

Problem: Poor ultrasonic signal strength or the signal exceeds the limits entered via the *Keypad Program*.

Cause: Poor signal strength may be caused by a defective cable, a flowcell problem, a defective transducer or a problem in the electronics console. A signal that exceeds the programmed limits is probably caused by the entry of an improper value in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Action: Using the procedures in Chapter 3, *Diagnostics*, check the components listed above. Also, check the limit values entered into the Channelx-**Set up-Signal** submenu, as described in Chapter 1, *Programming Site Data*, of the *Programming Manual*.

E2: Sound Speed Error

Problem: The sound speed exceeds the limits programmed in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Cause: The error may be caused by incorrect programming, poor flow conditions or poor transducer orientation.

Action: Compare the measured sound speed to tabulated nominal values for the gas being used and correct any programming errors. Refer to Chapter 3, *Diagnostics*, to correct any flowcell and/or transducer problems.

E3: Velocity Range

Problem: The velocity exceeds the limits programmed in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Cause: This error may be caused by the entry of improper programming data or by poor flow conditions and/or excessive turbulence.

Action: Make sure the actual flow rate is within ±75 ft/sec (±23 m/sec). See Chapter 1, *Programming Site Data*, in the *Programming Manual* for details. Refer to Chapter 3, *Diagnostics*, to correct any flowcell and/or transducer problems.

E4: Signal Quality

Problem: The signal quality is outside the limits programmed in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Cause: The peak of the upstream or downstream correlation signals has fallen below the correlation peak limit, as set in the Channelx-**Set up-Signal** submenu. This may be caused by a flowcell or electrical problem.

Action: Check for sources of electrical interference and verify the integrity of the electronics console by temporarily substituting a test flowcell that is known to be good. Check the transducers and relocate them, if necessary. See Chapter 3, *Diagnostics*, for further instructions.

E5: Amplitude Error

Problem: The signal amplitude exceeds the limits programmed in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Cause: Excessive levels of an attenuating gas, such as CO_2, may be present in the flowcell. Solid or liquid particulates may be present in the flowcell.

Action: Refer to Chapter 3, *Diagnostics*, to correct any flowcell problems.

E6: Cycle Skip, Accel.

Problem: The acceleration exceeds the limits programmed in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Cause: This condition is usually caused by poor flow conditions or improper transducer alignment.

Action: Refer to Chapter 3, *Diagnostics*, to correct any flowcell and/or transducer problems.

E7: Analog Out Error

Problem: The current in the analog output circuit exceeds the limits for the analog output port.

Cause: The output load exceeds the specified limits for the analog output port.

Action: Make sure the output load is <600 ohms for the **Slot 0** analog outputs or is <1,000 ohms for an analog outputs option card in **Slot 1**.

E8: Temperature In

Problem: This message indicates a temperature input error.

Cause: The temperature exceeds the specified limits for the analog/RTD inputs option card or no input device is connected.

Action: Check the temperature transmitter and the connecting cable. Refer to Chapter 1, *Calibration*, and recalibrate the analog/RTD inputs option card.

E9: Pressure In

Problem: This message indicates a pressure input error.

Cause: The pressure exceeds the specified limits for the analog inputs option card or no input device is connected.

Action: Check the pressure transmitter and the connecting cable. Refer to Chapter 1, *Calibration*, and recalibrate the analog inputs option card.

E10: Special Input

Problem: This message indicates a special input error.

Cause: The special input exceeds the specified limits for the analog inputs option card.

Action: Check the special input device and the connecting cable. Refer to Chapter 1, *Calibration*, and recalibrate the analog inputs option card.

E11: Not Used

This error code message is not currently in use.

E12: Low Pressure

Problem: This error code is triggered when the pressure measurement is below the low pressure switch setting.

Cause: The pressure measurement exceeds the specified limits as set in the Channelx-Input/Output submenu.

Cause: Check the limit value (0 to 5,000 psia) entered into the Channelx-**Input/Output** submenu, as described in Chapter 1, *Programming Site Data*, of the *Programming Manual*.

E13: Over Range

Problem: This error code message indicates that the present measurement exceeds the range of the meter.

Cause: A internal mathematical overflow has occurred in either the volumetric or mass flow calculations.

Action: Select larger measurement units or a shorter time interval for the current measurement parameter. For example, choose **KSCF/M** instead of **SCF/M** in the **ChannelX-System** menu. See Chapter 2, *Initial Setup*, of the *Startup Guide* for instructions.

E14: Totals Overflow

Problem: The totalizers are unable to keep up with the total accumulated flow signals.

Cause: The programmed units/pulse value is too small.

Action: Select a larger number of units/pulse value.

E15: Equation Limit

Problem: The meter cannot resolve the molecular weight of the gas based on the measured sound speed, temperature, pressure and N_2 concentration.

Note: *The mw reading will appear as 2.0e3 or 3.0e3 in order to "flag" this condition.*

Cause: One or more of the above measurements must be incorrect.

Cause: Verify the pressure and temperature readings are correct. Verify the programmed (or input) nitrogen concentration is correct. Verify that the acoustic transit time measurements are operating properly, and that the programmed path and axial length dimensions are correct.

[no content intended for this page]

Chapter 3. Diagnostics

3.1 Introduction

This chapter explains how to troubleshoot the XGF868i if problems arise with the electronics enclosure, the flowcell, or the transducers. Indications of a possible problem include:

- Display of an error message on the LCD display screen
- Erratic flow readings
- Readings of doubtful accuracy (i.e., readings that are not consistent with readings from another flow measuring device connected to the same process).

If any of the above conditions occurs, proceed with the instructions presented in this chapter.

3.2 Displaying Diagnostic Parameters

The XGF868i has built-in *Diagnostic Parameters* to aid in the troubleshooting of flowcell, transducer and/or electrical problems. To access these parameters, use the *Keypad Program.* Then, complete the following instructions to display the desired diagnostic parameter:

Note: *To perform this function with PanaView software see Appendix C,* Programming with PanaView *in the* Programming Manual, *and/or the PanaView* User's Manual.

1. Press [Escape], [Enter], [Escape].
2. In the *Keypad Program* window, scroll to PROG and press [Enter].
3. In the PROG menu, scroll to GLOBL and press [Enter].
4. Scroll to I/O and press [Enter].
5. Scroll to LCD and press [Enter].
6. The window now asks for the *# of LCD Parameters*. Scroll to the desired number (from OFF through 1-4 and KEY) and press [Enter].

   The OFF setting switches the measurement display off, while the KEY setting enables users to change the measurement display via the arrow keys, without accessing the *Keypad Program.* If you select KEY:

   - To view a parameter other than the one currently displayed, press the [r] or [s] keys to scroll through the various parameters.
   - To scroll through the channel options on an XGF868i, press the [v] or [w] keys until you have reached the desired option.
7. Scroll to the desired *Channel option*, as listed in *Table 2* below.

Table 2: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

8. For each channel, select the desired *Measurement Parameter*, as shown in *Table 3*.

Note: *The measurement units that appear in these prompts are those selected in the* **GLOBL-SYSTM** *menu earlier in this section. Also, when differences in one channel's programming invalidate an output previously chosen for the other, the measurement defaults to the nearest selectable item in the parameter list.*

The previous two prompts repeat until all of the specified **# of LCD Parameters** have been set up. When all of the display parameters have been set up, the meter returns to the **Global I/O** window. To leave the *Keypad Program*, press the **[Escape]** key three times.

After leaving the *Keypad Program*, the XGF868i will reset itself and will begin to display the parameters specified in this section. If more than one parameter was set up, each of the parameters will be displayed in sequence, with a pause of several seconds between display changes.

Table 3: Available Diagnostic Parameters

Option Bar	Description	Good	Bad
VEL	Displays the flow velocity.	N.A.	N.A.
VOLUM	Displays the volumetric flow.	N.A.	N.A.
+TOTL	Displays the forward totalized volume flow.	N.A.	N.A.
-TOTL	Displays the reverse totalized volume flow.	N.A.	N.A.
TIME	Displays the total flow measurement time.	N.A.	N.A.
MDOT	Displays the mass flow.	N.A.	N.A.
+MASS	Displays the forward totalized mass flow.	N.A.	N.A.
-MASS	Displays the reverse totalized mass flow.	N.A.	N.A.
SS up	Displays the signal strength for the upstream transducer.	50–75	<50 or >75
SS do	Displays the signal strength for the downstream transducer.	50–75	<50 or >75
SNDSP	Displays the measured speed of sound in the gas.	N.A.	N.A.
Tup	Displays the upstream ultrasonic signal transit time.	N.A.	N.A.
Tdown	Displays the downstream ultrasonic signal transit time.	N.A.	N.A.
DELTA	Displays the transit time difference between the upstream and downstream signals.	N.A.	N.A.
Tot K	Displays the total number of K factors.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default).	N.A.	N.A.
Qup	Displays the signal quality for the upstream transducer.	≥1200	–400 to +400
Qdown	Displays the signal quality for the downstream transducer.	≥1200	–400 to +400
AMPup	Displays the value for the signal amplitude of the upstream transducer.	24 ± 5	<19 or >29
AMPdn	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29
CNTup	Displays the AGC DAC count for the upstream gain setting.	N.A.	N.A.
CNTdn	Displays the AGC DAC count for the downstream gain setting.	N.A.	N.A.
P#up	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
P#dn	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
TEMP	Displays the gas temperature (from 0/4-20 mA input).	N.A.	N.A.
PRESR	Displays the gas pressure (from 0/4-20 mA input).	N.A.	N.A.
Mw	Displays the molecular weight.	N.A.	N.A.
z	Displays the compressibility.	N.A.	N.A.
AcVOL	Displays actual volumetric flow.	N.A.	N.A.
StVOL	Displays standard volumetric flow.	N.A.	N.A.
Tu S[1]	Displays Skan transit time upstream.	N.A.	N.A.
Td S[1]	Displays Skan transit time downstream.	N.A.	N.A.
DT S[1]	Displays Skan Delta T.	N.A.	N.A.
Tu M[1]	Displays Measure transit time upstream.	N.A.	N.A.
Td M[1]	Displays Measure transit time downstream.	N.A.	N.A.
DT M[1]	Displays Measure Delta T.	N.A.	N.A.

Table 3: Available Diagnostic Parameters

Option Bar	Description	Good	Bad
Vinst	Displays the instantaneous velocity.	N.A.	N.A.
[1]available only if Burst Mode = S/M			

3.3 Flowcell Problems

If preliminary troubleshooting with the *Error Code Messages* and/or the *Diagnostic Parameters* indicates a possible flowcell problem, proceed with this section. Flowcell problems fall into two categories:

- Gas problems
- Pipe problems

Read the following sections carefully to determine if the problem is indeed related to the flowcell. If the instructions in this section fail to resolve the problem, contact the factory for assistance.

3.3.1 Gas Problems

Most gas-related problems result from a failure to observe the flowmeter system installation instructions, as described in the *Startup Guide*. Refer to Chapter 1, *Installation*, of the *Startup Guide* to correct any installation problems.

If the physical installation of the system meets the recommended specifications, it is possible that the gas itself may be preventing accurate flow rate measurements. The gas being measured must meet the following requirements:

1. *The gas must be homogeneous, single-phase and relatively clean.*
   Although a low level of entrained particles may have little effect on the operation of the XGF868i, excessive amounts of solid or liquid particles will absorb or disperse the ultrasound signals. This interference with the ultrasound transmissions through the gas will cause inaccurate flow rate measurements. In addition, temperature gradients in the gas flow may result in erratic or inaccurate flow rate readings.
2. *The gas must not excessively attenuate ultrasound signals.*
   Some gases (i.e. high-purity carbon dioxide, hydrogen, nitrogen, etc.) readily absorb ultrasound energy. In such a case, an **E1** error code message will appear on the display screen to indicate that the ultrasonic signal strength is insufficient for reliable measurements.
3. *The gas sound speed must not vary excessively.*
   The XGF868i will tolerate relatively large changes in the gas sound speed, as may be caused by variations in gas composition and/or temperature. However, such changes must occur slowly. Rapid fluctuations in the gas sound speed, to a value that is considerably different from that programmed into the XGF868i, will result in erratic or inaccurate flow rate readings. Refer to Chapter 2, *Initial Setup*, of the *Startup Guide* and make sure that the appropriate sound speed is programmed into the meter.

3.3.2 Pipe Problems

Pipe-related problems may result either from a failure to observe the installation instructions, as described in the *Startup Guide*, or from improper programming of the meter. By far, the most common pipe problems are the following:

1. *The collection of material at the transducer location(s).*
   Accumulated debris at the transducer location(s) will interfere with transmission of the ultrasound signals. As a result, accurate flow rate measurements are not possible. Realignment of the flowcell or transducers often cures such problems, and in some cases, transducers that protrude into the flow stream may be used. Refer to Chapter 1, *Installation*, of the *Startup Guide* for more details on proper installation practices.
2. *Inaccurate pipe measurements.*
   The accuracy of the flow rate measurements is no better than the accuracy of the programmed pipe dimensions. For a flowcell supplied by Panametrics, the correct data will be included in the documentation. For other flowcells, measure the pipe wall thickness and diameter with the same accuracy desired in the flow rate readings. Also, check the pipe for dents, eccentricity, weld deformity, straightness and other factors that may cause inaccurate readings. Refer to Chapter 2, *Initial Setup*, of the *Startup Guide* for instructions on programming the pipe data.

   In addition to the actual pipe dimensions, the path length (P) and the axial dimension (L), based on the actual

transducer mounting locations, must be accurately programmed into the flowmeter. For a Panametrics flowcell, this data will be included with the documentation for the system. If the transducers are mounted onto an existing pipe, these dimensions must be precisely measured. See Appendix C, *Measuring P and L Dimensions*, of the *Startup Guide* for a thorough discussion of this topic.

3. *Signal strength above 75.*
   The XGF868i is supplied with a signal preamplifier. However, this amplifier may not be necessary for high pressure applications. If the meter has a signal strength above 75, bypass the preamp and connect the coax cable directly to the transducers.

3.4 Transducer Problems

Ultrasonic transducers are rugged, reliable devices. However, they are subject to physical damage from mishandling and chemical attack. The most common transducer problems are listed below:

1. **LEAKS:** Leaks may occur around the transducer and/or the flowcell fittings. Repair such leaks immediately. If the leaking gas is corrosive, carefully check the transducer and cables for damage, after the leak has been repaired.
2. **CORROSION DAMAGE:** If the transducer material was not properly chosen for the intended application, the transducers may suffer corrosion damage. The damage usually occurs either at the electrical connector or on the transducer face. If corrosion is suspected, remove the transducer from the flowcell and carefully inspect the electrical connector and the transducer face for roughness and/or pitting. Any transducer damaged in this manner must be replaced. Contact Panametrics for information on transducers in materials suitable for the application.
3. **INTERNAL DAMAGE:** An ultrasonic transducer consists of a ceramic crystal bonded to the transducer case. The bond between the crystal and the case or the crystal itself may be damaged by extreme mechanical shock and/or temperature extremes. Also, the internal wiring can be corroded or shorted if contaminants enter the transducer housing.
4. **PHYSICAL DAMAGE:** Transducers may be physically damaged by dropping them onto a hard surface or striking them against another object. The transducer connector is the most fragile part and is most subject to damage. Minor damage may be repaired by carefully bending the connector back into shape. If the connector can not be repaired, the transducer must be replaced.

IMPORTANT: Transducers must be replaced in pairs. Refer to Chapter 2, Initial Setup, of the Startup Guide to program the new transducer data into the meter.

If the instructions in this section fail to resolve the problem, contact Panametrics for assistance.

Chapter 4. Parts Replacement

4.1 Introduction

The XGF868i has been designed to permit easy on-site upgrades and parts replacement. See *Figure 6 on page 29* for details of the standard XGF868i electronics enclosure assembly. The instructions in this chapter, along with a few common tools, are all that is required to perform the following tasks:

- Removing the circuit board assembly
- Replacing the LCD display/interconnect subassembly
- Replacing the fuse
- Replacing the User Program
- Installing an option card
- Assembling/installing the circuit board assembly



WARNING! **Prior to performing any maintenance procedures, be sure to disconnect the main power from the unit.If the XGF868i is installed in a hazardous environment, the electronics enclosure must be moved to a safe area prior to removing the covers. If the electronics enclosure cannot be moved to a safe area, ensure that the surrounding area is free of ignitable gases.**

IMPORTANT: For compliance with the EU Low Voltage Directive, this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.

Use *Figure 6 on page 29*, *Figure 7 on page 30* and *Figure 8 on page 31* to locate the relevant components, while completing the service procedures discussed in this chapter.

IMPORTANT: Keep a detailed record of all parts installations and replacements performed on the XGF868i in Appendix A, Service Record. This service history will be helpful in diagnosing any future problems.

4.2 Removing the Circuit Board Assembly

All parts replacement procedures for the XGF868i require the removal of the *circuit board assembly* from the electronics enclosure. Therefore, complete the instructions in this section before attempting any other service tasks.

The XGF868i circuit board assembly consists of circular front and rear circuit boards with several rectangular circuit boards sandwiched between the circular end boards and oriented perpendicular to them. Specifically, some or all of the following circuit boards may be included in the assembly:

FRONT BOARDS:

- LCD Display/Interconnect Board Subassembly

REAR BOARD:

- Terminal Board

MIDDLE BOARDS:

- Main Board
- Receiver Board
- Power Supply Board
- Slot 1 Input/Output Card (optional)
- Slot 2 Logging/RS485 Card (optional)

To disassemble the circuit board assembly, refer to *Figure 6 on page 29* and complete the following steps:

1. Disconnect the power to the XGF868i and move the electronics enclosure to a safe area.

Note: *If the electronics enclosure cannot be moved to a safe area, be sure the surrounding area is free of ignitable gases before proceeding to step 2.*



WARNING! **The main power to the XGF868i must be disconnected before proceeding.**

2. Refer to *Illustration 1* in *Figure 6 on page 29* and loosen the set screw on the rear cover. Place a rod or long screwdriver across the cover in the slots provided, and rotate the cover counterclockwise until it comes free from the enclosure.
3. Repeat Step 2 to remove the front cover.
4. From the rear of the enclosure, disconnect the power line leads from terminal block TB5. Unplug terminal blocks TB1 to TB6 from connectors J1-J4.
5. Refer to *Illustration 2* in *Figure 6 on page 29*, and remove the *four* terminal board *mounting screws* and the ground screw. This will disconnect one end of the green *grounding jumper wire* and the *label plate* with the ground symbol will come loose from beneath it.

IMPORTANT: Each screw will have a flat washer and a lock washer installed. Be careful not to lose these washers.

6. Refer to *Illustration 3* in *Figure 6 on page 29*and carefully rotate the circuit board assembly counterclockwise about 20°, until the five bosses in the enclosure are visible through the slots along the circumference of the terminal board. Then, slowly push the circuit board assembly through the enclosure and remove it from the front of the enclosure.

Bring the circuit board assembly to a clean, safe work area and proceed to the appropriate section of this chapter to perform the desired service procedure.

4.3 Replacing the LCD Display/Interconnect Board Subassembly

The LCD display normally provides years of dependable service, but it is easily field-replaceable when necessary. To replace the LCD display, see *Figure 7 on page 30* for the component locations, and complete the following steps:

1. Complete the steps in "*Removing the Circuit Board Assembly" on page 22*.
2. Place the circuit board assembly on a flat surface with the LCD display board facing upward. See *Illustration 4* in *Figure 7 on page 30*, and remove the *three mounting screws* (with flat washers and lock washers) indicated.
3. Grasp the LCD display/keypad board/interconnect board subassembly at the top and bottom edges, and carefully pull it straight upward until it comes free from the main board and option boards. Refer to *Illustration 5* in *Figure 7 on page 30*. Remove two screws from the back of the interconnect board. Then hold the edge of the keypad board by one hand, and the edge of the LCD display/interconnect board by the other hand, and pull the two boards apart.

Note: *The two circuit boards are attached by a connector located beneath the top edge of the LCD display board (see Illustration 5 in* Figure 7 on page 30*). The LCD display is attached to the interconnect board as one subassembly.* Do not *disassemble the LCD display from the interconnect board.*

4. Place the keypad board directly over the new LCD display/interconnect board subassembly and align the J1 connector on the rear of the keypad board with the P6 pins on the interconnect board. Firmly, push the two boards together until the interconnect board contacts the two standoffs on the keypad board.
5. Secure the keypad board to the interconnect board with the two screws, flat washers and lock washers previously removed.
6. Firmly insert and seat the complete assembly by aligning the P4 connector on the interconnect board to the J4 connector on the main board and the P1 and P2 connectors to any option card (as applicable). Replace the three screws removed in step 2, while referring back to *Illustration 4* in *Figure 7 on page 30*.

Complete the LCD display/interconnect board subassembly replacement by proceeding to "*Installing the Circuit Board Assembly" on page 28*.

4.4 Replacing the Fuse

IMPORTANT: This procedure applies only to the fuse on the DC power supply. The fuse on the AC power supply is not field-replaceable; please contact Panametrics for replacement.

If the fuse in the XGF868i has been blown, complete the following steps to install a new fuse:

1. Complete the steps in "*Removing the Circuit Board Assembly" on page 22*.
2. Place the circuit board assembly on its side, with the terminal board on the left and the interconnect board on the right. Rotate the assembly until the power supply board is facing upward.
3. Locate the fuse along the left side of the power supply board, just below the terminal board (refer to *Illustration 6* in *Figure 7 on page 30*).
4. Pull the plastic cover off the fuse holder and remove the old fuse.
5. Obtain a new fuse of the same rating and type. Use only a type 3AG (1-1/4" x 1/4") Slo-Blo fuse, having a rating as indicated in *Table 4* below.

Table 4: Line Voltages & Fuse Ratings

Line Voltage	Fuse Rating
12-28 VDC	2.0 A, Slo-Blo
85-250 VAC	Not field replaceable (contact Panamtrics)

6. Press the new fuse into the fuse holder and reinstall the plastic fuse cover.

To complete the fuse replacement, proceed to "*Installing the Circuit Board Assembly" on page 28*.

Note: *Be sure to record the fuse replacement in Appendix A*, Service Record.

4.5 Replacing the User Program

The XGF868i's *User Program* is stored on an erasable programmable read only memory (EPROM) chip. The EPROM, which is designated as component **U6**, is mounted in a socket on the front of the main circuit board. EPROM replacement may be required to replace a defective chip or to upgrade to a newer software version.

To replace the *User Program*, refer to *Figure 7 on page 30* and complete the following steps:

1. Complete the steps in *"Removing the Circuit Board Assembly" on page 22*.
2. Place the circuit board assembly on a flat surface with the terminal board facing upward. See *Illustration 7* in *Figure 7 on page 30*, and remove the *three PCB mounting screws* (with flat washers and lock washers) indicated. This will also remove the green *grounding jumper*.
3. Locate and unscrew a fourth smaller bracket screw close to J2 on the terminal board, capturing the lock washer, flat washer and bracket nut on the back side. Then, carefully pull the *terminal board* away from the main board/power supply board assembly and option board.
4. Remove the two screws, flat washers, lock washers and heat sink in the corners of the power supply board (see *Illustration 8* in *Figure 7 on page 30*).

Note: *An XGF868i with a DC power supply will include two more mounting screws, but no heat sink.*

5. Carefully pull up the power supply board and heat sink assembly, then slide it out.

   The U6 EPROM is located along the upper edge of the main board, on the side that was facing the power supply board (see *Illustration 8* in *Figure 7 on page 30*). It is the only socketed chip on this board and it has a white identification label.
6. Using a chip puller, remove the EPROM from its socket. If a chip puller is unavailable, a straightened paper clip may be used in the notches at the upper right and lower left corners of the socket. Gently pry the EPROM up, a little at a time, at each notch until it comes free.



CAUTION! **The EPROM is easily damaged by static electricity. Before handling the new chip, touch a grounded metal object to discharge any built-up static electricity and avoid touching the leads on the side of the chip.**

7. Make sure that the beveled corner on the new EPROM is aligned with the beveled corner of the socket and place the EPROM into the socket.
8. By applying equal pressure on all four corners, gently press the EPROM into the socket until it is fully seated. Do not strike the EPROM or apply excessive force during this procedure.

Complete the *User Program* replacement by proceeding to *"Assembling the Circuit Board Assembly" on page 26*.

4.6 Installing an Option Card

The XGF868i flowmeter can accommodate up to two option cards. A communication card may be installed in **Slot 2** and a variety of I/O option cards are available for installation in **Slot 1**.

To install an option card, see *Illustrations 9, 10 and 11* in *Figure 8 on page 31* and complete the following steps:

1. Complete the steps in *"Removing the Circuit Board Assembly" on page 22*.
2. Remove the terminal board from the main board/power supply board subassembly by completing Steps 1-3 in *"Replacing the User Program" on page 25*.
3. Remove the screw from the angle bracket on the main board, as shown in *Illustration 11* in *Figure 8 on page 31*.

Note: *Do not lose the* nylon washer *located between the small* angle bracket *on the terminal board and the main board.*

4. If necessary, remove any option card (and optional I/O heat sink) currently in use.
5. There is a 36 pin connector (P2) and a 30 pin connector (P1) on the rear of the interconnect board. The option cards must be plugged into these connectors.
   a. To install a *communication card into Slot 2*, orient the option card so that its 36 pin connector is positioned over connector P2 on the interconnect board. Then, firmly seat the card into its connector. When properly installed, the side of the option card with the 36-pin connector must face the center of the interconnect board, and the edge of the option card must not overhang the edge of the interconnect board.
   b. To install an *I/O option card with optional heat sink into Slot 1*, orient the option card so that its 30 pin connector is positioned over connector P1 on the interconnect board. Then, firmly seat the card into its connector. When properly installed, the side of the option card with the 30-pin connector must face away from the center of the interconnect board, and the edge of the option card must not overhang the edge of the interconnect board. (However, the optional heat sink will extend beyond the edge.)

Note: *To attach an optional heat sink to an I/O option card, see "Attaching an Optional Heat Sink to an I/O Option Card" on page 26. When the XGF868i includes both an I/O board (Slot 1) and an option board (Slot 2), the two boards must be attached to each other with the hardware shown in* Illustration 10 *in* Figure 8 on page 31. *Pre-attach the nylon washer to the screw before inserting the boards into the assembly.*

4.6.1 Attaching an Optional Heat Sink to an I/O Option Card

If you need to attach an optional heat sink to an I/O option card (the TI, TR, FI or FR options in Appendix B of the *Startup Guide)*, refer to *Illustration 9* in *Figure 8 on page 31* and complete the following steps:

1. Orient the thermal heat pad(s) to the heat sink as shown in *Figure 8 on page 31* and apply it to the heat sink.
2. Loosely attach the aluminum backplate to the I/O heat sink with three screws, lock washers and flat washers.

Note: *The following step applies only to the TR and FR option cards. Otherwise, proceed to step 4.*

3. If you have an optional heat sink bridge, attach it to the I/O heat sink with two screws, lock washers, flat washers and nuts.
4. Attach the assembled heat sink by straddling the power supply components on the option card with the aluminum plate to the left (inside) and the heat sink to the right (outside).
5. Tighten the three screws (step 2) to secure the aluminum backplate to the heat sink.

Complete the option card installation by proceeding to *"Assembling the Circuit Board Assembly" on page 26*.

4.7 Assembling/Installing the Circuit Board Assembly

Most of the parts replacement procedures described in this chapter require removal of the circuit board assembly from the electronics enclosure. Furthermore, most of the procedures require varying degrees of disassembly of the circuit board assembly. See *Figure 8 on page 31* and follow the instructions in this section to assemble the circuit board assembly and/or to install it in the electronics enclosure.

4.7.1 Assembling the Circuit Board Assembly

If the circuit board assembly has been disassembled to any degree, complete the steps below. Otherwise proceed directly to *"Installing the Circuit Board Assembly" on page 28*. See *Figure 8 on page 31* and complete the following steps:

1. If necessary, replace the angle bracket on the main board, insert the screw (with flat washer and lock washer), and screw it into the standoff on the main board. See *Illustration 11* in *Figure 8 on page 31*.

IMPORTANT: The small angle bracket on the terminal board must be positioned on the outside of the main board with the previously removed nylon washer between them.

2. Face the *User Program* side of the main board toward the rear of the power supply board. Orient the boards so that the pins along the bottom of the main board align with connectors J2 and J6 on the power supply board, and push the two boards firmly together.

Note: *If the thermal gap filler pad of the power supply board has been damaged, you must remove and replace it before reinserting the power supply board. First, remove and discard the damaged pad. Then remove the blue protective liner from the new pad and apply it with the white face against the power supply board.*

3. Secure the power supply board and heat sink to the main board by reinstalling the screws, flat washers and lock washer previously removed from the corners of the power supply board. See *Illustration 11* in *Figure 8 on page 31*.

4. Refer back to *Illustration 7* in *Figure 7 on page 30*. Carefully align the terminal board onto the main board/power supply assembly and the two option boards (Slot 1 and Slot 2, where applicable), so that the connectors listed in *Table 5* below are facing each other. Then, firmly press the terminal board and the interconnect board toward each other until all of the connectors are completely seated.

Table 5: Mating Connectors for Terminal Board

	Terminal Board	Mating Board
1	J7 Connector (Large Three-Pin Connector Plug)	Power Tab on AC Power Supply Board
2	J6 Connector (Large Three-Pin Connector Plug)	Power Tab on DC Power Supply Board
3	P7 Connector	J7 Connector on Main Board
4	P10 Connector	J9 Connector on Main Board
5	P9 Connector	J10 Connector on Main Board
6	P8 Connector	J8 Connector on Main Board
7	P21 Connector	J1/J3 Connector on I/O Board, Slot 2 Option
8	P22 Connector	P2 Connector on I/O Board, Slot 1

IMPORTANT: With two option cards installed, it may require some patience to get all of the connectors properly aligned. Do not force the assembly together, or some of the pins may not enter the sockets properly.

5. Secure the assembly together by installing the three mounting screws, flat washers and lock washers previously removed from the terminal board. Be sure to install one end of the green grounding jumper wire under the screw indicated in *Illustration 7* in *Figure 7 on page 30*. The smaller screw should be used at the angle bracket location, and secured with a nut, lock washer and flat washer.

Proceed to the next section for instructions on installing the reassembled circuit board assembly in the electronics enclosure.

4.7.2 Installing the Circuit Board Assembly

Be sure that the circuit board assembly is completely assembled, as described in the previous section. Then, refer to *Illustrations 1, 2 and 3* in *Figure 6 on page 29* and install the circuit board assembly into the electronics enclosure as follows:

1. Slide the terminal board end of the circuit board assembly into the front of the electronics enclosure. By aligning the slots around the circumference of the terminal board with the bosses inside the enclosure, guide the circuit board assembly into the enclosure until the terminal board just clears the bosses at the rear of the enclosure (see *Illustration 3*).
2. From the rear of the enclosure, rotate the circuit board assembly about 20° clockwise so that the mounting holes in the terminal board are positioned over the tapped holes in the bosses. Secure the circuit board assembly to the enclosure with four mounting screws, flat washers and lock washers previously removed (see *Illustration 2*).

IMPORTANT: If the circuit board assembly is inserted too far into the enclosure, it cannot be rotated properly.

3. Attach the loose end of the green grounding jumper wire to the enclosure with the mounting screw, flat washer and lock washer previously removed. Be sure to install the metal label plate under this screw (see *Illustration 2*).
4. From the rear of the enclosure, connect the power line leads to terminal block TB5. Plug the connectors back into terminal blocks J1-J4. If necessary, see Chapter 1, *Installation*, of the *Startup Guide* for detailed wiring instruction.
5. Install the front and rear covers on the electronics enclosure and secure them in place with the set screws provided (see *Illustration 1*).

The XGF868i is now ready to be placed back into service. Before taking measurements, refer to Chapter 2, *Initial Setup*, of the *Startup Guide* and Chapter 1, *Calibration*, of this manual for instructions on properly setting up the meter for accurate flow rate measurements.

Note: *Be sure to enter a complete and detailed account of any parts replacement performed on the XGF868i in Appendix A,* Service Record*.*

To purchase the parts mentioned in this chapter or any items not specifically discussed, contact Panametrics for assistance. To make sure the proper components are obtained, be sure to include the *serial number* of your XGF868i when you place your parts order.

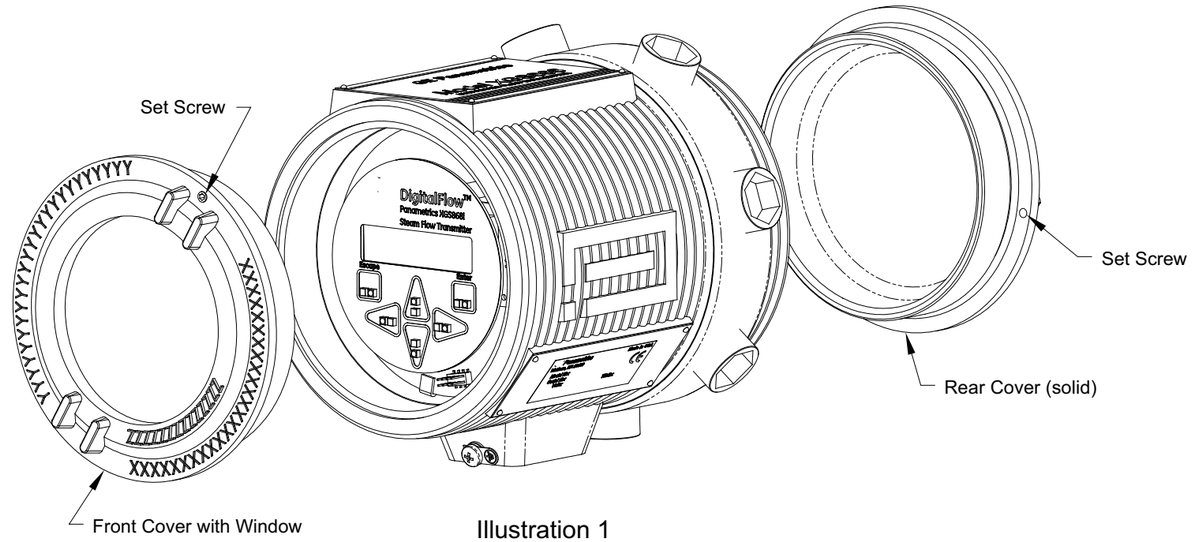


Illustration 1

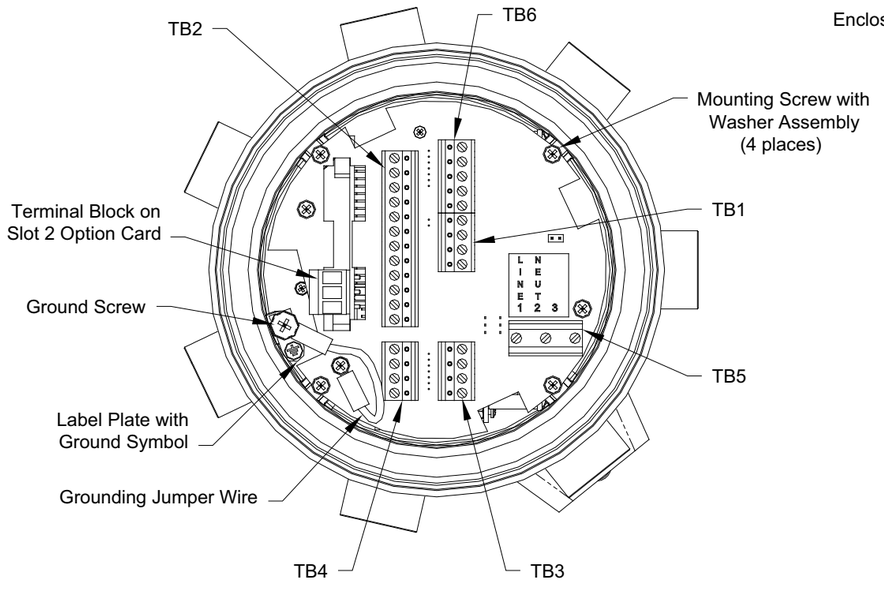


Illustration 2

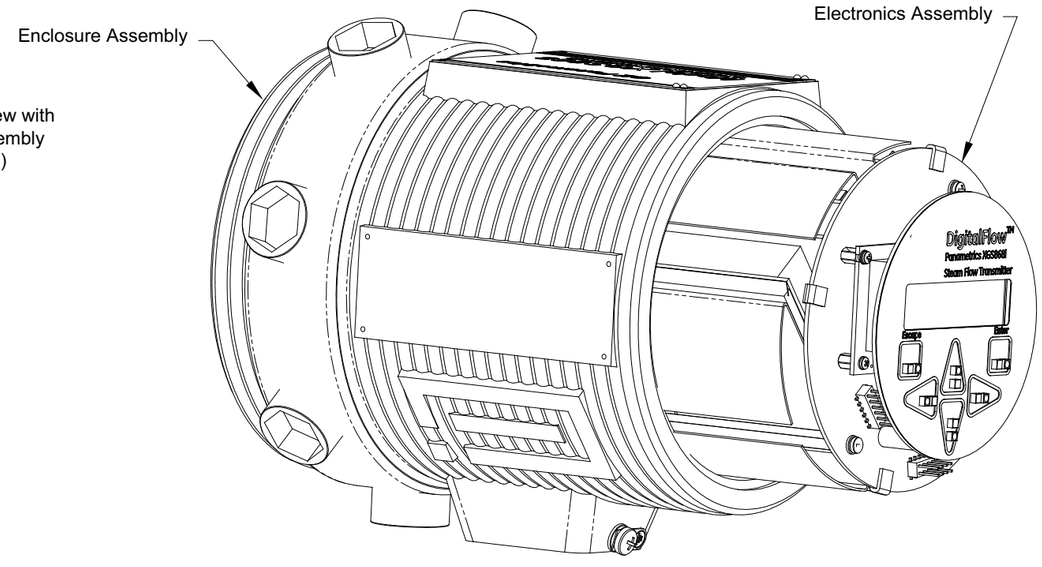


Illustration 3

Figure 6: Model XGF868i Electronics Console Assembly

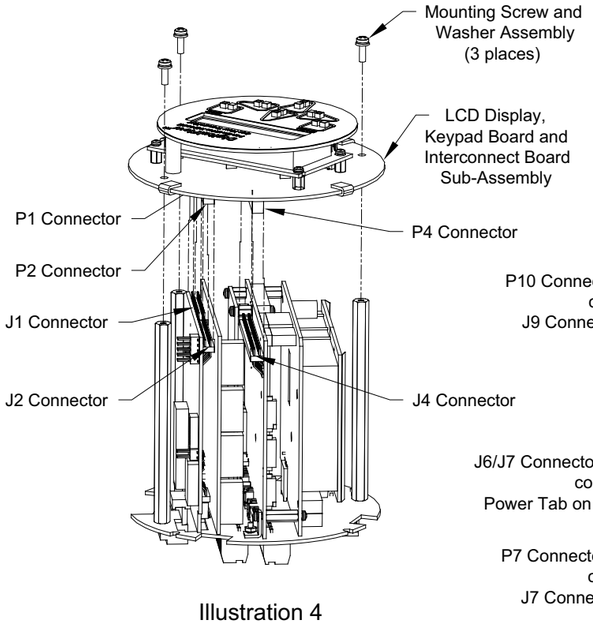


Illustration 4

(shown with heatsinks removed for clarity)

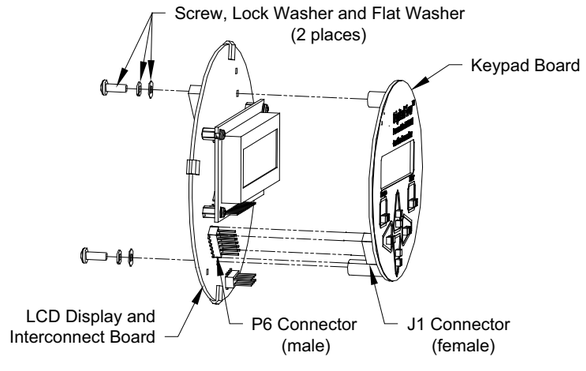


Illustration 5

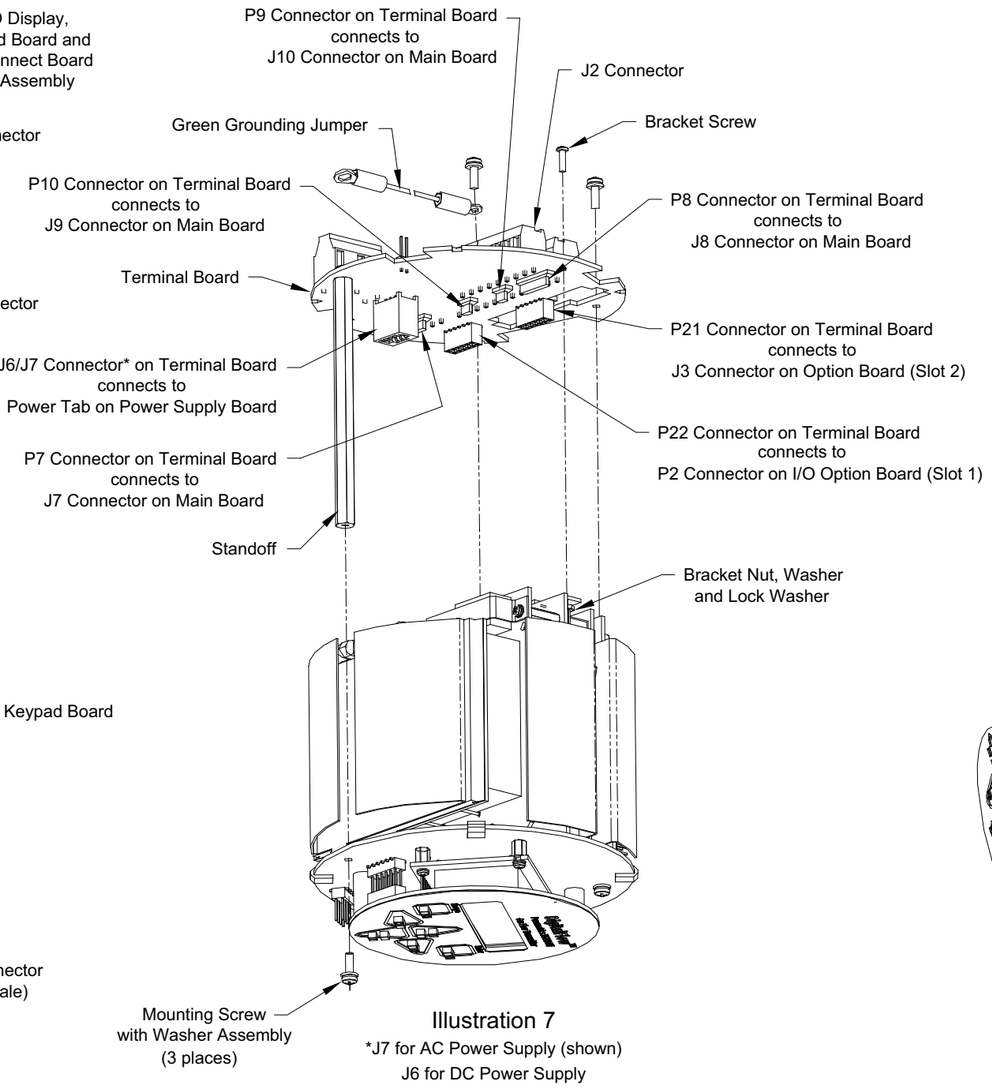


Illustration 7

*J7 for AC Power Supply (shown)

J6 for DC Power Supply

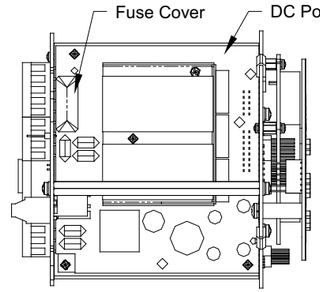


Illustration 6

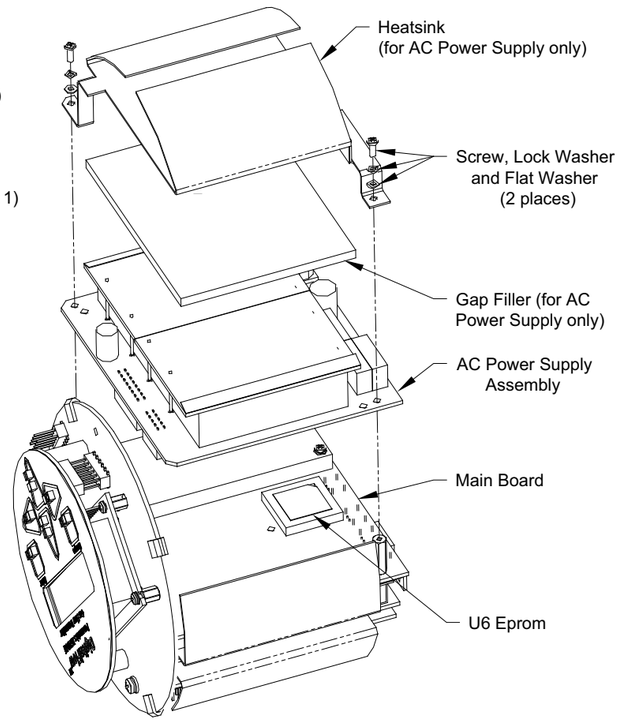


Illustration 8

(shown with AC Power Supply) Note: There are no Heat Sink and Gap Fillers with a DC Power Supply.

Figure 7: Model XGF868i LCD Display/Interconnect Board Subassembly

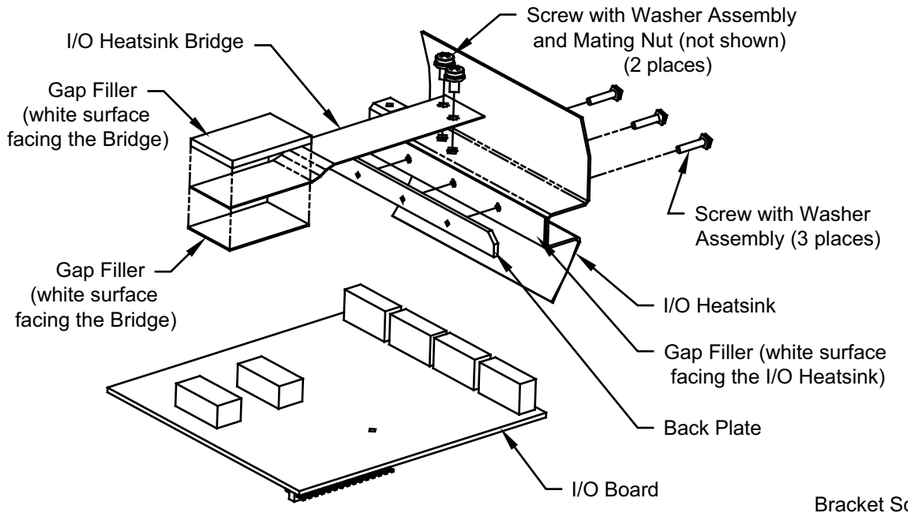


Illustration 9

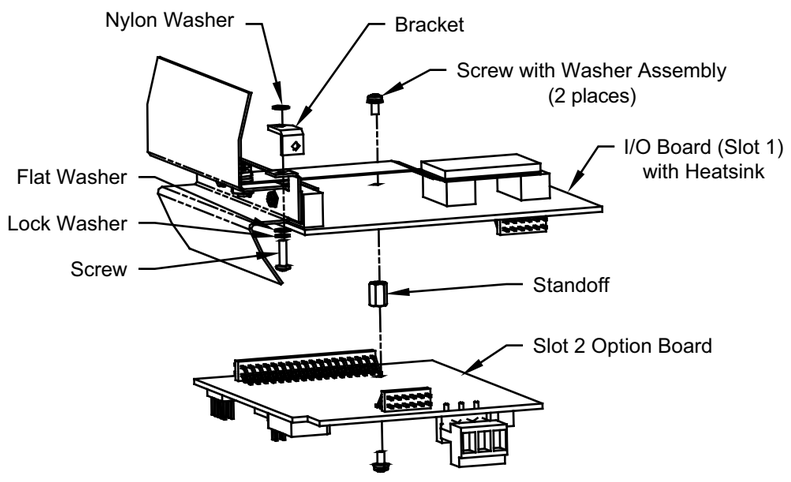


Illustration 10

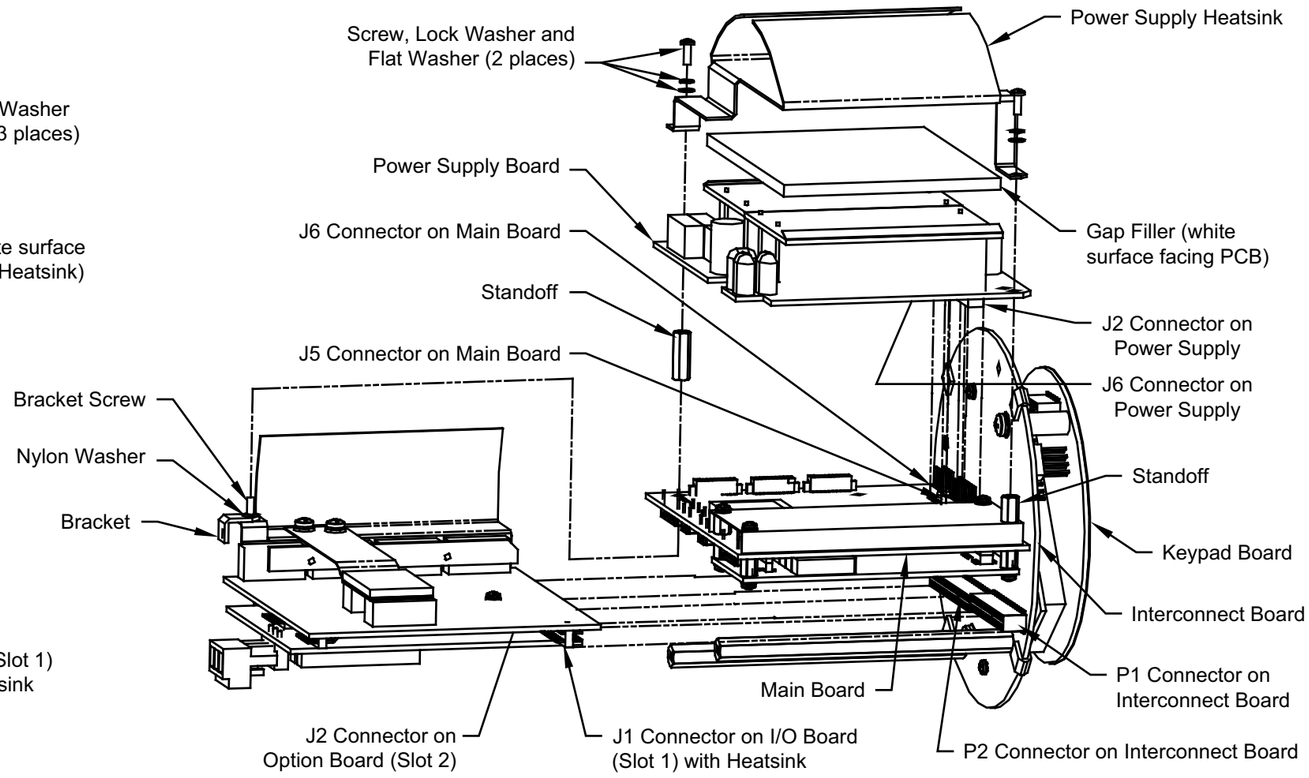


Illustration 11

Figure 8: Model XGF868i I/O Option Card Subassembly

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Appendix A. Service Record

A.1 Introduction

Whenever any service procedure is performed on the XGF868i flow transmitter, the details of the service should be recorded in this appendix. An accurate service history of the meter can prove very helpful in troubleshooting any future problems.

A.2 Data Entry

Record complete and detailed service data for the XGF868i in *Table 6* below. Make additional copies of the table as needed.

Table 6: Data Entry

Date	Description of Service	Performed By

Table 6: Data Entry

Date	Description of Service	Performed By

A.3 Diagnostic Parameters

After a successful initial installation of the XGF868i and whenever any system malfunction is noticed, the values for the diagnostic parameters should be entered in *Table 7* below.

Table 7: Diagnostic Parameters

Parameter	Initial	Current	Parameter	Initial	Current
SS up			CNTdn		
SS do			P#up		
SNDSP			P#dn		
Tup			TEMP		
Tdown			PRESR		
DELTA			AcVOL		
Mw			StVOL		
REYN#			Tu S[1]		
Tot K			Td S[1]		
PEAK%			DT S[1]		
Qup			Tu M[1]		
Qdown			Td M[1]		
AMPup			DT M[1]		
AMPdn			Vinst		
CNTup					

[1]available only if Burst Mode = S/M

[no content intended for this page]

Appendix B. Calibration and Testing with PanaView

B.1 Introduction

This appendix explains how to calibrate the XGF868i analog outputs and inputs using PanaView™ interface software. In addition, testing the optional totalizer, frequency and alarm relay outputs, and XGM868i hardware and software is discussed. The appendix includes the following specific topics:

- Calibrating the Slot 0 analog outputs
- Calibrating option card analog outputs
- Calibrating option card analog inputs and RTD inputs
- Testing option card alarm relays
- Testing option card totalizer and frequency outputs
- Uploading XGF868i signal array data and memory data
- Testing the EPROM, RAM and DAC
- Setting the number of channels
- Resetting the XGF868i to default values

The XGF868i electronics enclosure includes one slot for installation of an input/output option card. This slot is designated as Slot 1, and a variety of option cards are available. In addition, every XGF868i flowmeter includes two built-in analog outputs (A and B) at terminal block J1, which is designated as Slot 0.

Note: *Convention in this manual identifies any expansion slot as* Slot X, *where* X *is a number from 0-2.* Slot 2 *is used only for communication cards.*

See Chapter 1, *Installation*, and Appendix B, *Data Records*, in the *Startup Guide* for a complete description of the available option cards and the procedures for wiring them.

B.2 Accessing the Calibration/Test Menu

The *Calibration/Test* menu is accessed through the *New Meter Browser* menu of PanaView software. Use this menu to calibrate and test the Slot 0 analog outputs, as well as to calibrate and/or test any option cards that are installed in expansion Slot 1. Refer to the menu maps in *Figure 3 on page 9* as a guide in following the calibration instructions.

IMPORTANT: *Before you attempt to communicate with the XGF868i, be sure you have linked your PC to the XGF868i via an RS232 interface. For details on wiring the interface, refer to* Wiring the Serial Port *in the* Startup Guide*, and to the document* EIA-RS Serial Communications *(916-054). You must also install PanaView, as discussed in the* PanaView User's Manual *(910-211).*

1. Power up the XGF868i and wait until it has initialized.
2. Launch PanaView and wait until it initializes the XGF868i and displays the basic PanaView window.
3. As described in the *PanaView User's Manual,* open the *Meter Browser* window and highlight the XGF868i.
4. Expand the *Edit Functions* option. A window now appears similar to that shown in *Figure 9* below.

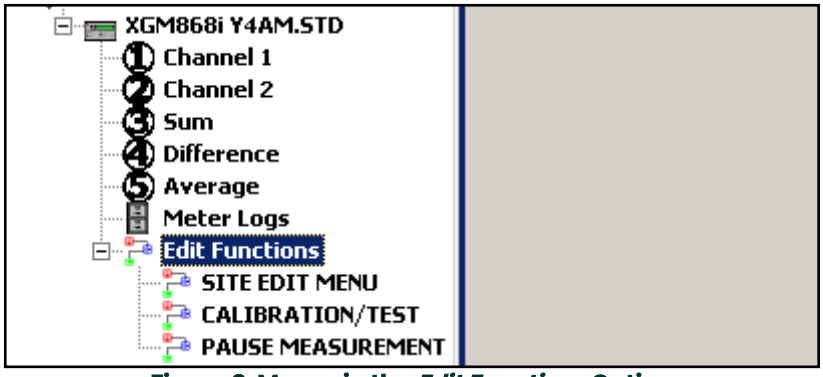


Figure 9: Menus in the *Edit Functions* Option

5. To enter data into the user program, double-click on the *Calibration/Test* menu. The window appears similar to *Figure 10* below.

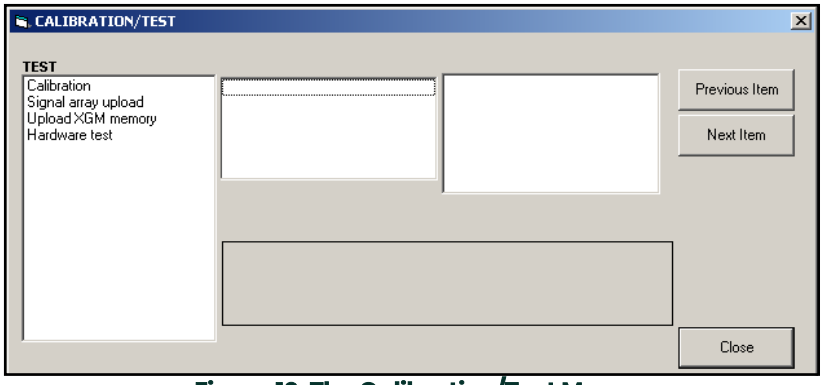


Figure 10: The Calibration/Test Menu

Proceed to the appropriate sections of this appendix to calibrate or test any of the installed inputs or outputs.

B.3 Calibrating Slot 0 Analog Outputs

Every XGF868i flowmeter includes two built-in analog outputs (A and B) at terminal block J1, which is designated as Slot 0. Both the zero-point and full-scale values for each output must be calibrated. After calibrating the outputs, which have a resolution of 5.0 μA (0.03% full scale), their linearity should be tested.

Note: *The zero point of the analog output may be set for either 0 mA or 4 mA. However, the calibration procedure always uses the 4 mA point, as the meter will extrapolate this value to obtain the 0 mA point.*

Prepare for calibration by inserting an ammeter in series with the load on analog output A at terminal block J1, as shown in *Figure 11* below.

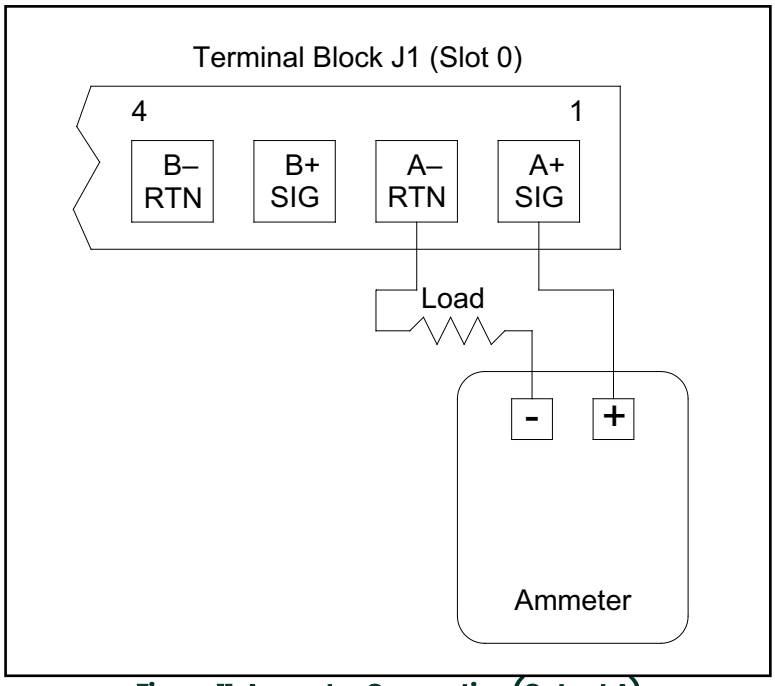


Figure 11: Ammeter Connection (Output A)

1. From the *Calibration/Test* menu (see *Figure 10 on page 38*), double-click on the *Calibration* entry to open the option.
2. In the center pane, double-click on *Slot 0*.

Note: *The* Slot 1 *option only appears in the center pane if an option card has been installed in this slot.*

3. Double-click on either *Output A* or *Output B* to open the *Analog Output* menu. (Output A will be used as an example in this manual.)

IMPORTANT: *The procedure for calibrating* Output B *is identical to that for calibrating* Output A. *However, when calibrating* Output B, *be sure to reconnect the ammeter on terminal block* J1. *See* Figure 11 on page 39 *for the correct pin numbers.*

4. Double-click on *4 milliamps* to calibrate the low end of the output range.
5. Double-click on *4 mA UP* or *4 mA DOWN* to adjust the ammeter reading UP or DOWN, until a 4 mA reading is achieved, or ₀ouble-click on *4 mA Numer,* and directly enter the mA reading in the right pane.
6. Once you have achieved a 4 mA reading, double-click on either *4 mA STORE* to store the calibration, or on *4 mA ABORT* to exit the menu without storing the calibration.

Note: *If the ammeter reading cannot be adjusted within 5.0 μA of the 4 or 20 mA setting, contact the factory for assistance.*

7. PanaView returns to the *Analog Output* window. Double-click on *20 milliamps*, and repeat steps 5 and 6 to calibrate the high end of the output range.

Note: *Skip the following prompt, if linearity testing of the output will not be performed at this time.*

8. Double-click on *% Test* to test the linearity of the currently selected analog output.
9. Check the ammeter reading at *50% output*. Then, enter a different *output* (0-100%) and double-click on *percent*. Check the ammeter reading at this setting and click [Exit Page] when done.

Table 8 on page 40 lists the expected ammeter readings at various *% Full Scale* settings, for both 4-20 mA and 0-20 mA scales. Refer to this table to verify the accuracy of the ammeter readings taken above.

Table 8: Expected Ammeter Readings

% Full Scale	4-20 mA Scale*	0-20 mA Scale*
0	4.000	0.000
10	5.600	2.000
20	7.200	4.000
30	8.800	6.000
40	10.400	8.000
50	12.000	10.000
60	13.600	12.000
70	15.200	14.000
80	16.800	16.000
90	18.400	18.000
100	20.000	20.000
* all ammeter readings should be ±0.005 mA		

If the linearity test readings are not within 5 μA of the values listed in *Table 8* above, check the accuracy and wiring of the ammeter. Then, repeat the low and high end calibrations. If the analog output still does not pass the linearity test, contact the factory for assistance.

10. Double-click on *Exit Function* to return to the *Calibration* menu. Then choose another output to calibrate or click on [Exit Page] to leave the *Calibration/Test* menu.

This completes calibration of the Slot 0 analog outputs. Proceed to the appropriate section to calibrate additional inputs/outputs.

B.4 Calibrating Slot 1 Option Cards

To calibrate any option card installed in Slot 1 of the XGF868i, enter the *Calibration/Test* menu as shown in *Figure 10 on page 38*.

1. In the center pane, double-click on *Slot 1*.

Note: *The* Slot 1 *option only appears in the center pane if an option card has been installed in this slot.*

Notice that all of the available outputs (usually four) appear at the above prompt. The desired type of output may appear as the A and B output pair and/or as the C and D output pair. Simply select the appropriate output for calibration and/or testing. For clarity in this chapter, the desired outputs are always placed in the A and B positions, and the C and D positions are not specifically listed. In addition, Output A is always used as an example. Proceed to the appropriate sub-section for specific instructions, and substitute the correct output letter for the "A" shown in the procedures.

B.4.1 Analog Outputs

Additional analog outputs may be added to the XGF868i by installing an appropriate option card in Slot 1. This option card contains two or four analog outputs, which are designated as A, B, C and D. Both the zero-point and full-scale values for each output must be calibrated. After calibrating the outputs, which have a resolution of 5.0 μA (0.03% full scale), their linearity should be tested.

Note: *The zero point of the analog output may be set for either 0 mA or 4 mA. However, the calibration procedure always uses the 4 mA point, as the meter will extrapolate this value to obtain the 0 mA point.*

Prepare for calibration by inserting an ammeter in series with the load on Output A of the option card. See *Figure 4 on page 10* to identify the OUT(+) and RTN(–) pins for Output A on terminal block J2.

2. Double-click on either *Output A* or *Output B* to open the *Analog Output* menu. (Output A will be used as an example in this manual.)

IMPORTANT: *The procedure for calibrating* Output B *is identical to that for calibrating* Output A. *However, be sure to reconnect the ammeter on terminal block* J2. See Figure 4 on page 10 *for the correct pin numbers.*

3. Double-click on *4 milliamps* to calibrate the low end of the output range.
4. Double-click on *4 mA UP* or *4 mA DOWN* to adjust the ammeter reading UP or DOWN, until a 4 mA reading is achieved, or double-click on *4 mA Numeric Cal,* and directly enter the mA reading in the right pane.
5. Once you have achieved a 4 mA reading, double-click on either *4 mA STORE* to store the calibration, or on *4 mA ABORT* to exit the menu without storing the calibration.

Note: *If the ammeter reading cannot be adjusted within 5.0 μA of the 4 or 20 mA setting, contact the factory for assistance.*

6. PanaView returns to the *Analog Output* window. Double-click on *20 milliamps*, and repeat steps 3 through 5 to calibrate the high end of the output range.

Note: *Skip the following prompt, if linearity testing of the output will not be performed at this time.*

7. Double-click on *% Test* to test the linearity of the currently selected analog output.
8. Check the ammeter reading at *50% output*. Then, enter a different *output* (0–100%) and double-click on *percent*. Check the ammeter reading at this setting and press [Exit Page] when done.

Table 8 on page 40 lists the expected ammeter readings at various *% Full Scale* settings, for both 4-20 mA and 0-20 mA scales. Refer to this table to verify the accuracy of the ammeter readings taken above. If the linearity test readings are not within 5 μA of the values listed in the table, check the accuracy and wiring of the ammeter. Then, repeat the low and high end calibrations. If the analog output still does not pass the linearity test, contact the factory for assistance.

Click [Exit Page] to return to the *Slot 1* window and calibrate additional inputs/outputs, or click [Exit Page] again to close the *Calibration/Test* menu.

B.4.2 Analog Inputs

Analog inputs may be added to the XGF868i by installing an appropriate option card in Slot 1. This option card contains two or four analog inputs, which are designated as A, B, C and D. Both the zero-point and full-scale values for each input must be calibrated.

Calibration of the analog inputs requires the use of a calibrated current source. If an independent calibrated current source is not available, one of the Slot 0 analog outputs may be used for the calibration. During the analog input calibration, the Slot 0 analog output will supply the low reference, high reference, 4 mA and 20 mA signals at the appropriate times.

IMPORTANT: *If a* Slot 0 *analog output will be used to calibrate the analog inputs, the* Slot 0 *analog output calibration procedure must be completed first.*

Prepare for the calibration procedure by connecting a Slot 0 analog output (or independent calibrated current source) to Input A of the option card. See Figure 4 on page 10 to identify the IN(+) and RTN(-) pins for Input A on terminal block J2.

Note: *The zero point of the analog input may be set for either 0 mA or 4 mA. However, the calibration procedure always uses the 4 mA point, as the meter will extrapolate this value to obtain the 0 mA point.*

1. In the center pane of the *Calibration/Test* window, double-click on *Slot 1*.
2. Double-click on the desired input to open the *Analog Input* menu (Input A is used as an example in this manual).

IMPORTANT: *Calibrating* Inputs B, C or D *is identical to calibrating* Input A. *However, be sure to reconnect the current source on terminal block* J2. *Refer to* Figure 4 on page 10 *for the correct pin numbers.*

3. Double-click on the appropriate option to select the reference point to be calibrated.

Proceed to the corresponding sub-section for specific instructions on each of the options available in step 3.

B.4.2.1 4 mA Option

Set the calibrated current source to 4 mA.

- If you selected the *4 mA* option in the *Analog Input* menu, double-click on *Store* to accept the current 4 mA value or on *Abort* to cancel the entry. In either case, the Analog Input prompt reappears.

B.4.2.2 20 mA Option

Set the calibrated current source to 20 mA.

- If you selected the *20 mA* option in the *Analog Input* menu, double-click on *Store* to accept the current 20 mA value or on *Abort* to cancel the entry. In either case, the Analog Input prompt reappears.

Click [Exit Page] to return to the *Slot 1* window and calibrate additional inputs/outputs, or click [Exit Page] again to close the *Calibration/Test* menu.

B.4.3 RTD Inputs

RTD inputs may be added to the XGF868i by installing an appropriate option card in Slot 1. This option card contains two or four RTD inputs, which are designated as A, B, C and D. Both the set and slope temperature values for each input must be calibrated.

Calibration of the RTD inputs requires the use of a calibrated RTD source.

IMPORTANT: *If a* Slot 0 *analog output will be used to calibrate the analog inputs, the* Slot 0 *analog output calibration procedure must be completed first.*

Prepare for the calibration procedure by connecting an independent calibrated RTD source to the desired input of the option card. See *Figure 4 on page 10* to identify the RTD (+) and COM(-) pins for Input A on terminal block J2.

1. In the center pane of the *Calibration/Test* window, double-click on *Slot 1*.
2. Double-click on the desired input to open the *RTD Calibration* menu.

IMPORTANT: *The procedure for calibrating* each input is identical*. However, be sure to reconnect the temperature reference on terminal block* J2. See Figure 4 on page 10 *for the correct pin numbers.*

Proceed to the corresponding sub-section for specific instructions on each of the options shown above.

B.4.4 Entering the Set Point

1. Before proceeding, place the RTD in a temperature bath and allow it to stabilize at the desired set point temperature. If you have connected the RTD to an RTD simulator, set the RTD simulator to the low temperature value.
2. Double-click on *Set t*o program the RTD set point.
3. In the right pane, enter the desired set point temperature and click [Next Item].
4. Double-click on *STORE* to accept the new set point value or *ABORT* to cancel the entry.

B.4.5 Entering the Slope

1. Place the RTD in a temperature bath and allow it to stabilize at the desired slope point temperature. If you have connected the RTD to an RTD simulator, set the RTD simulator to the high temperature value.
2. Double-click on *Slope* to program the RTD slope point.
3. In the right pane, enter the desired slope point temperature and click [Next Item]
4. Double-click on *STORE* to accept the new slope point value or *ABORT* to cancel the entry.

Click [Exit Page] to return to the *Slot 1* window and calibrate additional inputs/outputs, or click [Exit Page] again to close the *Calibration/Test* menu.

B.4.6 Testing Frequency Outputs

Frequency outputs may be added to the XGF868i by installing an appropriate option card in Slot 1. This option card contains two or four frequency outputs, which are designated A, B, C and D.

Prepare for the testing procedure by connecting a frequency counter to Output A of the option card. See *Figure 2 on page 7* for frequency output wiring, and *Figure 4 on page 10* to identify the OUT(+) and RTN(-) pins for Output A on terminal block J2.

1. In the center pane of the *Calibration/Test* window, double-click on *Slot 1*.
2. Double-click on the desired output to open the *Frequency Output* menu. (Output A will be used as an example in this manual.)

IMPORTANT: *The procedure for testing* Outputs B, C or D *is identical to that for testing* Output A. *However, be sure to reconnect the frequency counter on terminal block* J2. *See* Figure 4 on page 10 *for the correct pin numbers.*

3. At the *Frequency* prompt, enter a frequency (between 1 and 10,000 Hz) and click [Next Item]. Verify that the frequency counter reads the correct value.
4. Repeat steps 2 and 3 to test all of the available frequency outputs. If any of the frequency outputs fails the test, contact Panametrics for assistance.

Click [Exit Page] to return to the *Slot 1* window and calibrate additional inputs/outputs, or click [Exit Page] again to close the *Calibration/Test* menu.

B.5 Testing the XGF868i Software and Hardware

In addition to calibration procedures for input and output cards, the *Calibration/Test* menu offers tests for XGF868i hardware and procedures for uploading the signal array data and the XGM868i memory contents into PC files for examination. To test the XGF868i hardware and software:

1. Open the *Meter Browser* window and highlight the XGF868i.
2. Expand the *Edit Functions* option. The window now appears similar to that shown in *Figure 9 on page 38*.
3. Double-click on the *Calibration/Test* menu. The window appears similar to *Figure 10 on page 38*.

Proceed to the appropriate section to upload data and test hardware.

B.5.1 Uploading the Signal Array Data

By uploading XGF868i signal array data for examination, a user can check if the transducer signal is the proper shape, and change setup parameters if necessary.

IMPORTANT: *Consult with Panametrics before using this data to change any parameters.*

1. In the *Calibration/Test* menu, double-click on the *Signal Array Upload* option.
2. Double-click on the desired *Channel*.
3. The next prompt asks for the specific *Array to Load.* Five choices are available:
   - Raw UP (Upstream) Signal
   - Raw DOWN (Downstream) Signal
   - CFUNC UP (Correlation Function Upstream)
   - CFUNC DOWN (Correlation Function Downstream)
   - CCFUNC (Cross-Correlation Function)

Double-click on the desired array.

4. PanaView now offers two options for *Uploading* the array data.
   - If you double-click on *To Display*, the right pane of the window appears similar to *Figure 12* below, and the data is available for immediate evaluation. Click [Exit Page] to close the window and return to the *Calibration/Test* menu.

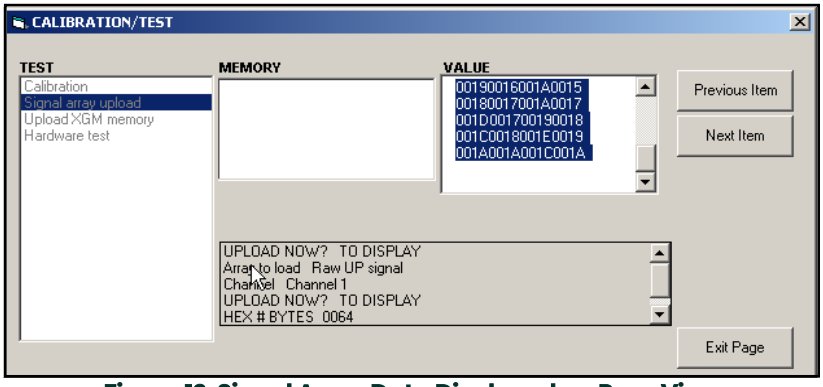


Figure 12: Signal Array Data Displayed on PanaView

   - If you double-click on *To File*, another window opens similar to *Figure 13* below. Enter a file name and click [Save]. PanaView stores the array data in a Windows file, and closes the *Calibration/Test* window.

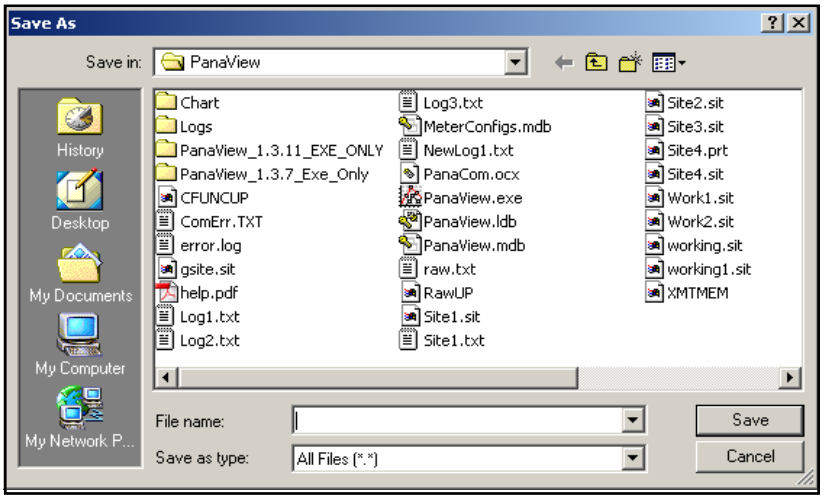


Figure 13: Saving Signal Array Data to File

B.5.2 Uploading the XGF868i Memory

IMPORTANT: *This option is for factory use only.*

The *Upload XGM Memory* option is another diagnostic tool.

IMPORTANT: *Consult with Panametrics before using this data to change any parameters.*

1. In the *Calibration/Test* menu, double-click on the *Upload XGM Memory* option.
2. The first prompt shows the *Hex Start Address*. Click [Next Item].
3. The next prompt displays the value for the *Hex # Bytes*. Click [Next Item].
4. PanaView now offers two options for *Uploading* the XGM memory.
   - If you double-click on *To Display*, the right pane of the window appears similar to *Figure 14* below, and the data is available for immediate evaluation. Click [Exit Page] to close the window and return to the *Calibration/Test* menu.

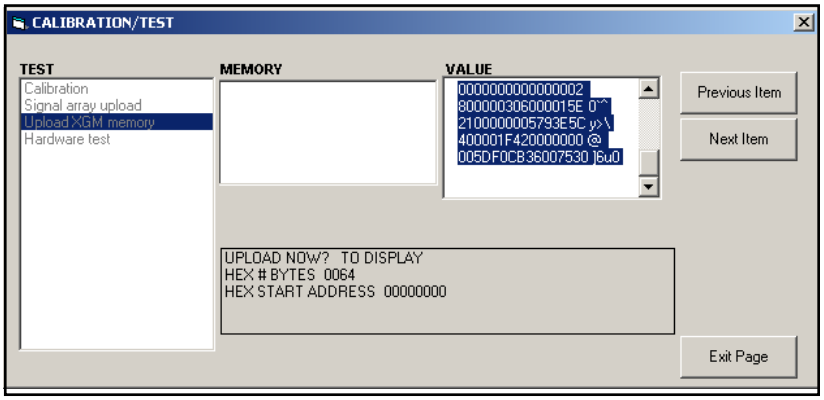


Figure 14: XGF868i Memory Data Displayed on PanaView

   - If you double-click on *To File*, the *Save As* window (similar to *Figure 13 on page 47*) opens. Enter a file name and click [Save]. PanaView stores the array data in a Windows file, and closes the *Calibration/Test* window.

B.5.3 Testing the XGF868i Hardware

Using PanaView, you can check crucial elements of the XGF868i hardware: the EPROM, the NVR, the RAM, FIFO, and the DAC. You can also:

- Program and test optional cards
- Read site checksums and calibration values
- Test and set the contrast for the LCD
- Set the number of channels (either 1 or 2)
- Re-initialize the XGF868i to its default values

IMPORTANT: *Contact Panametrics if the XGF868i fails any of the tests in the following sections.*

B.5.3.1 EPROM Test

To test the EPROM from the *Calibration/Test* menu:

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *EPROM TEST*.
3. The right pane displays the *EPROM Sum Value*. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.2 NVR Test

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.

Note: *If you are in the Hardware Test option, skip to step 2.*

2. In the center pane, double-click on *NVR TEST*.
3. A message in the right pane cautions that the test will take several minutes, and that interrupting the test may corrupt the memory. Click [Next Item] to continue the test.
4. If the NVR passes the test, the screen appears similar to *Figure 15* below. Click [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

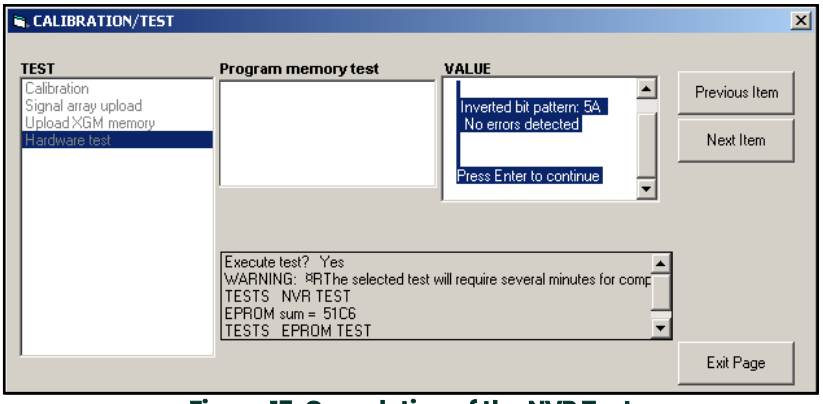


Figure 15: Completion of the NVR Test

B.5.3.3 RAM Test

To check the RAM:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *RAM TEST*.
3. The right pane displays the *RAM Value,* along with an indication as to whether the RAM is functioning. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.4 FIFO Test

To check the FIFO:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *FIFO TEST*.
3. In the right pane, a message lists the desired number of bits, along with the approximate bias and the average sample. Click [Next Item] to perform the test and return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.5 LCD Test

To test the LCD:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *LCD TEST*.
3. The LCD display flashes three times, while a message in the PanaView right pane displays the test values. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.6 LCD Contrast

To change the LCD contrast:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *LCD CONTRAST*.
3. Double-click on *Darken* or *Lighten* to shift the LCD contrast.
4. When you have achieved the desired contrast, double-click on *Store* to save the contrast or on *Abort* to return to the *Hardware Test* menu without changing the contrast.

B.5.3.7 DAC Test

To test the DAC (digital to analog converter):

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test w*indow, double-click on *Hardware Test*.
2. In the center pane, double-click on *DAC TEST*.
3. The center pane indicates whether or not the *Zero Scale* is functioning. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.8 Site Checksums

To display the site checksums:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *SITE CHECKSUMS*.
3. The right pane displays a list of site checksum values. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.9 Calibration Values

To display the calibration values:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *CALIBRATION VALUES*.
3. The right pane displays a list of DAC calibration values. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.10 Programming an Optional Card EEPROM

To program the EEPROM for an optional card:

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *PROG OPCARD EEPROM*.
3. To enable you to *Choose an Opcard*, the center pane displays a list of possible option cards. Scroll to and double-click on the type of card installed.
4. The program asks for the *Board Revision*. Enter the revision letter in the right pane, and click [Next Item].
5. The next prompt asks for the *Group #*. Enter the appropriate value, and click [Next Item].
6. The next prompt asks for the *Special Mod#*. Enter the appropriate value, and click [Next Item].
7. The program now asks for the *Month*. Scroll to and double-click on the desired month.
8. The next prompt asks for the *Day*. Enter the desired value (from 1 to 31), and click [Next Item].
9. The next prompt asks for the *Year*. Enter the appropriate value, (from 2002 to 2089) and click [Next Item].
10. The final prompt asks for the *Serial #*. Enter the appropriate value, and click [Next Item].
11. The right pane now displays the programmed *Header Information*. When you have reviewed the data, click [Next Item] or [Exit Page] to return to the *Hardware Test* option.

B.5.3.11 Reading an Optional Card EEPROM

To read the data of the EEPROM for an optional card:

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *READ OPCARD EEPROM*.
3. Double-click on the *Slot* (1 or 2) that holds the optional card.
4. The right pane lists the *Header Information*. When you have reviewed this data, click [Next Item].
5. The right pane now shows *Calibration Values*. When you have reviewed this data, click [Next Item].
6. The right pane now shows *RTD Calibration Values*.When you have reviewed this data, click [Next Item] or [Exit Page] to return to the *Hardware Test* option.

B.5.3.12 Setting the Number of Channels

To set the number of XGF868i channels for display:

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *Set #Chans*.
3. In the *Number of Channels* window, double-click on *1* or *2 Channels*. PanaView returns to the *Hardware Test* option. Click [Exit Page] to return to the main *Calibration/Test* menu, and [Close] to exit the *Calibration/Test* menu.

B.5.3.13 Initializing the XGF868i to Default Values

To restore the XGF868i to its original default values:

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *Initialize Meter*.
3. The right pane displays a *Warning* that all application parameters must be reentered after initialization. Click [Next Item] to continue, or [Exit Page] to return to the *Hardware Test* option.
4. In the center pane, double-click on *Yes* to *Reset Meter*, or on *No* to leave the XGF868i in its current state. If you select *Yes*, the XGF868i returns to its default settings, and PanaView exits the *Calibration/Test* menu.

Note: *When you first initialize the XGF868i, the number of LCD parameters is set to OFF. You must program the LCD to display any measured parameters.*

1. In the *Edit Functions* menu, double-click on the *Site Edit Menu.*
2. In the *Site Edit Menu*, double-click on the Global entry, and then on the Input/Output option.
3. From the Input/Output option, highlight and double-click on the *Display* option in the center pane.
4. The first prompt asks for the *# of LCD Parameters*. Double-click on the desired number (from OFF through 1-4 and KEY).

The OFF setting switches the measurement display off, while the KEY setting enables users to change the measurement display via the arrow keys, without accessing the *Keypad Program*. If you select KEY:

- To view a parameter other than the one currently displayed, press the [△] or [▽] keys to scroll through the various parameters.
- To scroll through the channel options on a two-channel XGF868i, press the [◁] or [▷] keys until you have reached the desired option.

5. Scroll to the desired *Channel option*, as listed in *Table 9* below.

Table 9: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

6. For each channel, select the desired *Measurement Parameter*, as shown in *Table 10*.
7. Repeat steps 3 and 4 for each parameter. PanaView returns to the Global I/O menu.

Table 10: Available Measurement Parameters

Option Bar	Description	Good	Bad
VEL	Displays the flow velocity	N.A.	N.A.
VOLUM	Displays the volumetric flow	N.A.	N.A.
+TOTL	Displays the forward totalized volume flow	N.A.	N.A.
-TOTL	Displays the reverse totalized volume flow	N.A.	N.A.
TIME	Displays the total flow measurement time	N.A.	N.A.
MDOT	Displays the mass flow	N.A.	N.A.
+MASS	Displays the forward totalized mass flow	N.A.	N.A.
-MASS	Displays the reverse totalized mass flow	N.A.	N.A.
SS up	Displays the signal strength for the upstream transducer	50–75	<50 or >75
SS do	Displays the signal strength for the downstream transducer	50–75	<50 or >75
SNDSP	Displays the measured speed of sound in the gas	N.A.	N.A.
Tup	Displays the upstream ultrasonic signal transit time	N.A.	N.A.
Tdown	Displays the downstream ultrasonic signal transit time	N.A.	N.A.
DELTA	Displays the transit time difference between the upstream and downstream signals	N.A.	N.A.
Tot K	Displays the total K factor.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default)	N.A.	N.A.
Qup	Displays the signal quality for the upstream transducer	≥1200	–400 to +400
Qdown	Displays the signal quality for the downstream transducer	≥1200	–400 to +400
AMPup	Displays the signal amplitude value of the upstream transducer	24 ± 5	<19 or >29
AMPdn	Displays the signal amplitude value of the downstream transducer	24 ± 5	<19 or >29
CNTup	Displays the AGC DAC count for the upstream gain setting.	N.A.	N.A.
CNTdn	Displays the AGC DAC count for downstream gain setting.	N.A.	N.A.
P#up	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
P#dn	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
TEMP	Displays the gas temperature (from 0/4-20 mA input).	N.A.	N.A.
PRESR	Displays the gas pressure (from 0/4-20 mA input).	N.A.	N.A.
Mw	Displays the molecular weight.	N.A.	N.A.
z	Displays the compressibility.	N.A.	N.A.
AcVOL	Displays actual volumetric flow.	N.A.	N.A.
StVOL	Displays standard volumetric flow.	N.A.	N.A.
Tu S[1]	Displays Skan transit time upstream.	N.A.	N.A.
Td S[1]	Displays Skan transit time downstream.	N.A.	N.A.
DT S[1]	Displays Skan Delta T.	N.A.	N.A.
Tu M[1]	Displays Measure transit time upstream.	N.A.	N.A.
Td M[1]	Displays Measure transit time downstream.	N.A.	N.A.
DT M[1]	Displays Measure Delta T.	N.A.	N.A.
Vinst	Displays the instantaneous velocity.	N.A.	N.A.

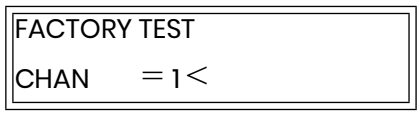
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Appendix C. Factory Tests

C.1 Introduction

For user security, the XGF868i offers two special functions in a separate menu: selection of one-channel or two-channel operation, and the factory-default reset. While the first function enables you to reset the channel configurations set during manufacturing, the reset function, by restoring the meter to its original state, allows you to purge potential errors in program memory.

To enter the *Factory Test* menu, press [Escape], followed in succession by the up arrow key ([△]), the right arrow key ([▷]), the down arrow key ([▽]), the left arrow key ([◁]), the up arrow key again (forming a loop around the keypad), and finally the [Enter] key. The screen displays FACTORY TEST, as shown below.



C.2 Resetting the Number of Channels

To reset the number of channels displayed:

1. In the *Factory Test* menu, scroll to CHAN and press [Enter].
2. Scroll to the desired number of channels (1 or 2) and press [Enter].
3. The XGF868i returns to the *Factory Test* menu. Press [Escape] to return to parameter display.

C.3 Resetting the XGF868i to Factory Defaults

1. In the *Factory Test* menu, scroll to INIT and press [Enter].
2. The screen displays the initial string "ESKE0". Use the left and right arrow keys to move among characters, and the up and down arrow keys to alter each character until the string is "FRIG" plus the number of channels (that is, FRIG1 or FRIG2). Press [Enter].

   The XGF868i re-initializes with factory default settings, and displays the message, *"Review meter settings."* Since the default for the meter display is OFF, you will need to enter the *Keypad Program* to reset the LCD, as described below.
3. Press [Escape], [Enter], [Escape].
4. In the *Keypad Program* window, scroll to PROG and press [Enter].
5. In the PROG menu, scroll to GLOBL and press [Enter].
6. Scroll to I/O and press [Enter].
7. Scroll to LCD and press [Enter].
8. The window now asks for the *# of LCD Parameters*. Scroll to the desired number (from OFF through 1-4 and KEY) and press [Enter].
9. Scroll to the desired *Channel option*, as listed in *Table 11* below.

Table 11: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

10. For each channel, select the desired *Measurement Parameter*, as shown in the *Programming Manual.*

Note: *The measurement units that appear in these prompts are those selected in the* GLOBL-SYSTM *menu.*

The previous two prompts repeat until all of the specified # of LCD Parameters have been set up. When all of the display parameters have been set up, the meter returns to the Global I/O window. To leave the *Keypad Program*, press the [Escape] key three times.

After leaving the *Keypad Program*, the XGF868i will reset itself and will begin to display the parameters specified in this section. If more than one parameter was set up, each of the parameters will be displayed in sequence, with a pause of several seconds between display changes.

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Warranty

Each instrument manufactured by Panametrics is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of Panametrics. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics determines that the equipment was defective, the warranty period is:

- One year from delivery for electronic or mechanical failures.
- One year from delivery for sensor shelf life.

If Panametrics determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Panametrics, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a Panametrics instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify Panametrics, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, Panametrics will issue a Return Material Authorization (RMA), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, Panametrics will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If Panametrics determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

[no content intended for this page]

Scan here or use the link below for
Customer Service, Technical Support,
or Service Information:
https://panametrics.com/support

Technical Support email:
panametricstechsupport@bakerhughes.com

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BH060C61 EN F (06/2024)

SECTION 1.15

SHIPPING,HANDLING,STORAGE & PRESERVATION PROCEDURES - ULTRASONIC FLOWMETER

1724001317-QC-PRO-00018

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

SHIPPING, HANDLING, STORAGE and PRESERVATION PROCEDURES

Document Number: 1724001317-QC-PRO-00018

Document Class: 3

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
Rosetti Marino	09/05/2025

01	28/04/2025	Issue for Information (IFI)	BH DC	Tom Griffin	Niall Townsend
00	18/10/2024	Issue for Information (IFI)	BH DC	Tom Griffin	Niall Townsend
Rev.	Date	Description	Prepared	Reviewed	Approved

Baker Hughes

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		00	01						
1	Cover	X	X						
2	Table of Contents	X	X						
3	Revision / Change Log / Hold List	X	X						
4	SHIPPING, HANDLING, STORAGE and PRESERVATION PROCEDURES - ULTRASONIC FLOWMETER	X	X						

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Revision / Change Log

Rev.	Description
00	Issue for Information (IFI)
01	Issue for Information (IFI)

HOLDS LIST

No.	Description
1.	
2.	
3.	
4.	

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Title: Preservation, Packing and Marking Procedure

Procedure Number: PS-411 **Revision: T** **Date: 27/June/2023**

1.0 SCOPE

This document specifies the preservation method, packing and marking requirements to be applied to all products for export.

2.0 REFERENCES

PS-017	Dangerous Good Packing Procedure
PS-020	Shipping Process

3.0 PRESERVATION METHOD

Products for export shall undergo the following preservation procedure prior to being packing in boxes / crates.

3.1 The Packer shall perform an inspection to ensure the material is clean & dry.

3.2 In the case of sample systems entry and exit fittings shall be sealed off using protective material compliant with preservation requirements to prevent the nuts vibrating loose during transportation and to prevent entry of foreign matter.

3.3 All Electronic units shall to be packed in a box or crate and shall be wrapped in 400/500-gauge Polythene film with desiccant added, and sealed off using plastic adhesive tape. Sharp edges shall be protected using protective material compliant with preservation.

3.4 In the case of electronic instrument packaging, a sachet of desiccant (silica gel granules) shall be enclosed within the shipment.

3.5 Sachets of desiccant (silica gel granules) shall be located / stored in re-sealable containers mounted on either side of all packing stations to prevent moisture content being absorbed prior to packing.

4.0 PACKING

Box sizes and creates are allocated based on product type see appendix 1.
For special non-standard packing see 4.3

4.1 Airfreight

Material for airfreight shall be packed in cardboard boxes except for Special packing requirement covered in 4.3 below

A minimum allowance of 25mm for packing all around the goods shall be factored in when there is a customised requirement.

4.1.1 Having selected a box, line the base of the box with foam / aero board lining

4.1.2 Place the wrapped package in the centre of the foam / aero board lining

4.1.3 Fill up the remaining space within the box with Padpak expandable corrugates or instapak pre-formed foam.

4.1.4 Ensure slight overfill of aero beads is applied before closing the box lapels.

4.1.5 Strap the box shut using 10mm wide plastic strapping. The number of straps to be applied shall be 2 or increased as necessary.

4.2 Sea freight

The packer will check for a customer's specification in SAP and where specified sea-freight packing shall be observed.



4.3 Special Packing

Non-standard product will be packed as specified below: -

4.3.1 Cable

Depending on cable type, Cable >80-100m length is packed on reels, constructed using 10mm thick plywood. Reels are secured with timber screws and strapping to a pallet.





4.3.2 Transducers with Isolation Valves and Spool-pieces.

This equipment is packed in custom specific cardboard boxes with timber floors and polyethylene inserts ISTA 51 drop test certified. This is also fitted with external ribbing for strengthening purposes. used to retain parts within the box to prevent movement of the material during transport. For non-standard IMA lengths, we will use plywood boxes where applicable.

4.3.3 Sample Systems in Large Weatherproof Enclosures

'Standard' sample systems will be packaged in boxes with foam corner inserts (on each corners- top/bottom) with the box sizes based on the below matrix and as per below pictures.

Box Dimensions	Enclosure Part No.	Enclosure Size
865 x 780 x 390	425-607	760 x 600 x 210
865 x 780 x 390	425-608	760 x 600 x 210
865 x 780 x 390	425-581	760 x 600 x 210
905 x 865 x 390	425-611	760 x 600 x 300
905 x 865 x 390	425-612	760 x 600 x 300
905 x 865 x 390	425-633	760 x 600 x 300
1105 x 940 x 390	425-613	1000 x 800 x 300
1105 x 940 x 390	425-614	1000 x 800 x 300
1105 x 940 x 390	425-640	1000 x 800 x 300







Large sample system in excess of 1000mm x 700mm will be crated and secured with fixing bolts to a pallet.
Any system smaller than the above size will be packed into cardboard boxes lines with 2-inch aero board.
No double packing

4.3.4 Clean Gas Analysers

All CGA units shall be packed as per Para. 4.1.1 to 4.1.6. If additional parts are required on the sales order, the box shall be placed inside a larger box and the remaining space shall be filled to overflow with Padpak expandable corrugates or instapak pre-formed foam.

4.3.5. Flowcells

- Flowcell shall be packed in timber crates.
- Flowcells shall be put in position in crate on the upright chocking supports.
- Flowcell shall be supported in place in crate using timber battons.
- Foam is placed under the batton before they are screwed into place.
- If a Flowcell Tag Plate stops you from securing the batton a foam insert is also placed underneath the batton.
- The ends of the flowcell shall be sealed with a plywood disc to ensure no damage is done to the raised face on the flange. When all the above is completed the crate shall be sealed up & is then ready for shipping.

5.0 BOX MARKINGS

5.1 Stencil Markings

Standard shipping marks are created using A3/A4 laminated sheets which are affixed to the box using adhesive and staples. For customer requiring a permanent ink, stencils are procured locally .



5.2 Labels

All Boxes now come with international shipping labels incorporated ie Fragile, Keep upright and Keep Dry.

5.3 Packing List

A packing list shall be attached to each box. The packing list shall be enclosed in an adhesive backed plastic wallet (waterproof) which is attached to the box. Metal plates are supplier when required by our customer.



6.0 HAZARDOUS GOODS

6.1 Electrolyte Solution for Servomex Cells

In accordance with the IATA Regulations governing the transport of hazardous goods, electrolyte solution shall be packed as specified below.

6.1.1 Electrolyte shall be packed in special 4G UN-BOX 4G/X16. A single shipment shall not exceed a volume = 5 Litres or weight =30Kg.

6.1.2 The bottom of the box shall be lined with aero board.

6.1.3 Place containers in an upright position in the box ensuring that there is at least 25mm space all around the periphery to accommodate packing.

6.1.4 Fill remaining space with Padpak expandable corrugates or instapak pre-formed foam to prevent movement of the containers within the box.

6.1.5 Place a sheet of 25mm thick aero board on top and seal with tape.

6.1.6 Labelling and Markings

Only operatives with the relevant dangerous goods training will be allowed to apply the following labels for shipment of dangerous goods, in accordance with IATA regulations.

This is an example of Labelling required on a Class 8 and Class 9 Dangerous Goods





Note: Arrows up, class 9/8 & UN number 3363/1814 labels

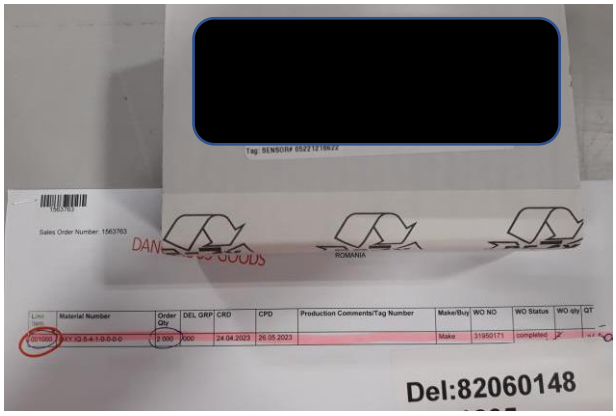
Once complete the Dangerous Goods Declaration will be completed and then placed on the box along with the AWB ready for collection.



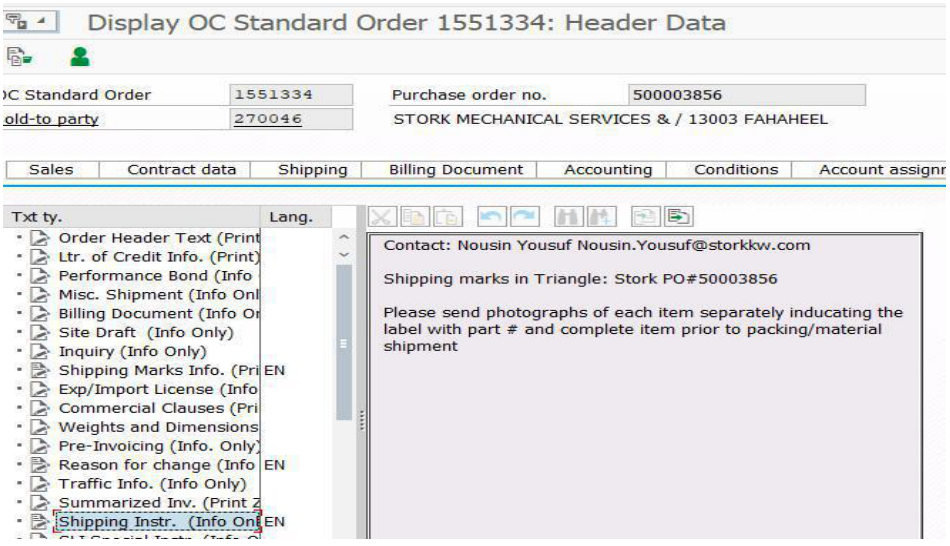
7.0 S.O.P Shipping

7.1 Boxes come from staging (if C.P.T. – Jamie/Dylan) everything else goes to location 555

7.2 Product taken from location 555, checks are carried out to ensure the label (s)on the part (s) match up with the information on the traveller.



7.3 Check to see if there are any special shipping instructions (photo's, barrier bagged, crated, nett weights per line).



7.4 Pack into required packaging, attach Sales Orders and Delivery Numbers to the outside of the boxes.

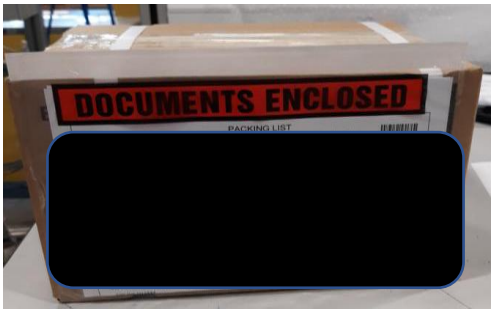


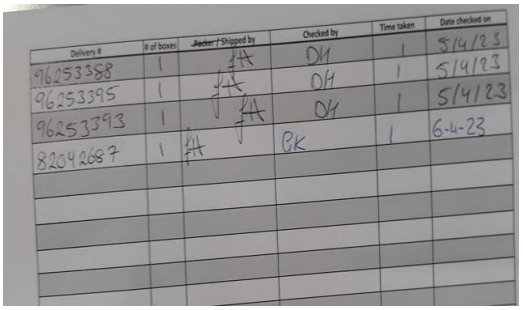
7.5 Get weights and dimensions in mm and kg's.

7.6 Transact on S.A.P. and enter volume (shelf location in shipping)

7.7 Print packing list, verify that the packing list and labels have the same Sales Orders and Delivery Notes.

ENSURE BUDDY CHECK IS CARRIED OUT ONCE ALL LABELS, PACKING LIST AND AIRWAY BILL ARE ON PLACE.





7.8 Physically place the product into the correct location, ensuring the labels are visible.



7.9 Place traveller document into designated location on the shelf to be scanned against that working day for reference later if required.



8.0 LONG TERM STORAGE

8.1 The equipment to be stored should be maintained in its original transit packaging.

8.2 Stores parts/shipping crates /production parts /documentation / equipment / Orders “On-Hold” may be stored offsite.

- The storage area shall be indoors and be a clean, dry, level surface, away from, or protected from vehicular traffic and protected from direct sunlight.
- The Shipping Supervisor shall maintain a log of Parts / Orders at Off-site storage.
- The offsite storage company shall provide an electronic stock sheet.
- The Shipping Supervisor shall cross check this with the site log to verify integrity of records.

8.3 The storage area should not be subject to:

- Contaminant Sources. i.e., saliferous or sulphurous atmospheres.
- Variation in temperature or high humidity.
- Limits: Temperature: -5 to +35 Deg C
- Relative Humidity: 0 to 60% RH.

8.4 Equipment packing cases over 25kg shall not be stacked.

8.5 When removing items from storage a visual inspection on the outside of the package should be performed to ensure packing is still adequate i.e., not affected by moisture, rodents etc.

8.6 Large parts/crates being returned to site from off-site storage may have to be brought on-site via shipping entrance. They shall bear suitable identification, to prevent any inadvertent shipping during congested periods.

Title: Preservation, Packing and Marking Procedure

Procedure Number: PS-411 **Revision: T** **Date: 27/June/2023**

APPROVALS / REVISION RECORD

REV NO	PARA. NUMBER	REVISION
R	4.3.3	Updated reference to Sample System Packaging & Inclusion of Dangerous Goods Requirements DCO# 1955
S	7.0 2.0	New S.O.P section added DCO# 2251 Removed PS-018,PS019, PS470, Added PS017,PS020
T	Approvals / revision record table Throughout	Updated to only show the lates 3 revisions and the Approver "Technical" changed to "Process Owner" DCO# 2262 Removed redundant information & blanked out redundant/data sensitive portions of photos

APPROVALS

REV	SIGN/DATE	SIGN/DATE	SIGN/DATE
T	TJ Chorba 27-June-2023	Niamh Cahalan 27-June-2023	N/A
S	RK 27/04/23	ES 27/04/23	FH 27/04/23
R	PP 18/09/2017	PT 18/09/2017	N/A
	PREPARED BY	**Q.A.**	**PROCESS OWNER**

SECTION 2

TEST, RECORDS, REPORTS

SECTION 2.1

PRESSURE TEST REPORT

Baker Hughes

HYDROSTATIC PRESSURE TEST CERTIFICATE

Customer: ROSETTI MARINO SPA **P.O. No:** 1724001317 123A90A

Baker Hughes Ref: 1706864 **Issue Date:** 13/2/2025

BAKER HUGHES EMEA UNLIMITED COMPANY - SHANNON HEREBY CERTIFY THAT THE EQUIPMENT SUPPLIED ON THE ABOVE REFERENCED ORDER HAS BEEN TESTED AND APPROVED ACCORDING TO HYDROSTATIC TESTING PROCEDURE FOR GAS FLOWMETER NUMBER PS-219. ALL RECORDS OF THE TESTING ARE ON FILE.

Tested By: Dorough Kenny **Date**: 13/2/2025

TEST INFORMATION

System Tested	:	Transducer & Insertion Mechanism
Part Nos.	:	T5MAXS-18-10-33-NT-S6-2-2-4-2-0 & IMA72-I-15-SS-20-IN-10-IN-3-4-NT-S
Serial Nos.	:	03241654 & 12246636
Test Fluid	:	Water
Test Pressure	:	412.5 psig
Duration	:	10 Minutes
Tag No.	:	43-FT-001

(D. Furneaux)
"FTR 060 CROSSWIND"
X Witness X Review
13th Feb. 2025

	Revision and Approvals Table				
REV	DCO No.	Change & Justification	Approval - Author	Approval - Process Owner	Approval - Quality
A	2198	New Form	D McN 23/06/22	J S 29/06/22	N C 29/06/22

SECTION 2.2

PMI REPORT

Baker Hughes
Sensing House
Shannon Free Zone East
Shannon, Co. Clare, Ireland

PMI INSPECTION REPORT - IMA72

	Location: Workshop		**12/02/2025**
CUSTOMER=ROSETTI	**Equipment:** Niton Alloy Analyser		**Serial No: 54995**
Subject: Alloy Components	**PMI Procedure: PS-613A**		**Model:** XL3T 800
	Calibration DUE Date: 10/06/25		
TAG NO=43-FT-001			

Summary of Results

Description	HEAT NO.		% MO	% NI	% FE	% CR	%CU				ALLOY
Compression fitting - Body	9ET/9CW		2.64	11.75	69	16.61					SS-316
Compression fitting - Nut			2.16	12.84	66.22	17.67					SS-316
Bolting -Stud	DX B7/L7 2H										NA
Bolting -Nut											NA
1" Pipe	TH21626 / N2010228AS02		2.17	10.59	69	16.35					SS-316
2" Flange			2.29	12.24	66.61	16.48					SS-316
Packing Gland	437359		2.08	10.27	68.9	16.48					SS-316
Packing Nut	509612		2.37	12.57	65.21	17.8					SS-316
Packing Ring	283504		2.04	10.32	68.35	17.32					SS-316
Stop Ring	509612		2.22	11.36	65.81	17.39					SS-316
Compression fitting - Body	7WV/9ER/7ZD/9KC		2.19	14.12	64.81	16.72					SS-316
Compression fitting - Nut			2.38	13.23	65.75	16.56					SS-316
			.								
Compression fitting - Body	9ET/9CW										
Compression fitting - Nut											
Bolting -Stud	DX B7/L7 2H										
Bolting -Nut											
1" Pipe	TH21626 / N2010228AS02										
2" Flange											
Packing Gland	437359										
Packing Nut	509612										
Packing Ring	283504										
Stop Ring	509612										
Compression fitting - Body	7WV/9ER/7ZD/9KC										
Compression fitting - Nut											
Isolation Valve- Body	RAAX/RAAZ										
Isolation Valve- Adaptor											
Isolation Valve- Body	RAAX/RAAZ										
Isolation Valve- Adaptor											
Nozzle	N/A										
Nozzle	N/A										
2" gasket			2.06	10.54	68.89	16.9					SS-316
3" gasket											

Signed on behalf of BAKER HUGHES

Acceptance Standard: Report all Findings

Inspection Acceptance for Client

Date: 12/02/25

Date:

PS-613/1 Rev A

(D. Furneaux)
FTR 060 CROSSWIND
Witness X Review
12th Feb. 2025

SECTION 2.3

FUNCTION TEST REPORT

BH Sensing Flowtest Lab

Sensing House
Shannon Free Zone East,
Shannon, Co. Clare, Ireland
Tel: + 353 61 470200 Fax +353 61 471359

Gas Flowmeter Test Report

Customer :	ROSETTI MARINO	**Test ID:**	02250091A
Sales Order :	1706864	**Transducer :**	T5-18-10-33-NT-TI
Tag Number :	43-FT-001	**T Serial UP :**	12246636
Flowmeter :	XGF868I	**T Serial DN :**	03241654
Serial No. :	XGFI-2588E	**Pre Amp UP :**	24101153
Channel No. :	Ch1	**Pre Amp DN :**	24101300

The above referenced Ultrasonic Gas Flowmeter was functionally tested on the BH in-house calibrated flowloop, on the date shown below.

This is to certify that the unit Passed the flow test.

Time Stamp	Reference m/s	Flowmeter m/s	Flowmeter Error m/s	Flowmeter Error (%)
12:18:38	2.98	2.96	-0.02	-0.67
12:20:32	6.04	6.01	-0.03	-0.50
12:22:35	9.05	8.97	-0.08	-0.88
12:24:30	12.05	11.95	-0.10	-0.83

Signed: Ray Foster

(Authorised Signatory)

Date: 13_02_2025 (DD_MM_YYYY)

The BH Flowloops reference meter is calibrated by an EA (European Co-operation for Accreditation) accredited calibration facility. The calibration is traceable to Primary Standards.

(D. Furneaux)
"FTR obo Crosswind"
Witness Review
13th Feb. 2025

BH Sensing Flowtest Lab

Sensing House
Shannon Free Zone East,
Shannon, Co. Clare, Ireland
Tel: + 353 61 470200 Fax +353 61 471359

Gas Flowmeter Test Report

Customer :	ROSETTI MARINO	**Test ID:**	02250092A
Sales Order :	1706864	**Transducer :**	T5-18-10-33-NT-TI
Tag Number :	43-FT-001	**T Serial UP :**	12246636
Flowmeter :	XGF868I	**T Serial DN :**	03241654
Serial No. :	XGFI-2588E	**Pre Amp UP :**	24101153
Channel No. :	Ch2	**Pre Amp DN :**	24101300

The above referenced Ultrasonic Gas Flowmeter was functionally tested on the BH in-house calibrated flowloop, on the date shown below.

This is to certify that the unit Passed the flow test.

Time Stamp	Reference m/s	Flowmeter m/s	Flowmeter Error m/s	Flowmeter Error (%)
12:31:19	2.98	2.98	0.00	0.00
12:33:19	6.06	6.04	-0.02	-0.33
12:35:00	9.05	9.00	-0.05	-0.55
12:36:49	12.08	12.04	-0.04	-0.33

Signed: Ray Cotter _____ Date: 13_02_2025

(Authorised Signatory) (DD_MM_YYYY)

The BH Flowloops reference meter is calibrated by an EA (European Co-operation for Accreditation) accredited calibration facility. The calibration is traceable to Primary Standards.

(D. Furneaux)
"FTR 060 CROSSWIND"
X Witness X Review
13th Feb. 2025

SECTION 2.4

INSPECTION RELEASE NOTE

PLEASE REFERENCE SECTION 2.5

N/A

SECTION 2.5

SHIPPING RELEASE NOTE

ROSETTI MARINO	RELEASE NOTE	Nr. RN-1317-BKH-01	Sheet 1 of 2
		DATA *Date* 14/02/2025	Rev. 00

PROGETTO *Project* **HOLLANDSE KUST NOORD WIND PARK**	**CLIENTE** *Client* CROSSWIND	**COMMESSA** *Job* ***123A90***
FORNITORE *Vendor* Baker Hughes	**NUMERO D' ORDINE** *Purchase Order No.* 1724001317	

Release Note	☐ FOR PAYMENT	☒ FOR SHIPMENT

RELEASE NOTE FOR PAYMENT

PO Art.	

RELEASE NOTE FOR SHIPMENT

POS. *Item*	**QTÀ** *Quantity*	**DESCRIZIONE** *Description*	**Nr. TAG** *TAG No.*	**TIPO DI ISPEZIONE** *Kind of Inspection*	**ESITO** *Result*
10	1	Flow Transmitter	XGF868I-2-2-OI-H7-3-4-0-CC	N/A	N/A
20	1	Flow Transmitter	255-1184	N/A	N/A
30	1	Flow Transmitter	712-1455	N/A	N/A
40	1	Flow Transmitter	//	N/A	N/A
50	1	Flow Transmitter	FC-ARCOAX-10-M-FL150-075HAZLOC-BNC75-075HAZLOC-SS0	N/A	N/A
60	2	Flow Transmitter	T5MAXS-18-10-33-NT-S6-2-2-4-2-0-PMI	N/A	N/A
70	2	Flow Transmitter	IMA72-I-15-SS-20-IN-10-IN-3-4-NT-S-PNT	N/A	N/A
80	2	Flow Transmitter	IVA-2IN-15-SS-GV-NTSS-1-S-PMI-PNT	N/A	N/A
100		Spare Parts (Commissioning and Start-up)		N/A	N/A
110	N/A	Spare Parts (2y)		N/A	N/A
120	N/A	Spare Parts (Special Tools)		N/A	N/A

Warehouse open Monday to Friday from 08.00 to12.00 and from 13.00 to 17.00.
Contact Mr Rota +39 3451608099

DOCUMENTI APPLICABILI / *APPLICABLE DOCUMENTS*

POSIZIONE *Items*	**TIPO DI DOCUMENTO** *Type of Document*	**NUMERO DI DOCUMENTO** *Document Number*	**Rev.**	**COD. DI APPROV.** *Approval Code*
N/A	PO	1724001317	01	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 the actual delivery date isn't greater than two weeks from contractual delivery date.*

INCARICATO *Person in charge* **ROSETTI MARINO** *Supply Management dept.*		**RAPPR. DEL CLIENTE** *Client Representative*	**FORNITORE** *Vendor*	**CONSTRUCTION MANAGER** *Only requested for Punch List to be closed at Yard*
Nome Cognome *Name Surname*	**Firma** *Signature*			
Leonardo PASQUALI		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.*

ROSETTI MARINO	RELEASE NOTE	Nr. RN-1317-BKH-01	Sheet 2 of 2
		DATA *Date* 14/02/2025	Rev. 00
PROGETTO *Project* HOLLANDSE KUST NOORD WIND PARK	CLIENTE *Client* CROSSWIND	COMMESSA *Job* 123A90	
FORNITORE *Vendor* Baker Hughes	NUMERO D' ORDINE *Purchase Order No.* 1724001317		

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*

None

INCARICATO *Person in charge* ROSETTI MARINO *Supply Management dept.*		RAPPR. DEL CLIENTE *Client Representative*	FORNITORE *Vendor*	CONSTRUCTION MANAGER *Only requested for Punch List to be closed at Yard*
Nome Cognome *Name Surname*	**Firma** *Signature*			
Leonardo PASQUALI		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.*

SECTION 2.6

PACKING LIST

PACKING LIST

Baker Hughes EMEA Unlimited Company
Sensing House, Shannon Free Zone East
Shannon
CO CLARE
V14 V992
IRELAND
Phone:+36-27-565-314

PACKING LIST NO. **82461263**
PACKING DATE **17-Feb-2025**

SHIP TO: **222494**	SOLD TO:
ROSETTI MARINO SPA	**ROSETTI MARINO SPA**
VIA DEL MARCHESATO 37	**VIA TRIESTE 230**
YARD PIOMBONI	**48100 RAVENNA RA**
48122 MARINA DI RAVENNA	**ITALY**
ITALY	

FREIGHT PAYMENT TERMS:
INCOTERMS: **DAP Customer Site**
BOL/AWB NO.: **SF**
MODE OF TRANSPORT:

NO. OF PKGS: 2
GROSS WEIGHT: **119.000 KG / 262.350 LB**

DESCRIPTION	QUANTITY
# **3459209** PACKAGE 1 OF 2 WEIGHT: **77.000 KG / 169.756 LB** DIMENSIONS: **810.00x610.00x800.00 MM / 0.00x0.00x0.00**	
Your Ref: **1724001317 123A90A** Customer Part: **43-FT-001** Our Ref:: **1706864 // 001000** Material No.: **XGF868I -2-2-OI-H7-3-4-0-CC** **EP XMTR STYLE FIXED INST FLARE FM 1OR2P**	**1 ST**
Country Of Origin:IE ECN:NLR Origin HS Code:9026900000	

With following configuration

A. Model number XGF868I	**Flare Transmitter**
B. Power	**12 - 28 VDC**
C. Enclosure	**Stainless Exd**
D. Input/Output	**AOUTx2, AINx2**
E. Digital communications	**HART 7 communication**
F. Certifications	**ATEX/IECEX Exd IIG/C T6 IP66**
G. Transducer Frequency	**100 kHz**
Z. Special	**None**
Conformal Coating	**Conformal Coating**

Backordered Qty: **0.000**
Serial Number:
(XGFI-2588E)

- -

We hereby certify that the articles and services covered by the shipment were produced and performed in compliance with all applicable requirements of Sections 6, 7, and 12 of the Fair Labor Act, as Amended and the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

PACKING LIST

PACKING LIST NO.:
82461263

DESCRIPTION	QUANTITY
Your Ref: **1724001317 123A90A** Customer Part: **43-FT-001** Our Ref:: **1706864 // 001010** Material No.: **255-1184**	**5 ST**
REDUCER STAINLESS STEEL, 3/4" NPT X M20 Country Of Origin:GB ECN:NLR Origin HS Code:7307298090 Backordered Qty: **0.000**	
Your Ref: **1724001317 123A90A** Customer Part: **43-FT-001** Our Ref:: **1706864 // 001020** Material No.: **712-1455**	**1 EA**
Mounting Bracket Kit - stainless steel Country Of Origin:IE ECN:NLR Origin HS Code:7326909890 Backordered Qty: **0.000**	
Your Ref: **1724001317 123A90A** Customer Part: **43-FT-001** Our Ref:: **1706864 // 001030** Material No.: **SS NAMEPLATE**	**1 ST**
SS ENGRAVED TAG (MULTIPLE LINES OF DATA) Country Of Origin:IE ECN:NLR Origin HS Code:8310000000 Backordered Qty: **0.000**	
Your Ref: **1724001317 123A90A** Customer Part: **43-FT-001** Our Ref:: **1706864 // 001040** Material No.: **FLOWMETER CABLE**	**1 ST**
-ARCOAX-10-M-FL150-075HAZLOC-BNC75-075HAZLOC-SS-0 **FLOWMETER Cable** Country Of Origin:IE ECN:NLR Origin HS Code:8544429090	
With following configuration **B-CABLE TYPE** **FLAME RETARDANT SWA RG-62** **C-CABLE LENGTH** **10.00**	

We hereby certify that the articles and services covered by the shipment were produced and performed in compliance with all applicable requirements of Sections 6, 7, and 12 of the Fair Labor Act, as Amended and the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

PACKING LIST

PACKING LIST NO.:
82461263

DESCRIPTION	QUANTITY
D-UNIT OF LENGTH **METERS** **E-FRONT CONNECTOR** **FL, XXX868i/1000, IG, DF/GX 4X** **F-FRONT GLAND** **XXX868i/1000, IGM** **G-END CONNECTOR** **BNC PLUG, STANDARD TRANSDUCERS** **H-END GLAND** **3/4 NPT FOR HAZARDOUS AREAS** **I-MATERIAL** **316 STAINLESS STEEL** **Z-SPECIAL** **NO SPECIAL** Backordered Qty: **0.000**	
Your Ref: **1724001317 123A90A** Customer Part: **43-FT-001** Our Ref:: **1706864 // 001070** Material No.: **IVA** **-2IN-15-SS-GV-NTSS-1-S-PMI** **2IN & 3IN ISOLATION VALVE** Country Of Origin:IE ECN:NLR Origin HS Code:8481809990 With following configuration **B-Size** **Isolation Valve for 2IN** **C-Rating** **150 lb. RF** **D-Material** **Stainless Steel** **E- Value Type** **Gate Valve** **F-Carbon steel Temperature** **-50˚C to 150˚C (-58˚F to 302˚F** **J-Hardware** **VALVE HW NUT Gr.2H STUD Gr.B7** **Z-Misc** **Special** **PMI** **Positive Material ID** Backordered Qty: **0.000**	**2 ST**
Your Ref: **1724001317 123A90A** Customer Part: **SPARE PARTS** Our Ref:: **1706864 // 001090** Material No.: **RSPKIT-FLOW-02** **Comm Spare Prts: Fuses; Terminal Blocks** Country Of Origin:IE ECN:NLR Origin HS Code:8536909500 Backordered Qty: **0.000**	**1 EA**

We hereby certify that the articles and services covered by the shipment were produced and performed in compliance with all applicable requirements of Sections 6, 7, and 12 of the Fair Labor Act, as Amended and the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

PACKING LIST

PACKING LIST NO.:
82461263

DESCRIPTION	QUANTITY
Your Ref: **1724001317 123A90A** Customer Part: **SPARE PARTS** Our Ref:: **1706864 // 001100** Material No.: **RSPKIT-FLOW-IMA** **Comm Spare Prts: Stop Ring 316LSS, Male** Country Of Origin:IE ECN:NLR Origin HS Code:7326909890 Backordered Qty: **0.000**	**2 EA**
Your Ref: **1724001317 123A90A** Customer Part: **SPARE PARTS** Our Ref:: **1706864 // 002000** Material No.: **703-1284-03** **ASSY RECEIVER (100K NB)** Country Of Origin:IE ECN:NLR Origin HS Code:8517620000 Backordered Qty: **0.000** Serial Number: **(X515-11927E)**	**1 EA**
Your Ref: **1724001317 123A90A** Customer Part: **SPARE PARTS** Our Ref:: **1706864 // 002010** Material No.: **703-1354-02** **UNIV DC POWER SUPPLY HV TRANSMIT PCB** Country Of Origin:CN ECN:NLR Origin HS Code:8504500090 Backordered Qty: **0.000**	**1 ST**
Your Ref: **1724001317 123A90A** Customer Part: **SPARE PARTS** Our Ref:: **1706864 // 002020** Material No.: **XAMP** **-2-1-4-0** **PREAMPLIFIR FOR GAS FM,MOUNTABLE,XDCR JB** Country Of Origin:IE ECN:NLR Origin HS Code:9026900000 With following configuration	**2 ST**

We hereby certify that the articles and services covered by the shipment were produced and performed in compliance with all applicable requirements of Sections 6, 7, and 12 of the Fair Labor Act, as Amended and the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

PACKING LIST

PACKING LIST NO.: **82461263**

DESCRIPTION	QUANTITY
B - Transformer — **w/o transformer (STANDARD)** **C - Package** — **Without enclosure** **D - Gain** — **Gain of 40** **E - Miscellaneous** — **None** Backordered Qty: **0.000** Serial Number: **(24101135, 24101136)**	
Your Ref: **1724001317 123A90A** Customer Part: **SPARE PARTS** Our Ref:: **1706864 // 002030** Material No.: **RSPKIT-FLOW-IMA** **Comm Spare Prts: Stop Ring 316LSS, Male** Country Of Origin:IE ECN:NLR Origin HS Code:7326909890 Backordered Qty: **0.000**	**2 EA**
Your Ref: **1724001317 123A90A** Customer Part: **SPARE PARTS** Our Ref:: **1706864 // 003020** Material No.: **PANAVIEW** **PanaView Software complete with manual W** Country Of Origin:IE ECN:NLR Origin HS Code:8523599000 Backordered Qty: **0.000**	**1 ST**
Your Ref: **1724001317 123A90A** Customer Part: **SPARE PARTS** Our Ref:: **1706864 // 003030** Material No.: **704-662-12** **RS232 cable, computer to xx868 series** Country Of Origin:IE ECN:NLR Origin HS Code:8544429090 Backordered Qty: **0.000**	**1 ST**

We hereby certify that the articles and services covered by the shipment were produced and performed in compliance with all applicable requirements of Sections 6, 7, and 12 of the fair Labor Act, as Amended and the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

PACKING LIST

PACKING LIST NO.: **82461263**

DESCRIPTION	QUANTITY
Your Ref: **1724001317 123A90A** Customer Part: **INSPECTION** Our Ref:: **1706864 // 004000** Material No.: **FLOW INSPECTION** **-GAS-N-0-Y-T5-Y-MG-Y-YES / XRF-FLOW CELL-Y-N** **Flow Witness Inspection**	**1 ST**

Country Of Origin:IE ECN:NLR Origin HS Code:0000000000

With following configuration

B-Meter Description	**Gas Meter**
C-FC Pressure Function Test	**No FC Pressure Funct Test**
D-FC Pressure Test Cell Size	**None**
E-Functional Test	**Functional Test**
F-Func Test Type	**Functional Test T5**
G-Zero Flow	**Zero Flow Test**
H-Zero Flow Flow Cell Size	**Medium Gas <=DN400**
I-IMA/FxPA Pressure Test	**IMA /FxPA Pressure Test**
J-PMI Testing	**PMI Test - XRF only. No OES ty**
K-PMI Test Type	**Flow Cell**
L-Packaging	**Packaging**
M-Remote Witness	**In House Witness Only**
Variant condition.	**FLOWINSPECTION-B-GAS**
Variant condition.	**FLOWINSPECTION-C-N**
Variant condition.	**FLOWINSPECTION-E-Y**
Variant condition.	**FLOWINSPECTION-F-T5**
Variant condition.	**FLOWINSPECTION-G-Y**
Variant condition.	**FLOWINSPECTION-H-MG**
Variant condition.	**FLOWINSPECTION-I-Y**
Variant condition.	**FLOWINSPECTION-J-YES / XRF**
Variant condition.	**FLOWINSPECTION-K-FLOW CELL**
Variant condition.	**FLOWINSPECTION-L-Y**
Variant condition.	**FLOWINSPECTION-M-N**

Backordered Qty: **0.000**

- -

DESCRIPTION	QUANTITY
Your Ref: **1724001317 123A90A** Customer Part: **DOCS** Our Ref:: **1706864 // 005000** Material No.: **FLOW DOC APP**	**1 ST**

Flow documents approval

Country Of Origin:IE

ECCN
Origin HS code
Backordered Qty: **0.000**

We hereby certify that the articles and services covered by the shipment were produced and performed in compliance with all applicable requirements of Sections 6, 7, and 12 of the Fair Labor Act, as Amended and the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

PACKING LIST

PACKING LIST NO.: **82461263**

DESCRIPTION	QUANTITY
Your Ref: **1724001317 123A90A** Customer Part: **DOCS** Our Ref:: **1706864 // 005010** Material No.: **FLOW DOC FINAL** **Flow documents Final** Country Of Origin:IE **ECCN** **Origin HS code** Backordered Qty: **0.000**	**1 ST**
Your Ref: **1724001317 123A90A** Customer Part: **PACKING &FREIGHT** Our Ref:: **1706864 // 006000** Material No.: **PACKING** **PACKING** Country Of Origin:IE ECN:NLR Origin HS Code:9031900000 Backordered Qty: **0.000**	**1 ST**
= =	
# **3459210** PACKAGE 2 OF 2 WEIGHT: **42.000 KG / 92.594 LB** DIMENSIONS: **1440.00x300.00x600.00 MM / 0.00x0.00x0.00**	
Your Ref: **1724001317 123A90A** Customer Part: **43-FT-001** Our Ref:: **1706864 // 001050** Material No.: **T5MAXS** **-18-10-33-NT-S6-2-2-4-2-0-PMI** **T5 Max Flare Gas Transducer** Country Of Origin:US ECN:NLR Origin HS Code:9026808000	**2 ST**

With following configuration

B-Head Angle	**Straight head, 180 degree**
C-Frequency	**100 KHz frequency**
D-Tube Length	**33.00**
E-Temperature Range	**Normal: -55 to 150 C**
F-Material	**316 Stainless Steel**
G-Junction Box	**Stainless Exd**
H-XAMP	**Std XAMP, no transformer**
I-Preamp Gain	**Gain of 40 (Std for 100kHz)**

We hereby certify that the articles and services covered by the shipment were produced and performed in compliance with all applicable requirements of Sections 6, 7, and 12 of the fair Labor Act, as Amended and the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

PACKING LIST

PACKING LIST NO.: **82461263**

DESCRIPTION	QUANTITY

J-Certification	**ATEX II 2 G Exd IIC T6...TX Gb**
Z-Miscellaneous	**None**
PMI	**Positive Material ID**

Backordered Qty: **0.000**
Serial Number:
(03241654., 12246636.)

- -

Your Ref: **1724001317 123A90A** Customer Part: **43-FT-001**
Our Ref:: **1706864 // 001065**
Material No.: **IMA72** **2 ST**
-I-15-SS-20-IN-10-IN-3-4-NT-S-PNT
2IN_PACK GLAND&BRRL WITH FITT & WRENCH

Country Of Origin:IE ECN:NLR Origin HS Code:9026900000

With following configuration

B-Flange Type	**Integral forged packing gland**
C-Flange Rating	**150# RF packing gland & barrel**
D-Material	**Gland: 316SS, Barrel Flange:SS**
E-Barrel Length	**20.000**
F-Units	**Inches**
G-Pipe Size	**10.000**
H-Units	**Inches**
I-Material Certifications	**EN10204/3.1, NACE MR0175 & PMI**
J-Hardware	**2in HW NUT Gr.8M STUD Gr.B8M**
K-Temperature Range	**Normal Temp Operation (250C)**
Z-Miscellaneous	**Special**
PAINT	**Paint**

Backordered Qty: **0.000**

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THESE COMMODITIES, TECHNOLOGY OR SOFTWARE WERE EXPORTED FROM THE EU IN ACCORDANCE WITH THE EU, MEMBER STATE NATIONAL EXPORT DUAL-USE, AND/OR ADMINISTRATION REGULATIONS. DIVERSION CONTRARY TO APPLICABLE LAW(S) IS PROHIBITED.
If an Intra- Community transfer of dual-use items listed in Annex I, Article 22(10) of Regulations 428/2009: These commodities are subject to and may be controlled under applicable export control and trade sanction laws (including those of the E.U. and the U.S.) and a licence may be required for their export, re-export or sale.

NOTICE
The ATEX QAN responsibilities of SGS BASEEFA Ltd have been transferred to SGS FIMKO OY for this site; all services associated with any "1180" product markings are now provided by Notified Body 0598.
The PED surveillance responsibilities of Hartford Steam Boiler UK Ltd have been transferred to Hartford Steam Boiler Ireland Ltd for this site; all services associated with any "2561" product markings are now provided by Notified Body 2833

We hereby certify that the articles and services covered by the shipment were produced and performed in compliance with all applicable requirements of Sections 6, 7, and 12 of the fair Labor Act, as Amended and the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

PACKING LIST

PACKING LIST NO.:
82461263

DESCRIPTION	QUANTITY
Order Creator Name : **Jacqueline Gavin** Email: **jacqueline.gavin1@bakerhughes.com**	

We hereby certify that the articles and services covered by the shipment were produced and performed in compliance with all applicable requirements of Sections 6, 7, and 12 of the Fair Labor Act, as Amended and the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

SECTION 2.7

ASSET REGISTER ULTRASONIC FLOWMETER 1724001317-QC-PRO-00019

Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

ASSET REGISTER - ULTRASONIC FLOWMETER

Document Number: 1724001317-QC-PRO-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
Filippo Zanellati	24/11/2025

02	06/011/2025	Issue for Information (IFI)	BH DC	Tom Griffin	Niall Townsend
01	21/07/2025	Issue for Information (IFI)	BH DC	Tom Griffin	Niall Townsend
00	01/05/2025	Issue for Information (IFI)	BH DC	Tom Griffin	Niall Townsend
Rev.	Date	Description	Prepared	Reviewed	Approved

BakerHughes

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Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

Table of Contents

SH.	DESCRIPTION	REVISIONS							
		00	01	02					
1	Cover	X	X	X					
2	Table of Contents	X	X	X					
3	Revision / Change Log / Hold List	X	X	X					
4	ASSET REGISTER - ULTRASONIC FLOWMETER	X	X	X					

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Revision / Change Log

Rev.	Description
00	Issue for Information (IFI)
01	Issue for Information (IFI)
02	Issue for information (IFI)

HOLDS LIST

No.	Description
1.	
2.	
3.	
4.	

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Tag Number	Tag Description	Physical Class Name	Location	System/SubSystem Code	Purchase Order Number	Vendor Company Name	Manufacturer Company Name	Model Number	Equipment Manufacturer Serial Number	Model Part No	Hazardous Area Equip Relevant	Hazardous Area Certificate Standard	Hazardous Area Certifying Authority	Hazardous Area Certificate Number	Atex Classification	Explosion Protection Examination Certificate Document Number	Layout Drawing	Datasheet	Assembly/Dimensional Drawing	General Arrangement	Operating & Maintenance Manual	Wiring Diagram	Spare Parts List	Lubricant Document Reference	Criticality	Remarks
43-FE-001A	Hydrogen from KO DRUM V-43001 to vent stack Q-43004	SensingElement			1724001317	Baker Hughes	Panametrics LLC	T5MAXS	12246636	T5-18-10-33-NT-TI	Transducer	SIRA	ATEX	SIRA 20ATEX1001X	EX dIIC T6 Gb	20ATEX1001X	1724001317-IN-DA-00003	1724001317-IN-DS-00006	1724001317-IN-DA-00003	1724001317-IN-DA-00003	1724001317-IN-MAN-00017	1724001317-IN-DG-00004	1724001317-COM-LIS-00016	N.A.	3	
43-FE-001B	Hydrogen from KO DRUM V-43001 to vent stack Q-43004	SensingElement			1724001317	Baker Hughes	Panametrics LLC	T5MAXS	03241654	T5-18-10-33-NT-TI	Transducer	SIRA	ATEX	SIRA 20ATEX1001X	EX dIIC T6 Gb	20ATEX1001X	1724001317-IN-DA-00003	1724001317-IN-DS-00006	1724001317-IN-DA-00003	1724001317-IN-DA-00003	1724001317-IN-MAN-00017	1724001317-IN-DG-00004	1724001317-COM-LIS-00016	N.A.	3	
43-FT-001	Hydrogen form KO DRUM V-43001 to vent stack Q-43004	Flow Transmitter			1724001317	Baker Hughes	Panametrics LLC	XGF868i	XGF868i-2588E	XGF868i-2-2-OI-H7-3-4-0-CC	Flowmeter	SIRA	ATEX	SIRA 17ATEX 1304X	EX dIIC T6 Gb	17ATEX1304X	1724001317-IN-DA-00003	1724001317-IN-DS-00006	1724001317-IN-DA-00003	1724001317-IN-DA-00003	1724001317-IN-MAN-00017	1724001317-IN-DG-00004	1724001317-COM-LIS-00016	N.A.	3	
C-43-FT-001/43-FE-001A	Armoured Coaxial Cable	I&CCable			1724001317	Baker Hughes	Panametrics LLC	FLAME RETARDENT RG-62	N/A	flowmeter cable-ARCOMAX-10-M-FL150-075HAZLOC-BNC75-075HAZLOC-SS-0	Cable	CML	ATEX	CML-19ATEX4109X	Ex nR IIC Gc	19ATEX4109X	N.A.	N.A.	N.A.	N.A.	N.A.	1724001317-IN-DG-00004	N.A.	N.A.	3	
C-43-FT-001/43-FE-001B	Armoured Coaxial Cable	I&CCable			1724001317	Baker Hughes	Panametrics LLC	FLAME RETARDENT RG-62	N/A	flowmeter cable-ARCOMAX-10-M-FL150-075HAZLOC-BNC75-075HAZLOC-SS-0	Cable	CML	ATEX	CML-19ATEX4109X	Ex nR IIC Gc	19ATEX4109X	N.A.	N.A.	N.A.	N.A.	N.A.	1724001317-IN-DG-00004	N.A.	N.A.	3	

SECTION 2.8

CALIBRATION CERTIFICATE

CERTIFICATE OF CALIBRATION

Issued By
Calibration Specialists Ltd., Holland Rd., National Technology Pk., Castletroy, Limerick. Ireland.
Tel: +353 61 330333 - Fax: +353 61 330452 - website: www.calibrationspecialists.ie

Certificate No: CD2501011

Date of Issue: 14TH JANUARY 2025

Approved Signatory: David Mullins
Timmy Davern (Head of Laboratory)
Tony O'Mara (Technical Manager)
David Mullins (Lab Supervisor)

Category: B - BAKER HUGHES, CO. CLARE

Customer: BAKER HUGHES

Address: CO. CLARE

Details Of Unit Calibrated:

Manufacturer:	STEWARTS	**Date Received:**	13TH JANAURY 2025
Range:	0-1000 **psi**	**Date Calibrated:**	13TH JANAURY 2025
Serial No:	13925098/5	**Calibrated By:**	CILLIAN DELANEY
Ref No.	SHAN00331	**Temperature:**	(23± 5) °C
Description:	PRESSURE GAUGE (NOT FOR OXYGEN USE)	**Humidity:**	(50±25) %

The above instrument was calibrated in accordance with the requirements of BS EN837-1:1998. This report relates solely to the instrument described above.

The reported results are traceable to recognised National and International standards. The copyright of this report is reserved to Calibration Specialists Limited (CSL) and it shall not be used either in whole or in part for the purposes of advertising, publicity, litigation or otherwise without the prior consent of CSL. This calibration certificate contains information belonging to Calibration Specialists Ltd.,which is confidential and/or legally privileged. Information is intended only for the use of the entity named above. If you have received this certificate in error, please notify us by telephone immediately at the above number.

The reported expanded uncertainty is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EAL Publication EA-4/02.

(D. Furneaux)
FTR obo CROSSWIND
Witness ☒ Review
13th Feb. 2025

CERTIFICATE OF CALIBRATION

Issued By
Calibration Specialists Ltd., Holland Rd., National Technology Pk., Castletroy, Limerick. Ireland.
Tel: +353 61 330333 - Fax: +353 61 330452 - website: www.calibrationspecialists.ie

Date of Calibration: 13TH JANAURY 2025 **Certificate No:** CD2501011

Method:

The gauge under test was first allowed to stabilise to laboratory conditions.
The pressure on the gauge was then raised to its full scale value and held for 10 seconds as a test for leakage. The gauge was then tested for accuracy by applying known pressures both increasing and decreasing and findings recorded.
The gauge needle was observed throughout for smoothness of movement.

RESULTS

Full Scale: 1000 psi

Gauge Reading psi	Min psi	Measured Pressure Increasing psi	Measured Pressure Decreasing psi	Max psi	Uncertainty ± psi
0	-16	0	0	16	0.02
200	184	208	209	216	0.02
400	384	410	407	416	0.02
600	584	606	607	616	0.02
800	784	806	808	816	0.02
1000	984	1009	1009	1016	0.02

Specification: ± 1.6 % of Full Scale

STANDARDS USED:

Asset No.: 189 Pressure Calibrator Due Date: May 2025

COMMENTS: Upon receipt the above instrument was within specification at all points tested.
No adjustments were necessary.

This item was calibrated using as a basis for test the requirements of the British Standard BS EN 837-1:1998.

----------End of Certificate----------

(D. Furneaux)
"FTR 060 CROSSWIND"
Witness X Review
13th Feb. 2025

Procedure:Presgaug.xls Control No.X0786 Rev No.6.00 Date:12/05/2015

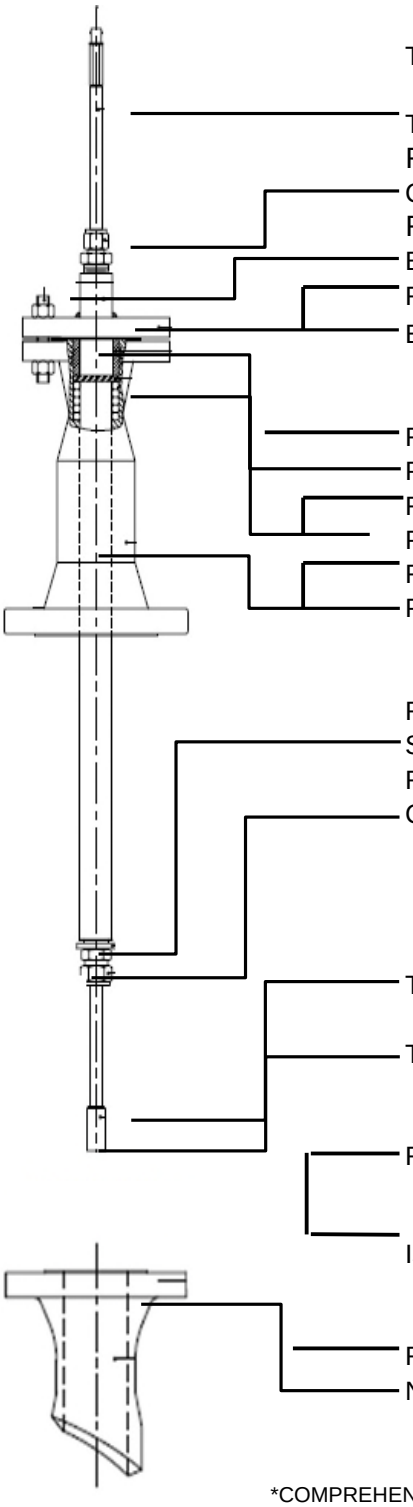
SECTION 2.9

MATERIAL TRACEABILITY RECORDS

Material Tracebility Chart
Insertion Mechanism Assembly / Transducer

Order Ref: 1706864

Tag No.: 43-FT-001



Transducer Serial Numbers:	03241654	12246636
Transducer Tube Heat #.	YX2308-2112	N25459
Rec't #	5008079102	5008079102
Compression Fitting Heat #.	9ET/9CW	9ET/9CW
Rec't #	5008047745	5008047745
Bolting Stud / Nut	DX B7/L7 2H	DX B7/L7 2H
Rec't #	5006865390	5006865390
Barrel Pipe/Flange Heat #.	TH21626 / N2010228AS02	TH21626 / N2010228AS02
Rec't #	5007993990	5007993990
Packing Nut Heat #.	509612	509612
Rec't #	5007948638	5007948638
Packing Ring Heat #.	283504	283504
Rec't #	5007608474	5007608474
Packing Gland Heat #.	437359	437359
Rec't #	5008005657	5008005657
Stop Ring Heat #.	509612	509612
Rec't #	5008069741	5008069741
Compression Fitting Heat #.	7WV/9ER/7ZD/9KC	7WV/9ER/7ZD/9KC
Transducer Cover Heat #.	CC576	CC576
Transducer Cap Heat #.	36SGA330A	36SGA330A
Rec't #	5008012652	5008012652
Isolation Valve Heat #*	RAAX/RAAZ	RAAX/RAAZ
Rec't #	N/A	N/A
Nozzle Heat #.	N/A	N/A

*COMPREHENSIVE INTERNAL HEAT NUMBERS SUPPLIED IN CERTIFICATION PACK

(D. Furneaux)
"FTR 060 CROSSWIND"
~~Witness~~ X Review
12th Feb. 2025

Baker Hughes Confidential

MATERIAL CERTIFICATION

Material	**Heat No.**
Transducer Tube	YX2308-2112
	N25459

(D. Furneaux)
FTR obo CROSSWIND
Witness X Review
12th Feb. 2025

Baker Hughes Confidential

Metallics
Nasmyth Doughty
Nasmyth Doughty Ltd
Unit 4-6, 100 Sherbrook Road
Daybrook, Nottingham NG5 6AB
United Kingdom
Tel: +44 (0) 1159 660600
Fax: +44 (0) 1159 660601
www.nasmythgroup.com

CERTIFICATE OF CONFORMITY

CUSTOMER : PANAMETRICS LLC
1100 TECHNOLOGY PARK DRIVE
BILLERICA
USA
MA 01821

C OF C NO : 54697
ADVICE NO : 49754
OUR WO NO : D37110/1/1
OUR CONTRACT NO : D37110
YOUR ORDER NO : 5052257575

DATE ENTERED 26-Apr-2024

QTY	PART NO.	DESCRIPTION	DRAWING NO / REVISION	SERIAL NO.	BATCH NO.	CAST / HEAT NO.
30	531-1022-0460-REV-A	T5/T17 CSA GROUP B TRANSDUCER TUBING, SS, 60" LONG	531-1022-REV-A /	162376	D37110/1/1	YX2308-2112

SPECIFICATIONS AND TESTS :

SPECIFICATION TESTS	RESULT

DEVIATIONS : **CONCESSIONS :**

Certified that the suppliers/services detailed hereon have been inspected and tested in accordance with the conditions and requirements of ISO 9001:2015 and AS9100-REV-D and is ROHS compliant. They comply with the contract or purchase order, and unless otherwise noted below conform in all respects to the specification(s), drawing(s) relevant thereto.

Parts conform to NACE MR0175 and NACE MR0103

Signed _____

(QUALITY INSPECTION)

Baker Hughes Panametrics
Documentation Reviewed by:
Marco A. Adar
12:58 pm, May 01 2024

DPS 123 INSP 162376

CERTIFICATE OF CONFORMITY / TEST CERTIFICATE

CUSTOMER:
Nasmyth Doughty Limited
Units 4 – 6
100 Sherbrook Road
Daybrook
Nottingham
NG5 6AB

DATE: 11th April 2024

CUSTOMER ORDER NUMBER: 29560

OUR REFERENCE: 77780

COUNTRY OF ORGIN: China

SIZE: ½" od x 16swg

SPECIFICATION: S/S Seamless Tube Grade 316/316L

CAST NUMBER: YX2308-2112 ←

We certify that the whole of the supplies detailed hereon, unless otherwise stated, are covered by the sources Certificate of Conformity / Test Certificate referenced hereon And have been subject to the Quality System Requirements, in accordance with the conditions of our Bureau Veritas Certification UK Limited to BS/EN/ISO 9001:2008.

Signature

Sharon Roberts
Quality Control & Certification

Chase Alloys Ltd
Littleton Business Park, Cocksparrow Lane,
Huntington, Cannock, Staffs, WS12 4TR, UK
Tel: (044) 01543 573200 **Fax:** (044) 01543 573298
Registered Company No. 02509180

Baker Hughes Panametrics
Documentation Reviewed by:
Marco A. Adar
12:58 pm, May 01 2024

ZHEJIANG ETUNE SPECIAL STEEL TUBE Co.,LTD

Inspection Certificate EN 10204-3.1

BNTR-015-A/0
Address: Shendang Industrial Zone
Jiaxing City Zhejiang, China.
Post Code:314311
TEL: +86-573-86922018
FAX: +86-573-86922789
Certificate No:IC-QC202311160302

DPE 128 162376

AD2000-Merkblatt W0 / PED 2014/68/EU(QAC6049662/A)
ISO9001:2015 NO:00111Q20460R1M/3300

Contract No:N-YG002-23001169-1	Customer name:.
Commodity:STAINLESS STEEL SEAMLESS TUBE	P.O.NO:IEBN2023-1169-1
Specification:EN10216-5/ASTM A213/A269 TP316/L	Date of Report:2023.11.16

Steel Grade	Heat No.	Lot No.	Dimensions			Quantity		Process	Delivery Condition	Macroscopic Inspection	
			O.D.(mm)	W.T.(mm)	Length(m)	Piece	Meter			Size	Appearance
TP316/L	YX2308-2112	A2309-129	12.7	1.65	6	200	1200	Cold-finsihed	Bright Annealed(CFA)	OK	OK

Chemical Composition (%) according to ASTM A269/A213 SA-A213/EN10216-5

Element	C	Si	Mn	P	S	Cr	Ni	Mo	N	Ti	Cu	Sn	Al	W
Requirements	≤0.030	≤1.00	≤2.00	≤0.040	≤0.015	16.50-18.00	10.00-13.00	2.00-2.50	≤0.11	/	/	/	/	/
Product Analysis	0.020	0.28	0.67	0.030	0.002	16.78	10.10	2.06	0.06	/	/	/	/	/

Mechanical Properties according to ASTM A269/A213 SA-A213/EN10216-5

Test Item	Y.S.(MPa)Rp0.2	T.S.(MPa)	E.L.(%)	Reduction of Area Z(%)	Hardness (HRB)	Roughness (Ra)	Flaring Test	FlatteningTest
Requirements	≥190	485-690	≥40	/	≤80	≤0.600um	ASTM A1016	ASTM A1016
Test Results	274/281	609/607	57/58	/	74	0.454	OK	OK

Non Destructive Tests			Hydrostatic Test	Intergranular Corrosion Test	Flange Test
Test Item	Eddy Current Test	Ultrasonic Test			
Requirements	ASTM E426	ASTM E213	ASTM A1016	ASTM A262 E	
Test Results	OK	/	/	/	/

NOTE	We hereby certify that the material described herein has been made and tested completely in accordance with the above specification and with the requirements of the purchase order or contract.

1). Tolerance according to EN10216-5/ASTM A213/A269 standard.
2). All pipes are according to
①NACE MR0175/ISO15156-2005
②NACE MR0103-2007 producing.
3). Test Certificate 3.1 acc to EN10204 PED 2014/68/EU
4). AD2000 W0/W2/W10-inspected tubes.
5). NDT is according to EN10246-2.

Prepared by		Approved by	

C. Certified Checked
A.P .....
L. Signed .....

CHASE ALLOYS LIMITED
certified true copy of
mill certificate

Baker Hughes Panametrics
Documentation Reviewed by:
Marco A. Adar
12:59 pm, May 01 2024

CTQ MEASUREMENT REPORT

PART-NO / REVISION	PART DESCRIPTION	BATCH-NO
531-1022-0460-REV-A	T5/T17 CSA GROUP B TRANSDUCER TUBING, SS, 60" LONG	D37110/1/1

	Ø 0.499 - 0.498	3.000 +/- 0.005						
1	0.4987	3.0000						
2	0.4986	3.0000						
3	0.4983	3.0000						
4	0.4982	3.0000						
5	0.4987	3.0000						
6	0.4981	3.0000						
7	0.4986	3.0000						
8	0.4985	3.0000						
9	0.4984	3.0000						
10	0.4986	3.0000						
11	0.4982	3.0000						
12	0.4987	3.0000						
13	0.4983	3.0000						
14	0.4984	3.0000						
15	0.4983	3.0000						
16	0.4988	3.0000						
17	0.4988	3.0000						
18	0.4983	3.0000						
19	0.4987	3.0000						
20	0.4983	3.0000						
21	0.4986	3.0000						
22	0.4986	3.0000						
23	0.4981	3.0000						
24	0.4982	3.0000						
25	0.4986	3.0000						

MEASURED BY

PRINT:	Jake Orton
SIGNATURE :	
DATE:	26/04/2024

Document Owner	Document Number	Document Revision	Date Issued
Quality	QA-CTQ001	REV-1	09/01/2023

CTQ MEASUREMENT REPORT

PART-NO / REVISION	PART DESCRIPTION	BATCH-NO
531-1022-0460-REV-A	T5/T17 CSA GROUP B TRANSDUCER TUBING, SS, 60" LONG	D37110/1/1

	Ø 0.499 - 0.498	3.000 +/- 0.005						
26	0.4985	3.0000						
27	0.4981	3.0000						
28	0.4984	3.0000						
29	0.4986	3.0000						
30	0.4983	3.0000						
31	0.4987	3.0000						
32	0.4983	3.0000						
33	0.4985	3.0000						
34	0.4987	3.0000						
35	0.4986	3.0000						
36	0.4985	3.0000						
37	0.4987	3.0000						
38	0.4984	3.0000						
39	0.4983	3.0000						
40	0.4984	3.0000						

Baker Hughes Panametrics

Documentation Reviewed by:

Marco A. Adar

1:02 pm, May 01 2024

MEASURED BY

PRINT: Jake Orton

SIGNATURE :

DATE: 26/04/2024

Document Owner	Document Number	Document Revision	Date Issued
Quality	QA-CTQ001	REV-1	09/01/2023

F & B Profiles Limited
Units 29-31 Uddens Trading Estate
Wimborne
Dorset
BH21 7NL

Tel: 01202 861337
Fax: 01202 861338

wimborne@precisionprofiles.co.uk
www.precisionprofiles.co.uk

CERTIFICATE OF CONFORMITY

CUSTOMER: Nasmyth IEC Ltd
Brookside Avenue
Rustington
West Sussex
BN16 3LF

DATE: 22.11.24

C OF C/ADVICE NO. 010083647/001
YOUR ORDER NO. 90850

DESCRIPTION OF GOODS / BATCH / CAST NUMBER

	Batch	Cast
316L SEAMLESS TUBE 1/2" O/D X 1.65MM X 1527MM NACE MR-01-75 & MR-01-03 1527MM – 1531MM LONG 105 OFF		N25459



RECEIVED
27 NOV 2024
BY: happleby

Precision Profiles
QUALITY CONTROL

A. Benham
Authorised Signatory

GRN 148934

MS 5

FASTENERS
TOOLS
STEEL STOCK
NON-FERROUS
PROFILES & PLASMA
LASER CUTTING
GRINDING

We hereby certify that the above items on this advice note comply with your purchase order and specification.

Yours Faithfully,

A Benham

Amanda Benham
Stock Controller
Precision Profiles (Wimborne)

ISO 9001 CERTIFIED ORGANISATION
URS
UKAS QUALITY MANAGEMENT 043-A
Certificate No. 13945

Registered Office: Southway Drive, North Common, Warmley, Bristol BS30 0QW
F & B Profiles Ltd
Registered in England No.218582

YCP SPECIAL STEEL CO.,LTD.

INSPECTION CERTIFICATE

3.1 According to ISO 10474/EN10204

RECEIVED 27 NOV 2023 BY: GRN 198934

23, Hwajeonsandan 5-ro, Gangseo-gu
Busan, Republic of Korea
Tel. : 82-51-941-6233~4
Fax.: 82-51-941-6235
www.ycp.co.kr

Certificate No. : 20230421-204-07
Specification : EN10216-5:2013 1.4404(ASTM A269, A213&ASME SA213-21ED TP316L)
Delivery condition : Seamless Tubes / Cold Finished
Issued date : 2023/04/21

Customer : PREMINOX Co.
Customer W(: PO0051204
Project Nam(: N/A
Project No. : N/A

Chemical Composition (%)

Heat No.		*1		C	Mn	P	S	Si	Cr	Ni	Mo	N				Non-Metallic Inclusion Test
			MIN	-	-	-	-	-	16.5	10.0	2.0					
			MAX	0.03	2.00	0.04	0.015	1.00	18.5	13.0	2.5	0.10				
1	N25459		L	0.014	1.534	0.0300	0.0058	0.499	17.222	12.110	2.014					
			P	0.011	1.584	0.0311	0.0058	0.487	17.224	12.189	2.020	0.03				
						BLANK										

Mechanical Property

Test No. (Heat No. or Lot No.)		Size (OD x Wall x Length) (Unit: mm)	Quantity (pcs)	Mass (Kg)	T/S No.	Tensile Test *2 Y.S (off set 0.2%) MPa	Y.S (off set 1.0%) MPa	T.S MPa	E.L %	Hardness (Body) HRB	Roughness Ra(㎛)	Intergranular corrosion Test ASTM A262	Remark
						190 Min	315 Min	490 To 690	40 Min	80 Max	0.8 Max	Practice E	
1	220823-B6C3b221	Ø12.7x1.65tx6,000L	269	738		325	342	636	61.6	77.2	0.46	-	* NACE MR 0175 & 0103
						330	347	631	61.0	78.9	0.49		
					BLANK								

Heat treatment *3	NDT(Eddy Current Test)	Dimension & Visual Inspection	Hydrostatic Test	Flaring Test	Flattening Test
S.T-BA(1,080℃)	Eddy Current Test Accepted(EN10893-1)	Accepted	Not applicable	Accepted	Accepted

[Remark]
* 316, 316L / 1.4401, 1.4404

MARKING : YCP CO LTD EN10216-5-1.4404 Ø12.7x1.65tx6,000L 220823-B6C3b221 N25459 PREMINOX COLD FINISHED SEAMLESS TUBE

*1: L=Ladle Analysis, P=Product Analysis
*2: Y.S=Yield Strength, T.S=Tensile Strength, E.L=Elongation
W=Width, H=Height, D=Diameter, G.L=Gage Length,
*3: N=Normalized, Q=Quenched, T=Tempered, S.T=Solution Treatment, BA=Bright Annealing

We hereby certify that the material herein has been made and tested in accordance with the above specification and also with the requirement called for by the above order.

J. G. MOON
Quality Team Manager

EN10216/A1:2019/AC:2019 DNV.GL.MAT.0007 REV 00
724001317-QC-DB-00014

Nasmyth IEC PO - 96850

Supplier C of C - 61008364 7/001

Goods inwards Inspector - MS

Raw Material Reciept Checklist

Supplier identification is evident and kept with the material	✓
Material has been identified with Supplier C of C by yellow paint pen	✓
Material is free from corrosion/damage	✓
Correct quantity has been delivered	✓
Material dimensionally conforms to supplier incoming paperwork and Nasmyth IEC PO	✓
Material is correct grade that has been requested on Nasmyth IEC PO	✓
Supplier C of C has been checked against mill certificate and is correct batch / heat	✓
Material has been correctly identified	MS 3
XRF scan matches C of C material	MS 3
Buddy check has been completed against the material certs, P/O, drawing (if known) and unique material identification label & that GRN written on C of C is correct	MS 3

Please Note - This form is to be kept with the supplier documentation and scanned into the Incoming Supplier C of C folder.

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BY

GRN 198934

Thermo
SCIENTIFIC

Thermo Fisher Scientific
2 Radcliff Road
Tewksbury, MA 01876 USA

Certificate of Verification

XL2-108813

Reading No	31
Mode	General Metals
Time	2024-11-27 09:22
Duration	8.35
Units	%
Sigma Value	2
Sequence	Final
Alloy1	SS-316 : 0.00
Alloy2	No Match : *4.67
Flags	
SAMPLE	
HEAT	N25459
LOT	
BATCH	198934
MISC	
NOTE	
User Login	Paul Smith



Ele	%	+/-	±2σ
Sb	<LOD	:	0.014
Sn	<LOD	:	0.011
Cd	<LOD	:	0.009
Pd	<LOD	:	0.004
Ag	<LOD	:	0.008
Ru	<LOD	:	0.015
Mo	2.193	+/-	0.041
Nb	<LOD	:	0.023
Zr	<LOD	:	0.009
Bi	<LOD	:	0.013
Pb	<LOD	:	0.016
Se	<LOD	:	0.005
Au	<LOD	:	0.002
W	<LOD	:	0.057
Zn	<LOD	:	0.034
Cu	0.383	+/-	0.053
Ni	10.723	+/-	0.194
Co	0.341	+/-	0.139
Fe	68.153	+/-	0.262
Mn	0.943	+/-	0.110
Cr	17.090	+/-	0.143
V	0.111	+/-	0.032
Ti	<LOD	:	0.069
Al	<LOD	:	80.000
ResElt	28.196	+/-	0.000
EQF	4.776	+/-	0.000

Supervised By: _____

Systems & Defence
Nasmyth IEC
Nasmyth IEC Limited
Brookside Avenue, Rustington
West Sussex BN16 3LF
Tel: +44 (0) 1903 773337
Fax: +44 (0) 1903 786619
www.nasmythgroup.com

ISO/IEC 17050-1:2004(E)

Supplier's Declaration of Conformity (in accordance with ISO/IEC 17050-1)

1) No: 82539-3-1

2) Issuer's name: Nasmyth IEC Limited.

Issuer's address: Brookside Avenue, Rustington, West Sussex, BN16 3LF, UK.

3) Object of the declaration:

531-1022-0460 Rev A T5/T17 CSA transducers tubing stainless steel 316/316L (60" length)..

4) The object of the declaration described above is in conformity with the requirements of the following documents:

Documents No:	Title:	Edition / Date of Issue:
531-1022	T5/T17 CSA TRANSDUCERS TUBING	A 24/08/2015.

Additional information:

6)

Critical to Quality report supplied to support this Declaration of Conformity.

Signed for and on behalf of:

Nasmyth IEC Limited

04th December 2024

7)

James Bull

Account Manager



Baker Huges CTQ Report			
Batch No.:	82539-3-1	**Customer P/O:**	51983051760
IEC C of C:		**Quantity:**	40
CTQ Feature:	**3.000" +/-0.005" Length**	**CTQ Feature:**	**ø0.499/0.498"**
1	3.0015"	1	0.49845"
2	3.002"	2	0.49865"
3	3.0015"	3	0.49810"
4	3.0015"	4	0.49845"
5	3.002"	5	0.49845"
6	3.0015"	6	0.49860"
7	3.0015"	7	0.49850"
8	3.0015"	8	0.49855"
9	3.001"	9	0.49840"
10	3.001"	10	0.49860"
11	3.001"	11	0.49845"
12	3.0015"	12	0.49870"
13	3.001"	13	0.49810"
14	3.001"	14	0.49875"
15	3.0015"	15	0.49860"
16	3.003"	16	0.49835"
17	3.001"	17	0.49845"
18	3.0025"	18	0.49830"
19	3.0015"	19	0.49815"
20	3.001"	20	0.49850"
21	3.0035"	21	0.49870"
22	3.0015"	22	0.49865"
23	3.001"	23	0.49825"
24	3.002"	24	0.49835"
25	3.0015"	25	0.49850"
26	3.001"	26	0.49880"
27	3.001"	27	0.49835"
28	3.001"	28	0.49805"
29	3.0015"	29	0.49835"
30	3.0025"	30	0.49845"
31	3.001"	31	0.49825"
32	3.001"	32	0.49890"
33	3.003"	33	0.49840"
34	3.0025"	34	0.49860"
35	3.001"	35	0.49825"
36	3.0015"	36	0.49875"
37	3.0025"	37	0.49850"
38	3.003"	38	0.49850"
39	3.0015"	39	0.49835"
40	3.0015"	40	0.49860"
41		41	
42		42	

FORM 1 - PART NUMBER ACCOUNTABILITY

1. Part Number:	2. Part Name:	3. Serial Number:	4. FAIR Identifier:
531-1022-0460	T5 / T17 CSA TRANSDUCERS TUBING	N/A	IEC-3200
5. Part Revision Level:	**6. Drawing Number:**	**7. Drawing Revision Level:**	**8. Additional Changes:**
A	531-1022	A	N/A
9. Manufacturing Process Reference:	**10. Organization Name:**	11. Supplier Code:	12. Purchase Order Number:
N/A	NASMYTH IEC LIMITED	ABC123	51983051760

13. Detail: X	14. Full FAI X	Partial FAI:
Assembly:	Baseline Part Number (Including revision level): N/A	
	Reason for Full / Partial FAI: Initial Production Run	

a) if above part number is a detail part only, go to Field 19
b) if above part number is an assembly, go to the "INDEX" section below

INDEX of part numbers or sub-assembly numbers required to make the assembly noted above.

15. Part Number:	16. Part Name:	17. Part Type:	18. FAIR Identifier:

19. Does FAIR Contain a Documented Nonconformance(s)? Yes ___ No X

20. FAIR Verified By:	21. Date:
D.Stone	04/12/2024
22. FAIR Reviewed/Approved By:	**23. Date:**
G.Davies	04/12/2024
24. Customer Approval:	***25. Date:***

26. Comments

FORM 2 - PRODUCT ACCOUNTABILITY - MATERIALS, SPECIAL PROCESSES AND FUNCTIONAL TESTING

1. Part Number:	2. Part Name:		3. Serial Number:		4. FAIR Identifier:
531-1022-0460	T5 / T17 CSA TRANSDUCERS TUBING		N/A		IEC-3200
5. Material or Process Name:	*6. Specification Number:*	7. Code:	*8. Supplier:*	*9. Customer Approval Verification:*	*10. Certificate of Conformance Number:*
St Steel	316L Stainless	N/A	Precision Profiles	N/A	010083647/001

11. Functional Test Procedure Number:	*12. Acceptance Report Number:*
N/A	N/A

13. Comments

N/A

F & B Profiles Limited
Units 29-31 Uddens Trading Estate
Wimborne
Dorset
BH21 7NL

Tel: 01202 861337
Fax: 01202 861338

wimborne@precisionprofiles.co.uk
www.precisionprofiles.co.uk

CERTIFICATE OF CONFORMITY

CUSTOMER: Nasmyth IEC Ltd
Brookside Avenue
Rustington
West Sussex
BN16 3LF

DATE: 22.11.24

C OF C/ADVICE NO. 010083647/001
YOUR ORDER NO. 90850

DESCRIPTION OF GOODS / BATCH / CAST NUMBER

	Batch	Cast
316L SEAMLESS TUBE 1/2" O/D X 1.65MM X 1527MM NACE MR-01-75 & MR-01-03 1527MM – 1531MM LONG 105 OFF		N25459

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27 NOV 2024
BY: happleby

Precision Profiles
QUALITY CONTROL

A. Benham

Authorised Signatory

GRN 148934

MS 5

We hereby certify that the above items on this advice note comply with your purchase order and specification.

Yours Faithfully,

Amanda Benham
Stock Controller
Precision Profiles (Wimborne)

FASTENERS
TOOLS
STEEL STOCK
NON-FERROUS
PROFILES & PLASMA
LASER CUTTING
GRINDING

ISO 9001 CERTIFIED ORGANISATION
URS
UKAS QUALITY MANAGEMENT 003-A
Certificate No. 11985

F & B Profiles Ltd
Registered in England No.218582

YCP SPECIAL STEEL CO.,LTD.

INSPECTION CERTIFICATE

3.1 According to ISO 10474/EN10204

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Page : 1 of 1

23, Hwajeonsandan 5-ro, Gangseo-gu
Busan, Republic of Korea
Tel. : 82-51-941-6233~4
Fax.: 82-51-941-6235
www.ycp.co.kr

Certificate No. : 20230421-204-07
Specification : EN10216-5:2013 1.4404(ASTM A269, A213&ASME SA213-21ED TP316L)
Delivery condition : Seamless Tubes / Cold Finished
Issued date : 2023/04/21

Customer : PREMINOX Co.
Customer W(: PO0051204
Project Nam(: N/A
Project No. : N/A

Chemical Composition (%)

Heat No.		*1		C	Mn	P	S	Si	Cr	Ni	Mo	N				Non-Metallic Inclusion Test
			MIN	-	-	-	-	-	16.5	10.0	2.0					
			MAX	0.03	2.00	0.04	0.015	1.00	18.5	13.0	2.5	0.10				
1	N25459		L	0.014	1.534	0.0300	0.0058	0.499	17.222	12.110	2.014					
			P	0.011	1.584	0.0311	0.0058	0.487	17.224	12.189	2.020	0.03				
						BLANK										

Test No. (Heat No. or Lot No.)		Size (OD x Wall x Length) (Unit: mm)	Quantity (pcs)	Mass (Kg)	Mechanical Property								Remark
					T/S No.	Tensile Test *2						Intergranular corrosion Test	
						Y.S (off set 0.2%)	Y.S (off set 1.0%)	T.S	E.L	Hardness (Body)	Roughness		
						MPa			%	HRB	Ra(μm)	ASTM A262	
						190 Min	315 Min	490 To 690	40 Min	80 Max	0.8 Max	Practice E	
1	220823-B6C3b221	Ø12.7x1.65tx6,000L	269	738		325	342	636	61.6	77.2	0.46	-	* NACE MR 0175 & 0103
						330	347	631	61.0	78.9	0.49		
					BLANK								

Heat treatment *3	NDT(Eddy Current Test)	Dimension & Visual Inspection	Hydrostatic Test	Flaring Test	Flattening Test
S.T-BA(1,080℃)	Eddy Current Test Accepted(EN10893-1)	Accepted	Not applicable	Accepted	Accepted

[Remark]
* 316, 316L / 1.4401, 1.4404

MARKING : YCP CO LTD EN10216-5-1.4404 Ø12.7x1.65tx6,000L 220823-B6C3b221 N25459 PREMINOX COLD FINISHED SEAMLESS TUBE

*1: L=Ladle Analysis, P=Product Analysis
*2: Y.S=Yield Strength, T.S=Tensile Strength, E.L=Elongation
W=Width, H=Height, D=Diameter, G.L=Gage Length,
*3: N=Normalized, Q=Quenched, T=Tempered, S.T=Solution Treatment, BA=Bright Annealing

We hereby certify that the material herein has been made and tested in accordance with the above specification and also with the requirement called for by the above order.

J. G. MOON
Quality Team Manager

YCP SPECIAL STEEL CO.,LTD.

111216/111216DN0091699/0001

Nasmyth IEC PO - 9850

Supplier C of C - 0100836471001

Goods inwards Inspector - MS

Raw Material Reciept Checklist

Supplier identification is evident and kept with the material	✓
Material has been identified with Supplier C of C by yellow paint pen	✓
Material is free from corrosion/damage	✓
Correct quantity has been delivered	✓
Material dimensionally conforms to supplier incoming paperwork and Nasmyth IEC PO	✓
Material is correct grade that has been requested on Nasmyth IEC PO	✓
Supplier C of C has been checked against mill certificate and is correct batch / heat	✓
Material has been correctly identified	MS 1
XRF scan matches C of C material	MS 3
Buddy check has been completed against the material certs, P/O, drawing (if known) and unique material identification label & that GRN written on C of C is correct	MS 2

Please Note - This form is to be kept with the supplier documentation and scanned into the Incoming Supplier C of C folder.

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27 NOV 2024
BY Traffolyn

GRN 198934

F044 Issue 3

Thermo SCIENTIFIC

Thermo Fisher Scientific
2 Radcliff Road
Tewksbury, MA 01876 USA

Certificate of Verification

XL2-108813

Reading No	31
Mode	General Metals
Time	2024-11-27 09:22
Duration	8.35
Units	%
Sigma Value	2
Sequence	Final
Alloy1	SS-316 : 0.00
Alloy2	No Match : *4.67
Flags	
SAMPLE	
HEAT	N25459
LOT	
BATCH	198934
MISC	
NOTE	
User Login	Paul Smith



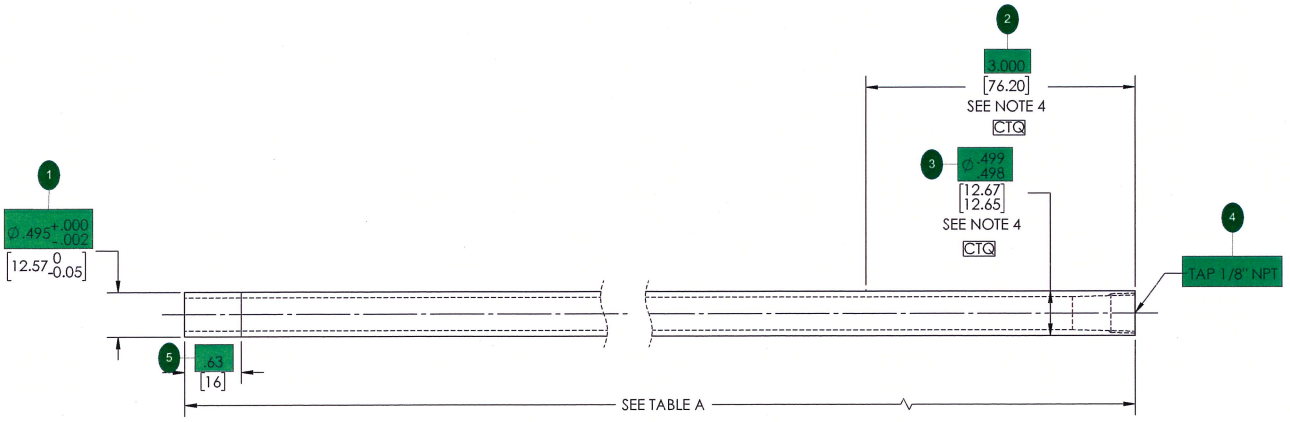
Ele	%	+/-	±2σ
Sb	<LOD	:	0.014
Sn	<LOD	:	0.011
Cd	<LOD	:	0.009
Pd	<LOD	:	0.004
Ag	<LOD	:	0.008
Ru	<LOD	:	0.015
Mo	2.193	+/-	0.041
Nb	<LOD	:	0.023
Zr	<LOD	:	0.009
Bi	<LOD	:	0.013
Pb	<LOD	:	0.016
Se	<LOD	:	0.005
Au	<LOD	:	0.002
W	<LOD	:	0.057
Zn	<LOD	:	0.034
Cu	0.383	+/-	0.053
Ni	10.723	+/-	0.194
Co	0.341	+/-	0.139
Fe	68.153	+/-	0.262
Mn	0.943	+/-	0.110
Cr	17.090	+/-	0.143
V	0.111	+/-	0.032
Ti	<LOD	:	0.069
Al	<LOD	:	80.000
ResElt	28.196	+/-	0.000
EQF	4.776	+/-	0.000

Supervised By: _____

REVISIONS					
REV	ECO	DESCRIPTIONS	DWN	CKD	APVD
A	158170783	RELEASED TO ECO CONTROL	CD SMART 2/8/17	J. CAIRA 2/8/17	J. CAIRA 2/8/17

TABLE A			
MATERIAL	DASH NO.	LENGTH	MAKE FROM
TITANIUM TUBE CP Gr 2 ASTM B338	-0108	8.5 [215.90]	531-578-01
	-0116	16.0 [406.40]	531-578-01
	-0122	22 [558.80]	531-578-11
	-0124	24.0 [609.60]	531-578-11
	-0128	28.0 [711.20]	531-578-12
	-0131	31.0 [787.40]	531-578-13
	-0133	33.0 [838.20]	531-578-02
	-0135	35.0 [889.00]	531-578-14
	-0136	36.0 [914.40]	531-578-03
	-0137	37.0 [939.80]	531-578-04
	-0139	39.0 [990.60]	531-578-15
	-0141	41.0 [1041.40]	531-578-05
	-0143	43.0 [1092.20]	531-578-16
	-0145	45.0 [1143.00]	531-578-06
	-0149	49.0 [1244.60]	531-578-07
	-0154	54.0 [1371.60]	531-578-17
	-0160	60.0 [1524.00]	531-578-18
	-0172	72.0 [1828.80]	-
MONEL 400 UNS N04400 TUBE	-0216	16.0 [406.40]	531-1007-01
	-0224	24.0 [609.60]	531-1007-11
	-0228	28.0 [711.20]	531-1007-12
	-0231	31.0 [787.40]	531-1007-13
	-0233	33.0 [838.20]	531-1007-02
	-0235	35.0 [889.00]	531-1007-14
	-0236	36.0 [914.40]	531-1007-03
	-0237	37.0 [939.80]	531-1007-04
	-0239	39.0 [990.60]	531-1007-15
	-0241	41.0 [1041.40]	531-1007-05
	-0243	43.0 [1092.20]	531-1007-16
	-0245	45.0 [1143.00]	531-1007-06
	-0249	49.0 [1244.60]	531-1007-07
	-0254	54.0 [1371.60]	531-1007-17
	-0260	60.0 [1524.00]	531-1007-18
HASTELLOY C276 UNS N10276 TUBE	-0316	16.0 [406.40]	531-892-01
	-0324	24.0 [609.60]	531-892-11
	-0328	28.0 [711.20]	531-892-12
	-0331	31.0 [787.40]	531-892-13
	-0333	33.0 [838.20]	531-892-02
	-0335	35.0 [889.00]	531-892-14
	-0336	36.0 [914.40]	531-892-03
	-0337	37.0 [939.80]	531-892-04
	-0339	39.0 [990.60]	531-892-15
	-0341	41.0 [1041.40]	531-892-05
	-0343	43.0 [1092.20]	531-892-16
	-0345	45.0 [1143.00]	531-892-06
	-0349	49.0 [1244.60]	531-892-07
	-0354	54.0 [1371.60]	531-892-17
	-0360	60.0 [1524.00]	531-892-18
S1 STAINLESS STEEL 316/316l UNS S31600/S31603 TUBE	-0416	16.0 [406.40]	531-1008-01
	-0424	24.0 [609.60]	531-1008-11
	-0428	28.0 [711.20]	531-1008-12
	-0431	31.0 [787.40]	531-1008-13
	-0433	33.0 [838.20]	531-1008-02
	-0435	35.0 [889.00]	531-1008-14
	-0436	36.0 [914.40]	531-1008-03
	-0437	37.0 [939.80]	531-1008-04
	-0439	39.0 [990.60]	531-1008-15
	-0441	41.0 [1041.40]	531-1008-05
	-0443	43.0 [1092.20]	531-1008-16
	-0445	45.0 [1143.00]	531-1008-06
	-0449	49.0 [1244.60]	531-1008-07
	-0454	54.0 [1371.60]	531-1008-17
	-0460	60.0 [1524.00]	531-1008-18

6



NOTES:

1. MATERIAL: Ø.500 X .C71/.053 W [Ø12.7 X 1.80/1.35 W]
2. ALL MATERIAL TO BE CERTIFIED TO EN 10204 3.1 AND TO NACE MR-01-75 AND MR-01-03. 7
3. ENGRAVING INFORMATION: 8
   MANUFACTURING: T5 SEE DRAWING 442-1932
   T17 SEE DRAWING 442-1933
   INCOMING INSPECTION: SEE DRAWING 442-836
4. DIMENSIONS INCH [MM]
5. DIAMETER TOLERANCE TO BE INSPECTED AND CONTROLED WITHIN SPECIFIED LENGTH FROM TUBING THREADED END. DIMENSIONS TO BE TURNED FROM STOCK PART NUMBER SHOWN IN TABLE 1 LISTED UNDER COLUMN "MAKE FROM". 10
6. 100% OF THE INDICATED CTQ'S FOR EACH PART MUST BE INSPECTED PER DRAWING; CERTIFICATE OF COMPLIANCE MUST BE ISSUED IN ACCORDANCE WITH IEC17050-1 AND -2. ALL INSPECTION RECORDS MUST BE MAINTAINED FOR A PERIOD OF 10 YEARS AFTER THE DISCONTINUATION OF THE PRODUCT. RECORDS ARE SUBJECT TO AUDIT BY GE. 11.1,11.2

CHANGES TO THIS DRAWING MAY REQUIRE PRIOR AGENCY AUTHORIZATION. CONTACT THE CERTIFICATION ENGINEER.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± 1/32" DECIMALS .XX ± .01 .XXX ± .005 ANGLES ± 1°
SURFACE FINISH 125 9

© COPYRIGHT 2014 GENERAL ELECTRIC CO.
PROPRIETARY INFORMATION- THIS DRAWING CONTAINS PROPRIETARY INFORMATION OF GENERAL ELECTRIC CO. AND MAY NOT BE VIEWED OR DISCLOSED TO OTHERS, EXCEPT WITH THE WRITTEN PERMISSION OF GENERAL ELECTRIC CO.

THIRD ANGLE PROJECTION

DRAWN 8/24/15 JC	APP'D MM/DD/YY XX		
CHECKED MM/DD/YY XX	SALES N/A N/A		
CERT N/A N/A	QC N/A N/A		
RN	GENERATED USING SOLIDWORKS		
MODEL NO. FLOW	SCALE 1:4	DO NOT SCALE DWG	SHEET 1 OF 1

PP
GE Infrastructure Sensing, LLC.
1100 Technology Park Drive
Billerica, MA 01821 USA

TITLE
T5/T17 CSA
TRANSDUCERS TUBING

SIZE	DRAWING NUMBER	REV
C	531-1022	A

FORM 3 - CHARACTERISTIC ACCOUNTABILITY, VERIFICATION, AND COMPATIBILITY EVALUATION.

1. Part Number	2. Part Name	3. Serial Number	4. FAIR Identifier
531-1022-0460	T5 / T17 CSA TRANSDUCERS TUBING	N/A	IEC-3200

Characteristic Accountability				Inspection / Test Results				
5. Char No.	6. Reference Location	7. Characteristic Designator	8. Requirement	9. Results	10. Designed / Qualified Tooling	11. NonConformance Number	12a. Measurement Equipment / Gauge No.	12b. Comments
1	3C	Minor	⌀ 0.495 +0.000 / -0.002	0.4935	N/A	N/A	Micrometer External EQP11184	
2	1D	Minor	3.000 ±0.005	3.0015	N/A	N/A	Caliper External EQP04089	
3	1C	Minor	⌀ 0.498 / 0.499	0.4986	N/A	N/A	Micrometer External EQP11184	
4	1C	Minor	TAP 1/8" NPT	Pass	N/A	N/A	Screw Plug Gauge SPG11391	
5	3C	Minor	0.63 ±0.01	0.6310	N/A	N/A	Caliper External EQP04089	
6	4A	Minor	60.0 ±0.01	60.005	N/A	N/A	Caliper External EQP03820	
7	3B	Minor	MATERIAL CERTIFIED TO EN10204 3.1, NACE MR-01-75 & NACE MR-01-03	Pass	N/A	N/A	3.1 Cert - See Attachments	
8	3B	Minor	ENGRAVE I.A.W. 442-1932 / 442-1933	Pass	N/A	N/A	Visual Inspection	
9	2A	Minor	✓ MAX 125	23.33	N/A	N/A	Surftest SJ210 EQP10918	
10	3B	Minor	Ø TOL INSPECTED & CONTROLLED FROM TUBING THREAD END	Pass	N/A	N/A		
11.1	3A	Minor	100% CTQ's INSPECTED I.A.W. DRAWING	Pass	N/A	N/A		
11.2	3A	Minor	STATEMENT OF CONFORMANCE TO BE SUPPLIED	Pass	N/A	N/A		

MATERIAL CERTIFICATION

Material	**Heat No.**
Compression fitting	9ET/9CW

Baker Hughes Confidential

Swagelok Company
29500 Solon Rd
Solon, OH 44139 U.S.A.

440.349.5600

Inspection Certificate EN 10204-3.1

Distributor	Customer	Customer PO#
FST (Scotland) Ltd Silvertrees Drive Silvertrees Business Park Westhill Aberdeen Aberdeenshire, Scotland AB32 6BH	Baker Hughes EMEA Unlimited Company Baker Hughes EMEA Unlimited Company Sensing House Shannon Free Zone East Sh	5052344039

No.	Part Number	Qty	Prod ID/Batch Num	Mfg Order #	Reference #	Component	Heat Code
1	SS-810-1-0125	100	0005075097	111480	SS-810-1-0125-TF	Body	9ET
					(5201)	Nut	9CW

Swagelok products referenced above are manufactured from material purchased and certified as being in accordance with the specification(s) listed below.

Information contained in the above customer address column (marked as "Customer") and area marked "Reference" (when applicable) of this certification are for reference purposes only. Swagelok Company makes no stipulations, nor takes responsibility, for the accuracy or reliability of such information.

Swagelok products are manufactured under conditions which are free from mercury. No mercury bearing components have been used in the products of your order and no mercury bearing instruments or other equipment have been used in their manufacture, assembly, or testing in such a manner as might cause contamination.

No asbestos or asbestos-containing components are used in Swagelok brand products.

MATERIAL STANDARDS

Components	Material	Standards
Shaped Fittings	F316/F316L Stainless Steel Forgings	ASTM A182, ASME SA182
Straight Fittings	316/316L Stainless Steel Bar	ASTM A479, ASME SA479, ASTM A276 (exception of square and rectangular bar)

Type 316 Stainless Steel Bar material is in the Strain-Hardened Level 2 condition.

Specific chemistry obtained from analysis of product made from this material may vary from the batch values as provided with this certification.

Stainless steel material has passed the Intergranular Corrosion Test requirements of EN ISO 3651-2, Method A, and ASTM A-262 Practice E.

All parts were cleaned and packaged in accordance with Swagelok Specifications.

The Swagelok® products specified above were manufactured in accordance with Swagelok Company's Quality Manual (SQS-F latest revision, Revision O, dated February 7, 2024).

Swagelok Company's Quality System is approved to ISO:9001 (BSI Certificate # FM01729).

Annexes: Material Certificates

REVIEWED
By Martin McMahon at 10:31 am, Jan 11, 2025

Certifications Supervisor
Michael J. Zickes

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231406
Trace ID/Heat Code: 9ET

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104341024	SSD-HB-106250	1-1/16" HEX BAR	34,458

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), revision N, dated February 7, 2024, which satisfies the applicable requirements of NCA-3300 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and ASME NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and the 2015, 2017, 2019 and 2022 Editions. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), revision O, dated February 7, 2024 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 9 May 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 5/8/2024
P.O. No.: 4506182330
W/O No.: CRA002-24-05-00807-1
Date Received: 5/2/2024

MO:	000104341024 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ET
P/N:	SSD-HB-106250
Two (2) 1-1/16" HEX SS 316 Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	
1	9.98	94.6	652	99.9	689	104.6		721		33.5	27.5	73	Mid 50%
2	9.98	94.9	654	100.5	693	105.2		725		34.0	28.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	23	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#** 24E-088
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	

	Average Grain Size
Specimen 1	ASTM #3.0 – 4.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	5/8/2024
P.O. No.:	4506182330
W/O No.:	CRA002-24-05-00807-1
Date Received:	5/2/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/27/2024 9ET

HEAT E231406 ORDER 705322/ 01 BOL 0262433 * CERTIFICATION * 03/25/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer
OSB 8

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259478 10/13/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 22 Total Weight 35064 Approx. Hot Red. Ratio 138:1

WO 2128961 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U, 1V SON= 355067

---------- SPECIFICATIONS ----------
ASTM A479/A479M-23a
ASTM A751 21
EN 10272 Grade 1.4401
10-CFR-21
Swagelok SQS-00012 Rev AK
Produced according to -
ASME B&PV Code Section III
Subsection NCA3800
MSR QPM-101 R14, 1/11/23
Approved by Swagelok Company
ASME SA-479/479M 2023 Ed
Bars are 100% UT inspected

ASTM A484/A484M 23a
DIN 50049/EN 10204 Type 3.1
EN ISO 3651-2 Method A
10CFR50-Appendix B
Swagelok SQS-00020 Rev N
Swagelok SQS-00021 Rev Q
1.4401/1.4404, 316/316L
Exception to SQS-00171 Rev F
Swagelok SMS-00833 Rev D
Swagelok SQC-03992 init. rel
ASTM E1001

---------- MECHANICAL & OTHER TESTS ----------
Micro OK
Intergranular corrosion

Tensile strength,KSI (MPa)	.0 (0)
0.2% Yield Strngth,KSI(MPa)	.0 (0)
Elongation % in 4D	.0
Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			

De-long Ferrite

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.

Free from contamination by mercury or mercury compounds when despatched from SMACC.

No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2470-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit Stainless steel, hot rolled billets. Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling. Intended for further hot working and heat treatment. No mechanical tests performed. Not solution annealed.	Our order Unsere Auftrag Notre commande 83104	Advice of delivery Lieferschein Avie d'expedition 273457
Requirements-Prüfgrundlagen-Exigences OSB MS-1014 Rev.3 OSB Grade Codes for Material Procurement. ASTM A276, A479 ASME SA479 AD 2000-Merkblatt W2, W10 EN 10272 SWAGELOK SMS-10001 SWAGELOK SMS-10002 SWAGELOK SQS-00021	Purchaser-Besteller-Acheteur MARCEGAGLIA STAINLESS RICHBURG LLC (AVESB) 3043 CRENSHAW PARKWAY SC 29729 RICHBURG U.S.A	

Marking-Kennzeichnung-Marquage

Type of steel Werkstoff Nr. Nuance 316LCM Rev.0 Type 316, 316L, UNS S31600, S31603. EN 1.4401, 1.4404 17-10-2L	Brand mark Herstellerzeichen Signe du producteur W	Inspectors´stamp Abnahmestempel Poincon de l´expert DJ 10	Melting process Erschmelzungsart Procède de fusion EAF AOD-Converter refining CC to bloom size (mm): 462x262

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-01	1	150x150	E231406	145080			1 634	915-2
01-02	1	150x150	E231406	145985			1 652	815-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais The requirements according to AMS-QQ-S-763D are fulfilled. The order requirements stipulated are satisfied. US-tested according to DLP OFP-222. Approved.	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel No remarks-Ohne Beanstandung-Pas de remarque PMI-test has been performed on every bar/billet with X-ray spectro, without remarks. No weld repair has been performed on the material. Free of known Mercury contamination at time of shipment.
EN ISO 9001:2015 and EN ISO 14001:2015. Certificate no. 5749-3027684-0102. Approved by TÜV NORD Scandinavia AB.	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. Certificate no. 07/203/9140/WP/0689/18 PED 2014/68/EU, approved by TÜV Nord Systems. Certificate no. 07/202/9140/WZ/0689/18	Degerfors Long Products AB Digitally signed by: Jörgen Johansson QA Head
Reg.No.:559332-4907 V.A.T.No.:SE559332490701 Registered office: Degerfors, Sweden	

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/13/2024 9ET

HEAT E231406 ORDER 711288/ 01 BOL 0262339 * CERTIFICATION * 03/13/24

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259477 3/13/24 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 21 Total Weight 34458 Approx. Hot Red. Ratio 138:1

WO 2128960 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U SON= 355066

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

APPROVED BY SARA MALIK 3/13/2024 9ET

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38262	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

.

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL.+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2471-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit **Stainless steel, hot rolled billets.** **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	Our order Unsere Auftrag Notre commande **83104**	Advice of delivery Lieferschein Avie d'expedition **273457**

Requirements-Prüfgrundlagen-Exigences **OSB MS-1014 Rev.3** **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	Purchaser-Besteller-Acheteur **MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel **316LCM Rev.0** **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	Brand mark W	Inspectors stamp DJ 10	Melting process **EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item	Quantity	Dimensions, mm	Cast No.	Lot No.	Test No	Heat treatm.Lot No	Weight Kg	Bloom No
01-03	1	150x150	E231406	145986	145986-1,2		1 608	815-1
01-04	1	150x150	E231406	145987	145987-1,2		1 616	915-1
01-05	1	150x150	E231406	145988	145988-1,2		1 782	803-1
01-06	1	150x150	E231406	145989	145989-1,2		1 820	905-1
01-07	1	150x150	E231406	145990	145990-1,2		1 816	914-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: **2023-08-11**
Ladle analysis attached

% Ferrite measured with ferritscope on samples from both billet ends. 8 points measured from half radius, in one line, cross the centre area to half radius on the other side of the centre.

	Billet end 1			Billet end 2			
Test No	min	max	average	min	max	average	Pit furnace no.
145986-1,2	0.0	0.13	0.02	0.0	0.26	0.10	2
145987-1,2	0.0	0.23	0.04	0.0	0.32	0.04	2
145988-1,2	0.0	0.20	0.06	0.0	0.10	0.01	2
145989-1,2	0.0	0.10	0.01	0.0	0.12	0.03	2
145990-1,2	0.0	0.11	0.01	0.0	0.10	0.02	2

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais **The requirements according to AMS-QQ-S-763D are fulfilled.** **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel **No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TÜV NORD Scandinavia AB.**	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Degerfors Long Products AB** Jörgen Johansson
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office: Degerfors, Sweden**	**Digitally signed by:** **Jörgen Johansson** **QA Head**

APPROVED BY SARA MALIK 05/22/2024 9ET

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231406
Trace ID/Heat Code: 9ET

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104340933	SSD-HB-106250	1-1/16" HEX BAR	35,064

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), revision N, dated February 7, 2024, which satisfies the applicable requirements of NCA-3300 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and ASME NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and the 2015, 2017, 2019 and 2022 Editions. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), revision O, dated February 7, 2024 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 9 May 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 5/21/2024
P.O. No.: 4506197413
W/O No.: CRA002-24-05-01484-1
Date Received: 5/14/2024

MO:	000104340933 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ET
P/N:	SSD-HB-106250
Two (2) 1-1/16" Hex SS 316 Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	-
1	9.98	95.5	658	101.0	696	105.7		729		33.5	28.0	73	Mid 50%
2	9.98	95.5	659	100.8	695	105.5		727		32.0	26.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	26	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#**
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	24E-271

	Average Grain Size
Specimen 1	ASTM #5.0 – 6.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	5/21/2024
P.O. No.:	4506197413
W/O No.:	CRA002-24-05-01484-1
Date Received:	5/14/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara
Digitally Signed by Britney Bahara
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/27/2024 9ET

HEAT E231406 ORDER 705322/ 01 BOL 0262433 * CERTIFICATION * 03/25/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259478 10/13/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 22 Total Weight 35064 Approx. Hot Red. Ratio 138:1

WO 2128961 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U, 1V SON= 355067

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.

Free from contamination by mercury or mercury compounds when despatched from SMACC.

No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2470-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit Stainless steel, hot rolled billets. Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling. Intended for further hot working and heat treatment. No mechanical tests performed. Not solution annealed.	Our order Unsere Auftrag Notre commande 83104	Advice of delivery Lieferschein Avie d'expedition 273457
Requirements-Prüfgrundlagen-Exigences OSB MS-1014 Rev.3 OSB Grade Codes for Material Procurement. ASTM A276, A479 ASME SA479 AD 2000-Merkblatt W2, W10 EN 10272 SWAGELOK SMS-10001 SWAGELOK SMS-10002 SWAGELOK SQS-00021	Purchaser-Besteller-Acheteur MARCEGAGLIA STAINLESS RICHBURG LLC (AVESB) 3043 CRENSHAW PARKWAY SC 29729 RICHBURG U.S.A	

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance 316LCM Rev.0 Type 316, 316L, UNS S31600, S31603. EN 1.4401, 1.4404 17-10-2L	Brand mark Herstellerzeichen Signe du producteur W	Inspectors stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion EAF AOD-Converter refining CC to bloom size (mm): 462x262

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-01	1	150x150	E231406	145080			1 634	915-2
01-02	1	150x150	E231406	145985			1 652	815-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais The requirements according to AMS-QQ-S-763D are fulfilled. The order requirements stipulated are satisfied. US-tested according to DLP OFP-222. Approved.	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel No remarks-Ohne Beanstandung-Pas de remarque PMI-test has been performed on every bar/billet with X-ray spectro, without remarks. No weld repair has been performed on the material. Free of known Mercury contamination at time of shipment.
EN ISO 9001:2015 and EN ISO 14001:2015. Certificate no. 5749-3027684-0102. Approved by TÜV NORD Scandinavia AB.	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. Certificate no. 07/203/9140/WP/0689/18 PED 2014/68/EU, approved by TÜV Nord Systems. Certificate no. 07/202/9140/WZ/0689/18	Degerfors Long Products AB Digitally signed by: Jörgen Johansson QA Head
Reg.No.:559332-4907 V.A.T.No.:SE559332490701 Registered office: Degerfors, Sweden	

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/13/2024 9ET

HEAT E231406 ORDER 711288/ 01 BOL 0262339 * CERTIFICATION * 03/13/24

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259477 3/13/24 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 21 Total Weight 34458 Approx. Hot Red. Ratio 138:1

WO 2128960 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U SON= 355066

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

APPROVED BY SARA MALIK 3/13/2024 9ET

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38262	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

.

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL.+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2471-23

DEGERFORS LONG PRODUCTS AB
S-693 81 DEGERFORS, SWEDEN
Ref.QA-Dept. Jörgen Johansson

Date-Datum-Date: 2023-11-21
Your order-Ihre Bestellung-Votre commande: 9320286

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d'expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**83104**	**273457**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel	Brand mark	Inspectors stamp	Melting process
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item	Quantity	Dimensions, mm	Cast No.	Lot No.	Test No	Heat treatm.Lot No	Weight Kg	Bloom No
01-03	1	150x150	E231406	145986	145986-1,2		1 608	815-1
01-04	1	150x150	E231406	145987	145987-1,2		1 616	915-1
01-05	1	150x150	E231406	145988	145988-1,2		1 782	803-1
01-06	1	150x150	E231406	145989	145989-1,2		1 820	905-1
01-07	1	150x150	E231406	145990	145990-1,2		1 816	914-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11
Ladle analysis attached

% Ferrite measured with ferritscope on samples from both billet ends. 8 points measured from half radius, in one line, cross the centre area to half radius on the other side of the centre.

	Billet end 1			Billet end 2			
Test No	min	max	average	min	max	average	Pit furnace no.
145986-1,2	0.0	0.13	0.02	0.0	0.26	0.10	2
145987-1,2	0.0	0.23	0.04	0.0	0.32	0.04	2
145988-1,2	0.0	0.20	0.06	0.0	0.10	0.01	2
145989-1,2	0.0	0.10	0.01	0.0	0.12	0.03	2
145990-1,2	0.0	0.11	0.01	0.0	0.10	0.02	2

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
The requirements according to AMS-QQ-S-763D are fulfilled. **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	**No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TÜV NORD Scandinavia AB.**	**No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Degerfors Long Products AB**
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office: Degerfors, Sweden**	**Digitally signed by: Jörgen Johansson** **QA Head**

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001311935

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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SELLER / VERKÄUFER / VENDEUR **PAGE 1 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED COLD DRAWN
PART NUMBER: SSD-HB-087500

SPECIFICATION: SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQC-03998 REV A (01/26/18)
SWAGELOK COMPANY SQS-00226 REV (08/23/17)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)
SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. I (07/28/22)
ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-22 (09/01/22)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 8 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
SWAGELOK COMPANY SVS-00012 (02/23/01)
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)

SIZE 0.875000 IN.(22.23 MM) HEX BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.021	1.14	0.50	0.034	0.026	17.60

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.12	2.04	0.37	0.45	0.02

MELT DATE: 07/18/23

CONTINUED ON NEXT PAGE

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FORM E2-366

REVIEWED
By Martin McMahon at 10:32 am, Jan 11, 2025

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001311935

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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P.O.BOX 0629
MEDINA ,OH 44258

SELLER / VERKÄUFER / VENDEUR **PAGE 2 OF 5**

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND INDUSTRIE SERVICE GMBH, NO. 01 202 USA/Q-03 8928, IN ACCORDANCE WITH PED 2014/68/EU ANNEX I PARA. 4.3 + AD 2000 W0
MATERIAL VISUAL AND DIMENSIONAL INSPECTED - ACCEPTABLE.
THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL REVISION 38, DATED 08/21/2022 "AS ACCEPTED BY SWAGELOK COMPANY" IN COMPLIANCE WITH ASME B & P V CODE SECTION III, DIVISION 1 SUBSECTION NCA 3800 2017 EDITION.
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
100% COMPARATOR TESTED TO DETECT/SORTOUT HIGH IRON/LOW ALLOY INCLUSIONS.
ULTRASONIC INSPECTED (IMMERSION) PER CTC PROCEDURE - ACCEPTABLE.
CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
EDDY CURRENT TESTED AND APPROVED AT FINISH
IT IS HEREBY CERTIFIED THAT THE SPECIALTY METALS SUPPLIED HEREUNDER HAVE BEEN PRODUCED IN THE UNITED STATES.
NO WELD REPAIR.
THIS MATERIAL HAS BEEN SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND MEETS ALL SPECIFICATION REQUIREMENTS.
INSPECTION CERTIFICATE 3.1 IN ACCORDANCE WITH EN 10204 AND DIN 50049
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
PROVISIONS OF 10 CFR PART 21 & 10 CFR PART 50 - APPENDIX B APPLY.
IN PRODUCTION OR TESTING OF MATERIAL SHIPPED AGAINST THIS ORDER, NO DIRECT CONNECTED MERCURY MANOMETER, MERCURY PUMPS, MERCURY SEALS, OR MERCURY IN GLASS THERMOMETERS HAVE BEEN USED. NOR IN SUCH PRODUCTION OR TESTING HAS MERCURY BEEN HANDLED IN THE IMMEDIATE VICINITY OF SUCH MATERIAL.
THIS CERTIFICATE AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY US, OR OUR SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE ORDER REQUIREMENTS AS MAY HAVE BEEN MODIFIED BY PRIOR CORRESPONDENCE BETWEEN THE PARTIES.
THIS MATERIAL WAS MANUFACTURED FREE FROM MERCURY, RADIUM AND ALPHA SOURCE CONTAMINATION.
ALL TESTS AND INSPECTIONS PERFORMED VERIFY CONFORMANCE TO SPECIFICATION REQUIREMENTS AND THE MATERIAL COMPLIES WITH ALL REQUIREMENTS OF THE PURCHASE ORDER.
INTERGRANULAR CORROSION TESTED PER ISO 3651
MATERIAL IS COMPLIANT TO REACH; THE E.U.'S REGISTRATION, EVALUATION, AUTHORIZATION, AND REGISTRATION OF CHEMICALS LEGISLATION.
MATERIAL IS COMPLIANT TO 2015/863/EU (ROHS3) DIRECTIVE.
THIS HEAT MELTED BY THE ELECTRIC ARC/AOD PROCESSES
MELT DATE OF HEAT: 07/18/23
MILL HEAT TREATMENT:
TYPE SOLUTION ANNEAL
TEMP 1951F (1066C)
TIME AT TEMP CONTINUOUS FURNACE
QUENCH WATER

CONTINUED ON NEXT PAGE

FORM E2-366

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Certification ID:001311935

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SWAGELOK COMPANY
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MEDINA ,OH 44258

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4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

HARDNESS AS SHIPPED, HRC - 20

***-->TESTED AT READING**

(T)RANSVERSE (L)ONGITUDINAL	L	L
YIELD STRENGTH, (0.20 %) KSI(MPA)	85.5(590)	86.5(596)
YIELD STRENGTH, (1.00 %) KSI(MPA)	96.5(665)	97.0(669)
TENSILE STRENGTH, KSI(MPA)	102.0(703)	102.0(703)
ELONGATION IN 2.00", %	37.0	37.0
ELONGATION IN 2.50", %	32.0	32.0
REDUCTION OF AREA, %	74.0	75.0

***-->TESTED AT READING**

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
***-->TESTED AT READING**

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (2H).

ORDER LENGTH REQUIREMENT: 144"

INTERGRANULAR CORROSION TEMP (F): 1292 HR: 0 MN: 30 QUENCH: WATER
***-->TESTED AT READING**

FORM E2-366

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4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

ADDRESS OF TESTING LOCATIONS:
READING - 101 WEST BERN ST, READING, PA 19601

MATERIAL HAS BEEN MELTED AND MANUFACTURED IN THE USA WHICH IS A QUALIFYING COUNTRY TO DFARS REQUIREMENTS 252.225-7014 WITH ALTERNATE 1 FOR QUALIFYING COUNTRY 225.872.1, SUPERSEDED BY DFARS REQUIREMENTS DFARS 252.225-7008 AND 252.225-7009.

UNLESS OTHERWISE STATED, THE TEST WERE PERFORMED TO THE LATEST REVISION OF THE STANDARDS LISTED BELOW: 1) BEND TEST - ASTM E290, 2) CHARPY IMPACT - ASTM E23, 3)COEFFICIENT OF LINEAR THERMAL EXPANSION - ASTM E228, 4)FRACTURE TOUGHNESS - ASTM E399, 5) BRINELL HARDNESS - ASTM E10, 6)ROCKWELL HARDNESS-ASTM E18, 7)MICRO VICKERS HARDNESS-ASTM E92, 8)KNOOP HARDNESS-ASTM E92, 9)MACRO VICKERS HARDNESS-ASTM E92, 10)STRESS RUPTURE/CREEP RUPTURE-ASTM E139, 11)STRESS RUPTURE(COMBINATION)-ASTM E292, 12)ROOM TEMPERATURE TENSILE-ASTM E8, 13)ELEVATED ROOM TEMPERATURE TENSILE-ASTM E21, 14)DECARBURIZATION-ASTM E1077 15)DELTA FERRITE AMS 2315, 16)GRAIN SIZE-ASTM E112, 17)INCLUSION CONTENT/MICROCLEANLINESS-ASTM E45, 18) INTERGRANULAR ATTACH - ASTM A262, 19)INTERGRANULAR CORROSION-ASTM A262, 20)MACRO ETCH&TESTING - ASTM A604/E381, 21)PITTING CORROSION - ASTM A923, 22)CREVICE CORROSION-ASTM G48, 23) HARDNESS CONVERSIONS - ASTM E140, 24)XRF-ASTM E572/E1085/E2465, 25) OES - ASTM E415/E1086, 26)COM - ASTM E1019, 27)FUS - ASTM E1019, 28)MS - CARPENTER METHODS 206.8500/206.8530 29)CHEMISTRY RESULTS ARE ROUNDED IN ACCORDANCE WITH ASTM A751 WHICH CONFORMS TO ASTM E29 WITH ONE SPECIAL EXCEPTION THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL, REVISION 38 DATED 08/21/2022.

CARPENTER'S QUALITY MANAGEMENT SYSTEM IS REGISTERED TO ISO 9001, AS9100, AND AS9120. THIS CERTIFICATION OF TEST IS TYPE 3.1 PREPARED IN ACCORDANCE WITH EN 10204 (DIN 50049). WE HEREBY CERTIFY THAT THE ABOVE TEST DATA ARE IN ACCORDANCE WITH THE PURCHASE ORDER AND SPECIFICATION REQUIREMENTS, AS DOCUMENTED IN THIS CERTIFICATE OF TESTS.

TEST METHODS ARE PER THE ASTM STANDARDS ON FILE AND IN EFFECT AT TIME OF ORDER ACCEPTANCE, STANDARD PRACTICES, OR AS AGREED UPON BETWEEN CARPENTER & CUSTOMER.

THE ABSENCE OF A REPORTED TEST TEMPERATURE INDICATES THAT THE TEST WAS COMPLETED AT ROOM TEMPERATURE.

FORM E2-366

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 5 OF 5**

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4505207307	**W51462**		**29165**

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

DECISION RULE: UNLESS OTHERWISE SPECIFIED IN A CUSTOMER/INDUSTRY SPECIFICATION, CARPENTER TECHNOLOGY CORPORATION WILL DETERMINE ACCEPTABILITY OF ANY TEST RESULT BY COMPARISON OF THE RESULT WITH THE SPECIFICATION LIMITS, WITHOUT ANY ADDITIONAL CONSIDERATION OF THE MEASUREMENT UNCERTAINTY. WHEN REQUESTED, CARPENTER TECHNOLOGY CORPORATION WILL PROVIDE UNCERTAINTY BUDGETS FOR ANY TEST RESULT THAT IS NOT ADDRESSED BY THE INDUSTRY STANDARD.

AMANDA EVANS /WI 27993 DIGITALLY SIGNED BY JASON M RAYMOND
ADMINISTRATOR - QUALITY
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W51462/HEAT 760675/LOT 01

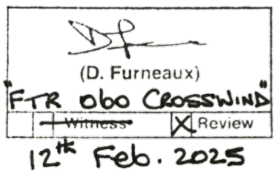


FORM E2-366

This certification is made to the customer printed on this form. Carpenter neither makes, nor assumes responsibility for, any representation or certification to other parties.
Die vorliegende Zertifizierung ist nur für den in diesem Formular genannten Kunden gültig. Carpenter übernimmt gegenüber Dritten keinerlei Haftung für die ausgewiesenen Daten oder Zertifizierungen.
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MATERIAL CERTIFICATION

Material	**Heat. No.**
Bolting - Stud/Nut	DX B7/L7 2H
	084 / 2HZN



Baker Hughes Confidential

INSPECTION CERTIFICATE BS EN 10204 3.1

CUSTOMER

NAME:	Purchase Order:
BAKER HUGHES EMEA UNLIMITED COMPANY	5052376852
	Date: 13/12/2024
	Internal Ref: 193330-1

HYDROBOLT HOLDINGS
MONMORE BUSINESS PARK
DIXON STREET
WOLVERHAMPTON
WV2 2EE
TEL: +44(0)1902 878000
FAX: +44(0)1902 878089

HYDROBOLT
STUDBOLT
PIPELINE

TEST CERTIFICATE No. 176368

1 OF 1

Description / Beschreibung		Material / Matiere	
ITEM	STUDBOLT	SPEC	ASTM A193
SPEC		GRADE	B7
DRAWING	412-2156 REV C	CAST	B2-2202454
PART No	412-2156		
SIZE	0.625"UNC X 4.25"		
STAMPING	DX,B7/L7		
QTY	24		

Heat Analysis / Analyse Chimique et Mecanique / Chemische und Mechanische Analyse

C	Si	Mn	P	S	Cr	Mo
0.400	0.220	0.830	0.013	0.0020	0.910	0.179

TENSILE TEST - OBTAINED VALUES

TEMP °C	TENSILE KSI	YIELD RP 0.2% KSI	E %	R.A %
RT	139.47	121.33	19.47	59.83

IMPACT TEST OBTAINED VALUES

IMPACT TEST	T °C	ABSORBED ENERGY JOULES 1	2	3

HARDNESS ON SAMPLE AFTER H.T 24 HRS

HB	HRB	T°C	MIN

FINAL HARDNESS

		HRC	MIN	MAX
		X	28	30

PROOF LOAD	VALUE kNf	CHECKED
		KD

CUSTOMER SPEC	
HEAT TREATMENT	QUENCHED AT 880°C FOR 60 MIN & TEMPERED @ 655°C FOR 120 MIN
CAST CODE	
PLATING	HOT DIP GALVANISED TO ASTM A153 / A143
FERRITE	
MACROETCH	S2/R2/C3
MICROSTRUCTURE	

MATERIAL ORIGIN	CHINA

CERTIFICATE OF CONFORMITY STATEMENT:
Certified that the goods detailed hereon have been inspected and tested in accordance with the conditions and requirements of the Contract or Purchase Order and unless otherwise stated above, conform in all respects to the specification(s)and / or drawing(s) relevent thereto.

PRINTED IN COMPLIANCE WITH BS EN 10204-3.1

Reviewed by: Nikki Horton (12)
Certification Engineer

ON BEHALF OF HYDROBOLT GROUP LTD

BAKER HUGHES
ACCEPTED
Signed: _____ Date: _____

INSPECTION CERTIFICATE BS EN 10204 3.1

CUSTOMER

NAME:	Purchase Order:
BAKER HUGHES EMEA UNLIMITED COMPANY	5052376852
	Date: 13/12/2024
	Internal Ref: 193330-1A

LONESTAR FASTENERS HYDROBOLT LTD
MONMORE BUSINESS PARK
DIXON STREET
WOLVERHAMPTON
WV2 2EE
TEL: +44(0)1902 878000
FAX: +44(0)1902 878089

HYDROBOLT
STUDBOLT
PIPELINE

TEST CERTIFICATE No. 178411

1 OF 1

Description / Beschreibung		Material / Matiere	
ITEM	HEAVY HEX NUT	SPEC	ASTM A194
SPEC		GRADE	2H
DRAWING	412-2156 REV C	CAST	M22134525
PART No	412-2156		
SIZE	0.625"UNC		
STAMPING	DX 2H		
QTY	48		

Heat Analysis / Analyse Chimique et Mecanique / Chemische und Mechanische Analyse

C	Si	Mn	P	S
0.40	0.24	0.83	0.015	0.004

TENSILE TEST - OBTAINED VALUES / IMPACT TEST OBTAINED VALUES / HARDNESS ON SAMPLE AFTER H.T 24 *HRS* / FINAL HARDNESS

TEMP °C	TENSILE	YIELD RP 0.2%	E %	R.A %	IMPACT TEST	T °C	ABSORBED ENERGY JOULES 1	2	3	HRB	MIN	MAX	T°C	HRB	HB	HRC	MIN	MAX	PROOF LOAD	VALUE LBF
										X	92	94	540			X	25.5	33	SAT	39550

CUSTOMER REQ	
HEAT TREATMENT	QUENCHED @830°C FOR 60 MIN, TEMPERED @ 520°C FOR 90 MIN.
CAST CODE	
PLATING	HOT DIP GALVANISED TO ASTM A153 / A143
FERRITE	
MACROETCH	S2 R2 C3
MICROSTRUCTURE	

RAW MATERIAL (STEEL) ORIGIN	CHINA

CERTIFICATE OF CONFORMITY STATEMENT:
Certified that the goods detailed hereon have been inspected and tested in accordance with the conditions and requirements of the Contract or Purchase Order and unless otherwise stated above, conform in all respects to the specification(s)and / or drawing(s) relevent thereto.

PRINTED IN COMPLIANCE WITH BS EN 10204-3.1

Reviewed by: Nikki Horton (12)
Certification Engineer

ON BEHALF OF LONESTAR FASTENERS HYDROBOLT LTD

PROMAT BD LTD BURTON DELINGPOLE
Unit 20, Walsall Enterprise Park
Regal Drive, Pleck,
Walsall. WS2 9HQ
Tel No. 01922 748310 Fax No. 01922 748320

Certificate of Conformity No 4246

This certificate meets the requirements of EN10204 type 2.1

Baker Hughes EMEA Unlimited Company,
Sensing House,
Shannon Free Zone East,
Shannon,
Co Clare CL. Ireland

Client Order No.	5052362004
Promat Job No.	PS047770
Date.	21/11/2024

ITEM 10	P/N: 183M7716	
8 OFF	5/8" X 4" LONG STUDBOLTS – ASTM A193 B7 CAST 216084	HOT DIP GALVANISED
16 OFF	5/8" HEAVY HEX NUTS – ASTM A194 GR 2H CAST SA53937	HOT DIP GALVANISED
ITEM 20	P/N: 183M5315	
16 OFF	5/8" X 3 ½" LONG STUDBOLTS – ASTM A193 B7 CAST 216084	HOT DIP GALVANISED
32 OFF	5/8" HEAVY HEX NUTS – ASTM A194 GR 2H CAST SA53937	HOT DIP GALVANISED

We certify that items supplied, comply fully with the requirements of the above referenced purchase order.

On Behalf of Promat BD Ltd.

Quality Control Dept.

PROMAT BD LTD
DJT0
QA VERIFIED/RELEASED

BAKER HUGHES
ACCEPTED
Signed: MC Date: 2/12/24

MANUFACTURERS OF STUDBOLTS AND SPECIAL FASTENERS
FOR INDUSTRIAL & PETRO-CHEMICAL REQUIREMENTS

STEADFAST ENGINEERING

Arden Works
No.2B Broadway
Hyde, Cheshire
SK14 – 4GA, United Kingdom
Tel- 0161 368 3636
Fax- 0161 368 3646

724001317-QC-DB-00014

MATERIAL TEST CERTIFICATE NO: 232972 DATE: 06/11/2024

CUSTOMER:
PROMAT BD LIMITED
UNIT 20, WALSALL ENTERPRISE PARK
REGAL DRIVE, PLECK
WALSALL
WEST MIDLANDS
WS2 9HQ

CUSTOMER O/NO: PD300324
DESCRIPTION: STUDBOLT
MATERIAL : ASTM A193
COATING : HOT DIP GALVANISED

MATERIAL CERTIFICATE TO EN10204 3.1

REV.3 15-09-16

MECHANICAL PROPERTIES

ITEM	QTY	PART NO.	SIZE	Cast No:	IMPACT TEST @ -101C			TENSILE	YIELD STRENGTH 0.2% OFFSET	ELONG 4D	REDUCTION OF AREA	HARDNESS	MARKING
					J			MPA	MPA	%	%	HBW	
1	16	183M5315	5/8" UNC X 4"	216084	31	34	33	948	837	21.2	61	293	B7 S 084
2	8	183M7716	5/8" UNC X 3.1/2"	216084	31	34	33	948	837	21.2	61	293	B7 S 084

QUENCHED & TEMPERED

CHEMICAL ANALYSIS (AS SUPPLIED)

CAST NO:	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	B					
216084	0.400	0.810	0.290	0.010	0.001	1.050	0.230	0.240	0.200	0.0001					

CERTIFIED THAT, UNLESS OTHERWISE STATED ABOVE, THE WHOLE OF THE ABOVE MENTIONED FASTENERS HAVE BEEN MANUFACTURED, TESTED AND INSPECTED IN ACCORDANCE WITH THE CONTRACT AND CONFORM FULLY TO THE STANDARDS.

ADDITIONAL TESTS: VISUAL TEST SATISFACTORY

SIGNED:

FOR AND ON BEHALF OF STEADFAST ENGINEERING CO LTD, QA DEPARTMENT.

REGISTERED IN ENGLAND No. 1410223
REGISTERED OFFICE AS UK ADDRESS

THE WORKS OPERATE A QUALITY MANAGEMENT SYSTEM COMPLIANT TO ISO9001 AND THE REQUIREMENTS OF ANNEX 1, SECTION 4.3 OF THE PRESSURE EQUIPMENT DIRECTIVE (PED) 2014/68/EU

PROMAT BD Ltd QA/QC DEPT VALIDATED LJB ...TE ACCEPTED 21/11/24

REV 00

sidenor

MILL TEST CERTIFICATE

ISO 9001; IATF 16949; ISO 14001 E ISO 45001

AENOR QUALITY MANAGEMENT ISO9001 | AENOR QUALITY IN AUTOMOTIVE SECTOR IATF-16949

Vitoria Plant

SIDENOR ACEROS ESPECIALES S.L.U.
Portal De Gamarra, 22 01080 Vitoria (Alava)
TLF. 945164678 FAX 945164752
www.sidenor.com

Product Made in Spain

CUSTOMER:**MARLA TUBE FITTINGS LIMITED**		WORKS REFERENCE:**2180592**
REFERENCE:**PH021598**	SALES ORDER:**340058-1**	HEAT NUMBER:**216084**
PRODUCT NR:**RBL7058**	MASTER REFERENCE:**277513**	ROLLED:**28.07.2021**

REQUIRED PRODUCT

A320L7 ROUND BARS COLD DRAWN Q+T+STRESS RELIEVED 0.560"-0.563" ISO h10 3.000/4.000mm NORMAL

EXPEDITION | DELIVERY:0080748643 WEIGHT (KG):20.979 BUNDLES:21 UNITS:4.194

MADE ACCORDING TO

ASTM A193-A193M -19 01.11.2019; ASTM A29-A29M -20 01.07.2020; ASTM A320-A320M 18 01.06.2018
ASTM A962-A962M 19 01.09.2019; EN 10204 - OCT. 2004 3.1; ISO 9001 5ED. 2015
MARLA MDS 109131-REV 01 - 09.03.2017

CHEMICAL ANALYSIS OF HEAT U:% HEAT NUMBER:216084

	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	B
Cer.	0,400	0,810	0,290	0,010	0,001	1,050	0,230	0,240	0,200	0,0001

MECHANICAL PROPERTIES AS SUPPLIED (CONDITIONS)

Temperature of:(1):Quenching 860°C; Time:(1):45Minutes; Cooling:(1):Oil
Temperature of:(2):Tempering 655°C; Time:(2):150Minutes; Cooling:(2):Air
Temperature of:(3):Stress Relieved 600°C; Time:(3):120Minutes

MECHANICAL PROPERTIES AS SUPPLIED (TEST)

Specimen Test location:Nucleus; Tensile dir.:Longitudinal
Ts:948MPa; Ys:Rp(0,2%) 837MPa; El.:4d 21,2%; Z:61%
Notch Impact dir.:Longitudinal; N. Impact sample type:CHARPY-V; Notch Impact Temp.:-101°C; K(1):31J
K(2):34J; K(3):33J; K(avg):32,67J; K(single):31J; Hardness:298HV10; Surface hardness:293HBW
Hardness at:at 1/2 radius of the bar 295HBW

ADDITIONAL TESTS (SUPPLY CONDITIONS)

Macroetching std.(ASTM E381 17 01.06.2017); Macroetching(1):S 1; Macroetching(2):R 1; Macroetching(3):C 1

ADDITIONAL INFORMATION

Continuous Casting 155 x 155 mm.; Reduction ratio 135,95; Dual-certified ASTM A193 B7/ ASTM A320 L7;

Material melted and manufactured 100% in Spain through the Electric Arc Furnace (EAF) and Vacuum Degassing route (VOD).
Steel not exposed to Mercury, or to any other metal alloy that is liquid, at ambient temperatures during processing or while in Sidenor's possession.
Steel is free from Uranium or any other harmful radioactive contamination.
Steel products were not repaired by welding.

TECHNOLOGY & QUALITY CERTIFIES THAT THE PRODUCT FULL FILLS THE ORDER'S SPECIFICATION

APPROVED BY:IGNACIO URBIETA LAVIADA SIGN:

DATE:12.01.2022

REF.:4001872130000

Analyst of Quality certificates

THE MANUFACTURE OF STUDBOLTS, ANCHOR BOLTS AND ASSOCIATED ITEMS. HOT UPSET FORGING. THE MANUFACTURE AND SUPPLY OF PLATE FLANGES, SPECTACLE BLINDS AND SPADE SPACERS. THE SUPPLY OF DRIP RINGS, GASKETS AND ASSOCIATED ITEMS.

STEADFAST ENGINEERING

STEADFAST ENGINEERING COMPANY LTD
2 BROADWAY
HYDE, CHESHIRE, SK14 4GA
UNITED KINGDOM
TEL: +44 (0) 161 368 3636
FAX: +44 (0) 161 368 3646
www.steadfast.co.uk

Date: 06th NOVEMBER 2024

PROMAT BD LIMITED
UNIT 20, WALSALL ENTERPRISE PARK
REGAL DRIVE, PLECK
WALSALL
WEST MIDLANDS
WS2 9HQ

For the attention of Quality Assurance

LETTER OF CONFORMITY

We hereby certify that the goods supplied against the following order conform
To the specifications stated below:-

ORDER No: PD300324

ITEM	QTY	SIZE	REF:	DESCRIPTION
1	32	5/8	183M5315	MILD STEEL FLAT WASHER – HOT DIP GALVANISED
2	16	5/8	183M7716	MILD STEEL FLAT WASHER – HOT DIP GALVANISED

.....
On Behalf of Steadfast Engineering Company Ltd

PROMAT BD LTD QA/QC DEPT VALIDATED LJB ACCEPTED 21/11/24

A Division of the Marla Group of Companies Registered address
3 Kinwarton Farm Road
Arden Forest Industrial Estate
Alcester, Warwickshire B49 6EH

Registered in England No. 1410223
Registered Office as UK Address

MANUFACTURERS OF STUDBOLTS AND SPECIAL FASTENERS
FOR INDUSTRIAL & PETRO-CHEMICAL REQUIREMENTS

STEADFAST ENGINEERING

MATERIAL TEST CERTIFICATE NO: 229366 **DATE:** 06/11/2024

CUSTOMER:
PROMAT BD LIMITED
UNIT 20, WALSALL ENTERPRISE PARK
REGAL DRIVE, PLECK
WALSALL
WEST MIDLANDS
WS2 9HQ

CUSTOMER O/NO: PD300324
DESCRIPTION: HEAVY HEX NUTS
MATERIAL : ASTM A194 GRADE 2H
COATING : HOT DIP GALVANISED

Arden Works
No.2B Broadway
Hyde, Cheshire
SK14 – 4GA, United Kingdom
Tel- 0161 368 3636
Fax- 0161 368 3646

MATERIAL CERTIFICATE TO EN10204 3.1

REV.3 15-09-16

MECHANICAL PROPERTIES

ITEM	QTY	PART NO.	SIZE	Cast No:	PROOF LOAD		IMPACT TEST @ -73C			HARDNESS SAMPLE			PRODUCTION HARDNESS		MARKING
					39,550 lbf		N/A			AFTER 24H @ 540C		HRC	HB	HRC	
1	32	183M5315	5/8" UNC	SA53937	SATISFACTORY							26		32	2HZN CGC
2	16	183M7716	5/8" UNC	SA53937	SATISFACTORY							26		32	2HZN CGC
					QUENCHED AND TEMPERED										

CHEMICAL ANALYSIS (AS SUPPLIED)

CAST NO:	C	SI	MN	P	S	CR	NI	CU
SA53937	0.45	0.25	0.72	0.017	0.009	0.03	0.02	0.01

CERTIFIED THAT, UNLESS OTHERWISE STATED ABOVE, THE WHOLE OF THE ABOVE MENTIONED FASTENERS HAVE BEEN MANUFACTURED, TESTED AND INSPECTED IN ACCORDANCE WITH THE CONTRACT AND CONFORM FULLY TO THE STANDARDS.

ADDITIONAL TESTS: VISUAL TEST SATISFACTORY

SIGNED:

FOR AND ON BEHALF OF STEADFAST ENGINEERING CO LTD, QA DEPARTMENT.

REGISTERED IN ENGLAND No. 1410223
REGISTERED OFFICE AS UK ADDRESS

THE WORKS OPERATE A QUALITY MANAGEMENT SYSTEM COMPLIANT TO ISO9001 AND THE REQUIREMENTS OF ANNEX 1, SECTION 4.3 OF THE PRESSURE EQUIPMENT DIRECTIVE (PED) 2014/68/EU

PROMAT BD LTD QA/QC DEPT VALIDATED LJB ACCEPTED 21/11/24

256556

INSPECTION CERTIFICATE

KPF FACTORY : 50, CHUNGJUSANDAN 5-RO, CHUNGJU-SI
CHUNGCHEONGBUK-DO, KOREA 380-250
TEL : (043)849 - 1114 FAX : (043)849 - 1234

FIELD OF TESTING : MECHANICAL TESTING
LAB. ID. : 111983
CERT. NO. : 0882.01

STANDARD OF CERTIFIED : IATF 16949, ISO 9001, ISO 14001
CERTIFICATE NO. : TS-01899, AC-01899, EAC-01899

STANDARD OF CERTIFIED : EN 14399-1,2,3,4,5,6,10
CERTIFICATE NO. : 1020 - CPR - 070038467

STANDARD OF CERTIFIED : EN 15048-1
CERTIFICATE NO. : 1020 - CPR - 070048404

Certificate No. : J420210309031
P/O No. : PH020769
L/C No. : STEADFAST(T/T60)
Date Issued : 2021.03.09
Date Shipped : 2021.03.09
Date Tested : 2021.01.13
Date Manufactured : 2020.12.29
Specifications : ASTM A194/A194M - 18

Customer : STEADFAST
Description : H/H N GR.2H HDG
Grade : GR.2H
Size : 5/8-11UNC(0.020")
Marking : 2HZN,CGC,KPF LOGO
Surface Condition : HDG
Lot No. : 2034058200
Q'ty Shipped : 32,320 PCS

229366

1. Chemical Composition (%)

Heat No.		C x100	Si x100	Mn x100	P x1000	S x1000	Cr x100	Mo x100	Ni x100	B x10000	Cu x100	Ti x100	V x100	Al x1000
Spec.	Min.	40												
	Max.		40	100	40	50								
SA53937		45	25	72	17	9	3		2		1			

2. Macroetch Meet

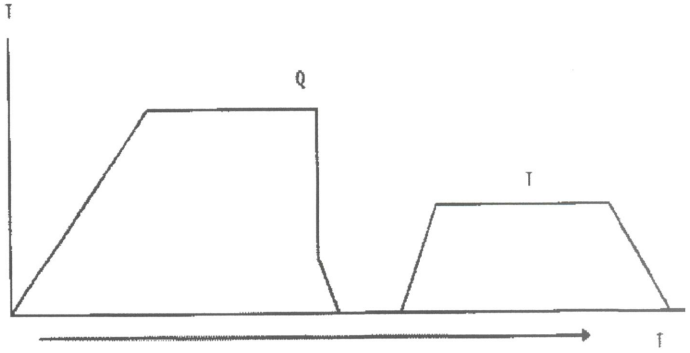
Division	Surface Condition	Random Condition	Center Segregation	Spec. of Test Method
Spec.	S2	R2	C3	ASTM E381 - 2017
Results	S1	R1	C1	
Tested By	C.I.LEE			

3. Mechanical Properties

Division		Hardness Surface	Hardness Core	Proof Load	Sample Nut Hardness 540℃/24hr	Impact Test Individual	Impact Test Average
		n= 5		n = 5	n = 1		
Unit	Min.	HRC		LBF	HRB		
	Max.	HRC					
Spec.	Min.	24		39,550	89		
	Max.	35					
Results	1	HRC 32		39,550	HRC 26		
	2	32		39,550			
	3	31		39,550			
	4	32		39,550			
	5	31		39,550			
	6						
	7						
	8						
	9						
	10						
	Avg.	32		39,550	26		
Tested By		C.I.LEE		C.I.LEE	C.I.LEE		
Spec. of Test Method		ASTM A370-19		ASTM A370-19	ASTM A370-19		

4. Heat Treatment

Quenching	Min. Temp.	
	Max. Temp.	
	Working Temp.	875 ℃
	Holding Time	30 min.
Tempering	Min.Temp.	455 ℃
	Working Temp.	480 ℃
	Holding Time	90 min.



Reference : 1. PART NO:HN058UNC2HGVK
2. EN10204-3.1

This is to certify that the above results are true and correct in every details

jai man Park
JAI - MAN PARK
Chief of Quality Management Dept

KPF

7240013417-QC-DB-00014 REV 00

KSA
ISO 9001/14001 CERTIFIED
IATF 16949 CERTIFIED

INSPECTION CERTIFICATE
검 사 증 명 서

SeAH SeAH Special Steel Co.,Ltd.
SEOUL OFFICE
24F, SEAH TOWER,45 YANGHWA-RO,MAPO-GU,SEOUL 121-841,KOREA
TEL: (02) 6970-0200 FAX: (02) 6970-0208
HEADQUARTERS & POHANG WORKS
40 GOEDONG-RO,NAM-GU,POHANG-SI,GYEONGSANGBUK-DO 790-240,KOREA
TEL: (054) 285-8833 FAX: (054) 285-8832
CHUNGJU WORKS I
103 CHUNGJUSANDAN2-RO,CHUNGJU-SI,CHUNGCHEONGBUK-DO,KOREA
TEL: (043) 855-2170 FAX: (043) 855-2174
CHUNGJU WORKS II
34 CHUNGJUSANDAN1-RO,CHUNGJU-SI,CHUNGCHEONGBUK-DO,KOREA
TEL: (043) 842-0680 FAX: (043) 842-0683

CUSTOMER/수요가: (주)송현홀딩스
ORDER NO./수주번호: CD2020111594-7
MANUFACTURE NO./제조번호: P20BHD352
COMMODITY/품명: S45C PC/O ROD 원형 22

CERTIFICATE NO./증명서 번호: P20201124-00134
DATE OF ISSUE/발행일자: 2020-11-24
COATING/피막:
PACKING/포장: BARE

SPECIFICATION/규격: JIS G4051

MILL NO. 소재번호		PRODUCT NO. 제품번호	WEIGHT 제품중량	DIA 선경	LENGTH 길이	ROUND-NESS 편경차	PHYSICAL PROPERTIES 물리적 성질 검사										APPEARANCE 외관
Heat No	Coil No						Y.S	T.S	EL	R.A	HARDNESS	S.A	DECARBURIZATION		CARBURIZATION Y/N	ST'GT 직진도	
			Kg	mm		mm	kgf/mm²	kgf/mm²	%	%	HrB	GRADE	DmF	DmT		mm/M	
SPEC	MAX MIN			22.500 21.500		0.600											
SA53930	VBF5450481	0100	1,985	22.000		0.300											GOOD
SA53930	VBF5450471	0200	1,975	22.000		0.300											GOOD
SA53937	VBF5520081	0300	1,970	22.000		0.300											GOOD
SA53937	VBF5520051	0400	1,967	22.000		0.300											GOOD
SA53937	VBF5520061	0500	1,961	22.000		0.300											GOOD
TOTAL		5	9,858	REMARK:													

MILL NO. 소재번호		CHEMICAL COMPOSITION(%) 화학성분																OTHER THINGS 기타		
Heat No	Coil No	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	Sol-Al	Pb	B	Ti	V	Bi				
		X100			X1000		X100				X1000	X100	X10000	X1000		X100				
SPEC	MAX MIN	48 42	35 15	90 60	30	35	20		20	30										
SA53930	VBF5450481	45.38	25.6	71.9	10.7	8.5	2		1.2	0.9										
SA53930	VBF5450471	45.38	25.6	71.9	10.7	8.5	2		1.2	0.9										
SA53937	VBF5520081	45.03	24.8	72.3	16.9	9	3.4		1.5	1.1										
SA53937	VBF5520051	45.03	24.8	72.3	16.9	9	3.4		1.5	1.1										
SA53937	VBF5520061	45.03	24.8	72.3	16.9	9	3.4		1.5	1.1										

Accepted
2020.11.25
KPF QM

SURVEYOR TO

NOTES(주) T.S:Tensile Strength Y.S:Yield Strength EL:Elongation R.A:Reduction of Area S.A:Spheroidized Annealing
DmF:Decarburized microscope Ferrite DmT:Decarburized microscope Total ST'GT:Straightness

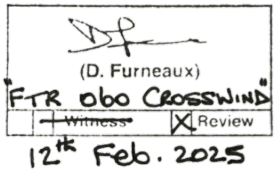
WE HEREBY CERTIFY THAT MATERIAL HAS BEEN TESTED IN ACCORDANCE WITH THE SPECIFICATION.
상기 강재는 규정의 시험을 행하여 합격하였음을 증명합니다.

CHIEF OF Q.A SECTION

Tae Won Lee

MATERIAL CERTIFICATION

Material	**Heat No.**
1" Pipe / Flange	TH21626 / N2010228AS02



Baker Hughes Confidential

Chongqing Endurance Industry Stock Co.,Ltd.The Yangliu street No.6 of Chongqing.

CERTIFICATE OF CONFORMANCE

We certify that the whole of the material detailed below has been inspected and certified, and fully conform to the purchase order,drawings,and specifications.Tel：023-67300160 Number：100

Your purchase order NO: 5052086923

Your part NO: 566-361 (REV B)

Date: 30-May-23

Certificate No: ND230403

Batch No: TH21626/N210228AS02-ND230403

Remark:

Quality Control Dept.Quality Engineer

Sign by/date: 2023.5.30

BAKER HUGHES ACCEPTED Signed: 14/6/23

渗透检验报告
Liquid Penetrant Examination Report

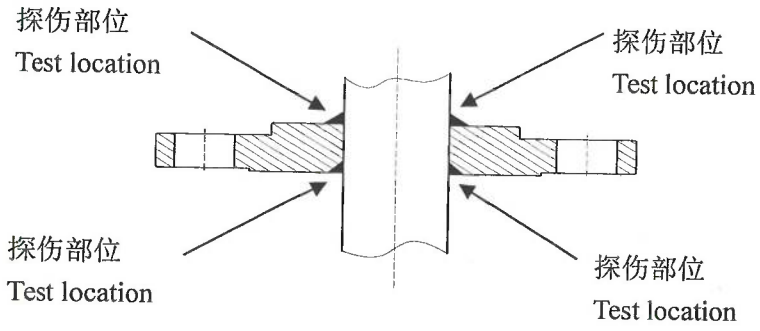
No. 230432
Page 1 of 1

工作令号 Work No.	0000391	零部件号/序号 Part/Joint No.	5052059150 1~100
项目名称 Work Name	Double Welded Barrel Assembly	图号 DWG No.	566-361（Rev B）
材质及厚度 Material& Thk.	ASTM A182 F316/316L and ASTM A312 TP316/316L	检验地点 Location	workshop
检验规程 Procedure	NDAP008 Rev.7		
渗透剂类型 Type of penetrant	■ 着色 Color Contrast □ 荧光 Fluorescent	■ 溶剂清洗 Solvent removable □ 水清洗 Water washable	
表面 Surface Condition	□ 焊后 As welded ■ 机加工 Machined □ 打磨 Ground	检验温度 Temperature	22 ℃

商品名称 Exam. Material	厂家 Manufacturer	牌号 Type	批号 Lot No.	操作时间 Applied Time
预清洗 Pre-cleaner	上海新美达	DPT-5	220104	10 min
渗透剂 Penetrant	上海新美达	DPT-5	220913	12 min
清洗剂 Remover	上海新美达	DPT-5	220104	11 min
显像剂 Developer	上海新美达	DPT-5	220913	13 min

光照设备 Lighting Equipment	TGX-918 LED Searchlight	光照度 Light intensity	1085 Lx	检验日期 Date Examined	2023.5.16

详细记录 Examination Details



Detection Results:

There are 100 welded joints in this batch of parts and the results meet ASME Ⅷ Div. 1 APPENDIX 8.

验收标准 Accept STD.	结果 Result
ASME Ⅷ Div. 1 APPENDIX 8	■ 合格 Acceptable □ 不合格 Unacceptable

检验 Examined by PT Level II

日期 Date 2023.5.16

BAKER HUGHES ACCEPTED Signed: Date: 14/6/23

温州市中星管业有限公司 Wen Zhou Zhong Xing Guan Ye CO.,LTD.

不锈钢产品质量证明书 Mill Test Certificate

收货单位 Customer	重庆耐德工业股份有限公司 Chongqing Endurance Industry Stock Co.,Ltd.								交货状态 CONDITION	固溶 SOLUTION ANNEALED		证明书号 CERTIFICATE NO.	1812063981
产品名称 COMMODITY	不锈钢无缝钢管 SEAMLESS STAINLESS STEEL TUBE				标准 SPECIFICATION	ASME SA312	支数 PIECES	423				热处理批号 HEAT TREATMENT NO.	1812063981A
钢号 GRADE	TP316L		规格 SIZE(mm)	Φ34.4*6.85*855		重量 WEIGHT(kgs)						签发日期 DATE OF ISSUE	2023.3.24
炉号 HEAT NO.	化学成分(CHEMICAL CONTENTS(WT%)									抗拉强度 TS(MPa)	伸长率(%) EL	屈服强度 0.2%YS(MPa)	硬度 HARDNESS
	C	Mn	P	S	Si	Ni	Cr	Mo	Ti				
N210228AS02	0.016	0.82	0.037	0.0006	0.354	10.05	16.36	2.02	/	542	44	227	145HB
外形尺寸 OUTSIDE MEASUREMENT	表面质量 SURFACE QUALITY		水压试验 HYDROSTATIC TEST	涡流探伤 EDDY CURRENT TEST (100%)		扩口试验 FLARING TEST	压扁试验 FLATTENING TEST		晶间腐蚀 IC-TEST			晶粒度 GRAIN SIZE	
合格 ACCEPTABLE	合格 ACCEPTABLE		合格 ACCEPTABLE	合格 ACCEPTABLE		合格 ACCEPTABLE	合格 ACCEPTABLE		合格 ACCEPTABLE			/	

Remarks:1、The hardness is 145HB according to the specification of the NACE MR-01-75/MR-01-03

2、1050-1080℃·1.5-2.5h Solution treatment and quenched in water;

3、We hereby certify that material described herein has manufactured and tested with satisfactory results in accordance with the requirements of the above material specification.

Judges: Yang Fei Zhu

Comfirmed: Yang Fei Zhu

单位盖章 复印无效

UNIT STAMP:

温州市中星管业有限公司 质量检验章

Inspection Certificate EN 10204：2004.3.1 生产许可证编号：ZX01-21-00061

DIN EN ISO9001-2000 NO: 04006Q13002ROM

ACCEPTED Signed: Date: 14/6/23

7240044117-QC-DB-00014 REV 00

上海点山实业有限公司检验证明书

Shanghai DianShan Industrial Co.,Ltd (ISO-9001:2015)

地址：上海青浦区华新镇华纪路233号 邮编:201708
电话Tel:(86-21)59796981/59796997 传真Fax:(86-21)59793959

客户Customer	重庆耐德工业股份有限公司	日期Date	2023-4-7	编号File	HT230407001
钢种Steel Grade	UNS S31603 / 316L	品名Commodity	成品法兰	定单号码Order	

项目 Item	轧号 rolling-No	炉批号 Heat No.	尺寸 Size(mm)	数量 Quantity(P'cs)	重量 Weight(kg)	区分 Condition	特殊要求 Workmanship
1	-	TH21626	2" 150#	200		HRS	S:固溶化(Solution Treated)

化学成分(重量百分比)Chemical Composition(WT%)

Kind of Text	C	Si	Mn	P	S	Ni	Cr	Mo	N
Spec	≤ 0.03	≤ 1.00	≤ 2.00	≤ 0.045	≤ 0.030	10.0 14.0	16.0 18.0	2.00 3.00	≤ 0.10
1	0.018	0.471	1.14	0.035	0.004	12.12	16.48	2.069	0.031

硬度 Hardness (HB)	机械性质Mechanical Properties				
	抗拉强度 Tensile Strength (N/mm2)	屈伏强度 Yield Strength (N/mm2)	伸长率 Elongation (%)	面积缩减率 Reduction of Area (%)	表面状况 Surface Condtion
	≥485	≥170	≥40	≥50	
168.5	543	238	53	64	OK

区分(Conditon): FC炉冷 (Furnace Cooled)
S:固溶化(Solution Treated) HR:热轧(Hot Rolled)
HF:热锻(Hot Forged) P:抛光(Polished)
R:压光(Reeled) A:退火(Annealed)
CD:冷抽(Cold Drawn) CG:研磨(Centerless Grinding)
RS: 矫直(Re Straight ness Turned) ST: 剥皮(Smooth

备注:Remark
1.Conformity to ASTM A182
2. In According With EN 10204-2004 3.1
3. Conformity to NACE MR0175

Shape: FB:Rectangu
H:Hexagond
S:Square
SR:Square-Round
E:Ellipse
RB:Rectangular

此证明表所列产品均依材料规格制造及试验并符合规格要求
Here We certify that material described herein has been manufactured and tested with satisfactory resuslts in accordance with the requirement of the above material specification

报告人Report	舒艳娇	批准Aprrove	质检处	盖章 Seal	

BAKER HUGHES ACCEPTED Signed: Date: 14/6/23

MANAGER OF QUAL ITY ASSURANCE DEPARTMNT

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230412

Customer BH

Part No.

Part Name

Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923

Manufacturer Chongqing Endurance Industry Stock Co., Ltd.

Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China

Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			1	2	3	4	5	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.691	0.691	0.691	0.690		calipers	Pass
3	deepness	0.06REF					0.061	0.062	0.062	0.063	0.063		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.312	Φ1.312	Φ1.313	Φ1.313		calipers	Pass
6	cylindricity	0.015				CTQ	0.004	0.006	0.005	0.004	0.004		dial indicator	Pass
7	length	30.5	0.06	0.06			30.520	30.512	30.516	30.520	30.512		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.020	33.012	33.016	33.020	33.012		ruler	Pass
10	thickness	1.00MIN				CTQ	1.014	1.015	1.016	1.016	1.016		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.002	0.004	0.004	0.003	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.108	1.108	1.109	1.108	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: [signature]

Date Inspected: 2023.5.22

Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230413

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd.
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			6	7	8	9	10	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.692	0.690	0.691	0.691	0.691		calipers	Pass
3	deepness	0.06REF					0.063	0.062	0.063	0.063	0.063		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.313	Φ1.313	Φ1.311	Φ1.313		calipers	Pass
6	cylindricity	0.015				CTQ	0.002	0.004	0.004	0.003	0.004		dial indicator	Pass
7	length	30.5	0.06	0.06			30.528	30.512	30.512	30.512	30.524		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.028	33.012	33.012	33.012	33.024		ruler	Pass
10	thickness	1.00MIN				CTQ	1.017	1.015	1.016	1.016	1.016		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.002	0.004	0.003	0.002	0.004		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.108	1.108	1.108	1.108	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡松 Date Inspected: 2023.5.22 Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230414

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			11	12	13	14	15	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.691	0.692	0.692	0.690		calipers	Pass
3	deepness	0.06REF					0.062	0.063	0.063	0.063	0.062		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.314	Φ1.313	Φ1.313	Φ1.314		calipers	Pass
6	cylindricity	0.015				CTQ	0.005	0.004	0.004	0.004	0.003		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.508	30.504	30.524	30.512		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.012	33.008	33.004	33.024	33.012		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.016	1.017	1.017	1.015		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.002	0.002	0.003	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.109	1.108	1.109	1.109	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: [signature]

Date Inspected: 2023.5.22

Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

ENDURANCE 耐德工业

Inspection Report

Report No.:230415

Customer BH

Part No.

Part Name

Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923

Manufacturer Chongqing Endurance Industry Stock Co., Ltd

Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China

Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			16	17	18	19	20	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.691	0.691	0.691	0.691		calipers	Pass
3	deepness	0.06REF					0.063	0.063	0.062	0.063	0.063		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.314	Φ1.313	Φ1.314	Φ1.311		calipers	Pass
6	cylindricity	0.015				CTQ	0.004	0.004	0.002	0.002	0.004		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.516	30.524	30.512	30.516		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.012	33.016	33.024	33.012	33.016		ruler	Pass
10	thickness	1.00MIN				CTQ	1.017	1.017	1.016	1.016	1.017		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.003	0.002	0.002	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.109	1.108	1.109	1.109	1.108		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡沧

Date Inspected: 2023.5.22

Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

ENDURANCE 耐德工业

Inspection Report

Report No.:230416

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			21	22	23	24	25	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.691	0.693	0.692	0.691		calipers	Pass
3	deepness	0.06REF					0.063	0.063	0.063	0.063	0.062		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.313	Φ1.309	Φ1.309	Φ1.311	Φ1.313		calipers	Pass
6	cylindricity	0.015				CTQ	0.003	0.004	0.002	0.005	0.004		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.512	30.512	30.516	30.512		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.012	33.012	33.012	33.016	33.012		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.017	1.017	1.017	1.016		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.002	0.003	0.002	0.002	0.000		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.108	1.109	1.108	1.109	1.108		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: [signature] Date Inspected: 2023.5.22 Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230417

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			26	27	28	29	30	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.692	0.690	0.691	0.691	0.692		calipers	Pass
3	deepness	0.06REF					0.062	0.062	0.062	0.062	0.062		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.313	Φ1.313	Φ1.313	Φ1.313	Φ1.313		calipers	Pass
6	cylindricity	0.015				CTQ	0.005	0.004	0.004	0.004	0.005		dial indicator	Pass
7	length	30.5	0.06	0.06			30.520	30.504	30.508	30.508	30.512		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.020	33.004	33.008	33.008	33.012		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.016	1.017	1.017	1.016		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.004	0.003	0.003	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.109	1.109	1.109	1.109	1.108		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡冷 Date Inspected: 2023.5.22 Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230418

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			31	32	33	34	35	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.691	0.692	0.691	0.691		calipers	Pass
3	deepness	0.06REF					0.063	0.062	0.062	0.062	0.062		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.311	Φ1.314	Φ1.313	Φ1.314	Φ1.313		calipers	Pass
6	cylindricity	0.015				CTQ	0.005	0.004	0.006	0.005	0.005		dial indicator	Pass
7	length	30.5	0.06	0.06			30.508	30.512	30.516	30.508	30.512		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.008	33.012	33.016	33.008	33.012		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.017	1.017	1.016	1.018		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.002	0.003	0.003	0.004	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.109	1.108	1.109	1.109	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡冷

Date Inspected: 2023.5.22

Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd

Inspection Report

Report No.:230419

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			36	37	38	39	40	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.692	0.691	0.691	0.689	0.691		calipers	Pass
3	deepness	0.06REF					0.062	0.063	0.063	0.063	0.063		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.309	Φ1.314	Φ1.309	Φ1.311		calipers	Pass
6	cylindricity	0.015				CTQ	0.004	0.005	0.004	0.004	0.005		dial indicator	Pass
7	length	30.5	0.06	0.06			30.516	30.492	30.492	30.512	30.390		ruler	Pass
8	length	2.50REF					2.500	2.513	2.514	2.500	2.618		ruler	Pass
9	length	33	0.10	0.10			33.016	33.005	33.006	33.012	33.008		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.015	1.015	1.014	1.017		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.004	0.003	0.003	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.108	1.107	1.107	1.109	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡兴 Date Inspected: 2023.5.22 Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230420

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			41	42	43	44	45	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.690	0.692	0.691	0.692	0.692		calipers	Pass
3	deepness	0.06REF					0.063	0.063	0.062	0.063	0.063		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.312	Φ1.314	Φ1.313	Φ1.313	Φ1.311		calipers	Pass
6	cylindricity	0.015				CTQ	0.005	0.005	0.004	0.004	0.003		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.508	30.512	30.512	30.516		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.012	33.008	33.012	33.012	33.016		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.016	1.013	1.013	1.016		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.002	0.003	0.002	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.109	1.108	1.108	1.108	1.108		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 林冷 Date Inspected: 2023.5.22 Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

ENDURANCE 耐德工业

Inspection Report

Customer: BH
Part No.:
Part Name:
Drawing No.: 566-361 (REV B)

Report No.:230421
Purchase Order No.: 5052086923
Manufacturer: Chongqing Endurance Industry Stock Co., Ltd
Address: No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced: 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			46	47	48	49	50	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.692	0.692	0.692	0.692	0.692		calipers	Pass
3	deepness	0.06REF					0.063	0.063	0.063	0.063	0.063		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.314	Φ1.313	Φ1.311	Φ1.313		calipers	Pass
6	cylindricity	0.015				CTQ	0.004	0.003	0.005	0.006	0.004		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.512	30.512	30.516	30.528		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.012	33.012	33.012	33.016	33.028		ruler	Pass
10	thickness	1.00MIN				CTQ	1.017	1.017	1.017	1.017	1.017		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.003	0.004	0.003	0.002		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.108	1.108	1.108	1.109	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 杨飞

Date Inspected: 2023.5.22

Stamp of manufacturer:

7240015177-QC-DB-00014 REV 00

Chongqing Endurance Industry Stock Co., Ltd.

ENDURANCE 耐德工业

Inspection Report

Report No.:230422

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			51	52	53	54	55	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.692	0.693	0.692	0.692	0.693		calipers	Pass
3	deepness	0.06REF					0.062	0.061	0.062	0.062	0.062		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.312	Φ1.313	Φ1.313	Φ1.313	Φ1.313		calipers	Pass
6	cylindricity	0.015				CTQ	0.006	0.005	0.005	0.004	0.005		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.528	30.524	30.504	30.512		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.504		ruler	Pass
9	length	33	0.10	0.10			33.012	33.028	33.024	33.004	33.016		ruler	Pass
10	thickness	1.00MIN				CTQ	1.017	1.017	1.017	1.017	1.017		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.004	0.003	0.003	0.003	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.109	1.107	1.108	1.109	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: [signature]

Date Inspected: 2023.5.22

Stamp of manufacturer:

7240013117-QC-DB-00014 REV.00

ENDURANCE
耐 德 工 业

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230423

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			56	57	58	59	60	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.692	0.690	0.691	0.691	0.691		calipers	Pass
3	deepness	0.06REF					0.062	0.062	0.062	0.063	0.062		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.311	Φ1.313	Φ1.312	Φ1.313	Φ1.313		calipers	Pass
6	cylindricity	0.015				CTQ	0.006	0.004	0.004	0.005	0.004		dial indicator	Pass
7	length	30.5	0.06	0.06			30.516	30.512	30.520	30.512	30.508		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.016	33.012	33.020	33.012	33.008		ruler	Pass
10	thickness	1.00MIN				CTQ	1.017	1.013	1.016	1.016	1.015		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.004	0.003	0.003	0.003	0.004		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.108	1.108	1.109	1.109	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡会 Date Inspected: 2023.5.22 Stamp of manufacturer:

ENDURANCE
耐 德 工 业

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230424

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			61	62	63	64	65	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.693	0.691	0.691	0.691		calipers	Pass
3	deepness	0.06REF					0.061	0.061	0.061	0.061	0.061		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.313	Φ1.314	Φ1.313	Φ1.313	Φ1.314		calipers	Pass
6	cylindricity	0.015				CTQ	0.006	0.005	0.005	0.002	0.004		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.512	30.516	30.512	30.508		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.012	33.012	33.016	33.012	33.008		ruler	Pass
10	thickness	1.00MIN				CTQ	1.015	1.017	1.014	1.013	1.015		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.004	0.003	0.003	0.002	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.109	1.109	1.108	1.108	1.108		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: [signature] Date Inspected: 2023.5.22 Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230425

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			66	67	68	69	70	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.692	0.692	0.691	0.692	0.692		calipers	Pass
3	deepness	0.06REF					0.061	0.061	0.061	0.061	0.061		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.315	Φ1.314	Φ1.312	Φ1.313	Φ1.315		calipers	Pass
6	cylindricity	0.015				CTQ	0.004	0.004	0.005	0.004	0.004		dial indicator	Pass
7	length	30.5	0.06	0.06			30.516	30.508	30.512	30.512	30.512		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.016	33.008	33.012	33.012	33.012		ruler	Pass
10	thickness	1.00MIN				CTQ	1.014	1.016	1.016	1.015	1.016		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.002	0.003	0.003	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.109	1.109	1.108	1.109	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡玲 Date Inspected: 2023.5.22 Stamp of manufacturer:

7240013-TQC-DB-00014 REV.00

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230426

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			71	72	73	74	75	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.692	0.691	0.691	0.693		calipers	Pass
3	deepness	0.06REF					0.061	0.061	0.061	0.061	0.061		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.313	Φ1.314	Φ1.314	Φ1.314		calipers	Pass
6	cylindricity	0.015				CTQ	0.004	0.002	0.002	0.005	0.005		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.512	30.512	30.508	30.512		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.504	2.500		ruler	Pass
9	length	33	0.10	0.10			33.012	33.012	33.012	33.012	33.012		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.016	1.015	1.016	1.017		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.004	0.003	0.003	0.003	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.108	1.109	1.109	1.108	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡刚

Date Inspected: 2023.5.22

Stamp of manufacturer:

7240013-17QC-DB-00014 REV.00

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230427

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			76	77	78	79	80	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.691	0.691	0.692	0.691		calipers	Pass
3	deepness	0.06REF					0.062	0.062	0.062	0.062	0.061		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.315	Φ1.312	Φ1.314	Φ1.314	Φ1.314		calipers	Pass
6	cylindricity	0.015				CTQ	0.006	0.004	0.004	0.005	0.005		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.512	30.508	30.512	30.508		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.012	33.012	33.008	33.012	33.008		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.015	1.016	1.016	1.015		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.002	0.003	0.004	0.002	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.109	1.109	1.109	1.109	1.108		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 刘V2 Date Inspected: 2023.5.22 Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

ENDURANCE 耐德工业

Inspection Report

Customer: BH
Part No.:
Part Name:
Drawing No.: 566-361 (REV B)

Report No.:230428
Purchase Order No.: 5052086923
Manufacturer: Chongqing Endurance Industry Stock Co., Ltd
Address: No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced: 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			81	82	83	84	85	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.691	0.691	0.690	0.691		calipers	Pass
3	deepness	0.06REF					0.062	0.062	0.063	0.063	0.062		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.314	Φ1.312	Φ1.313	Φ1.313		calipers	Pass
6	cylindricity	0.015				CTQ	0.006	0.007	0.006	0.005	0.005		dial indicator	Pass
7	length	30.5	0.06	0.06			30.516	30.512	30.508	30.508	30.512		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.016	33.012	33.008	33.008	33.012		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.017	1.017	1.017	1.017		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.003	0.003	0.004	0.002		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.108	1.108	1.108	1.109	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡川

Date Inspected: 2023.5.22

Stamp of manufacturer:

ENDURANCE
耐 德 工 业

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230429

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			86	87	88	89	90	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.691	0.691	0.691	0.692		calipers	Pass
3	deepness	0.06REF					0.063	0.063	0.063	0.061	0.063		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.314	Φ1.314	Φ1.314	Φ1.315		calipers	Pass
6	cylindricity	0.015				CTQ	0.005	0.004	0.006	0.006	0.005		dial indicator	Pass
7	length	30.5	0.06	0.06			30.508	30.516	30.512	30.528	30.516		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.008	33.016	33.012	33.028	33.016		ruler	Pass
10	thickness	1.00MIN				CTQ	1.017	1.017	1.017	1.015	1.017		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.003	0.003	0.004	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.108	1.109	1.109	1.108	1.108		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡波 Date Inspected: 2023.5.22 Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230430

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			91	92	93	94	95	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.692	0.692	0.692	0.691	0.691		calipers	Pass
3	deepness	0.06REF					0.061	0.063	0.062	0.062	0.062		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.314	Φ1.314	Φ1.314	Φ1.314		calipers	Pass
6	cylindricity	0.015				CTQ	0.005	0.004	0.005	0.004	0.006		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.512	30.512	30.520	30.520		ruler	Pass
8	length	2.50REF					2.500	2.500	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.012	33.012	33.012	33.020	33.020		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.018	1.016	1.016	1.017		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.003	0.002	0.003	0.003		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.109	1.109	1.108	1.109	1.109		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: [signature]

Date Inspected: 2023.5.22

Stamp of manufacturer:

Chongqing Endurance Industry Stock Co., Ltd.

Inspection Report

Report No.:230431

Customer BH
Part No.
Part Name
Drawing No. 566-361 (REV B)

Purchase Order No. 5052086923
Manufacturer Chongqing Endurance Industry Stock Co., Ltd
Address No.6 YangLiu Rd.,New North Zone,Chongqing P.R.China
Date Produced 22-May-23

Item #	Units	Drawing Spec			DWG Zone	CTQ or CTS	Number					Measure Equipment		Pass or not
		Nominal	+TOL	-TOL			96	97	98	99	100	GRR%	Name	
1	thread	3/4"NPT(F)				CTQ	Pass	Pass	Pass	Pass	Pass		thread gauge	Pass
2	thickness	0.69REF					0.691	0.691	0.691	0.691	0.691		calipers	Pass
3	deepness	0.06REF					0.062	0.063	0.062	0.062	0.062		depth gauge	Pass
4	roughness	32				CTQ	Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
5	diameter	Φ1.315	0.01	0.01			Φ1.314	Φ1.313	Φ1.313	Φ1.314	Φ1.313		calipers	Pass
6	cylindricity	0.015				CTQ	0.005	0.006	0.006	0.007	0.006		dial indicator	Pass
7	length	30.5	0.06	0.06			30.512	30.513	30.516	30.520	30.528		ruler	Pass
8	length	2.50REF					2.500	2.507	2.500	2.500	2.500		ruler	Pass
9	length	33	0.10	0.10			33.012	33.020	33.016	33.020	33.028		ruler	Pass
10	thickness	1.00MIN				CTQ	1.016	1.016	1.015	1.016	1.016		calipers	Pass
11	pipe and flange engraving						Pass	Pass	Pass	Pass	Pass		eyes	Pass
12	roughness	250					Pass	Pass	Pass	Pass	Pass		rough specimens	Pass
13	squareness	0.008				CTQ	0.003	0.003	0.004	0.003	0.002		dial indicator	Pass
14	diameter	Φ0.921	0.005	0.005			Pass	Pass	Pass	Pass	Pass		gauge	Pass
15	deepness	1.1min					1.108	1.107	1.109	1.109	1.108		depth gauge	Pass
16	flange dimensions						Pass	Pass	Pass	Pass	Pass		calipers	Pass
17	grooves						Pass	Pass	Pass	Pass	Pass			Pass

REMARKS:

Work Inspector: 胡冷

Date Inspected: 2023.5.22

Stamp of manufacturer:

WELDING PROCEDURE SPECIFICATIONS (WPS) 焊接工艺指导书

Company Name 公司: ChongQing Endurance Industrial Stock Co., Ltd. 重庆耐德工业股份有限公司.

Welding Procedure Specification No.: WPS-GTAW316-01 Revision No.修订号: 2 Date 日期: 2010-3-26

Supporting PQR No.(s)评定记录号: POR-GTAW316-03 Date 日期: 2010-3-26 Welding Code: ASME Ⅸ

Welding Process(es)焊接方法: GTAW（钨极氩弧焊） Type(s)型号: Manual（手动）

JOINTS 接头 (QW-402)

Joint Design 接头设计: See right sketch（见右图）

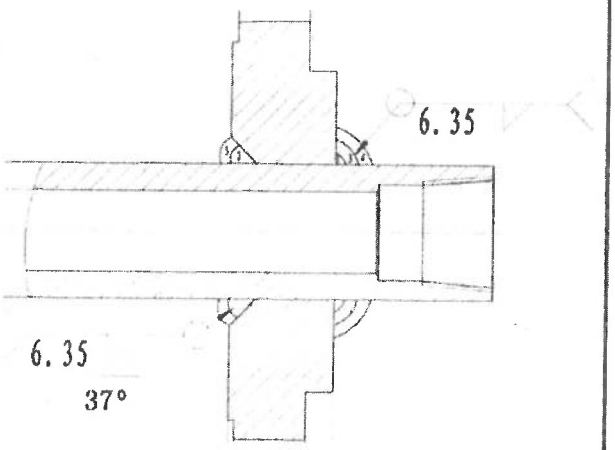
Backing 背垫: With(有)

Root Space 根部间距: 0mm-0.5mm

Backing Metal(Type)背垫材质:

- ■ Metal 金属
- ☐ Nonfusing Metal 非熔金属
- ☐ Nonmetalic 非金属
- ☐ Other 其它材料

Retainers 成型块: Without（无）



BASE METALS 母材 (QW-403)

P-No.: 8 Group No.:组别号: 1 To 至 P-No.: 8 Group No.组别号: 1 Or 或

Specification and type/grade or UNS Number 钢号和等级为:

to Specification and type/grade or UNS Number 钢号和等级为: Or 或

Chem. Analysis and Mech. Prop.化学成分和机械性能:

to Chem. Analysis and Mech. Prop.化学成分和机械性能:

Thickness Range 厚度范围:

Base Metal 母材: Groove 坡口焊缝 The thickness of the thinner member: 6.35-12.7mm; The maximum thickness of the thicker member: No Limitation(薄的尺寸范围: 6.35-12.7mm, 厚的尺寸范围: 没有限制)

Fillet 角焊接: Unlimited （不限）

Maximum Pass Thickness ≤13mm 每道焊缝最大厚度小于 13mm: NA 不适用

Other 其它: None(无)

FILLER METALS 填充材料 (QW-404)

Spec. No.(SFA)规格:	5.9
AWS No.(Class)级别:	ER316L
F-No.:	6
A-No.:	8
Size of Filler Metals 填充金属尺寸:	ϕ2.4mm
Filler Metal Product Form 填充金属型式	Solid 实芯
Weld Metal 熔敷金属:	
Thickness Range 厚度范围:	
Groove 坡口焊缝:	>0; ≤12.7mm
Fillet 角焊缝:	>0; Unlimited(不限)
Consumable Insert 消耗性填料:	None(无)
Flux 焊剂:	None (无)
Other 其它:	None(无)

SGS WITNESSED REVIEWED SGS-CSTC INDUSTRIAL SERVICES INSPECTOR

2010.3-29.

QW-482

WPS No.工艺指导书号：WPS-GTAW316-01 Rev.修订号：2

POSITION 位置（QW-405）

Position(s) of Groove 坡口焊位置：F(平焊),H(横焊)

Welding Progression 焊接方向:Up 上 N/A Down 下 N/A

Position(s) of Fillet 角位置：F(平焊),H(横焊)

Other 其它：None 无

POSTWELD HEAT TREATMENT 焊后热处理(QW-407)

Temperature Range 温度范围：None(无)

Time Range 时间范围：N/A(不适用)

Other 其它：None(无)

PREHEAT 预热(QW-406)

Preheat Temp.温度范围 Min.最小：10℃

Interpass Temp.层间温度 Max 最大：160℃

Praheat Maint enance 保持预热：N/A(不适用)

Other 其它：None 无

Gas 气体(QW-408)

Percent Composition 百分比含量

	Gas(es)气体	Mixture 混合比	Flow Rate 流量
Shielding 保护	Ar_2(氩气)	99.99%	8-12L/min
Trailing 拖后	None 无	N/A(不适用)	N/A(不适用)
Backing 背部	None 无	N/A(不适用)	N/A(不适用)
Other 其它	None 无	N/A(不适用)	N/A(不适用)

ELECTRICAL CHATACTERIDTICS 电特性(QW-409)

Weld Layer(s) 焊层	Process 方法	Filler Metal 填充金属		Current 电流		Volt range 电压范围	Travel Speed mm/min 焊接速度	Heat Input J/mm
		Classification 级别	Dia.直径	Type, Polar. 极性种类	Amp.Range 安培			
1	GTAW	ER316L	φ1.2	DC EN	80—100A	12—15V	60—100	1500
2	GTAW	ER316L	φ1.2	DC EN	80—100A	12—15V	60—100	1500
3	GTAW	ER316L	φ2	DC EN	100—120A	12—15V	60—100	1800
4	GTAW	ER316L	φ2	DC EN	100—135A	12—15V	60—100	2025
5	GTAW	ER316L	φ2.5	DC EN	100—144A	12—15V	60—100	2160

Pulsing Current 脉冲电流：None 无 Heat Input 热输入(max.最大)：2160J/mm

Tungsten Electrode Size and Type 钨针尺寸及种类：φ2.4mm W-Ce(钨-铈)

Mode of Metal Transfer for GMAW 金属过渡方式：N/A(不适用)

Electrode Wire feed speed range 焊丝送丝速度：N/A(不适用)

Other 其它：None 无

TECHNIQUE 工艺(QW-410)

String or Weave Bead String 直线或摆动运条：String or Weave(直线或摆动)

Orifice or Cup Size 气咀尺寸：φ9.5mm

Initial and Interpass Cleaning（Brushing,Grinding,etc.）初始和层间清理：Internal and external surfaces shall be cleared for at least 2"(50mm) from the fusion face using stainless steel brushes, not permission choose on other metals before welding. And it should not contain grease or residue on the surface.焊接前用不锈钢刷,不能用其他金属,将焊接处打磨出至少 50mm 的区域,不能有油污及氧化物

Method of Back Gouging 清根方法：None(无)

Oscillation 摆速：N/A(不适用)

Contact Tube to Work Distance 接触管至工作距离：5-10mm

Multiple or Single Pass(Per side)多层或单层焊道：Multiple pass(多层)

Multiple or Single Electrodes 多条或单条焊丝：N/A(不适用)

Peening 锤击：None(无) Other 其它：None(无)

焊接工程师 PREPARED BY: 2014.1.15 质保总监 APPROVED BY: 授权检验师 ACCEPTED BY AI:

SGS WITNESSED/REVIEWED SGS-CSTC INDUSTRIAL SERVICES INSPECTOR NO.: INDWH024

2018.3.27

PROCEDURE QUALIFICATION RECORDS (PQR) 焊接工艺评定记录

Company Name 公司: ChongQing Endurance Industrial Stock Co., Ltd. 重庆耐德工业股份有限公司,

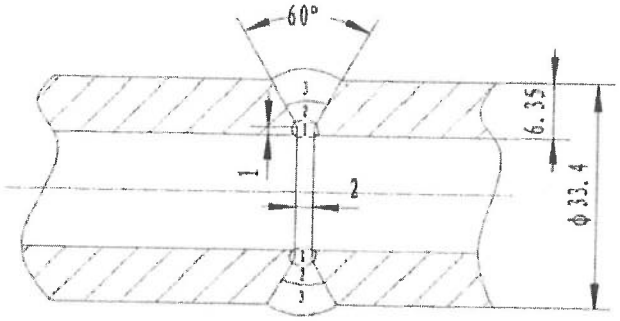
Procedure Qualification Record No.评定记录号: POR-GTAW316-03 Date 日期: 2010-03-26

Welding Procedure Specification No.工艺指导书号: WPS-GTAW316-01 Rev.2

Welding Process(es)焊接方法: GTAW（钨极氩弧焊）

Type(Manual,Automatic,Semi-Auto.)种类(手动,自动焊,半自动焊): Manual（手动）

JOINTS 接头 (QW-402) Unit(单位):mm



BASE METALS 母材 (QW-403)

Material Spec.材料规格:

ASME SA312 TP316L to ASME SA182 TP316L

P-No.: 8 Group 1 to 和 P-No.: 8 Group 1

Thickness of Test Coupon 试件厚度: 6.35mm

Diameter of Test Coupon:试件直径 33.4mm

Other: None 无

POSTWELD HEAT TREATMENT 焊后热处理 (QW-407)

Temperature 温度范围: None(无)

Time 时间: N/A(不适用)

Other 其它: None（无）

FILLER METALS 填充材料 (QW-404)

Spec. No.(SFA)标准: 5.9

Aws No.(Class)级别: ER316L

Filler Metal F-No.: 6

Weld Metal Analysis A-No.: 8

Size of Filler Metals 填充尺寸: φ2.4mm

Filler Metal Product Form: Solid 实芯

Flux 焊剂: None (无)

Weld Metal Thickness 熔敷金属厚度: 6.35 mm

Consumable Insert 消耗性填料: None (无)

Other 其它: No(无)

GAS 气体 (QW-408)

Percent Composition 百分比含量

	Gas(es)气体	Mixture 混合比	Flow Rate 流量
Shielding 保护	Ar_2(氩气)	99.99%	8-12L/min
Trailing 拖后	None 无	N/A(不适用)	N/A(不适用)
Backing 背部	Ar_2(氩气)	99.99%	7-9L/min
Other 其它	None 无	N/A(不适用)	N/A(不适用)

ELECTRICAL CHATACTERIDTICS 电特性 (QW-409)

Current 电流种类: DC(直流) Polarity 极性: EN(正接)

Pulsing 脉冲: No（无）

Amps 安培: see app.Table 见附表

Volts(Range) 电压: see app.Table 见附表

Tungsten Electrode Size 钨针尺寸: φ2.4mm W-Ce(钨-铈)

Other 其它: heat input: see app.Table 热输入，见下表

POSITION 位置 (QW-405)

Position of Groove 坡口焊位置: H(横焊)

Welding Progression 焊接方法:Up 上 N/A Down 下 N/A

Other 其它 None(无)

TECHNIQUE 工艺 (QW410)

Travel Speed 运条速度: see app.Table 见附表

String or Weave Bead 直线或摆动运焊: String or Weave(直线或摆动)

Oscillation 摆速: N/A（不适用）

Mulitple pass or Single Pass(per side)多层或单层焊道: Multiple (多层)

Other 其它: 1)Gas-cup size(喷咀尺寸): φ9.5mm

PREHEAT 预热 (QW-406)

Preheat Temp.预热温度: 20℃

Inter pass Temp.层间温度: see app.Table 见附表

Other 其它: None（无）

SGS WITNESSED / REVIEWED
SGS-CSTC INDUSTRIAL SERVICES
INSPECTOR NO.: INDWH024
2010.3.29

QW-483

Tensile Tests 抗拉试验（QW-150） 报告编号 Report No.: WHML090600382-02

Specimen No. 试样号	External Diameter (mm) 外径	Thickness (mm) 厚度	Area (SQ. mm) 面积	Ulrimate tensile Load (KN) 最大载荷	Tensile strength (MPa) 最大单位应力	Type of Fracture & Location 破坏种类和位置
1	33.21	6.50	545.43	289.21	530	Base Metal Ductility
2	33.32	6.50	547.67	292.51	535	Base Metal Ductility

Guided-Bend Tests 导向弯曲试验(QW-160) 报告编号 Report No.: WHML090600382-02

Specimen No. 式样号	Type and Figure No. 试验种类及图号	Result 结果
3	Transverse Face bends, QW-462.3(a)	Pass
4	Transverse Face bends, QW-462.3(a)	Pass
5	Transverse Root bends, QW-462.3(a)	Pass
6	Transverse Root bends, QW-462.3(a)	Pass

Toughness Tests 韧度试验(QW-170) 报告编号 Report No.: WHML090600382-02

Specimen No. 试样号	Notch Location 缺口位置	Specimen Size 试样尺寸（mm）	Test Temp 试验温度（℃）	Impact Values 冲击数据		Drop Weight Break (Y/N) 重锤坠落，断开(是、否)
				Absorbed energy (J)	Lateral expansion (mm)	
7	HAZ	55×10×3.3	-45	46	1.46	NA
8	HAZ	55×10×3.3	-45	47	1.40	NA
9	HAZ	55×10×3.3	-45	48	1.50	NA
10	Weld	55×10×3.3	-45	43	1.51	NA
11	Weld	55×10×3.3	-45	39	1.60	NA
12	Weld	55×10×3.3	-45	43	1.65	NA

Other 其它: The acceptable lateral expansion in the customer's requirement is 0.38 mm minimum.

Other Tests 其它试验

Hardness Tests(NACE MR0175) 报告编号 Report No.: WHML090600382-02

Test points	1	2	3	4	5	6	7	8	9	10
HV10	135	149	149	157	162	140	138	139	143	163
Test points	11	12	13	14	15	16	17	18	19	
HV10	163	176	178	160	154	160	145	156	142	

Other 其它： None（无）

Welder 焊工： Yong Wu 吴勇 I. D. No. 身份证号: 510212196806084156 Stamp 印章号: A

Tests conducted by 试验指导: Yong Yang 杨勇 Laboratory Test No. 实验室编号: IN-CQ-PC-09003

We certify that statements in this record are correct and that the test welds were accuracy,welded and tested are according to the requirements of Section IX of the ASME Code.兹证明上述记录正确和试验焊缝的准确、焊接、试验全部按 ASME 规范第九章要求进行。

Manufacture 制造商：Chongqing Endurance Industrial Stock Co., LTD.

Date 日期： 2014.1.15 By 由：

REVIEWED BY 审阅： Accepted By 批准：

SGS WITNESSED REVIEWED SGS-CSTC INDUSTRIAL SERVICES INSPECTOR NO.: INDWH324 2010.3.29

Page4of2

附表 ATTACHED

焊接方法 Welding process: GTAW 焊接工艺评定记录编号 PQR No.: PQR-GTAW316-03

施焊焊工 WELDER: Yong Wu 吴勇 焊接位置 Welding Position: 2G

日期 Date: 09.05.29

坡口装配记录 Groove Filting Record				
	A	B	C	备注
坡口角度 a Groove Angle	57	62	60	坡口及附近经清理无油、水、锈 The groove and adjacent zone shall be cleaned and out water and rust free
钝边厚度 b Edge Thickness (mm)	1.1	1.2	1.0	
根部间隙 c Root Gap (mm)	2.4	2.4	2.4	

焊道号 Pass No.	填充材料 Filler material		层间温度 Interpass Temperature (℃)	电特性 Electricity characteristics			焊接速度 Trave-speed mm/min	保护气 Shielding Gas		热输入 Heat input(J/mm) QW-409
	AWS No.	规格 size		极性 Polarity	电流 Current(A)	电压 Voltage(V)		种类 Type	流量 Flow	
1	ER316L	Φ2.4	20	DC EN	110	11	55	99.99% Ar	8-12L/min	1320
2	ER316L	Φ2.4	145	DC EN	128	12	50	99.99% Ar	8-12L/min	2048
3	ER316L	Φ2.4	150	DC EN	135	12	45	99.99% Ar	8-12L/min	2160

SGS WITNESSED REVIEWED
SGS-CSTC INDUSTRIAL SERVICES
INSPECTOR NO.: INDWH024
2010.3.29

Welder Performance Qualifications 焊工技能评定记录(WPQ)

Chongqing Endurance Industrial Stock Co., LTD. 重庆耐德工业股份有限公司	WPQ No. 编号	WPQ-GTAW316-2G	page 1 of 1 第 1 页共 1 页

Welder's name 焊工姓名: Yong Wu 吴勇 Stamp No.钢印号: A

Test Description 试验说明

Identification of WPS followed 所依据的 WPS No./Rev.: WPS-GTAW316-01Rev.2 ☑ Test coupon 试样 ☐Production weld 产品焊缝

Specification of base metal(s)母材牌号: ASME SA312 TP316 Thickness 厚度 6.35mm

Testing Conditions and Qualification Limits 试验条件和评定范围

Welding Variables 焊接变素 (QW-350)	Actual Values 实际值	Range Qualified 评定范围
Welding process(es)焊接方法	GTAW	GTAW
Type (ie: manual,semi-auto) used 自动化等级(手工,半自动)	Manual (手动)	Manual (手动)
Backing 衬垫 (metal,weld metal,double-welded,etc.)	Without 无	With or Without
☐ Plate 板 ☑ Pipe 管 (enter diameter,if pipe or tube)	Pipe 管	Groove: plate pipe 25mm O.D. and over Fillet: Plate and Pipe
Base metal P-or S-Number to P-or S-Number	P- No.8	P- No.1 through P- No.11, P- No.34and P- No.41 through P- No.49
Filler metal or electrode specifications(SFA) 填充金属或焊条标准	SFA 5.9	As per WPS
Filler metal or electrode classifications 填充金属或焊条型号	ER316L	As per WPS
Filler metal F-Number(s)填充金属的 F-No.	F-No.6	F-No.6
Consumable insert (GTAW or PAW)熔化性嵌条	Without	without
Filler type (solid/metal or flux cored/powder) (GTAW or PAW)	Soild	Soild
Deposit thickness for each process 每个焊接方法的熔敷厚度		
Process 1: GTAW 3layers minimum ☑ Yes ☐ No	6.35mm	12.7mm Maximum
Process 2: ____ 3layers minimum ☐ Yes ☐ No		
Position qualified (2G,6G,3F,etc.)评定的位置	2G	Groove: Pipe over 26mm OD: F.H Fillet: F.H
Vertical progression(uphill/downhill) 立焊前进方向(上或下)	N/A	N/A
Type of fuel gas (OFW)燃料气体的类型	N/A	N/A
Inert gas backing (GTAW,PAW, GMAW)惰性气体背面保护	With	With
Transfer mode (spray/globular or pulse to short circuit-GMAW)过渡模式	N/A	N/A
GTAW current type/polarity (AC,DCEP,DCEN)电流类型/极性	DC EN	DC EN

Results 结果

Visual Examination of Completed Weld 完成焊缝的外观检验 (QW-302.4) Acceptable

☐ Bend test 弯曲试验: ☑Transverse root and face 横向背弯和面弯 [QW-462.3(a)]; ☐ Side 侧弯(QW-462.2);

☐ Longitudinal root and face 纵向背弯和面弯 [QW-462.3(b)];

☐ Pipe bend specimen,corrosion-resistant overlay 管子弯曲试样,耐蚀金属堆焊 [QW-462.5(c)];

☐ Plate bend specimen,corrosion-resistant overlay 板材弯曲试样,耐蚀金属堆焊 [QW-462.5(d)];

☐ Macro test for fusion 熔合的宏观试样 [QW-462.5(b)]; ☐ Macro test for fusion 熔合的宏观试样 [QW-462.5(c)].

Type 类型	Result 结果	Type 类型	Result 结果
Transverse Face bends	Pass	Transverse Root bends	Pass
Transverse Face bends	Pass	Transverse Root bends	Pass

SGS WITNESSED ☑ REVIEWED ☑ SGS CSTC INDUSTRIAL SERVICES INSPECTOR NO.: INDWH024 2010.3.2

Alternative Radiographic examination results 改为射线照相检验结果(QW-191):

Fillet weld-fracture test 角焊缝-断裂试验(QW-180): Length and percent of defects 缺陷长度和%:

Macro examination 宏观检查(QW-184): Fillet size (mm) 角焊缝尺寸: ×

Concavity/convexity (mm)凹/凸度:

Other tests 其它试验

Film or specimens evaluated by 底片或试样评定者

Mechanical tests conducted by 力学性能试验者: Calving Wang Laboratory test No. 试验室编号 IN-CQ-PC-09003

Welding supervised by 焊接监督者 Yong Yang 杨 勇

We certify that the statements in this record are correct and that the test coupons were prepared, welded ,and tested in accordance with the requirements of Section IX of the ASME Code. 兹证明本报告所述均属正确,并且试验是根据 ASME 规范第 IX 卷的要求进行试件的制备、焊接和试验的。

Organization: Chongqing Endurance Industrial Stock Co., LTD.
重庆耐德工业股份有限公司

Prepared by 编制: Date:日期: 2014.1.15 Certified by 确认: Date:日期:

Declaration of EU RoHS Conformity

（欧盟 RoHS 符合性声明）

We, Chongqing Endurance Industry Stock Co.，**Ltd.,here by declare that our products indicated below were in full conformity with EU Directive 2011/65/EC,with respect to the following substances:**

我公司，重庆耐德工业股份有限公司 声明：

我公司生产的以下产品中各项有害物质的含量完全符合欧盟指令 2011/65/EC：

1) **Lead(Pb)铅,**
2) **Mercury(Hg)汞,**
3) **Cadmium(Cd)镉,**
4) **Hexavalent chromium(Cr6+)六价铬,**
5) **Polybrominated biphenyls(PBB) 多溴联苯,**
6) **Polybrominated diphenylethers (PBDE) 多溴二苯醚,**
7) **Hexabromocyclododecane(HBCDD)六溴环十二烷,**
8) **Diethylhexyl phthalate(DEHP)邻苯二甲酸二(2-乙基)己脂,**
9) **Dibutyl phthalate(DBP)邻苯二甲酸二丁脂,**
10) **Butyl benzyl phthalate(BBP)邻苯二甲酸丁苄脂。**

Item（项目）	I	II	III
Name of the product （产品名称）：	BAKKEL 超声波流量计整件		
Model & specification （规格型号）：	566-36(REV3)		
Quantity （数量）：	100		
P.O.No （合同号）：	PO:5052086223		
Goods exported to （输往国）：	Ireland 爱尔兰		

Note:

No changes have been made in composition of the products under the above P.O.

注：以上合同中产品的任何成分均未发生变化。

Authorized Signatory（授权签字人）： _____

Signature（签字）： _____

Title（职务）： _____

Date（日期）： _____

Telephone（电话）： _____

MATERIAL CERTIFICATION

Material	**Heat No.**
Packing Nut	509612

(D. Furneaux)
F-TR obo CROSSWIND
~~Witness~~ X Review
12th Feb. 2025

Baker Hughes Confidential

PROMAT BD LTD

INSPECTION CERTIFICATE TYPE BS EN 10204 3.1	CUSTOMER: BAKER HUGHES EMEA UNLIMITED COMPANY Sensing House, Shannon Free Zone East, Shannon, CO CLARE, Ireland	CERT NO. PRBD1907676 CLIENT PO NO. 5052360981 DATE 25/11/2024 PROMAT REF NO. PS047764

ITEM #	REFERENCE	QTY	HEAT	DESCRIPTION	MATERIAL GRADE	HEAT TREATMENT
30	TC22523-316	2 Nos.	509612	P/N: 162M4666 - FITTING (DRG: 162M4666 REV -)	ASTM A182/A182M F316/316L	Solution Annealed @ 1060C : Water quenched

724001317-QC-DB-00014

HEAT	C [%]	Si [%]	Mn [%]	S [%]	P [%]	Cr [%]	Ni [%]	Mo [%]	Ti [%]	Cu [%]	V [%]	Al [%]	Co [%]	Nb [%]	N [%]	Sn [%]	W [%]	B [%]	Ca [%]	Fe [%]	CEV [%]	PREN [%]	Ca : S [%]	Al : N [%]	V+Nb+Ti [%]
509612 (L)	0.019	0.062	1.570	0.0260	0.033	17.260	11.140	2.000	-	0.410	-	-	0.190	-	0.0245	-	-	-	-	-	-	24.25	-	-	-

BAKER HUGHES
ACCEPTED
Signed: MC Date: 4/12/24

REV 00

HEAT	TENSILE STRENGTH (MPa)	YIELD STRENGTH (MPa)	ELONGATION (%)	RED. OF AREA (%)	HARDNESS		CHARPY IMPACT				
							TEST TEMP. (°C)	ABS. ENERGY (J)	SHEAR AREA (%)	L.E (mm)	AVERAGE (J)
509612	557	258	52	73	143 HBW	-	20	247 , 252 , 249	-	-	249.33

Page 653 of 969

REMARKS	TRADEMARKS	AUTHORISATION
1: LRQA APPROVAL No: 00005177 2: MATERIALS CONFORM TO NACE MR-01-75/01-03 / ISO 15156 LATEST EDITION & SATISFIES PARA. 4.3 ANNEX 1 OF 2014/68/EU (PED)		I hereby confirm these records to be correct as contained in the records of the company. The document is transmitted and stored electronically. R. Wanglin Quality Manager QA VERIFIED/RELEASED DJT0

Unit 20 Regal Drive, Walsall Enterprise Park, Walsall, WS2 9HQ
Phone: +44 (0) 1922 748310, Fax: +44 (0) 1922 748320, Email: richard.wanglin@promatbd.co.uk

This certificate is valid when stamped QA VALIDATED.

TC22523

ACEROS INOXIDABLES OLARRA S.A.
Cm. Larrabarri, Elotxelerri, 1
48180 Loiu, Bizkaia
España
www.olarra.com

Management Systems Certified by LRQA
ISO 9001 / SGI 6000360
ISO 14001 / SGI 1870678

ACEROS INOXIDABLES
OLARRA

OLARRA U.K. LTD.
FOREST PARK - CLEOBURY MORTIMER
NR KIDDERMINSTER - DY 14 9BD - ENGLAND

Trade Mark - Zeichen des Lieferwerkes / Anagrama del suministrador

Works Inspector Stamp - Werkssachverständiger / Sello del Inspector: 3

Certificate type - APZ Nach / Certificado tipo	Certificate nº - Prüf-Nr / Certificado nº	Date - Datum - Fecha
EN 10204/3.1	446427	08 - 02 - 2021

Our order Nº / Werks - Nr / Nº de Referencia	Heat / Schmelze / Colada	Your order Nº / Bestell - Nr / Pedido Nº
732165	509612	OL9951

Steel Grade / Werkstoff / Calidad	According to / Entsprechend / Corresponde
316-S-11 AV	BS 970:PART 3:1991.

Shape and Size - Gegenstad / Perfil y dimensión	Tolerance - Toleranz / Tolerancia	Bundles / Bunde / Bultos	Bars / Stäbe / Barras	Weight / Gewicht / Peso
ROUND 60 mm	k 12 /ISO 286-1 /EN 10060	4		2417 Kg

Requirements - Anforderungen - Exigencias

EN 10088-3 2014.
EN 10272-2016.
ASTM A 182/A 182M-19.
ASTM A 479 / A 479M-20.
ASTM A 276/A 276M-17.
ASME SA 479 / SA 479M-19
ASME SA 182 / SA 182M-19
ASME SA 276-2019
NACE MR-0175/ISO 15156-3 2015.
NACE MR-0103/ISO 17945-2015.

NORSOK M-630 and MDS S01.
SAE AMS 5653J-19.
AMS QQS 763D-15 COND.A.
316S31AV-1.4404-1.4401-Type 316-Type 316L-F.316-F.316L.
PED 2014/68/EU, Annex I, Parag.4.3/DGR 2014/68/EU
Anhang I Absatz 4.3 Certificate/Zertifikat Nr. 348/2008/MUC

Melting process / Erschmelzungsart / Proceso de Fusión	Heat treatment / Wärmebehandlung / Tratamiento térmico
E.A.F. / A.O.D.	1060C 4H/Std WATER/WASSER/AGUA

Solution annealed/Abgeschreckt/Hipertemple-Turned/Drehen/Torneado-

Test results - Ergebnis der Prüfungen - Resultados de los ensayos

Reference standard / Bezugsnorm / Norma de referencia		Rp0,2% N/mm2 MPA	Rp 1% N/mm2 MPA	Rm N/mm2 MPA	A %L 5D	A %L 4D	Z %	Hardness Härte HBw	Impact test / Kerbschlagzaehigkeit / Resiliencia ISO V Jules
ASTM A370, ISO 6892	Min.	190	225	490	40				
	Max.								
Temperature ºC: 20	Spec. Nº. / Probe Nr. / Pro Nº.: 1	258	289	557	52	55	73	143	247/252/249

	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	N	Co
Min.						16,50	2,00	11,00			
Max.	0,030	1,00	2,00	0,045	0,030	18,50	2,50	14,00	0,70		
	0,019	0,62	1,57	0,033	0,026	17,26	2,00	11,14	0,41	0,0245	0,19

Visual and dimensional inspection / Besichtigung und Ausmessung / Control visual y dimensional	Radioactivity inspection / Radioaktivitätskontrolle / Control de Radioactividad	Antimixing test / Spektrosk Verwechslungspr / Antimezcla	Grain Size / Korngrösse / Tamaño de grano
O.K.	O.K.	O.K.	6-7 ASTM E-112-13

Remarks - Bemerkungen - Observaciones

IC test acc./IK prüfung nach ASTM A 262 E.15. OK
100% US test/US prüfung. OK
This material complies to DFARS 252.225-7014.
No welding repair.
Free from mercury or radio-activity contamination.
Country of origin: Spain
Crack control/Rissgeprüft acc. EN 10277-1 class 3. OK

PRESMAT BB
QA/QC DEPT
VALIDATED
RDW0
28/5/21
CERTIFICATE ACCEPTED

EDV / EDP
Acc. EN 10.204
Marian Tejedo
Quality Mng.

Works Inspector
Der Werkssachverständige
Inspector de fábrica

We hereby certify that material described herein complies with the requirements agreed on the order.

Firmado digitalmente por / Signed digitally by
ACEROS INOXIDABLES OLARRA SA - CIF A48663546
Fecha / Date:08-02-2021 12:14

ROTECH LABORATORIES

MOXLEY INDUSTRIAL CENTRE
WESTERN WAY
WEDNESBURY
WEST MIDLANDS
WS10 7BG
TEL: 0121 505 4050
FAX: 0121 505 1115
www.rotechlabs.co.uk
info@rotechlabs.co.uk

UKAS TESTING
0366

Test Report

Number: 21-06603 **Issue:** 1 **Date Reported:** 23/06/2021

A/C No: P077

Tested For:

PROMAT BD LIMITED
UNIT 20, WALSALL PARK
REGAL DRIVE
PLECK
WALSALL
WS2 9HQ

RELEVANT INFORMATION

Description	GXS25BAR60-60mmØ Round Bar Cast: 509612 ASTM A182 F316/316L
Specification:	ASTM A262 Pr E
Submitted by:	RICHARD WANGLIN
Purchase Order No.	P15842
Date Sample(s) Received:	18/06/2021
Date(s) tested:	23/06/2021

INTRODUCTION:

The test items were submitted to the laboratory for:

- **Corrosion - Intergranular susceptibility**
- **Metallographic - Microexamination**

PROMAT BD LTD QA/QC DEPT VALIDATED RDW0 23/6/21 CERTIFICATE ACCEPTED

REPORT ISSUED AND AUTHORISED BY

Craig Easton
Head of Metallurgy

FOR REPORTS CONTAINING ACCREDITED TESTS, TESTS MARKED "NOT UKAS ACCREDITED" ARE NOT INCLUDED IN THE UKAS ACCREDITATION SCHEDULE FOR OUR LABORATORY.
TESTS MARKED "SC" HAVE BEEN SUBCONTRACTED. RESULTS IN THIS REPORT RELATE ONLY TO THE ITEMS TESTED, AS RECEIVED
OPINIONS AND INTERPRETATIONS EXPRESSED HEREIN ARE OUTSIDE THE SCOPE OF UKAS ACCREDITATION.
THIS TEST REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT WRITTEN APPROVAL OF THE LABORATORY.
TESTING CONDUCTED IN ACCORDANCE WITH MANAGEMENT SYSTEM MANUAL ISSUE 4.
Decision Rule:
1 When a statement of conformity is not requested and where applicable, test results will be reported as found together with the uncertainty of measurement.
2 When a statement of conformity is requested for test results against limits set out in a standard or specification (i.e. ASTM, BS EN ISO) that already considers measurement uncertainty, the requirements in the standard or specification will be followed..
3 When a statement of conformity is requested for a test result against limits set out in a standard or specification that does not consider measurement uncertainty, zero guard banding will be applied with a "Pass" reported when the measured result is in-tolerance and a "Fail" reported when the measured result is out-of-tolerance. However, should the expanded measurement uncertainty of the measured result be greater than 1/3 the tolerance limits, the decision rule will default to 1 above.

Test Report

Job no: 21-06603 **Issue:** 1

Customer PROMAT BD LIMITED

Purchase order no.: P15842

Corrosion - Intergranular susceptibility **Sample: 21-06603-001**

Tested in accordance with: ASTM A262 practice E - 2015

Practice E - Copper - copper sulfate 16% sulfuric acid test for detecting susceptability to intergranular attack

Sensitising heat treatment 1hour at 675DegC.

The specimen degreased using acetone and dried.

Minimum test time 15hrs. If not 15hrs, the test time shall be specified.

The bend specimen was examined under low (5 to 20x) magnification.

Heat treated	Sensitised
Test duration [hrs]	15hrs

Sample ID	Observation
#1	Bend test revealed no evidence of fissures or cracks
Rqmnts->	Bend test revealed no evidence of fissures or cracks

Complies with the tested requirements of ZR COR2 - corrosion intergranular suscept;

Metallographic - Microexamination **Sample: 21-06603-002**

Tested in accordance with: RP368

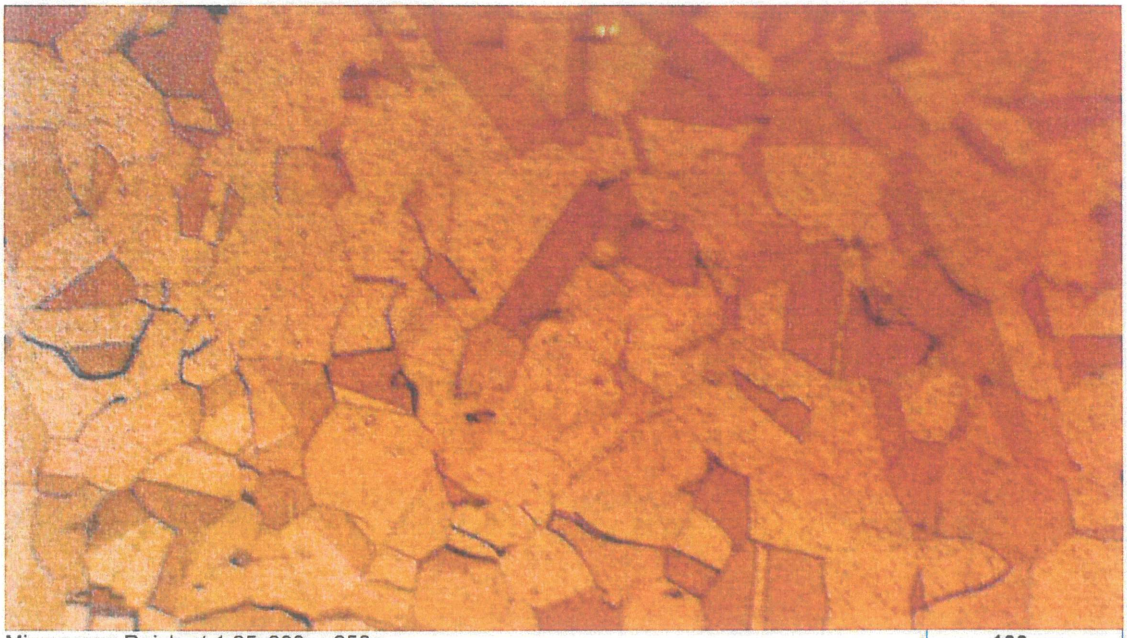
The sample was cross sectioned and prepared for metallographic examination according to the recommended procedures in ASTM E3-11(2017) and when appropriate etched using appropriate reagent, such as listed in ASTM E407-07(2015)e1.

After etching in kallings No 2 reagent the specimen revealed a twinned grain austenitic microstructure with no significant intermetallic phases or grain boundary precipitates.

See figure 1

Test Report - Photos

Job no: 21-06603 **Issue:** 1
Customer PROMAT BD LIMITED
Purchase order no.: P15842



Microscope Reichert 1.25x200x : 250x

Figure 1: Photomicrograph showing sample microstructure : Etchant;- Kallings No2

ROTECH LABORATORIES — Test Report

MOXLEY INDUSTRIAL CENTRE, WESTERN WAY,
WEDNESBURY. WEST MIDLANDS, WS10 7BG
TEL: 0121 505 4050
www.rotechlabs.co.uk, info@rotechlabs.co.uk

UKAS TESTING 0366

Rotech Number: 23-07270
Issue: 1
Date Reported: 06/07/2023
Purchase Order No. P16406

724001317-QC-DB-00014

Description 60mmØ Bar
Part No: TESTING-GXS25BAR60
Cast No: 509612
WO No: 2476

The test item was submitted to the laboratory for:
Mechanical - Tensile

Specification: None Stated
Requirements: Customer PO
Submitted by: RICHARD WANGLIN
Date Sample(s) Received: 29/06/2023
Date(s) tested: 06/07/2023

Tested For:
PROMAT BD LIMITED
UNIT 20, WALSALL PARK
REGAL DRIVE
PLECK
WALSALL
WS2 9HQ

REV 00

Sample: 23-07270-001 **Mechanical - Tensile** Tested in accordance with: BS EN ISO 6892-2 - 2018

Description: Longitudinal test piece **Test piece type:** Bars **Test temperature [°C]:** 550 **Control mode:** A133 **Test piece size [mm]:** 9.01Ø **Original gauge length [mm]:** 5.65/So
Soaking time [mins]: 10

Sample ID	Yield strength Rp0.2% [MPa]	Tensile strength [MPa]	Elongation [%]	Reduction of area [%]
#1	162	425	39.5	67
Rqmts	98 Min	-	-	-

Complies with the specified requirements.

PASS

PROMAT BD LTD
QA/QC DEPT VALIDATED
RDW0
1d7/23
CERTIFICATE ACCEPTED

REPORT ISSUED AND AUTHORISED BY Chris Jones, Senior Technician

TESTS MARKED "NOT UKAS ACCREDITED" IN THIS REPORT/CERTIFICATE ARE NOT INCLUDED IN THE UKAS ACCREDITATION SCHEDULE FOR OUR LABORATORY.
TESTS MARKED "SC" HAVE BEEN SUBCONTRACTED. RESULTS IN THIS REPORT RELATE ONLY TO THE ITEMS TESTED.
OPINIONS AND INTERPRETATIONS EXPRESSED HEREIN ARE OUTSIDE THE SCOPE OF UKAS ACCREDITATION. THIS TEST REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT WRITTEN APPROVAL OF THE LABORATORY.
TESTING CONDUCTED IN ACCORDANCE WITH MANAGEMENT SYSTEM MANUAL ISSUE 6.

Decision Rule:
1 When a statement of conformity is not requested and where applicable, test results will be reported as found with the uncertainty of measurement available on request.
2 When a statement of conformity is requested for test results against limits set out in a standard or specification (i.e. ASTM, BS EN ISO) that already considers measurement uncertainty, the requirements in the standard or specification will be followed..
3 When a statement of conformity is requested for a test result against limits set out in a standard or specification that does not consider measurement uncertainty, zero guard banding will be applied with a "Pass" reported when the measured result is in-tolerance and a "Fail" reported when the measured result is out-of-tolerance. However, should the expanded measurement uncertainty of the measured result be greater than 1/3 the tolerance limits, the decision rule will default to 1 above.

MATERIAL CERTIFICATION

Material	**Heat No.**
Packing Ring	283504
	283504

(D. Furneaux)
FTR obo CROSSWIND
~~Witness~~ X Review
12th Feb. 2025

Baker Hughes Confidential

Y901

Acciaierie Valbruna S.p.A.

36100 VICENZA (Italia) - Viale della scienza, 25 z.i.
Telefono 0444.968211 - Fax 0444.963836
Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4/37
Telefono 0471.924111 - Fax 0471.924497

CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a : EN 10204 (2004) , 3.1 / ISO 10474 (2013) , 3.1
Nach/According to/Selon

Certificato nr. MEST621103 / 2020 /
Prüfung/Test/Essai

Cliente / Besteller/Purchaser/Client
VALBRUNA U.K. LTD.
OLDBURY ROAD
B70 9BH - WEST BROMWICH B70 9BH GB - GB

Ordine nr: 005059726 west bromwich
Bestell
Your order
Commande

Conferma ordine nr: EI20004514
Werks/Our Order/Ref nr.

Avviso di Spedizione: D-VI20022377
Lieferanzeige/Packing list/B.L.

Stato di fornitura : Hot rolled - Annealed Peeled
Lieferzustand
Delivery state
Etat de livraison

Tipo di Elaborazione: E+AOD
Erschmelzungsart
Melting process
Mode d'elaboration

Qualità: 1.4401/1.4404/316/316L
Werkstoff/Grade/Nuance

Marca: MVAPML (MAXIVAL)
Markenbezeichnung
Brand / Nuance

Produttore :
Hersteller/Item/Usine productrice

ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica: AV
Zeichen des Lieferwerkes
Trade marks
Sigles de l'usine productrice

Punzone del Collaudatore: MR
Stempel des Werkssachverständigen
Inspector's stamp/Poinçon de l'assayeur

Punzonatura: 1.4401/4/316/L
Kennzeichnung
Marking
Marquage

SPECIFICHE : Anforderungen / Requirements / Exigences	Note: Aufzeichnungen / Notes / Notes
VAL STOCK 2020 1.4404/316L A	
MDS S01 5 316 A (0)	(0)Norsok-standard M-630 Edition 6, October 2013
AISI 316	
AISI 316L	
ASME SA182 2019 S31600 A (1)	(1)Section II Part A 2019 EDITION For products machined directly from bar refer to ASME SA479.
ASME SA182 2019 S31603 A (2)	(2)Section II Part A 2019EDITION For products machined directly from bar refer to ASME SA479.
ASME SA193 2019 B8M CLASS 1 (3)	(3)Section II Part A 2019 EDITION
ASME SA276 2019 S31600 A (4)	(4)Section II Part A 2019 EDITION
ASME SA276 2019 S31603 A (5)	(5)Section II Part A 2019 EDITION
ASME SA320 2019 B8M CLASS 1 CLASS1 (6)	(6)Section II Part A 2019 EDITION
ASME SA479 2019 S31600 A (7)	(7)Section II Part A 2019 EDITION
ASME SA479 2019 S31603 A (8)	(8)Section II Part A 2019 EDITION
ASTM A182 2020 S31600 A (9)	(9)For products machined directly from bar refer also to ASTM A479.
ASTM A182 2020 S31603 (A)	(A)For products machined directly from bar refer also to ASTM A479.
ASTM A193 2019 B8M CLASS 1	
ASTM A262 2015 PRACTICE E	
ASTM A276 2017 S31600 A	
ASTM A276 2017 S31603 A	
ASTM A314 2019 S31600	
ASTM A320 2018 B8M CLASS 1 CLASS1	
ASTM A370 2019 . (B)	(B)2019E1
ASTM A479 2020 S31600 A	
ASTM A479 2020 S31603 A	
ASTM E10 2018 .	
ASTM E8 2016A .	
DIN 17440 96 1.4401 A	
DIN 17440 96 1.4404 A	
EN 10088-3 2014 1.4401 A	
EN 10088-3 2014 1.4404 A	
EN 10272 2007 1.4401 A	
EN 10272 2007 1.4404 A	
ISO 148-1 2016 .	
ISO 6506-1 2014 .	
ISO 6892-1 2019 .	
NACE MR0103 2015 S31600 A (C)	(C)ANSI/NACE MR0103/ISO 17945 November 23, 2015
NACE MR0103 2015 S31603 A (D)	(D)ANSI/NACE MR0103/ISO 17945 November 23, 2015
NACE MR0175 2015 S31600 A (E)	(E)ANSI/NACE MR0175/ISO 15156-3, third edition November 23,2015
NACE MR0175 2015 S31603 A (F)	(F)ANSI/NACE MR0175/ISO 15156-3, third edition November 23,2015

BAKER HUGHES
ACCEPTED
Signed: VC Date 12/11/24

QUALITY MANAGEMENT SYSTEM CERTIFIED BY LLOYD'S REGISTER ACCORDING TO ISO 9001 : 2015, IATF 16949 : 2016, AS 9100D

Vicenza, 09/10/2020 VCQ008 - MEST621103	Direzione Qualità Qualitätsmanagement/Quality Management/Gestion Qualité R.BERTELLI	Direzione Prodotto Produktmanagement/Product Management/Direction Produit P.MESSORI	Pagina 1 di 3

Acciaierie Valbruna S.p.A.

36100 VICENZA (Italia) - Viale della scienza, 25 z.i.
Telefono 0444.968211 - Fax 0444.963836
Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4/37
Telefono 0471.924111 - Fax 0471.924497

CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a / Nach/According to/Selon: EN 10204 (2004) , 3.1 / ISO 10474 (2013) , 3.1

Certificato nr. / Prüfung/Test/Essai: MEST621103 / 2020 /

Cliente / Besteller/Purchaser/Client:
VALBRUNA U.K. LTD.
OLDBURY ROAD
B70 9BH - WEST BROMWICH B70 9BH GB - GB

Ordine nr: 005059726 west bromwich
Bestell / Your order / Commande

Conferma ordine nr: EI20004514
Werks/Our Order/Ref nr.

Avviso di Spedizione: D-VI20022377
Lieferanzeige/Packing list/B.L.

Stato di fornitura: Hot rolled - Annealed Peeled
Lieferzustand / Delivery state / Etat de livraison

Tipo di Elaborazione: E+AOD
Erschmelzungsart / Melting process / Mode d'elaboration

Qualità: 1.4401/1.4404/316/316L
Werkstoff/Grade/Nuance

Marca: MVAPML (MAXIVAL)
Markenbezeichnung / Brand / Nuance

Produttore / Hersteller/Item/Usine productrice:
ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica / Zeichen des Lieferwerkes / Trade marks / Sigles de l'usine productrice: AV

Punzone del Collaudatore / Stempel des Werkssachverständigen / Inspector's stamp/Poinçon de l'assayeur: MR

Punzonatura / Kennzeichnung / Marking / Marquage: 1.4401/4/316/L

Pos. nr.	Oggetto	Tolleranza: k12 – Dimensioni - mm	Lunghezza - mm	Colata	Pezzi	Peso - KG	Lotto nr.
		Tolleranza/Allowance/Tolerance					
Pos. nr. / Item nr. / Nr. de poste	Gegenstand / Product description / Descrip. du produit	Abmessungen / Dimension / Dimension	Länge / Length / Longueur	Schmelze / Heat / Coulée	Stückzahl / Pieces / Pieces	Gewicht / Weight / Poids	Los-nr. / Lot nr. / Lot nr.
0030	Round	50,800	3045/ 3125	283504		5192,0	116206210

TEST ALLO STATO DI FORNITURA

Test on delivery condition / Prüefung auf lieferbereitem produkt / test a l'etat de fourniture / Prueba sobre el material así come entregado

1) L=longitudinale/längs, T=trasversale/quer, Q=Tangenziale/tangential

TEST	Provetta/ Probestab / Specimen/Eprouvette Larg.diam Spess. Breite Diam. Dicke Width Diam. Thickness Larg. diam. apais mm	°C		Posiz. Saggio / Probenlage / Location / Emplacement 1)	Snervamento / Streckgrenze / Yield Stress / Limite elastique Rp 0,2% N/mm2	Snervamento / Streckgrenze / Yield Stress / Limite elastique Rp 1% N/mm2	Resistenza / Zugfestigkeit / Tensile strength / Resistance à traction Rm N/mm2	Allungamento / Bruchdehnung / Elongation / Allongement A5 %	Allungamento E 4d %	Strizione / Einschnürung / Reduction of area / Striction Z %	Strizione RA %	Resilienza / Kerbschlagarbeit / Impact Value / Resilience KV J			Durezza / Haerte / Hardness / Durete HB		
Valori richiesti / Anforderungen/Required values / Valeurs demandées		min / max			205	240	515 / 690	40	40	-	50	100			- / 215		
A	10	20	L		271	336	594	54	56	68	68	243	240	248	170		
B	10	20	L		274	337	608	54	56	66	66	247	250	242	169		

TEST ALLO STATO DI FORNITURA

Test on delivery condition / Prüefung auf lieferbereitem produkt / Test a l'etat de fourniture / Prueba sobre el material así come entregado

TEST		min	max	
B	Grain size for ASTM E112			6

Mechanical properties according to ASTM A370.
Brinnell hardness according to ASTM E10
Tensile testing according to ASTM E8
Impact testing according to ISO 148-1
Brinnell hardness according to ISO 6506-1
Tensile testing according to ISO 6892-1

Analisi chimica

Chemische Zusammensetzung/Chemical Analysis/Analyse chimique

Colata /Heat / Schmelze/Coulée	C %	Si %	Mn %	Cr %	Mo %	Ni %	P %	S %	N %
min - max	- 0,030	- 1,00	- 2,00	16,50 - 18,00	2,00 - 2,50	10,00 - 13,00	- 0,045	- 0,030	- 0,100
283504	0,010	0,51	1,48	16,83	2,06	10,07	0,031	0,027	0,055

QUALITY MANAGEMENT SYSTEM CERTIFIED BY LLOYD'S REGISTER ACCORDING TO ISO 9001 : 2015, IATF 16949 : 2016, AS 9100D

Vicenza, 09/10/2020
VCQ008 - MEST621103

Direzione Qualità / Qualitätsmanagement/Quality Management/Gestion Qualité
R.BERTELLI

Direzione Prodotto / Produktmanagement/Product Management/Direction Produit
P.MESSORI

Acciaierie Valbruna S.p.A.

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In conformità a : EN 10204 (2004) , 3.1 / ISO 10474 (2013) , 3.1
Nach/According to/Selon

Certificato nr. MEST621103 / 2020 /
Prüfung/Test/Essai

Cliente / Besteller/Purchaser/Client
VALBRUNA U.K. LTD.
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Ordine nr: 005059726 west bromwich
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Lieferzustand
Delivery state
Etat de livraison

Tipo di Elaborazione: E+AOD
Erschmelzungsart
Melting process
Mode d'elaboration

Qualità: 1.4401/1.4404/316/316L
Werkstoff/Grade/Nuance

Marca: MVAPML (MAXIVAL)
Markenbezeichnung
Brand / Nuance

Produttore :
Hersteller/Item/Usine productrice

ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica: AV
Zeichen des Liefernwerkes
Trade marks
Sigles de l'usine productrice

Punzone del Collaudatore: MR
Stempel des Werkssachverständigen
Inspector's stamp/Poinçon de l'assayeur

Punzonatura: 1.4401/4/316/L
Kennzeichnung
Marking
Marquage

Corrosion test in 16% sulfuric acid and copper sulfate solutions

Test standard: ASTM A262-Practice E

Test	Heat treatment before test	Length of Period (h)	Test temp (°C)	Bend Angle (°)	Ø spindle (mm)	Result of visual inspection at 20 x magnification after bend test	Result
Intergranular corrosion	Sensitization	15	boil	180	5	Absence of cracks	SATISFACTORY

Corrosion test in 16% sulfuric acid and copper sulfate solutions

Test standard: UNI EN ISO 3651-2 Method A

Test	Heat treatment before test	Length of Period (h)	Test temp (°C)	Bend Angle (°)	Ø spindle (mm)	Result of visual inspection at 20 x magnification after bend test	Result
Intergranular corrosion	Sensitized T1	20	boil	90	5	Absence of cracks	SATISFACTORY

Reduction ratio = 14,7 : 1
Solution annealing by process annealing 1040°C min /
/ cooling water

Sono state soddisfatte tutte le condizioni richieste
Die gestellen Anforderungen sind it. Anlage erfüllt
The material has been furnished in accordance with the requirements
Le materiel à été trouvé conforme aux exigences

Controllo antimescolanza: OK
Verwechslungprüfung: spectralanalytisch durchgeführt
Antimixing testing performed: OK
Contrôle antimelange fait: r.a.s.

Controllo visivo e dimensionale: soddisfa le esigenze
Besichtigung und Ausmessung: ohne Beanstandung
Visual inspection and dimensional checks:satisfactory
Contrôle visuel et dimensions: satisfaisant

Melted, poured and manufactured in Italy No welding or weld repair Material free from Mercury contamination

We declare that the finished product is checked for radioactive contamination by the portal system when it leaves the production plant.

The Quality Management System is also Certified according Pressure Equipment Directive 2014/68/EU Annex 1,chapt.4.3 by TÜV and LLOYD`S
Any act of tampering, modification, alteration, counterfeiting and/or falsification and/or any other action which modifies the contents of this test certificate shall constitute a violation of applicable civil and criminal laws. Acciaierie Valbruna shall protect its rights and interests before any competent court, authority and jurisdiction.
Maxival and/or Valplus grades/products are manufactured with ladle techniques to control composition, distribution, size and shape of non-metallic inclusions for improved machinability.
The supplied product conforms to requirements expressly requested by the purchaser and conforms to requirements specified by certified norms and standards. Should the product be used for more severe, critical and/ or in any case different applications than those the material is generally intended for, any different and/or supplementary requirements shall be specifically demanded, at least, upon order of the Product by the Purchaser. Acciaierie Valbruna SpA shall not be responsible for any improper use of the Products.

WcPa2b0dE2fd005dE448E2dAD2d4D15a

MATERIAL CERTIFICATION

Material	**Heat No.**
Packing Gland	437359

(D. Furneaux)
FTR 060 CROSSWIND
~~Witness~~ X Review
12th Feb. 2025

Baker Hughes Confidential

GALPERTI TECH FORGED PRODUCTS S.p.A.
Capitale Sociale € 7.000.000,00 interamente versato
Sede legale e Amministrativa:
23823 COLICO (LC) - Via Ombriano, 14
C.C.I.A.A Lecco n. 03800290136 – R.E.A. 326757
C.F. 03800290136 - P.IVA IT03800290136
Tel. 0341-930186 - Fax 0341-930252
E-mail: galptech@galptech.com - www.galperti.com

The Original

LISTING OF ITEMS & QTY READY FOR INSPECTION

CLIENT: BAKER HUGHES EMEA UNLIMITED COMPANY
PO:5052259095 REV 0
GALPERTI JOB: 240259
TYPE OF MTC: 3.1

Item	Description	Quantity	S/A ***	Material	Heat/Test
001/010	SP SPECIAL				
	PACK GLAND				
	Pipe diameter 01 : 2,00				
	Pipe diameter 02 : 2,00				
	Maximum diameter or Height : 152,40				
	Minimum diameter or Width : 35,05				
	Maximum length : 235,00				
	Material : 316L MPS : 025				
	Fin. : Ver. : 0001	40	S	ASTM A182 F316/316L	437359/001
	566-1360-02				
	MATERIAL REV. LEVEL:B				
	2"X2"-150#,PACKING GLAND,SS				

*** S = BALANCE A = PARTIAL

GALPERTI TECH FORGED PRODUCTS S.p.A.
Capitale Sociale € 7.000.000,00 interamente versato
23823 COLICO (LC) - Via Ombriano, 14 - Tel. 0341-930186 - Fax 0341-930252
C.C.I.A.A Lecco n. 03800290136 – R.E.A. 326757 - C.F. 03800290136 - P.IVA IT03800290136
E-mail: galptech@galptech.com - www.galperti.com

SPETT.LE / MESSRS:
BAKER HUGHES EMEA UNLIMITED COMPANY

SENSING HOUSE, SHANNON FREE ZONE EAST
SHANNON, CO. CLARE (IE)

CERTIFICATO DI COLLAUDO EN 10204
TEST CERTIFICATE EN 10204
3.1

NS.ORDINE / INTERNAL JOB
240259

CERTIFICATO / M.T.CERTIFICATE N.	DATA / DATE	VS.ORDINE / YOUR	DATA / DATE
000145/1	03/04/2024	5052259095 REV 0	03/04/2024

POS / ITEM	DESCRIZIONE / DESCRIPTION	QUANTITA' QUANTITY	S/A	MATERIALE / MATERIAL	N° COLATA / PROVA HEAT N°/TEST N°	ACCIAIERIA STEEL MILL	#
001/010	SPECIAL PIECE SP 566-1360-02 MATERIAL REV. LEVEL:B 2"X2"-150#,PACKING GLAND,SS	40	S	ASTM A182 F316/316L	437359/001	VALBRUNA SPA	A

ANALISI CHIMICA / CHEMICAL ANALYSIS

#		C %	MN %	SI %	P %	S %	CR %	NI %	MO %	CU %	V %	SN %	AL %	NB %	TI %	N %	CO%		
A	L	0,017	1,760	0,620	0,029	0,029	16,820	10,190	2,070	0,500						0,073	0,106		
A	C	0,012	1,800	0,670	0,034	0,024	17,020	10,340	2,140	0,500						0,053	0,106		
A	L																		
A	C																		

NOTE / NOTES

L = ANALISI COLATA / LADLE ANALYSIS
C = ANALISI DI PRODOTTO / CHECK ANALYSIS

CARATTERISTICHE MECCANICHE / MECHANICAL PROPERTIES

#		TRAZIONE / TENSILE									RESILIENZA / CHARPY TEST			
		TIPO TYPE	DIAMETRO DIAMETER mm.	SEZIONE AREA mm2.	LUNGHEZZA LENGHT mm.	TEMP. TEMPERATURE C	ROTTURA TENSILE Mpa	SNERVAMENTO YIELD Mpa	ALL. ELONG %	CONTR. REDUCT. %	TIPO TYPE	TEMP. TEMP.	VALORI VALUES	DUREZZA HARDNESS HB
A	S		12,50	122,70	50,00	20	515	205	30,0	50,0				
A	O		12,50	122,70	50,00	20	557	250	60,9	66,6				165-163

NOTE / NOTES

O = OTTENUTE / OBTAINED
S = STANDARD

#	TRATTAMENTI TERMICI / HEAT TREATMENTS
A A	Quenched at 1050 dgr.C for 0 h.-Cooling from 1050 dgr.C in water (Annealed Solution).

NOTE GENERALI / GENERAL NOTES

FINITURE / ROUGHNESS

STANDARD

NOTE / NOTES
Material according to NACE MR0175/NACE MR0103/ISO 15156.

MARCHIO DI FABBRICA TRADE MARK	DATA COLLAUDO INT. INT. INSPECT DATE	COLLAUDATORE INT INT. INSPECTOR
	03/04/2024	RAIMONDI

ENTE UFFICIALE DI COLLAUDO
INSPECTION AUTHORITY

BAKER HUGHES
ACCEPTED
Signed: Date: 6/6/24

Acciaierie Valbruna S.p.A.

36100 VICENZA (Italia) - Viale della scienza, 25 z.i.
Telefono 0444.968211 - Fax 0444.963836
Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4/37
Telefono 0471.924111 - Fax 0471.924497

CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a / Nach/According to/Selon: EN 10204 (2004) , 3.1 / ISO 10474 (2013) , 3.1

Certificato nr. / Prüfung/Test/Essai: MEST021067 / 2024 /

Cliente / Besteller/Purchaser/Client:
GALPERTI TECH FORGED PRODUCTS SPA
VIA OMBRIANO, 14
23823 - COLICO - LC

Ordine nr: ORD.N.G00038/RJ
Bestell / Your order / Commande

Conferma ordine nr: MI24001307
Werks/Our Order/Ref nr.

Avviso di Spedizione: A-MI24000992
Lieferanzeige/Packing list/B.L.

Stato di fornitura: Laminato - Solubilizzato Pelato
Lieferzustand / Delivery state / Etat de livraison

Tipo di Elaborazione: E+AOD
Erschmelzungsart / Melting process / Mode d'elaboration

Qualità: 1.4401/1.4404/316/316L
Werkstoff/Grade/Nuance

Marca: MVAPML (MAXIVAL)
Markenbezeichnung / Brand / Nuance

Produttore:
Hersteller/Item/Usine productrice
ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica: AV
Zeichen des Lieferwerkes / Trade marks / Sigles de l'usine productrice

Punzone del Collaudatore: MR
Stempel des Werksachverständigen / Inspector's stamp/Poinçon de l'assayeur

Punzonatura: 1.4401/1.4404
Kennzeichnung / Marking / Marquage

SPECIFICHE:
Anforderungen / Requirements / Exigences

Note:
Aufzeichnungen / Notes / Notes

VAL STOCK W2 A/1 1.4404/316L A
MDS S01 5 316 A (0)
MDS S17 1 316 A (1)
(0)Norsok-standard M-630 Edition 6, October 2013
(1)Norsok-standard M-630: 2020 (2020-09-30)

AD 2000-M. W 2 2022 1.4401 A (2)
AD 2000-M. W 2 2022 1.4404 A (3)
AISI . 316/316L
(2)AD 2000-MERKBLATT W 2 edition 03.2022 AD 2000-MERKBLATT W 10 edition 06.2022
(3)AD 2000-MERKBLATT W 2 edition 03.2022 AD 2000-MERKBLATT W 10 edition 06.2022

AMS-QQ-S-763 D 316/316L A
ASME SA182 2023 S31600/03 A (4)
ASME SA193 2023 B8M CLASS 1 (5)
(4)Section II Part A 2023 EDITION For products machined directly from bar refer to ASME SA479.
(5)Section II Part A 2023 EDITION

ASME SA276 2023 S31600/03 A (6)
ASME SA320 2021 B8M CLASS 1 (7)
ASME SA479 2023 S31600/03 A (8)
(6)Section II Part A 2023 EDITION
(7)Section II Part A 2021 EDITION
(8)Section II Part A 2023 EDITION

ASTM A182 2023 S31600/03 A (9)
ASTM A193 2023 B8M CLASS 1
ASTM A262 PR. E 2015 316/316L (A)
(9)For products machined directly from bar refer also to ASTM A479.
(A)Reapproved 2021

ASTM A276 2024 S31600/03 A
ASTM A320 2022 B8M CLASS 1 CLASS1
ASTM A370 2022 .
ASTM A479 2023A S31600/03 A
ASTM E10 2023 .
ASTM E8 2022 .
EN 10088 PART 3 2014 1.4401 A
EN 10088 PART 3 2014 1.4404 A
EN 10272 2016. 1.4401 A
EN 10272 2016. 1.4404 A
ISO 148-1 2016 .
ISO 3651-2 98 METHOD A T1
ISO 6506-1 2014 .
ISO 6892-1 2019 .
NACE MR0103 2015 S31600/03 A (B)
(B)ANSI/NACE MR0103/ISO 17945 November 23, 2015

NACE MR0175 4 S31600/03 A (C)
QQ-S-763 F 316/316L A
ACH CO . .
KV L -196C . ISO 148-1
KV T -196C . ISO 148-1
(C)ANSI/NACE MR0175/ISO 15156-3:2020 Fourth edition, approved 21 Sep 2022.

BAKER HUGHES
ACCEPTED
Signed: Date: 6/6/24

Pos. nr. Pos. nr. Item nr. Nr. de posta	Oggetto Gegenstand Product description Descrip. du produit	Tolleranza: k12 Toleranz/Allowance/Tolerance Dimensioni - mm Abmessungen Dimension Dimension	Lunghezza - mm Länge Length Longueur	Colata Schmelze Heat Coulée	Pezzi Stückzahl Pieces Pièces	Peso - KG Gewicht Weight Poids	Lotto nr. Losnr. Lot nr. Lot nr.
0010	Tondo	175,000	4045/ 4065	437359	2	1553,0	302706760

QUALITY MANAGEMENT SYSTEM CERTIFIED BY LLOYD'S REGISTER ACCORDING TO ISO 9001 : 2015, IATF 16949 : 2016, AS 9100D

Vicenza, 13/02/2024
VCQ012 - MEST021067

Direzione Qualità
Qualitätsmanagement/Quality Management/Gestion Qualité
R.BERTELLI

Direzione Prodotto
Produktmanagement/Product Management/Direction Produit
P.MESSORI

Acciaierie Valbruna S.p.A.

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In conformità a / Nach/According to/Selon: EN 10204 (2004) , 3.1 / ISO 10474 (2013) , 3.1

Certificato nr. / Prüfung/Test/Essai: MEST021067 / 2024 /

Cliente / Besteller/Purchaser/Client:
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Qualità / Werkstoff/Grade/Nuance: 1.4401/1.4404/316/316L

Marca / Markenbezeichnung / Brand / Nuance: MVAPML (MAXIVAL)

Produttore / Hersteller/Item/Usine productrice:
ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica / Zeichen des Lieferwerkes / Trade marks / Sigles de l'usine productrice: AV

Punzone del Collaudatore / Stempel des Werkssachverständigen / Inspector's stamp/Poinçon de l'essayeur: MR

Punzonatura / Kennzeichnung / Marking / Marquage: 1.4401/1.4404

TEST ALLO STATO DI FORNITURA

TEST		min	max	
A	Dimensioni grano x ASTM E112			3

Charpy per ISO 148-1

1) L=longitudinale/längs, T=trasversale/quer, Q=Tangenziale/tangential

TEST	Provetta/ Probestab Specimen/Eprouvette Larg.diam Spess. Breite Diam. Dicke Width Diam. Thickness Larg. diam. epais mm	°C	Posiz. Saggio Probenlage Location Emplacement 1)	Resilienza Kerbschlagarbeit Impact Value Resilience KV2 J			Espansione laterale - Lateral Expansion - Lateral ex mm			Shear - Shear - % Shear %		
Valori richiesti Anforderungen/Required values Valeurs démandées		min max		-	-	-	-	-	-	-	-	-
B	10X10	-196	L	230	224	228	1,900	1,855	1,810	70	70	68

Test allo stato di fornitura per ASTM A370

1) L=longitudinale/längs, T=trasversale/quer, Q=Tangenziale/tangential

TEST	Provetta/ Probestab Specimen/Eprouvette Larg.diam Spess. Breite Diam. Dicke Width Diam. Thickness Larg. diam. epais mm	°C	Posiz. Saggio Probenlage Location Emplacement 1)	Snervamento Streckgrenze Yield Stress Limite elastique Rp 0,2% N/mm2	Snervamento Streckgrenze Yield Stress Limite elastique	Resistenza Zugfestigkeit Tensile strength Resistance à traction Rm N/mm2	Allungamento Bruchdehnung Elongation Allongement E 4d %		Strizione Einschnürung Reduction of area Striction RA %		Resilienza Kerbschlagarbeit Impact Value Resilience		Durezza Haerte Hardness Durete HB	
Valori richiesti Anforderungen/Required values Valeurs démandées		min max		210	-	520 790	-	40	-	50	-		- 223	
C	12,5	20	L	264		563		61		70			163	

Test allo stato di fornitura per ASTM A370

1) L=longitudinale/längs, T=trasversale/quer, Q=Tangenziale/tangential

TEST	Provetta/ Probestab Specimen/Eprouvette Larg.diam Spess. Breite Diam. Dicke Width Diam. Thickness Larg. diam. epais mm	°C	Posiz. Saggio Probenlage Location Emplacement 1)	Snervamento Streckgrenze Yield Stress Limite elastique Rp 0,2% N/mm2	Snervamento Streckgrenze Yield Stress Limite elastique	Resistenza Zugfestigkeit Tensile strength Resistance à traction Rm N/mm2	Allungamento Bruchdehnung Elongation Allongement E 4d %		Strizione Einschnürung Reduction of area Striction RA %		Resilienza Kerbschlagarbeit Impact Value Resilience		Durezza Haerte Hardness Durete	
Valori richiesti Anforderungen/Required values Valeurs démandées		min max		205	-	515	-	40	-	50	-		-	
D	12,5	20	T	259		569		61		71				

Acciaierie Valbruna S.p.A.

36100 VICENZA (Italia) - Viale della scienza, 25 z.i.
Telefono 0444.968211 - Fax 0444.963836
Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4/37
Telefono 0471.924111 - Fax 0471.924497

CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a / Nach/According to/Selon: EN 10204 (2004) , 3.1 / ISO 10474 (2013) , 3.1

Certificato nr. / Prüfung/Test/Essai: MEST021067 / 2024 /

Cliente / Besteller/Purchaser/Client:
GALPERTI TECH FORGED PRODUCTS SPA
VIA OMBRIANO, 14
23823 - COLICO - LC

Stato di fornitura / Lieferzustand / Delivery state / Etat de livraison: Laminato - Solubilizzato Pelato

Produttore / Hersteller/Item/Usine productrice:
ACCIAIERIE VALBRUNA S.P.A.

Tipo di Elaborazione / Erschmelzungsart / Melting process / Mode d'elaboration: E+AOD

Marchi di Fabbrica / Zeichen des Lieferwerkes / Trade marks / Sigles de l'usine productrice: AV

Ordine nr. / Bestell / Your order / Commande: ORD.N.G00038/RJ

Qualità / Werkstoff/Grade/Nuance: 1.4401/1.4404/316/316L

Punzone del Collaudatore / Stempel des Werksachverständigen / Inspector's stamp/Poinçon de l'essayeur: MR

Conferma ordine nr. / Werks/Our Order/Ref nr.: MI24001307

Marca / Markenbezeichnung / Brand / Nuance: MVAPML (MAXIVAL)

Punzonatura / Kennzeichnung / Marking / Marquage: 1.4401/1.4404

Avviso di Spedizione / Lieferanzeige/Packing list/B.L.: A-MI24000992

Prova di trazione per ISO 6892-1

1) L=longitudinale/längs, T=trasversale/quer, Q=Tangenziale/tangential

TEST	Provetta/ Probestab Specimen/Eprouvette Larg.diam Spess. Breite Diam. Dicke Width Diam. Thickness Larg. diam. epais mm	°C	Posiz. Saggio Probenlage Location Emplacement 1)	Snervamento Streckgrenze Yield Stress Limite elastique Rp 0,2% N/mm2	Snervamento Streckgrenze Yield Stress Limite elastique Rp 1% N/mm2	Resistenza Zugfestigkeit Tensile strength Resistance à traction Rm N/mm2	Allungamento Bruchdehnung Elongation Allongement A5 %		Strizione Einschnürung Reduction of area Striction Z %		Resilienza Kerbschlagarbeit Impact Value Resilience			Durezza Haerte Hardness Durete HB		
Valori richiesti Anforderungen/Required values Valeurs démandées		min max		200	235	500 700	30	-	-	-	-			-		215
E	10	20	T	250	298	557	54		65					158		
L	10	20	T	254	302	559	53		66					159		

Charpy per ISO 148-1

1) L=longitudinale/längs, T=trasversale/quer, Q=Tangenziale/tangential

TEST	Provetta/ Probestab Specimen/Eprouvette Larg.diam Spess. Breite Diam. Dicke Width Diam. Thickness Larg. diam. epais mm	°C	Posiz. Saggio Probenlage Location Emplacement 1)	Resilienza Kerbschlagarbeit Impact Value Resilience KV2 J			Espansione laterale Lateral Expansion Lateral ex mm			Shear Shear % Shear %		
Valori richiesti Anforderungen/Required values Valeurs démandées		min max		-	-	-	-	-	-	-	-	-
F	10X10	-196	T	80	80	87	0,485	0,320	0,810	27	20	20

Charpy per ISO 148-1

1) L=longitudinale/längs, T=trasversale/quer, Q=Tangenziale/tangential

TEST	Provetta/ Probestab Specimen/Eprouvette Larg.diam Spess. Breite Diam. Dicke Width Diam. Thickness Larg. diam. epais mm	°C	Posiz. Saggio Probenlage Location Emplacement 1)	Resilienza Kerbschlagarbeit Impact Value Resilience KV2 J			Espansione laterale Lateral Expansion			Shear Shear		
Valori richiesti Anforderungen/Required values Valeurs démandées		min max		60	60	60	-	-	-	-	-	-
I	10X10	20	T	97	90	88						
M	10X10	20	T	96	88	94						

Tensile testing according to ISO 6892-1
Impact testing according to ISO 148-1
Mechanical properties according to ASTM A370.
Brinnell hardness according to ASTM E10
Tensile testing according to ASTM E8
Brinnell hardness according to ISO 6506-1

Acciaierie Valbruna S.p.A.

36100 VICENZA (Italia) - Viale della scienza, 25 z.i.
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Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4/37
Telefono 0471.924111 - Fax 0471.924497

CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a : EN 10204 (2004) , 3.1 / ISO 10474 (2013) , 3.1
Nach/According to/Selon

Certificato nr. MEST021067 / 2024 /
Prüfung/Test/Essai

Cliente / Besteller/Purchaser/Client
GALPERTI TECH FORGED PRODUCTS SPA
VIA OMBRIANO, 14
23823 - COLICO - LC

Ordine nr: ORD.N.G00038/RJ
Bestell
Your order
Commande

Conferma ordine nr: MI24001307
Werks/Our Order/Ref nr.

Avviso di Spedizione: A-MI24000992
Lieferanzeige/Packing list/B.L.

Stato di fornitura : Laminato - Solubilizzato Pelato
Lieferzustand
Delivery state
Etat de livraison

Tipo di Elaborazione: E+AOD
Erschmelzungsart
Melting process
Mode d'elaboration

Qualità: 1.4401/1.4404/316/316L
Werkstoff/Grade/Nuance

Marca: MVAPML (MAXIVAL)
Markenbezeichnung
Brand / Nuance

Produttore :
Hersteller/Item/Usine productrice
ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica:
Zeichen des Lieferwerkes
Trade marks
Sigles de l'usine productrice

Punzone del Collaudatore:
Stempel des Werkssachverständigen
Inspector's stamp/Poinçon de l'assayeur
MR

Punzonatura: 1.4401/1.4404
Kennzeichnung
Marking
Marquage

Analisi chimica

Chemische Zusammensetzung/Chemical Analysis/Analyse chimique

Colata /Heat / Schmelze/Coulée		C %	Si %	Mn %	Cr %	Mo %	Cu %	Ni %	Co %	P %	S %	N %				
	min -	-	-	-	16,50	2,00	-	10,00	-	-	-	-	-	-	-	-
	max	0,030	1,00	2,00	18,00	2,50	1,00	13,00	-	0,045	0,030	0,100	-	-	-	-
437359		0,017	0,62	1,76	16,82	2,07	0,50	10,19	0,106	0,029	0,029	0,073				

Corrosion test in 16% sulfuric acid and copper sulfate solutions

Test standard: UNI EN ISO 3651-2 Method A

Test	Heat treatment before test	Length of Period (h)	Test temp (°C)	Bend Angle (°)	Ø spindle (mm)	Result of visual inspection at 20 x magnification after bend test	Result
Intergranular corrosion	Sensitized T1	20	boil	90	5	Absence of cracks	SATISFACTORY

Corrosion test in 16% sulfuric acid and copper sulfate solutions

Test standard: ASTM A262-Practice E

Test	Heat treatment before test	Length of Period (h)	Test temp (°C)	Bend Angle (°)	Ø spindle (mm)	Result of visual inspection at 20 x magnification after bend test	Result
Intergranular corrosion	Sensitization	15	boil	180	5	Absence of cracks	SATISFACTORY

Reduction ratio = 10,1 : 1
Solution annealed 1080°C for 4 h /water cooled.
ET ACC. TO EN 10088-3 TAB.1
UT ACC. TO:ASTM A388; EN 10308 Cl.1
"Issued in agreement with TÜV SÜD Industrie Service GMBH (07/1972)"
"Qs approved according to PED, Annex I, Para. 4.3 by Notified Body 0036"
"(Certification no. DGR-0036-QS-W 23/2002/MUC)"

Sono state soddisfatte tutte le condizioni richieste
Die gestellen Anforderungen sind it. Anlage erfüllt
The material has been furnished in accordance with the requirements
Le materiel à été trouvé conforme aux exigences

Controllo antimescolanza con tecnica XRF/OES portatile : OK
Verwechslungprüfung: durch XRF/QES Gerät geführt : OK
Antimbding testing performed with XRF/OES portable : OK
Contrôle antimélange avt technique XRF/QES portable : OK

Controllo visivo e dimensionale: soddisfa le esigenze
Besichtigung und Ausmessung: ohne Beanstandung
Visual inspection and dimensional checks:satisfactory
Contrôle visuel et dimensions: satisfaisant

Melted, poured and manufactured in Italy No welding or weld repair Material free from Mercury contamination

We declare that the finished product is checked for radioactive contamination by the portal system when it leaves the production plant.

QUALITY MANAGEMENT SYSTEM CERTIFIED BY LLOYD'S REGISTER ACCORDING TO ISO 9001 : 2015, IATF 16949 : 2016, AS 9100D

Vicenza, 13/02/2024
VCQ012 - MEST021067

Direzione Qualità
Qualitätsmanagement/Quality Management/Gestion Qualité
R.BERTELLI

Direzione Prodotto
Produktmanagement/Product Management/Direction Produit
P.MESSORI

Acciaierie Valbruna S.p.A.

36100 VICENZA (Italia) - Viale della scienza, 25 z.i.
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Telefono 0471.924111 - Fax 0471.924497

CERTIFICATO DI COLLAUDO - ABNAHMEPRUEFZEUGNIS - INSPECTION CERTIFICATE - CERTIFICAT DE RECEPTION

In conformità a / Nach/According to/Selon: EN 10204 (2004) , 3.1 / ISO 10474 (2013) , 3.1

Certificato nr. / Prüfung/Test/Essai: MEST021067 / 2024 /

Cliente / Besteller/Purchaser/Client:
GALPERTI TECH FORGED PRODUCTS SPA
VIA OMBRIANO, 14
23823 - COLICO - LC

Ordine nr: ORD.N.G00038/RJ
Bestell / Your order / Commande

Conferma ordine nr: MI24001307
Werks/Our Order/Ref nr.

Avviso di Spedizione: A-MI24000992
Lieferanzeige/Packing list/B.L.

Stato di fornitura: Laminato - Solubilizzato Pelato
Lieferzustand / Delivery state / Etat de livraison

Tipo di Elaborazione: E+AOD
Erschmelzungsart / Melting process / Mode d'elaboration

Qualità: 1.4401/1.4404/316/316L
Werkstoff/Grade/Nuance

Marca: MVAPML (MAXIVAL)
Markenbezeichnung / Brand / Nuance

Produttore:
Hersteller/Item/Usine productrice
ACCIAIERIE VALBRUNA S.P.A.

Marchi di Fabbrica: AV
Zeichen des Liefernwerkes / Trade marks / Sigles de l'usine productrice

Punzone del Collaudatore: MR
Stempel des Werkssachverständigen / Inspector's stamp/Poinçon de l'assayeur

Punzonatura: 1.4401/1.4404
Kennzeichnung / Marking / Marquage

The Quality Management System is also Certified according to Pressure Equipment Directive 2014/68/EU Annex 1,chapt.4.3 by TÜV and LLOYD`S
The Quality Management System is also Certified according to PER 2016/1105, Schedule 2, Part 4, Para 31 (8) by Competent Body TÜV SUD BABT Unlimited.
Any act of tampering, modification, alteration, counterfeiting and/or falsification and/or any other action which modifies the contents of this test certificate shall constitute a violation of applicable civil and criminal laws. Acciaierie Valbruna shall protect its rights and interests before any competent court, authority and jurisdiction.
Maxival and/or Valplus grades/products are manufactured with ladle techniques to control composition, distribution, size and shape of non-metallic inclusions for improved machinability.
The supplied product conforms to requirements expressly requested by the purchaser and conforms to requirements specified by certified norms and standards. Should the product be used for more severe, critical and/ or in any case different applications than those the material is generally intended for, any different and/or supplementary requirements shall be specifically demanded, at least, upon order of the Product by the Purchaser. Acciaierie Valbruna SpA shall not be responsible for any improper use of the Products.

WIP287842FDA122221FC8742FC873:EC86

GALPERTI TECH FORGED PRODUCTS S.p.A.
Capitale Sociale € 4.000.000,00 interamente versato
Sede legale e Amministrativa:
23823 COLICO (LC) - Via Ombriano, 14
C.C.I.A.A Lecco n. 03800290136 – R.E.A. 326757
C.F. 03800290136 -P.IVA IT03800290136
Tel. 0341-930186 - Fax 0341-930252
E-mail: galptech@galptech.com - www.galperti.com

VISUAL & DIMENSIONAL REPORT

Certificate No.:	240259-001 vd001
Revision No.:	0
Date :	27/05/2024

Main Information

Client:	BAKER HUGHES EMEA UNLIMITED COMPANY
Client Order No. :	5052259095 REV 0
Supplier:	GALPERTI TECH FORGED PRODUCTS S.p.A.
Supplier's Ref.No. :	240259-001
Items:	001
Material:	A182 F316/F316L
Drawing:	566-1360-02 Rev.B
Item Description:	PACKING GLAND
Tot. Qty :	4 0

Dimensional Detail

Type of inspection :	Dimensional inspection performed on 100% of pieces
Instrument :	Caliper
Light Intensity:	Intensity > 1000 lux
Result :	SATISFACTORY as per APPROVED DWG

Visual Detail

Type of inspection :	Visual inspection performed on 100% of pieces
Light Intensity:	Intensity > 1000 lux
Status of pieces:	Items cleaned from scale and processing compounds
Result :	SATISFACTORY, material found 100% without defect and conform to Spec.

Note

Temperature at time of inspection 20°C

Operator / Inspection

Prepared by:	Davide Raimondi
Level:	-
Date:	27/05/2024
Verify By:	Luca Panzeri
Date:	27/05/2024

GALPERTI TECH FORGED PRODUCTS S.p.A.
Capitale Sociale € 4.000.000,00 interamente versato
Sede legale e Amministrativa:
23823 COLICO (LC) - Via Ombriano, 14
C.C.I.A.A Lecco n. 03800290136 – R.E.A. 326757
C.F. 03800290136 -P.IVA IT03800290136
Tel. 0341-930186 - Fax 0341-930252
E-mail: galptech@galptech.com - www.galperti.com

CONFORMITY REPORT

Certificate No.:	240259-001 c001
Revision No.:	0
Date :	27/05/2024

Main Information

Client:	BAKER HUGHES EMEA UNLIMITED COMPANY
Client Order No. :	5052259095 REV 0
Supplier:	GALPERTI TECH FORGED PRODUCTS S.p.A.
Supplier's Ref.No. :	240259-001
Items:	001
Material:	A182 F316/F316L
Drawing:	566-1360-02 Rev.B
Item Description:	PACKING GLAND
Tot. Qty :	40

Declaration

We hereby certify that all items supplied for the above purchase order meet all requirements of the applicable specifications of manufacture, the purchase order item descriptions, purchase specifications and purchase order requirements.We certify that all applicable heat treatments, chemical analysis, mechanical tests, non destructive examinations, welding procedures, etc., as required in the purchase order, were performed and that the results were in accordance with the requirements of the purchase order. We certify that all required analysis and tests were performed on final production parts, or on specimens which were representative in all respects, of the final production part. We certify that all the instruments used for all the mesurements are properly calibrated according to our internal procedure P007.

MATERIAL ACCORDING TO: **NACE MR0175/ NACE MR0103/ISO 15156**

Operator / Inspection

Prepared by:	Davide Raimondi
Level:	-
Date:	27/05/2024
Verify By:	Luca Panzeri
Date:	27/05/2024

MATERIAL CERTIFICATION

Material	**Heat No.**
Stop ring	509612

Baker Hughes Confidential

PROMAT BD LTD

INSPECTION CERTIFICATE
TYPE BS EN 10204 3.1

CUSTOMER: BAKER HUGHES EMEA UNLIMITED COMPANY
Sensing House, Shannon Free Zone East,
Shannon, CO CLARE, Ireland

CERT NO.	PRBD1907594
CLIENT PO NO.	5052365644
DATE	26/11/2024
PROMAT REF NO.	PS047800

ITEM #	REFERENCE	QTY	HEAT	DESCRIPTION	MATERIAL GRADE	HEAT TREATMENT
10	TC22523-316	4 Nos.	509612	P/N: 183M5447 - FITTING (DRG: 183M5447 REV -)	ASTM A182/A182M F316/316L	Solution Annealed @ 1060C : Water quenched

HEAT	C [%]	Si [%]	Mn [%]	S [%]	P [%]	Cr [%]	Ni [%]	Mo [%]	Ti [%]	Cu [%]	V [%]	Al [%]	Co [%]	Nb [%]	N [%]	Sn [%]	W [%]	B [%]	Ca [%]	Fe [%]	CEV [%]	PREN [%]	Ca : S [%]	Al : N [%]	V+Nb+Ti [%]
509612 (L)	0.019	0.062	1.570	0.0260	0.033	17.260	11.140	2.000	-	0.410	-	-	0.190	-	0.0245	-	-	-	-	-	-	24.25	-	-	-

BAKER HUGHES
ACCEPTED
Signed: MC Date: 9/12/24

HEAT	TENSILE STRENGTH (MPa)	YIELD STRENGTH (MPa)	ELONGATION (%)	RED. OF AREA (%)	HARDNESS		CHARPY IMPACT				
							TEST TEMP. (^{0}C)	ABS. ENERGY (J)	SHEAR AREA (%)	L.E (mm)	AVERAGE (J)
509612	557	258	52	73	143 HBW	-	20	247 , 252 , 249	-	-	249.33

REMARKS

1: LRQA APPROVAL No: 00005177
2: MATERIALS CONFORM TO NACE MR-01-75/01-03 / ISO 15156 LATEST EDITION & SATISFIES PARA. 4.3 ANNEX 1 OF 2014/68/EU (PED)

TRADEMARKS

AUTHORISATION

I hereby confirm these records to be correct as contained in the records of the company. The document is transmitted and stored electronically.

R. Wanglin
Quality Manager

DJT0
QA VERIFIED/RELEASED

Unit 20 Regal Drive, Walsall Enterprise Park, Walsall, WS2 9HQ
Phone: +44 (0) 1922 748310, Fax: +44 (0) 1922 748320, Email: richard.wanglin@promatbd.co.uk

This certificate is valid when stamped QA VALIDATED.

724001317-QC-DB-00014
REV 00
Page 674 of 969

ACEROS INOXIDABLES OLARRA S.A.
Cm. Larrabarri, Elotxelerri, 1
48180 Loiu, Bizkaia
España
www.olarra.com

Management Systems Certified by LRQA
ISO 9001 / SGI 6000360
ISO 14001 / SGI 1870678

TC22523

ACEROS INOXIDABLES OLARRA

OLARRA U.K. LTD.
FOREST PARK - CLEOBURY MORTIMER
NR KIDDERMINSTER - DY 14 9BD - ENGLAND

Trade Mark - Zeichen des Lieferwerkes / Anagrama del suministrador
Works Inspector Stamp - Werkssachverständiger / Sello del Inspector: 3

Certificate type - APZ Nach / Certificado tipo	Certificate nº - Prüf-Nr / Certificado nº	Date - Datum - Fecha
EN 10204/3.1	446427	08 - 02 - 2021

Our order Nº / Werks - Nr / Nº de Referencia	Heat / Schmelze / Colada	Your order Nº / Bestell - Nr / Pedido Nº
732165	509612	OL9951

Steel Grade / Werkstoff / Calidad	According to / Entsprechend / Corresponde
316-S-11 AV	BS 970:PART 3:1991.

Shape and Size - Gegenstad / Perfil y dimensión	Tolerance - Toleranz / Tolerancia	Bundles / Bunde / Bultos	Bars / Stäbe / Barras	Weight / Gewicht / Peso
ROUND 60 mm	k 12 /ISO 286-1 /EN 10060	4		2417 Kg

Requirements - Anforderungen - Exigencias

EN 10088-3 2014.
EN 10272-2016.
ASTM A 182/A 182M-19.
ASTM A 479 / A 479M-20.
ASTM A 276/A 276M-17.
ASME SA 479 / SA 479M-19
ASME SA 182 / SA 182M-19
ASME SA 276-2019
NACE MR-0175/ISO 15156-3 2015.
NACE MR-0103/ISO 17945-2015.

NORSOK M-630 and MDS S01.
SAE AMS 5653J-19.
AMS QQS 763D-15 COND.A.
316S31AV-1.4404-1.4401-Type 316-Type 316L-F.316-F.316L.
PED 2014/68/EU, Annex I, Parag.4.3/DGR 2014/68/EU
Anhang I Absatz 4.3 Certificate/Zertifikat Nr. 348/2008/MUC

Melting process / Erschmelzungsart / Proceso de Fusión	Heat treatment / Wärmebehandlung / Tratamiento térmico
E.A.F. / A.O.D.	1060C 4H/Std WATER/WASSER/AGUA

Solution annealed/Abgeschreckt/Hipertemple-Turned/Drehen/Torneado-

Test results - Ergebnis der Prüfungen - Resultados de los ensayos

Reference standard / Bezugsnorm / Norma de referencia		Rp0,2% N/mm2 MPA	Rp 1% N/mm2 MPA	Rm N/mm2 MPA	A %L 5D	A %L 4D	Z %	Hardness Härte HBw	Impact test / Kerbschlagzaehigkeit / Resiliencia ISO V Jules
ASTM A370, ISO 6892	Min.	190	225	490	40				
	Max.								
Temperature ºC: 20	Spec. Nº. 1 / Probe Nr. / Pro Nº.	258	289	557	52	55	73	143	247/252/249

	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	N	Co
Min.						16,50	2,00	11,00			
Max.	0,030	1,00	2,00	0,045	0,030	18,50	2,50	14,00	0,70		
	0,019	0,62	1,57	0,033	0,026	17,26	2,00	11,14	0,41	0,0245	0,19

Visual and dimensional inspection / Besichtigung und Ausmessung / Control visual y dimensional	Radioactivity inspection / Radioaktivitätskontrolle / Control de Radioactividad	Antimixing test / Spektrosk Verwechslungspr / Antimezcla	Grain Size / Korngrösse / Tamaño de grano
O.K.	O.K.	O.K.	6-7 ASTM E-112-13

Remarks - Bemerkungen - Observaciones

IC test acc./IK prüfung nach ASTM A 262 E.15. OK
100% US test/US prüfung. OK
This material complies to DFARS 252.225-7014.
No welding repair.
Free from mercury or radio-activity contamination.
Country of origin: Spain
Crack control/Rissgeprüft acc. EN 10277-1 class 3. OK

PROMAT BD SL
QA/QC DEPT
VALIDATED
RDWO
28/5/21
CERTIFICATE ACCEPTED

EDV / EDP
Acc. EN 10.204
Marian Tejedo
Quality Mng.

Works Inspector
Der Werkssachverständige
Inspector de fábrica

We hereby certify that material described herein complies with the requirements agreed on the order.

Firmado digitalmente por / Signed digitally by: ACEROS INOXIDABLES OLARRA SA - CIF A48663546
Fecha / Date:08-02-2021 12:14

ROTECH LABORATORIES

MOXLEY INDUSTRIAL CENTRE
WESTERN WAY
WEDNESBURY
WEST MIDLANDS
WS10 7BG
TEL: 0121 505 4050
FAX: 0121 505 1115
www.rotechlabs.co.uk
info@rotechlabs.co.uk

UKAS TESTING
0366

Test Report

Number: 21-06603 **Issue:** 1 **Date Reported:** 23/06/2021

A/C No: P077

Tested For:

PROMAT BD LIMITED
UNIT 20, WALSALL PARK
REGAL DRIVE
PLECK
WALSALL
WS2 9HQ

RELEVANT INFORMATION

Description	GXS25BAR60-60mmØ Round Bar Cast: 509612 ASTM A182 F316/316L
Specification:	ASTM A262 Pr E
Submitted by:	RICHARD WANGLIN
Purchase Order No.	P15842
Date Sample(s) Received:	18/06/2021
Date(s) tested:	23/06/2021

INTRODUCTION:

The test items were submitted to the laboratory for:

- **Corrosion - Intergranular susceptibility**
- **Metallographic - Microexamination**

PROMAT BD LTD QA/QC DEPT VALIDATED RDW0 23/6/21 CERTIFICATE ACCEPTED

REPORT ISSUED AND AUTHORISED BY

Craig Easton
Head of Metallurgy

FOR REPORTS CONTAINING ACCREDITED TESTS, TESTS MARKED "NOT UKAS ACCREDITED" ARE NOT INCLUDED IN THE UKAS ACCREDITATION SCHEDULE FOR OUR LABORATORY.
TESTS MARKED "SC" HAVE BEEN SUBCONTRACTED. RESULTS IN THIS REPORT RELATE ONLY TO THE ITEMS TESTED, AS RECEIVED
OPINIONS AND INTERPRETATIONS EXPRESSED HEREIN ARE OUTSIDE THE SCOPE OF UKAS ACCREDITATION.
THIS TEST REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT WRITTEN APPROVAL OF THE LABORATORY.
TESTING CONDUCTED IN ACCORDANCE WITH MANAGEMENT SYSTEM MANUAL ISSUE 4.
Decision Rule:
1 When a statement of conformity is not requested and where applicable, test results will be reported as found together with the uncertainty of measurement.
2 When a statement of conformity is requested for test results against limits set out in a standard or specification (i.e. ASTM, BS EN ISO) that already considers measurement uncertainty, the requirements in the standard or specification will be followed..
3 When a statement of conformity is requested for a test result against limits set out in a standard or specification that does not consider measurement uncertainty, zero guard banding will be applied with a "Pass" reported when the measured result is in-tolerance and a "Fail" reported when the measured result is out-of-tolerance. However, should the expanded measurement uncertainty of the measured result be greater than 1/3 the tolerance limits, the decision rule will default to 1 above.

Test Report

Job no: 21-06603 **Issue:** 1

Customer PROMAT BD LIMITED

Purchase order no.: P15842

Corrosion - Intergranular susceptibility **Sample: 21-06603-001**

Tested in accordance with: ASTM A262 practice E - 2015

Practice E - Copper - copper sulfate 16% sulfuric acid test for detecting susceptability to intergranular attack

Sensitising heat treatment 1hour at 675DegC.

The specimen degreased using acetone and dried.

Minimum test time 15hrs. If not 15hrs, the test time shall be specified.

The bend specimen was examined under low (5 to 20x) magnification.

Heat treated	Sensitised
Test duration [hrs]	15hrs

Sample ID	Observation
#1	Bend test revealed no evidence of fissures or cracks
Rqmnts->	Bend test revealed no evidence of fissures or cracks

Complies with the tested requirements of ZR COR2 - corrosion intergranular suscept;

Metallographic - Microexamination **Sample: 21-06603-002**

Tested in accordance with: RP368

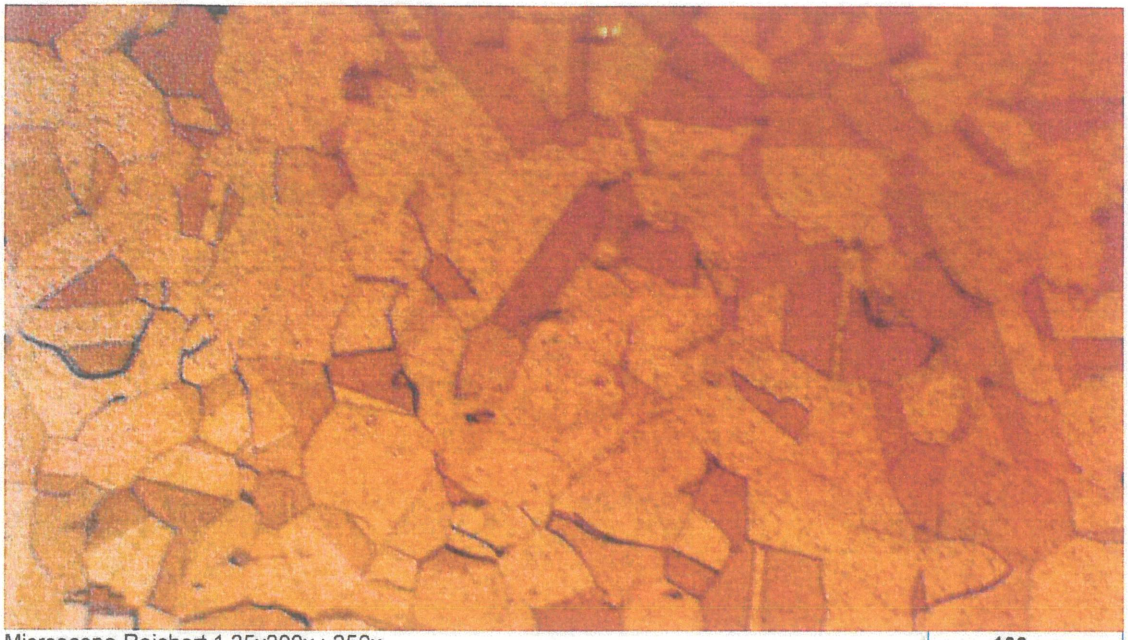
The sample was cross sectioned and prepared for metallographic examination according to the recommended procedures in ASTM E3-11(2017) and when appropriate etched using appropriate reagent, such as listed in ASTM E407-07(2015)e1.

After etching in kallings No 2 reagent the specimen revealed a twinned grain austenitic microstructure with no significant intermetallic phases or grain boundary precipitates.

See figure 1

Test Report - Photos

Job no: 21-06603 **Issue:** 1
Customer PROMAT BD LIMITED
Purchase order no.: P15842



Microscope Reichert 1.25x200x : 250x

Figure 1: Photomicrograph showing sample microstructure : Etchant;- Kallings No2

ROTECH LABORATORIES

Test Report

MOXLEY INDUSTRIAL CENTRE, WESTERN WAY,
WEDNESBURY. WEST MIDLANDS, WS10 7BG
TEL: 0121 505 4050
www.rotechlabs.co.uk, info@rotechlabs.co.uk

UKAS TESTING
0366

Rotech Number: 23-07270
Issue: 1
Date Reported: 06/07/2023
Purchase Order No. P16406

724001317-QC-DB-00014

Description 60mmØ Bar
Part No: TESTING-GXS25BAR60
Cast No: 509612
WO No: 2476

The test item was submitted to the laboratory for:
Mechanical - Tensile

Specification: None Stated
Requirements: Customer PO
Submitted by: RICHARD WANGLIN
Date Sample(s) Received: 29/06/2023
Date(s) tested: 06/07/2023

Tested For:
PROMAT BD LIMITED
UNIT 20, WALSALL PARK
REGAL DRIVE
PLECK
WALSALL
WS2 9HQ

REV-00

Sample: 23-07270-001 **Mechanical - Tensile** Tested in accordance with: BS EN ISO 6892-2 - 2018

Description: Longitudinal test piece **Test piece type:** Bars **Test temperature [°C]:** 550 **Control mode:** A133 **Test piece size [mm]:** 9.01Ø **Original gauge length [mm]:** 5.65/So
Soaking time [mins]: 10

Pass

Sample ID	Yield strength Rp0.2% [MPa]	Tensile strength [MPa]	Elongation [%]	Reduction of area [%]
#1	162	425	39.5	67
Rqmts	98 Min	-	-	-

Complies with the specified requirements.

PROMAT BD LTD
QA/QC DEPT VALIDATED
RDWO
CERTIFICATE ACCEPTED

Page 679 of 969

REPORT ISSUED AND AUTHORISED BY
Chris Jones
Senior Technician

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TESTING CONDUCTED IN ACCORDANCE WITH MANAGEMENT SYSTEM MANUAL ISSUE 6.

Decision Rule:
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MATERIAL CERTIFICATION

Material	**Heat No.**
Bottom Compresion Fitting	7WV/9ER/7ZD/9KC

(D. Furneaux)
FTR 060 CROSSWIND
~~Witness~~ X Review
12th Feb. 2025

Baker Hughes Confidential

Swagelok Company
29500 Solon Rd
Solon, OH 44139 U.S.A.

440.349.5600

Inspection Certificate EN 10204-3.1

Distributor	Customer	Customer PO#
FST (Scotland) Ltd Unit 20, Southern Cross Business Park Boghall Road Bray Dublin, County Wicklow A98 F590	Baker Hughes Emea Unlimited Co Sensing House Shannon Free Zone East Shannon County Clare	5052344037

No.	Part Number	Qty	Prod ID/Batch Num	Component	Heat Code
1	SS-810-1-0125	100	0005117087	Back ferrule	7WV
				Body	9ER
				Front ferrule	7ZD
				Nut	9KC

Swagelok products referenced above are manufactured from material purchased and certified as being in accordance with the specification(s) listed below.

Information contained in the above customer address column (marked as "Customer") and area marked "Reference" (when applicable) of this certification are for reference purposes only. Swagelok Company makes no stipulations, nor takes responsibility, for the accuracy or reliability of such information.

Swagelok products are manufactured under conditions which are free from mercury. No mercury bearing components have been used in the products of your order and no mercury bearing instruments or other equipment have been used in their manufacture, assembly, or testing in such a manner as might cause contamination.

No asbestos or asbestos-containing components are used in Swagelok brand products.

MATERIAL STANDARDS

Components	Material	Standards
Shaped Fittings	F316/F316L Stainless Steel Forgings	ASTM A182, ASME SA182
Straight Fittings	316/316L Stainless Steel Bar	ASTM A479, ASME SA479, ASTM A276 (exception of square and rectangular bar)

Type 316 Stainless Steel Bar material is in the Strain-Hardened Level 2 condition.

Specific chemistry obtained from analysis of product made from this material may vary from the batch values as provided with this certification.

Stainless steel material has passed the Intergranular Corrosion Test requirements of EN ISO 3651-2, Method A, and ASTM A-262 Practice E.

All parts were cleaned and packaged in accordance with Swagelok Specifications.

The Swagelok® products specified above were manufactured in accordance with Swagelok Company's Quality Manual (SQS-F latest revision, Revision O, dated February 7, 2024).

Swagelok Company's Quality System is approved to ISO:9001 (BSI Certificate # FM01729).

Annexes: Material Certificates

Certifications Supervisor
Michael J. Zickes

REVIEWED
1/2/2025
Page 681 of 969
By Martin McMahon at 10:00 am, Jan 10, 2025

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001309950

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Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505149474	W48167		30108

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760586**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED GROUND
---------- NUCLEAR QUAL
PART NUMBER: SSD-RB-062500

SPECIFICATION: SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. H (03/18/19)
---------- ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-21 (11/01/21)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 7 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)

SIZE 0.625000 IN.(15.88 MM) RD BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.020	1.15	0.59	0.027	0.026	17.57

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.14	2.05	0.49	0.35	0.03

MELT DATE: 06/26/23
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND

CONTINUED ON NEXT PAGE

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Certification ID:001309950

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CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505149474	**W48167**		**30108**

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760586**

INDUSTRIE SERVICE GMBH, NO. 01 202 USA/Q-03 8928, IN ACCORDANCE WITH PED 2014/68/EU ANNEX I PARA. 4.3 + AD 2000 W0
100% COMPARATOR TESTED TO DETECT/SORTOUT HIGH IRON/LOW ALLOY INCLUSIONS.
MATERIAL VISUAL AND DIMENSIONAL INSPECTED - ACCEPTABLE.
PROVISIONS OF 10 CFR PART 21 APPLY
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
ULTRASONIC INSPECTED (IMMERSION) PER CTC PROCEDURE - ACCEPTABLE.
CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
SOLUTION ANNEALED TO PROVIDE A MICROSTRUCTURE FREE FROM CONTINUOUS GRAIN BOUNDARY CARBIDE PRECIPITATION (NETWORK).
NO WELD REPAIR.
THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL REVISION 38, DATED 08/21/2022 "AS ACCEPTED BY SWAGELOK COMPANY" IN COMPLIANCE WITH ASME B & P V CODE SECTION III, DIVISION 1 SUBSECTION NCA 3800 2017 EDITION.
PROVISIONS OF 10 CFR PART 21 & 10 CFR PART 50 - APPENDIX B APPLY.
IN PRODUCTION OR TESTING OF MATERIAL SHIPPED AGAINST THIS ORDER, NO DIRECT CONNECTED MERCURY MANOMETER, MERCURY PUMPS, MERCURY SEALS, OR MERCURY IN GLASS THERMOMETERS HAVE BEEN USED. NOR IN SUCH PRODUCTION OR TESTING HAS MERCURY BEEN HANDLED IN THE IMMEDIATE VICINITY OF SUCH MATERIAL.
THIS CERTIFICATE AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY US, OR OUR SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE ORDER REQUIREMENTS AS MAY HAVE BEEN MODIFIED BY PRIOR CORRESPONDENCE BETWEEN THE PARTIES.
MATERIAL IS COMPLIANT TO REACH; THE E.U.'S REGISTRATION, EVALUATION, AUTHORIZATION, AND REGISTRATION OF CHEMICALS LEGISLATION.
THIS HEAT MELTED BY THE ELECTRIC ARC/AOD PROCESSES
MATERIAL IS COMPLIANT TO 2015/863/EU (ROHS3) DIRECTIVE.
THIS MATERIAL HAS BEEN SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND MEETS ALL SPECIFICATION REQUIREMENTS.
INTERGRANULAR CORROSION TESTED PER ISO 3651
THIS MATERIAL WAS MANUFACTURED FREE FROM MERCURY, RADIUM AND ALPHA SOURCE CONTAMINATION.
INSPECTION CERTIFICATE 3.1 IN ACCORDANCE WITH EN 10204 AND DIN 50049
MILL HEAT TREATMENT:
TYPE SOLUTION ANNEAL
TEMP 1951F (1066C)
TIME (BATCH FURNACE) .50 HOURS
QUENCH WATER

HARDNESS AS SHIPPED, HRC - 23
__ ________

***-->TESTED AT READING**

FORM E2-366

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CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001309950

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Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
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23 AUG 23

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P.O.BOX 0629
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RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505149474	W48167		30108

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760586**

(T)RANSVERSE (L)ONGITUDINAL	L	L
YIELD STRENGTH, (0.20 %) KSI(MPA)	92.0(634)	90.0(621)
YIELD STRENGTH, (1.00 %) KSI(MPA)	102.0(703)	102.0(703)
TENSILE STRENGTH, KSI(MPA)	106.0(731)	106.0(731)
ELONGATION IN 2.00", %	33.0	33.0
ELONGATION IN 2.50", %	28.0	28.0
REDUCTION OF AREA, %	73.0	73.0

*-->TESTED AT READING

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
*-->TESTED AT READING

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (1G OR 2G).

ORDER LENGTH REQUIREMENT: 144"

INTERGRANULAR CORROSION TEMP(F)1292 HR:0 MN:30 QUENCH:WATER
SPECIMEN SENSITIZATION *-->TESTED AT READING

FORM E2-366

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4505149474	W48167		30108

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760586**

ADDRESS OF TESTING LOCATIONS:
READING - 101 WEST BERN ST, READING, PA 19601

MATERIAL HAS BEEN MELTED AND MANUFACTURED IN THE USA WHICH IS A QUALIFYING COUNTRY TO DFARS REQUIREMENTS 252.225-7014 WITH ALTERNATE 1 FOR QUALIFYING COUNTRY 225.872.1, SUPERSEDED BY DFARS REQUIREMENTS DFARS 252.225-7008 AND 252.225-7009.

UNLESS OTHERWISE STATED, THE TEST WERE PERFORMED TO THE LATEST REVISION OF THE STANDARDS LISTED BELOW: 1) BEND TEST - ASTM E290, 2) CHARPY IMPACT - ASTM E23, 3)COEFFICIENT OF LINEAR THERMAL EXPANSION - ASTM E228, 4)FRACTURE TOUGHNESS - ASTM E399, 5) BRINELL HARDNESS - ASTM E10, 6)ROCKWELL HARDNESS-ASTM E18, 7)MICRO VICKERS HARDNESS-ASTM E92, 8)KNOOP HARDNESS-ASTM E92, 9)MACRO VICKERS HARDNESS-ASTM E92, 10)STRESS RUPTURE/CREEP RUPTURE-ASTM E139, 11)STRESS RUPTURE(COMBINATION)-ASTM E292, 12)ROOM TEMPERATURE TENSILE-ASTM E8, 13)ELEVATED ROOM TEMPERATURE TENSILE-ASTM E21, 14)DECARBURIZATION-ASTM E1077 15)DELTA FERRITE AMS 2315, 16)GRAIN SIZE-ASTM E112, 17)INCLUSION CONTENT/MICROCLEANLINESS-ASTM E45, 18) INTERGRANULAR ATTACH - ASTM A262, 19)INTERGRANULAR CORROSION-ASTM A262, 20)MACRO ETCH&TESTING - ASTM A604/E381, 21)PITTING CORROSION - ASTM A923, 22)CREVICE CORROSION-ASTM G48, 23) HARDNESS CONVERSIONS - ASTM E140, 24)XRF-ASTM E572/E1085/E2465, 25) OES - ASTM E415/E1086, 26)COM - ASTM E1019, 27)FUS - ASTM E1019, 28)MS - CARPENTER METHODS 206.8500/206.8530 29)CHEMISTRY RESULTS ARE ROUNDED IN ACCORDANCE WITH ASTM A751 WHICH CONFORMS TO ASTM E29 WITH ONE SPECIAL EXCEPTION THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL, REVISION 38 DATED 08/21/2022.

CARPENTER'S QUALITY MANAGEMENT SYSTEM IS REGISTERED TO ISO 9001, AS9100, AND AS9120. THIS CERTIFICATION OF TEST IS TYPE 3.1 PREPARED IN ACCORDANCE WITH EN 10204 (DIN 50049). WE HEREBY CERTIFY THAT THE ABOVE TEST DATA ARE IN ACCORDANCE WITH THE PURCHASE ORDER AND SPECIFICATION REQUIREMENTS, AS DOCUMENTED IN THIS CERTIFICATE OF TESTS.

TEST METHODS ARE PER THE ASTM STANDARDS ON FILE AND IN EFFECT AT TIME OF ORDER ACCEPTANCE, STANDARD PRACTICES, OR AS AGREED UPON BETWEEN CARPENTER & CUSTOMER.

THE ABSENCE OF A REPORTED TEST TEMPERATURE INDICATES THAT THE TEST WAS COMPLETED AT ROOM TEMPERATURE.

FORM E2-366

CONTINUED ON NEXT PAGE

This certification is made to the customer printed on this form. Carpenter neither makes, nor assumes responsibility for, any representation or certification to other parties.
Die vorliegende Zertifizierung ist nur für den in diesem Formular genannten Kunden gültig. Carpenter übernimmt gegenüber Dritten keinerlei Haftung für die ausgewiesenen Daten oder Zertifizierungen.
Ce certificat est uniquement valable pour le client dont le nom est imprimé sur ce formulaire. Carpenter n'assume pas de responsabilité pour une certification vis-à-vis d'une tierce personne.

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001309950

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

- THE RECORDING OF FALSE, FICTICIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHED AS A FELONY UNDER FEDERAL STATUTES INCLUDING FEDERAL LAW, TITLE 18, CHAPTER 47.
- THE VALUES AND OTHER TECHNICAL DATA REPRESENT THE RESULTS OF ANALYSES AND TESTS MADE ON SAMPLES COLLECTED FROM THE TOTAL LOT. ORIGINAL DATA RECORDS CAN BE TRACED BY REFERENCE TO THE CARPENTER ORDER NUMBER.
- MATERIAL IS MANUFACTURED FREE FROM MERCURY, RADIUM, ALPHA AND GAMMA SOURCE CONTAMINATION.
- THIS DOCUMENT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN CONSENT OF CARPENTER TECHNOLOGY CORPORATION.

23 AUG 23

CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 5 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505149474	**W48167**		**30108**

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760586**

DECISION RULE: UNLESS OTHERWISE SPECIFIED IN A CUSTOMER/INDUSTRY SPECIFICATION, CARPENTER TECHNOLOGY CORPORATION WILL DETERMINE ACCEPTABILITY OF ANY TEST RESULT BY COMPARISON OF THE RESULT WITH THE SPECIFICATION LIMITS, WITHOUT ANY ADDITIONAL CONSIDERATION OF THE MEASUREMENT UNCERTAINTY. WHEN REQUESTED, CARPENTER TECHNOLOGY CORPORATION WILL PROVIDE UNCERTAINTY BUDGETS FOR ANY TEST RESULT THAT IS NOT ADDRESSED BY THE INDUSTRY STANDARD.

DANIELLE KELLY /WI 15917 DIGITALLY SIGNED BY JASON M RAYMOND
ADMINISTRATOR - QUALITY
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W48167/HEAT 760586/LOT 01

FORM E2-366

This certification is made to the customer printed on this form. Carpenter neither makes, nor assumes responsibility for, any representation or certification to other parties.
Die vorliegende Zertifizierung ist nur für den in diesem Formular genannten Kunden gültig. Carpenter übernimmt gegenüber Dritten keinerlei Haftung für die ausgewiesenen Daten oder Zertifizierungen.
Ce certificat est uniquement valable pour le client dont le nom est imprimé sur ce formulaire. Carpenter n'assume pas de responsabilité pour une certification vis-à-vis d'une tierce personne.

APPROVED BY SARA MALIK 3/5/2024 9ER

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231404
Trace ID/Heat Code: 9ER

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104274533	SSD-HB-106250	1-1/16" HEX BAR	30,569

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), Revision M, dated May 12, 2023, which satisfies the applicable requirements of NCA-3800 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and 2015 Edition. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), Revision N, dated April 4, 2023 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 7 February 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 2/29/2024
P.O. No.: 4506074750
W/O No.: CRA002-24-02-97147-1
Date Received: 2/23/2024

MO:	000104274533 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ER
P/N:	SSD-HB-106250
Two (2) 1-1/16" Hex Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	-
1	9.93	101.4	699	107.9	744	112.2		773		31.0	25.0	71	Mid 50%
2	9.98	103.1	711	109.3	754	113.3		781		29.0	25.0	70	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18

Specimen	Hardness Value	Hardness Scale
1	26	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#** 24B-488
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	200x	

	Average Grain Size
Specimen 1	ASTM #6.0 – 7.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Hagan Duns

Digitally Signed by Hagan Duns
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	2/29/2024
P.O. No.:	4506074750
W/O No.:	CRA002-24-02-97147-1
Date Received:	2/23/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A

Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE

These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Hagan Duns

Digitally Signed by Hagan Duns
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 1/24/2024 9ER

HEAT E231404 ORDER 705189/ 01 BOL 0261964 * CERTIFICATION * 01/24/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer
OSB 8

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505245109 10/03/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 20 Total Weight 30569 Approx. Hot Red. Ratio 138:1

WO 2128298 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T SON= 351735

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.630
Phosphorus	(P)	.035	Sulphur	(S)	.026
Silicon	(Si)	.680	Chromium	(Cr)	17.310
Nickel	(Ni)	12.110	Cobalt	(Co)	.351
Copper	(Cu)	.530	Moly	(Mo)	2.040
Nitrogen	(N)	.050	Columbium	(Cb)	.043
Titanium	(Ti)	.006	Aluminum	(Al)	.004
Tin	(Sn)	.015	Cerium	(Ce)	.020
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.090	Tungsten	(W)	.111
Columbium/ Tantalum	(Cb+Ta)	.041			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128286	351692	E230889	1.062"	8	31,162#
2128297	351737	E231404	1.312"	10	39,710#
2128296	351738	E231404	1.312"	10	39,299#
2128298	351735	E231404	1.312"	10	39,755#
2128299	351736	E230951	1.312"	10	39,749#

By **George Gunter** Date **1/22/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL:+4622345302

Cons.
N/A
HS Code
721891

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023
Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

Chemical composition wt%

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231404	60		BLOOM	462*260*2250	124710

Certification Text:
Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023

Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

outokumpu

INSPECTION CERTIFICATE
EN 10204/3.1

No. **LP 2157-23**

OUTOKUMPU LONG PRODUCTS AB
S-693 81 DEGERFORS, SWEDEN
Ref.QC-Dept. Jörgen Johansson

Date-Datum-Date: **2023-09-28**

Your order-Ihre Bestellung-Votre commande: **9320277**

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d'expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**83100**	**273280**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance	Brand mark Herstellerzeichen Signe du producteur	Inspectors´stamp Abnahmestempel Poincon de l`expert	Melting process Erschmelzungsart Procède de fusion
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-13	**1**	**150x150**	**E231404**	**145549**			**1 820**	**805-1**
01-14	**1**	**150x150**	**E231404**	**145550**			**1 820**	**909-1**
01-15	**1**	**150x150**	**E231404**	**145551**			**1 758**	**905-2**
01-16	**1**	**150x150**	**E231404**	**145552**			**1 778**	**813-1**
01-17	**1**	**150x150**	**E231404**	**145553**			**1 780**	**986-1**
01-18	**1**	**150x150**	**E231404**	**145554**			**1 810**	**914-1**
01-19	**1**	**150x150**	**E231404**	**145555**			**1 810**	**913-1**

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No. Schmelze Nr. Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231404	**0.024**	**0.68**	**1.63**	**0.035**	**0.026**	**17.31**	**12.11**	**2.04**	**0.531**	**0.35**	**0.050**

Manufacture date: 2023-08-10

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais
The requirements according to AMS-QQ-S-763D are fulfilled.
The order requirements stipulated are satisfied.
US-tested according to DLP OFP-201. Approved.

EN ISO 9001:2015 and EN ISO 14001:2015.
Certificate no. 5749-3027684-0102.
Approved by TüV NORD Scandinavia AB.

AD 2000-Merkblatt W0, approved by TÜV Nord Systems.
Certificate no. 07/203/9140/WP/0689/18
PED 2014/68/EU, approved by TÜV Nord Systems.
Certificate no. 07/202/9140/WZ/0689/18

Reg.No.:559332-4907
V.A.T.No.:SE559332490701
Registered office:Stockholm, Sweden

Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
No remarks-Ohne Beanstandung-Pas de remarque
PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.
No weld repair has been performed on the material.
Free of known Mercury contamination at time of shipment.

Outokumpu Long Products AB

Digitally signed by: Jörgen Johansson
Section Manager Quality Control

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 1/23/2024 9ER

HEAT E231404 ORDER 705188/ 01 BOL 0261923 * CERTIFICATION * 01/22/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------

4505245108 10/03/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------

GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 19 Total Weight 28923 Approx. Hot Red. Ratio 138:1

WO 2128297 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S SON= 351737

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.630
Phosphorus	(P)	.035	Sulphur	(S)	.026
Silicon	(Si)	.680	Chromium	(Cr)	17.310
Nickel	(Ni)	12.110	Cobalt	(Co)	.351
Copper	(Cu)	.530	Moly	(Mo)	2.040
Nitrogen	(N)	.050	Columbium	(Cb)	.040
Titanium	(Ti)	.006	Aluminum	(Al)	.004
Tin	(Sn)	.015	Cerium	(Ce)	.020
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.090	Tungsten	(W)	.111
Columbium/ Tantalum	(Cb+Ta)	.041			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.
We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128286	351692	E230889	1.062"	8	31,162#
2128297	351737	E231404	1.312"	10	39,710#
2128296	351738	E231404	1.312"	10	39,299#
2128298	351735	E231404	1.312"	10	39,755#
2128299	351736	E230951	1.312"	10	39,749#

By **George Gunter** Date **1/22/2024**

APPROVED BY SARA MALIK 1/23/2024 9ER

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303464

MARCEGAGLIA

9ER

Mill Certificate

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code
72189

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023
Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231404	60		BLOOM	462*260*2250	124710

Certification Text:
Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023

Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

outokumpu

INSPECTION CERTIFICATE
EN 10204/3.1

No. **LP 2190-23**

OUTOKUMPU LONG PRODUCTS AB **S-693 81 DEGERFORS, SWEDEN** **Ref.QC-Dept. Jörgen Johansson**	Date-Datum-Date **2023-10-02**	Your order-Ihre Bestellung-Votre commande **9320277**

Product-Erzeugnisform-Produit **Stainless steel, hot rolled billets.** **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	Our order Unsere Auftrag Notre commande **83100**	Advice of delivery Lieferschein Avie d'expedition **273298**

Requirements-Prüfgrundlagen-Exigences **OSB MS-1014 Rev.3** **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	Purchaser-Besteller-Acheteur **MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance **316LCM Rev.0** **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	Brand mark Herstellerzeichen Signe du producteur W	Inspectors stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion **EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-33	**1**	**150x150**	**E231404**	**145569**			**1 790**	**886-2**
01-34	**1**	**150x150**	**E231404**	**145570**			**1 788**	**816-1**
01-35	**1**	**150x150**	**E231404**	**145571**			**1 824**	**916-1**
01-36	**1**	**150x150**	**E231404**	**145572**			**1 842**	**804-1**
01-37	**1**	**150x150**	**E231404**	**145573**			**1 788**	**986-2**
01-38	**1**	**150x150**	**E231404**	**145574**			**1 832**	**904-1**
01-39	**1**	**150x150**	**E231404**	**145575**			**1 838**	**921-1**
01-40	**1**	**150x150**	**E231404**	**145576**			**1 870**	**920-1**
01-41	**1**	**150x150**	**E231404**	**145577**			**1 830**	**917-1**
01-42	**1**	**150x150**	**E231404**	**145578**			**1 840**	**915-1**

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No. Schmelze Nr. Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231404	**0.024**	**0.68**	**1.63**	**0.035**	**0.026**	**17.31**	**12.11**	**2.04**	**0.531**	**0.35**	**0.050**

Manufacture date: **2023-08-10**

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais **The requirements according to AMS-QQ-S-763D are fulfilled.** **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel **No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TüV NORD Scandinavia AB.**	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Outokumpu Long Products AB**

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 2/1/2024 9ER

HEAT E231404 ORDER 705187/ 01 BOL 0261984 * CERTIFICATION * 02/01/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer
OSB 8

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505245107 10/03/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 20 Total Weight 31257 Approx. Hot Red. Ratio 138:1

WO 2128296 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T SON= 351738

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a
ASTM A751 21
EN 10272 Grade 1.4401
10-CFR-21
Swagelok SQS-00012 Rev AK
Produced according to -
ASME B&PV Code Section III
Subsection NCA3800
MSR QPM-101 R14, 1/11/23
Approved by Swagelok Company
ASME SA-479/479M 2023 Ed
Bars are 100% UT inspected

ASTM A484/A484M 23a
DIN 50049/EN 10204 Type 3.1
EN ISO 3651-2 Method A
10CFR50-Appendix B
Swagelok SQS-00020 Rev N
Swagelok SQS-00021 Rev Q
1.4401/1.4404, 316/316L
Exception to SQS-00171 Rev F
Swagelok SMS-00833 Rev D
Swagelok SQC-03992 init. rel
ASTM E1001

---------- MECHANICAL & OTHER TESTS ----------

Micro OK
Intergranular corrosion

Tensile strength,KSI (MPa)	.0 (0)
0.2% Yield Strngth,KSI(MPa)	.0 (0)
Elongation % in 4D	.0
Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.630
Phosphorus	(P)	.035	Sulphur	(S)	.026
Silicon	(Si)	.680	Chromium	(Cr)	17.310
Nickel	(Ni)	12.110	Cobalt	(Co)	.351
Copper	(Cu)	.530	Moly	(Mo)	2.040
Nitrogen	(N)	.050	Columbium	(Cb)	.043
Titanium	(Ti)	.006	Aluminum	(Al)	.004
Tin	(Sn)	.015	Cerium	(Ce)	.020
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.090	Tungsten	(W)	.111
Columbium/ Tantalum	(Cb+Ta)	.041			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.
We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128286	351692	E230889	1.062"	8	31,162#
2128297	351737	E231404	1.312"	10	39,710#
2128296	351738	E231404	1.312"	10	39,299#
2128298	351735	E231404	1.312"	10	39,755#
2128299	351736	E230951	1.312"	10	39,749#

By **George Gunter** Date **1/22/2024**

APPROVED BY SARA MALIK 2/1/2024 9ER

outokumpu

INSPECTION CERTIFICATE
EN 10204/3.1

No. **LP 1665-23**

OUTOKUMPU LONG PRODUCTS AB **S-693 81 DEGERFORS, SWEDEN** **Ref.QC-Dept. Jörgen Johansson**	Date-Datum-Date **2023-07-11**	Your order-Ihre Bestellung-Votre commande **605257**

Product-Erzeugnisform-Produit **Stainless steel, hot rolled billets.** **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	Our order Unsere Auftrag Notre commande **82740**	Advice of delivery Lieferschein Avie d'expedition **272756**

Requirements-Prüfgrundlagen-Exigences **OSB MS-1014 Rev.3** **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	Purchaser-Besteller-Acheteur **MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance **316LCM Rev.0** **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	Brand mark Herstellerzeichen Signe du producteur W	Inspectors'stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion **EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulèe n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
02-01	**1**	**150x150**	**E230769**	**142681**			**1 774**	**882-1**
02-02	**1**	**150x150**	**E230769**	**144319**			**1 782**	**982-2**

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No. / Schmelze Nr. / Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E230769	**0.025**	**0.66**	**1.60**	**0.032**	**0.024**	**17.27**	**12.17**	**2.02**	**0.386**	**0.27**	**0.050**

Manufacture date: **2023-04-24**

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais **The requirements according to AMS-QQ-S-763D are fulfilled.** **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-222. Approved.**	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel **No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TüV NORD Scandinavia AB.**	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Outokumpu Long Products AB**

Marcegaglia Stainless Sheffield Ltd. Address SMACC Meltshop, Europa Link, Sheffield, S9 1TZ
Telephone +44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons. N/A
HS Code 721891
Customer Order No 9973228
SMACC Order No 283516/1

Cast No. E231404
Code 231011
Campaign 38281

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Cert Date: 04 October 2023
Melt Date: 10 August 2023

Ordered Supply Condition
FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231404	60		BLOOM	462*260*2250	124710

Certification Text:
Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E-MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023

Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231404
Trace ID/Heat Code: 9ER

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104276112	SSD-HB-106250	1-1/16" HEX BAR	31,257

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), Revision M, dated May 12, 2023, which satisfies the applicable requirements of NCA-3800 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and 2015 Edition. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), Revision N, dated April 4, 2023 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 19 February 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 3/7/2024
P.O. No.: 4506083057
W/O No.: CRA002-24-02-97429-1
Date Received: 2/29/2024

MO:	000104276112 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ER
P/N:	SSD-HB-106250
Two (2) 1-1/16" Hex Bars, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	
1	10.01	102.2	705	108.3	747	112.2		773		29.5	24.0	70	Mid 50%
2	9.98	100.1	690	105.9	730	110.1		759		30.0	26.0	71	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18

Specimen	Hardness Value	Hardness Scale
1	27	**HRC**

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#** 24C-045
Method	Comparison	**Etchant**	Carpenters	**Magnification**	100x	

	Average Grain Size
Specimen 1	ASTM #4.0-5.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023 as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland

Paula Tesar

Digitally Signed by Paula Tesar

Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	3/7/2024
P.O. No.:	4506083057
W/O No.:	CRA002-24-02-97429-1
Date Received:	2/29/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

This document contains technical data whose export and re-export/retransfer is subject to control by the U.S. Department of Commerce under the Export Administration Act and the Export Administration Regulations. The Department of Commerce's prior written approval may be required for the export or re-export/retransfer of such technical data to any foreign person, foreign entity or foreign organization whether in the United States or abroad.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023 as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland

Paula Tesar

Digitally Signed by Paula Tesar

Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 1/24/2024 9ER

HEAT E231404 ORDER 705189/ 01 BOL 0261964 * CERTIFICATION * 01/24/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505245109 10/03/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 20 Total Weight 30569 Approx. Hot Red. Ratio 138:1

WO 2128298 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T SON= 351735

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.630
Phosphorus	(P)	.035	Sulphur	(S)	.026
Silicon	(Si)	.680	Chromium	(Cr)	17.310
Nickel	(Ni)	12.110	Cobalt	(Co)	.351
Copper	(Cu)	.530	Moly	(Mo)	2.040
Nitrogen	(N)	.050	Columbium	(Cb)	.043
Titanium	(Ti)	.006	Aluminum	(Al)	.004
Tin	(Sn)	.015	Cerium	(Ce)	.020
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.090	Tungsten	(W)	.111
Columbium/ Tantalum	(Cb+Ta)	.041			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128286	351692	E230889	1.062"	8	31,162#
2128297	351737	E231404	1.312"	10	39,710#
2128296	351738	E231404	1.312"	10	39,299#
2128298	351735	E231404	1.312"	10	39,755#
2128299	351736	E230951	1.312"	10	39,749#

By **George Gunter** Date **1/22/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To	Cons.	Cast No. E231404	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code 721891	Code 231011 Campaign 38281	Melt Date: 10 August 2023
	Customer Order No 9973228 SMACC Order No 283516/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231404	60		BLOOM	462*260*2250	124710

Certification Text:
Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

APPROVED BY SARA MALIK 1/24/2024 9ER

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023

Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

outokumpu

INSPECTION CERTIFICATE
EN 10204/3.1

No. **LP 2157-23**

OUTOKUMPU LONG PRODUCTS AB
S-693 81 DEGERFORS, SWEDEN
Ref.QC-Dept. Jörgen Johansson

Date-Datum-Date **2023-09-28**

Your order-Ihre Bestellung-Votre commande **9320277**

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d'expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**83100**	**273280**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance	Brand mark Herstellerzeichen Signe du producteur	Inspectors´stamp Abnahmestempel Poincon de l`expert	Melting process Erschmelzungsart Procède de fusion
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulèe n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-13	**1**	**150x150**	**E231404**	**145549**			**1 820**	**805-1**
01-14	**1**	**150x150**	**E231404**	**145550**			**1 820**	**909-1**
01-15	**1**	**150x150**	**E231404**	**145551**			**1 758**	**905-2**
01-16	**1**	**150x150**	**E231404**	**145552**			**1 778**	**813-1**
01-17	**1**	**150x150**	**E231404**	**145553**			**1 780**	**986-1**
01-18	**1**	**150x150**	**E231404**	**145554**			**1 810**	**914-1**
01-19	**1**	**150x150**	**E231404**	**145555**			**1 810**	**913-1**

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No. Schmelze Nr. Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231404	**0.024**	**0.68**	**1.63**	**0.035**	**0.026**	**17.31**	**12.11**	**2.04**	**0.531**	**0.35**	**0.050**

Manufacture date: **2023-08-10**

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais
The requirements according to AMS-QQ-S-763D are fulfilled.
The order requirements stipulated are satisfied.
US-tested according to DLP OFP-201. Approved.

EN ISO 9001:2015 and EN ISO 14001:2015.
Certificate no. 5749-3027684-0102.
Approved by TüV NORD Scandinavia AB.

AD 2000-Merkblatt W0, approved by TÜV Nord Systems.
Certificate no. 07/203/9140/WP/0689/18
PED 2014/68/EU, approved by TÜV Nord Systems.
Certificate no. 07/202/9140/WZ/0689/18

Reg.No.:559332-4907
V.A.T.No.:SE559332490701
Registered office:Stockholm, Sweden

Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
No remarks-Ohne Beanstandung-Pas de remarque
PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.
No weld repair has been performed on the material.
Free of known Mercury contamination at time of shipment.

Outokumpu Long Products AB

Digitally signed by: **Jörgen Johansson**
Section Manager Quality Control

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 1/23/2024 9ER

HEAT E231404 ORDER 705188/ 01 BOL 0261923 * CERTIFICATION * 01/22/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505245108 10/03/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 19 Total Weight 28923 Approx. Hot Red. Ratio 138:1

WO 2128297 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S SON= 351737

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.630
Phosphorus	(P)	.035	Sulphur	(S)	.026
Silicon	(Si)	.680	Chromium	(Cr)	17.310
Nickel	(Ni)	12.110	Cobalt	(Co)	.351
Copper	(Cu)	.530	Moly	(Mo)	2.040
Nitrogen	(N)	.050	Columbium	(Cb)	.040
Titanium	(Ti)	.006	Aluminum	(Al)	.004
Tin	(Sn)	.015	Cerium	(Ce)	.020
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.090	Tungsten	(W)	.111
Columbium/ Tantalum	(Cb+Ta)	.041			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.
We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128286	351692	E230889	1.062"	8	31,162#
2128297	351737	E231404	1.312"	10	39,710#
2128296	351738	E231404	1.312"	10	39,299#
2128298	351735	E231404	1.312"	10	39,755#
2128299	351736	E230951	1.312"	10	39,749#

By **George Gunter** Date **1/22/2024**

APPROVED BY SARA MALIK 1/23/2024 9ER

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303464

MARCEGAGLIA

9ER

Mill Certificate

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code
72189

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023
Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231404	60		BLOOM	462*260*2250	124710

Certification Text:
Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023

Melt Date: 10 August 2023

Customer Order No	Specification	Ordered Supply Condition
9973228 SMACC Order No 283516/1	DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

outokumpu

INSPECTION CERTIFICATE
EN 10204/3.1

No. **LP 2190-23**

OUTOKUMPU LONG PRODUCTS AB
S-693 81 DEGERFORS, SWEDEN
Ref.QC-Dept. Jörgen Johansson

Date-Datum-Date: **2023-10-02**

Your order-Ihre Bestellung-Votre commande: **9320277**

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d'expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**83100**	**273298**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance	Brand mark Herstellerzeichen Signe du producteur	Inspectors´stamp Abnahmestempel Poincon de l'expert	Melting process Erschmelzungsart Procède de fusion
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulèe n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-33	**1**	**150x150**	**E231404**	**145569**			**1 790**	**886-2**
01-34	**1**	**150x150**	**E231404**	**145570**			**1 788**	**816-1**
01-35	**1**	**150x150**	**E231404**	**145571**			**1 824**	**916-1**
01-36	**1**	**150x150**	**E231404**	**145572**			**1 842**	**804-1**
01-37	**1**	**150x150**	**E231404**	**145573**			**1 788**	**986-2**
01-38	**1**	**150x150**	**E231404**	**145574**			**1 832**	**904-1**
01-39	**1**	**150x150**	**E231404**	**145575**			**1 838**	**921-1**
01-40	**1**	**150x150**	**E231404**	**145576**			**1 870**	**920-1**
01-41	**1**	**150x150**	**E231404**	**145577**			**1 830**	**917-1**
01-42	**1**	**150x150**	**E231404**	**145578**			**1 840**	**915-1**

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No. Schmelze Nr. Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231404	**0.024**	**0.68**	**1.63**	**0.035**	**0.026**	**17.31**	**12.11**	**2.04**	**0.531**	**0.35**	**0.050**

Manufacture date: 2023-08-10

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
The requirements according to AMS-QQ-S-763D are fulfilled. **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	**No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TüV NORD Scandinavia AB.**	
AD 2000 Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Outokumpu Long Products AB**

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 2/1/2024 9ER

HEAT E231404 ORDER 705187/ 01 BOL 0261984 * CERTIFICATION * 02/01/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer
OSB 8

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505245107 10/03/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 20 Total Weight 31257 Approx. Hot Red. Ratio 138:1

WO 2128296 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T SON= 351738

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.630
Phosphorus	(P)	.035	Sulphur	(S)	.026
Silicon	(Si)	.680	Chromium	(Cr)	17.310
Nickel	(Ni)	12.110	Cobalt	(Co)	.351
Copper	(Cu)	.530	Moly	(Mo)	2.040
Nitrogen	(N)	.050	Columbium	(Cb)	.043
Titanium	(Ti)	.006	Aluminum	(Al)	.004
Tin	(Sn)	.015	Cerium	(Ce)	.020
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.090	Tungsten	(W)	.111
Columbium/ Tantalum	(Cb+Ta)	.041			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.
We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128286	351692	E230889	1.062"	8	31,162#
2128297	351737	E231404	1.312"	10	39,710#
2128296	351738	E231404	1.312"	10	39,299#
2128298	351735	E231404	1.312"	10	39,755#
2128299	351736	E230951	1.312"	10	39,749#

By **George Gunter** Date **1/22/2024**

APPROVED BY SARA MALIK 2/1/2024 9ER

outokumpu

INSPECTION CERTIFICATE
EN 10204/3.1

No. **LP 1665-23**

OUTOKUMPU LONG PRODUCTS AB **S-693 81 DEGERFORS, SWEDEN** **Ref.QC-Dept. Jörgen Johansson**	Date-Datum-Date **2023-07-11**	Your order-Ihre Bestellung-Votre commande **605257**

Product-Erzeugnisform-Produit **Stainless steel, hot rolled billets.** **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	Our order Unsere Auftrag Notre commande **82740**	Advice of delivery Lieferschein Avie d'expedition **272756**

Requirements-Prüfgrundlagen-Exigences **OSB MS-1014 Rev.3** **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	Purchaser-Besteller-Acheteur **MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance **316LCM Rev.0** **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	Brand mark Herstellerzeichen Signe du producteur W	Inspectors'stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion **EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulèe n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
02-01	**1**	**150x150**	**E230769**	**142681**			**1 774**	**882-1**
02-02	**1**	**150x150**	**E230769**	**144319**			**1 782**	**982-2**

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No. Schmelze Nr. Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E230769	**0.025**	**0.66**	**1.60**	**0.032**	**0.024**	**17.27**	**12.17**	**2.02**	**0.386**	**0.27**	**0.050**

Manufacture date: **2023-04-24**

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais **The requirements according to AMS-QQ-S-763D are fulfilled.** **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-222. Approved.**	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel **No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TüV NORD Scandinavia AB.**	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Outokumpu Long Products AB**

APPROVED BY SARA MALIK 2/1/2024 9ER

Marcegaglia Stainless Sheffield Ltd. Address SMACC Meltshop, Europa Link, Sheffield, S9 1TZ
Telephone +44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons. N/A
HS Code 721891
Customer Order No 9973228
SMACC Order No 283516/1

Cast No. E231404
Code 231011
Campaign 38281

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Cert Date: 04 October 2023
Melt Date: 10 August 2023

Ordered Supply Condition
FULLY BLACK

Chemical composition wt%

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231404	60		BLOOM	462*260*2250	124710

Certification Text:
Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E-MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023

Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231404
Trace ID/Heat Code: 9ER

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104276113	SSD-HB-106250	1-1/16" HEX BAR	28,923

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), Revision M, dated May 12, 2023, which satisfies the applicable requirements of NCA-3800 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and 2015 Edition. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), Revision N, dated April 4, 2023 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 19 February 2024

element

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 3/13/2024
P.O. No.: 4506092558
W/O No.: CRA002-24-03-97743-1
Date Received: 3/6/2024

MO:	000104276113 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ER
P/N:	SSD-HB-106250
Two (2) 1-1/16" Hex Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	-
1	9.98	101.6	700	107.1	738	111.2		767		30.0	24.5	72	Mid 50%
2	9.98	97.1	669	103.2	712	108.1		745		31.5	24.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	26	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#**
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	24C-176

	Average Grain Size
Specimen 1	ASTM #4.0 – 5.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland

Britney Bahara

Digitally Signed by Britney Bahara

Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	3/13/2024
P.O. No.:	4506092558
W/O No.:	CRA002-24-03-97743-1
Date Received:	3/6/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A

Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, ℃	Time at Temperatur e	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE

These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland

Britney Bahara

Digitally Signed by Britney Bahara

Quality Administrator

MARCEGAGLIA

Certificate of Test

APPROVED BY SARA MALIK 1/24/2024 9ER

HEAT E231404 ORDER 705189/ 01 BOL 0261964 * CERTIFICATION * 01/24/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505245109 10/03/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 20 Total Weight 30569 Approx. Hot Red. Ratio 138:1

WO 2128298 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T SON= 351735

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.630
Phosphorus	(P)	.035	Sulphur	(S)	.026
Silicon	(Si)	.680	Chromium	(Cr)	17.310
Nickel	(Ni)	12.110	Cobalt	(Co)	.351
Copper	(Cu)	.530	Moly	(Mo)	2.040
Nitrogen	(N)	.050	Columbium	(Cb)	.043
Titanium	(Ti)	.006	Aluminum	(Al)	.004
Tin	(Sn)	.015	Cerium	(Ce)	.020
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.090	Tungsten	(W)	.111
Columbium/ Tantalum	(Cb+Ta)	.041			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

APPROVED BY SARA MALIK 1/24/2024 9ER

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128286	351692	E230889	1.062"	8	31,162#
2128297	351737	E231404	1.312"	10	39,710#
2128296	351738	E231404	1.312"	10	39,299#
2128298	351735	E231404	1.312"	10	39,755#
2128299	351736	E230951	1.312"	10	39,749#

By **George Gunter** Date **1/22/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303464
Page 1 of 2

MARCEGAGLIA

9ER

Mill Certificate

To	Cons.	Cast No. E231404	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38281	Melt Date: 10 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973228	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283516/1		
TEL:+4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231404	60		BLOOM	462*260*2250	124710

Certification Text:
Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303464
Page 2 of 2

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023

Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

outokumpu

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2157-23

OUTOKUMPU LONG PRODUCTS AB **S-693 81 DEGERFORS, SWEDEN** **Ref.QC-Dept. Jörgen Johansson**	Date-Datum-Date **2023-09-28**	Your order-Ihre Bestellung-Votre commande **9320277**

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d'expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**83100**	**273280**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance	Brand mark Herstellerzeichen Signe du producteur	Inspectors´stamp Abnahmestempel Poincon de l`expert	Melting process Erschmelzungsart Procède de fusion
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulèe n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-13	**1**	**150x150**	**E231404**	**145549**			**1 820**	**805-1**
01-14	**1**	**150x150**	**E231404**	**145550**			**1 820**	**909-1**
01-15	**1**	**150x150**	**E231404**	**145551**			**1 758**	**905-2**
01-16	**1**	**150x150**	**E231404**	**145552**			**1 778**	**813-1**
01-17	**1**	**150x150**	**E231404**	**145553**			**1 780**	**986-1**
01-18	**1**	**150x150**	**E231404**	**145554**			**1 810**	**914-1**
01-19	**1**	**150x150**	**E231404**	**145555**			**1 810**	**913-1**

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No. Schmelze Nr. Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231404	**0.024**	**0.68**	**1.63**	**0.035**	**0.026**	**17.31**	**12.11**	**2.04**	**0.531**	**0.35**	**0.050**

Manufacture date: 2023-08-10

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
The requirements according to AMS-QQ-S-763D are fulfilled. **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	**No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TüV NORD Scandinavia AB.**	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Outokumpu Long Products AB**
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office:Stockholm, Sweden**	**Digitally signed by: Jörgen Johansson** **Section Manager Quality Control**

MARCEGAGLIA

Certificate of Test

APPROVED BY SARA MALIK 1/23/2024 9ER

HEAT E231404 ORDER 705188/ 01 BOL 0261923 * CERTIFICATION * 01/22/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer
OSB 8

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505245108 10/03/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 19 Total Weight 28923 Approx. Hot Red. Ratio 138:1

WO 2128297 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S SON= 351737

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.630
Phosphorus	(P)	.035	Sulphur	(S)	.026
Silicon	(Si)	.680	Chromium	(Cr)	17.310
Nickel	(Ni)	12.110	Cobalt	(Co)	.351
Copper	(Cu)	.530	Moly	(Mo)	2.040
Nitrogen	(N)	.050	Columbium	(Cb)	.040
Titanium	(Ti)	.006	Aluminum	(Al)	.004
Tin	(Sn)	.015	Cerium	(Ce)	.020
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.090	Tungsten	(W)	.111
Columbium/ Tantalum	(Cb+Ta)	.041			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.
We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

APPROVED BY SARA MALIK 1/23/2024 9ER

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128286	351692	E230889	1.062"	8	31,162#
2128297	351737	E231404	1.312"	10	39,710#
2128296	351738	E231404	1.312"	10	39,299#
2128298	351735	E231404	1.312"	10	39,755#
2128299	351736	E230951	1.312"	10	39,749#

By **George Gunter** Date **1/22/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303464
Page 1 of 2

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code
72189

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023
Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231404	60		BLOOM	462*260*2250	124710

Certification Text:
Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303464

MARCEGAGLIA

9ER

Mill Certificate

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023

Melt Date: 10 August 2023

Customer Order No	Specification	Ordered Supply Condition
9973228 SMACC Order No 283516/1	DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

outokumpu

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2190-23

OUTOKUMPU LONG PRODUCTS AB **S-693 81 DEGERFORS, SWEDEN** **Ref.QC-Dept. Jörgen Johansson**	Date-Datum-Date **2023-10-02**	Your order-Ihre Bestellung-Votre commande **9320277**

Product-Erzeugnisform-Produit **Stainless steel, hot rolled billets.** **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	Our order Unsere Auftrag Notre commande **83100**	Advice of delivery Lieferschein Avie d'expedition **273298**

Requirements-Prüfgrundlagen-Exigences **OSB MS-1014 Rev.3** **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	Purchaser-Besteller-Acheteur **MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance **316LCM Rev.0** **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	Brand mark Herstellerzeichen Signe du producteur W	Inspectors'stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion **EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulèe n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-33	**1**	**150x150**	**E231404**	**145569**			**1 790**	**886-2**
01-34	**1**	**150x150**	**E231404**	**145570**			**1 788**	**816-1**
01-35	**1**	**150x150**	**E231404**	**145571**			**1 824**	**916-1**
01-36	**1**	**150x150**	**E231404**	**145572**			**1 842**	**804-1**
01-37	**1**	**150x150**	**E231404**	**145573**			**1 788**	**986-2**
01-38	**1**	**150x150**	**E231404**	**145574**			**1 832**	**904-1**
01-39	**1**	**150x150**	**E231404**	**145575**			**1 838**	**921-1**
01-40	**1**	**150x150**	**E231404**	**145576**			**1 870**	**920-1**
01-41	**1**	**150x150**	**E231404**	**145577**			**1 830**	**917-1**
01-42	**1**	**150x150**	**E231404**	**145578**			**1 840**	**915-1**

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No. Schmelze Nr. Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231404	**0.024**	**0.68**	**1.63**	**0.035**	**0.026**	**17.31**	**12.11**	**2.04**	**0.531**	**0.35**	**0.050**

Manufacture date: 2023-08-10

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais **The requirements according to AMS-QQ-S-763D are fulfilled.** **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel **No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TüV NORD Scandinavia AB.**	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Outokumpu Long Products AB**

MARCEGAGLIA

Certificate of Test

APPROVED BY SARA MALIK 2/1/2024 9ER

HEAT E231404 ORDER 705187/ 01 BOL 0261984 * CERTIFICATION * 02/01/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer
OSB 8

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505245107 10/03/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 20 Total Weight 31257 Approx. Hot Red. Ratio 138:1

WO 2128296 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T SON= 351738

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a
ASTM A751 21
EN 10272 Grade 1.4401
10-CFR-21
Swagelok SQS-00012 Rev AK
Produced according to -
ASME B&PV Code Section III
Subsection NCA3800
MSR QPM-101 R14, 1/11/23
Approved by Swagelok Company
ASME SA-479/479M 2023 Ed
Bars are 100% UT inspected

ASTM A484/A484M 23a
DIN 50049/EN 10204 Type 3.1
EN ISO 3651-2 Method A
10CFR50-Appendix B
Swagelok SQS-00020 Rev N
Swagelok SQS-00021 Rev Q
1.4401/1.4404, 316/316L
Exception to SQS-00171 Rev F
Swagelok SMS-00833 Rev D
Swagelok SQC-03992 init. rel
ASTM E1001

---------- MECHANICAL & OTHER TESTS ----------

Micro	OK	Tensile strength,KSI (MPa)	.0 (0)
Intergranular corrosion		0.2% Yield Strngth,KSI(MPa)	.0 (0)
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.024	Manganese	(Mn)	1.630
Phosphorus	(P)	.035	Sulphur	(S)	.026
Silicon	(Si)	.680	Chromium	(Cr)	17.310
Nickel	(Ni)	12.110	Cobalt	(Co)	.351
Copper	(Cu)	.530	Moly	(Mo)	2.040
Nitrogen	(N)	.050	Columbium	(Cb)	.043
Titanium	(Ti)	.006	Aluminum	(Al)	.004
Tin	(Sn)	.015	Cerium	(Ce)	.020
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.090	Tungsten	(W)	.111
Columbium/ Tantalum	(Cb+Ta)	.041			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes.
We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

APPROVED BY SARA MALIK 2/1/2024 9ER

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128286	351692	E230889	1.062"	8	31,162#
2128297	351737	E231404	1.312"	10	39,710#
2128296	351738	E231404	1.312"	10	39,299#
2128298	351735	E231404	1.312"	10	39,755#
2128299	351736	E230951	1.312"	10	39,749#

By **George Gunter** Date **1/22/2024**

outokumpu

INSPECTION CERTIFICATE
EN 10204/3.1

No. **LP 1665-23**

OUTOKUMPU LONG PRODUCTS AB
S-693 81 DEGERFORS, SWEDEN
Ref.QC-Dept. Jörgen Johansson

Date-Datum-Date: **2023-07-11**

Your order-Ihre Bestellung-Votre commande: **605257**

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d`expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**82740**	**272756**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance	Brand mark Herstellerzeichen Signe du producteur	Inspectors`stamp Abnahmestempel Poincon de l`expert	Melting process Erschmelzungsart Procède de fusion
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulèe n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
02-01	**1**	**150x150**	**E230769**	**142681**			**1 774**	**882-1**
02-02	**1**	**150x150**	**E230769**	**144319**			**1 782**	**982-2**

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No. Schmelze Nr. Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E230769	**0.025**	**0.66**	**1.60**	**0.032**	**0.024**	**17.27**	**12.17**	**2.02**	**0.386**	**0.27**	**0.050**

Manufacture date: **2023-04-24**

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
The requirements according to AMS-QQ-S-763D are fulfilled. **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-222. Approved.**	**No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TüV NORD Scandinavia AB.**	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Outokumpu Long Products AB** Jörgen Johansson

Marcegaglia Stainless Sheffield Ltd. Address SMACC Meltshop, Europa Link, Sheffield, S9 1TZ
Telephone +44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons. N/A
HS Code 721891
Customer Order No 9973228
SMACC Order No 283516/1

Cast No. E231404
Code 231011
Campaign 38281

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Cert Date: 04 October 2023
Melt Date: 10 August 2023

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231404	60		BLOOM	462*260*2250	124710

Certification Text:
Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303464
Page 2 of 2

MARCEGAGLIA

Mill Certificate

9ER

To
SÖDRA PORTEN

KYRKVÄGEN
737 25 FAGERSTA, SWEDEN
E-MAIL R.LINDFORS@OUTOKUMPU.COM
TEL +4622345302

Cons.
N/A
HS Code

Cast No. E231404
Code 231011
Campaign 38281

Cert Date: 04 October 2023

Melt Date: 10 August 2023

Customer Order No
9973228
SMACC Order No
283516/1

Specification
DEGSTA 231011-F 17-10-2L - Chemical Analysis Only

Ordered Supply Condition
FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.024	0.68	1.63	0.035	0.026	17.31	2.04	12.11	0.004	0.53	0.015	0.04

W	V	Co	Ti	As	B	N	Pb	Ca	Ta	O
0.111	0.09	0.351	0.006	0.005	0.0010	0.050	0.0002	0.0019	0.001	

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001307606

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

- THE RECORDING OF FALSE, FICTICIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHED AS A FELONY UNDER FEDERAL STATUTES INCLUDING FEDERAL LAW, TITLE 18, CHAPTER 47.
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29 AUG 23

CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 1 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505222925	W51573		26544

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760529**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED GROUND
---------- NUCLEAR QUAL
PART NUMBER: SSD-RB-068750

SPECIFICATION: SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)
---------- SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. I (07/28/22)
ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-22 (09/01/22)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 7 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)

SIZE 0.687500 IN.(17.46 MM) RD BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.018	1.15	0.59	0.032	0.029	17.52

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.16	2.05	0.48	0.55	0.03

MELT DATE: 06/08/23
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND

CONTINUED ON NEXT PAGE

FORM E2-366

This certification is made to the customer printed on this form. Carpenter neither makes, nor assumes responsibility for, any representation or certification to other parties.
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CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001307606

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

- THE RECORDING OF FALSE, FICTICIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHED AS A FELONY UNDER FEDERAL STATUTES INCLUDING FEDERAL LAW, TITLE 18, CHAPTER 47.
- THE VALUES AND OTHER TECHNICAL DATA REPRESENT THE RESULTS OF ANALYSES AND TESTS MADE ON SAMPLES COLLECTED FROM THE TOTAL LOT. ORIGINAL DATA RECORDS CAN BE TRACED BY REFERENCE TO THE CARPENTER ORDER NUMBER.
- MATERIAL IS MANUFACTURED FREE FROM MERCURY, RADIUM, ALPHA AND GAMMA SOURCE CONTAMINATION.
- THIS DOCUMENT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN CONSENT OF CARPENTER TECHNOLOGY CORPORATION.

29 AUG 23

CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 2 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505222925	W51573		26544

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760529**

INDUSTRIE SERVICE GMBH, NO. 01 202 USA/Q-03 8928, IN ACCORDANCE WITH PED 2014/68/EU ANNEX I PARA. 4.3 + AD 2000 W0
100% COMPARATOR TESTED TO DETECT/SORTOUT HIGH IRON/LOW ALLOY INCLUSIONS.
MATERIAL VISUAL AND DIMENSIONAL INSPECTED - ACCEPTABLE.
PROVISIONS OF 10 CFR PART 21 APPLY
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
ULTRASONIC INSPECTED (IMMERSION) PER CTC PROCEDURE - ACCEPTABLE.
CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
SOLUTION ANNEALED TO PROVIDE A MICROSTRUCTURE FREE FROM CONTINUOUS GRAIN BOUNDARY CARBIDE PRECIPITATION (NETWORK).
NO WELD REPAIR.
THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL REVISION 38, DATED 08/21/2022 "AS ACCEPTED BY SWAGELOK COMPANY" IN COMPLIANCE WITH ASME B & P V CODE SECTION III, DIVISION 1 SUBSECTION NCA 3800 2017 EDITION.
PROVISIONS OF 10 CFR PART 21 & 10 CFR PART 50 - APPENDIX B APPLY.
IN PRODUCTION OR TESTING OF MATERIAL SHIPPED AGAINST THIS ORDER, NO DIRECT CONNECTED MERCURY MANOMETER, MERCURY PUMPS, MERCURY SEALS, OR MERCURY IN GLASS THERMOMETERS HAVE BEEN USED. NOR IN SUCH PRODUCTION OR TESTING HAS MERCURY BEEN HANDLED IN THE IMMEDIATE VICINITY OF SUCH MATERIAL.
THIS CERTIFICATE AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY US, OR OUR SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE ORDER REQUIREMENTS AS MAY HAVE BEEN MODIFIED BY PRIOR CORRESPONDENCE BETWEEN THE PARTIES.
MATERIAL IS COMPLIANT TO REACH; THE E.U.'S REGISTRATION, EVALUATION, AUTHORIZATION, AND REGISTRATION OF CHEMICALS LEGISLATION.
THIS HEAT MELTED BY THE ELECTRIC ARC/AOD PROCESSES
MATERIAL IS COMPLIANT TO 2015/863/EU (ROHS3) DIRECTIVE.
THIS MATERIAL HAS BEEN SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND MEETS ALL SPECIFICATION REQUIREMENTS.
INTERGRANULAR CORROSION TESTED PER ISO 3651
THIS MATERIAL WAS MANUFACTURED FREE FROM MERCURY, RADIUM AND ALPHA SOURCE CONTAMINATION.
INSPECTION CERTIFICATE 3.1 IN ACCORDANCE WITH EN 10204 AND DIN 50049
MILL HEAT TREATMENT:
TYPE SOLUTION ANNEAL
TEMP 1951F (1066C)
TIME AT TEMP CONTINUOUS FURNACE
QUENCH WATER

HARDNESS AS SHIPPED, HRC - 25
***-->TESTED AT READING**

FORM E2-366

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CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001307606

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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29 AUG 23

CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 3 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505222925	W51573		26544

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : 760529

(T)RANSVERSE (L)ONGITUDINAL	L	L
YIELD STRENGTH, (0.20 %) KSI(MPA)	93.0(641)	93.0(641)
YIELD STRENGTH, (1.00 %) KSI(MPA)	102.0(703)	102.0(703)
TENSILE STRENGTH, KSI(MPA)	106.0(731)	106.0(731)
ELONGATION IN 2.00", %	33.0	33.0
ELONGATION IN 2.50", %	29.0	29.0
REDUCTION OF AREA, %	73.0	73.0

*-->TESTED AT READING

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
*-->TESTED AT READING

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (1G OR 2G)

ORDER LENGTH REQUIREMENT: 144"

INTERGRANULAR CORROSION TEMP(F)1292 HR:0 MN:30 QUENCH:WATER
SPECIMEN SENSITIZATION *-->TESTED AT READING

FORM E2-366

CONTINUED ON NEXT PAGE

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 4 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

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4505222925	W51573		26544

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760529**

ADDRESS OF TESTING LOCATIONS:
READING - 101 WEST BERN ST, READING, PA 19601

MATERIAL HAS BEEN MELTED AND MANUFACTURED IN THE USA WHICH IS A QUALIFYING COUNTRY TO DFARS REQUIREMENTS 252.225-7014 WITH ALTERNATE 1 FOR QUALIFYING COUNTRY 225.872.1, SUPERSEDED BY DFARS REQUIREMENTS DFARS 252.225-7008 AND 252.225-7009.

UNLESS OTHERWISE STATED, THE TEST WERE PERFORMED TO THE LATEST REVISION OF THE STANDARDS LISTED BELOW: 1) BEND TEST - ASTM E290, 2) CHARPY IMPACT - ASTM E23, 3)COEFFICIENT OF LINEAR THERMAL EXPANSION - ASTM E228, 4)FRACTURE TOUGHNESS - ASTM E399, 5) BRINELL HARDNESS - ASTM E10, 6)ROCKWELL HARDNESS-ASTM E18, 7)MICRO VICKERS HARDNESS-ASTM E92, 8)KNOOP HARDNESS-ASTM E92, 9)MACRO VICKERS HARDNESS-ASTM E92, 10)STRESS RUPTURE/CREEP RUPTURE-ASTM E139, 11)STRESS RUPTURE(COMBINATION)-ASTM E292, 12)ROOM TEMPERATURE TENSILE-ASTM E8, 13)ELEVATED ROOM TEMPERATURE TENSILE-ASTM E21, 14)DECARBURIZATION-ASTM E1077 15)DELTA FERRITE AMS 2315, 16)GRAIN SIZE-ASTM E112, 17)INCLUSION CONTENT/MICROCLEANLINESS-ASTM E45, 18) INTERGRANULAR ATTACH - ASTM A262, 19)INTERGRANULAR CORROSION-ASTM A262, 20)MACRO ETCH&TESTING - ASTM A604/E381, 21)PITTING CORROSION - ASTM A923, 22)CREVICE CORROSION-ASTM G48, 23) HARDNESS CONVERSIONS - ASTM E140, 24)XRF-ASTM E572/E1085/E2465, 25) OES - ASTM E415/E1086, 26)COM - ASTM E1019, 27)FUS - ASTM E1019, 28)MS - CARPENTER METHODS 206.8500/206.8530 29)CHEMISTRY RESULTS ARE ROUNDED IN ACCORDANCE WITH ASTM A751 WHICH CONFORMS TO ASTM E29 WITH ONE SPECIAL EXCEPTION THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL, REVISION 38 DATED 08/21/2022.

CARPENTER'S QUALITY MANAGEMENT SYSTEM IS REGISTERED TO ISO 9001, AS9100, AND AS9120. THIS CERTIFICATION OF TEST IS TYPE 3.1 PREPARED IN ACCORDANCE WITH EN 10204 (DIN 50049). WE HEREBY CERTIFY THAT THE ABOVE TEST DATA ARE IN ACCORDANCE WITH THE PURCHASE ORDER AND SPECIFICATION REQUIREMENTS, AS DOCUMENTED IN THIS CERTIFICATE OF TESTS.

TEST METHODS ARE PER THE ASTM STANDARDS ON FILE AND IN EFFECT AT TIME OF ORDER ACCEPTANCE, STANDARD PRACTICES, OR AS AGREED UPON BETWEEN CARPENTER & CUSTOMER.

THE ABSENCE OF A REPORTED TEST TEMPERATURE INDICATES THAT THE TEST WAS COMPLETED AT ROOM TEMPERATURE.

FORM E2-366

CONTINUED ON NEXT PAGE

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CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001307606

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 5 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505222925	**W51573**		**26544**

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760529**

DECISION RULE: UNLESS OTHERWISE SPECIFIED IN A CUSTOMER/INDUSTRY SPECIFICATION, CARPENTER TECHNOLOGY CORPORATION WILL DETERMINE ACCEPTABILITY OF ANY TEST RESULT BY COMPARISON OF THE RESULT WITH THE SPECIFICATION LIMITS, WITHOUT ANY ADDITIONAL CONSIDERATION OF THE MEASUREMENT UNCERTAINTY. WHEN REQUESTED, CARPENTER TECHNOLOGY CORPORATION WILL PROVIDE UNCERTAINTY BUDGETS FOR ANY TEST RESULT THAT IS NOT ADDRESSED BY THE INDUSTRY STANDARD.

JEFFREY HALE /WI 48787 DIGITALLY SIGNED BY JASON M RAYMOND
ADMINISTRATOR - QUALITY
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W51573/HEAT 760529/LOT 01

FORM E2-366

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CUSTOMER / BESTELLER / CLIENT

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

SELLER / VERKÄUFER / VENDEUR **PAGE 1 OF 5**

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505222925	W51573		3192

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760529**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED GROUND
---------- NUCLEAR QUAL
PART NUMBER: SSD-RB-068750

SPECIFICATION: SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)
---------- SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. I (07/28/22)
ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-22 (09/01/22)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 7 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)

SIZE 0.687500 IN.(17.46 MM) RD BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.018	1.15	0.59	0.032	0.029	17.52

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.16	2.05	0.48	0.55	0.03

MELT DATE: 06/08/23
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND

CONTINUED ON NEXT PAGE

FORM E2-366

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Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 2 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505222925	W51573		3192

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760529**

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PROVISIONS OF 10 CFR PART 21 APPLY
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
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CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
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NO WELD REPAIR.
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TEMP 1951F (1066C)
TIME AT TEMP CONTINUOUS FURNACE
QUENCH WATER

HARDNESS AS SHIPPED, HRC - 25
***-->TESTED AT READING**

FORM E2-366

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CUSTOMER / BESTELLER / CLIENT

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

SELLER / VERKÄUFER / VENDEUR **PAGE 3 OF 5**

RDG

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YIELD STRENGTH, (1.00 %) KSI(MPA)	102.0(703)	102.0(703)
TENSILE STRENGTH, KSI(MPA)	106.0(731)	106.0(731)
ELONGATION IN 2.00", %	33.0	33.0
ELONGATION IN 2.50", %	29.0	29.0
REDUCTION OF AREA, %	73.0	73.0

*-->TESTED AT READING

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
*-->TESTED AT READING

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (1G OR 2G)

ORDER LENGTH REQUIREMENT: 144"

INTERGRANULAR CORROSION TEMP(F)1292 HR:0 MN:30 QUENCH:WATER
SPECIMEN SENSITIZATION *-->TESTED AT READING

FORM E2-366

CONTINUED ON NEXT PAGE

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CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001307606

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 4 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505222925	W51573		3192

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760529**

ADDRESS OF TESTING LOCATIONS:
READING - 101 WEST BERN ST, READING, PA 19601

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Certification ID:001307606

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 5 OF 5**

SWAGELOK COMPANY
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RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505222925	W51573		3192

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760529**

DECISION RULE: UNLESS OTHERWISE SPECIFIED IN A CUSTOMER/INDUSTRY SPECIFICATION, CARPENTER TECHNOLOGY CORPORATION WILL DETERMINE ACCEPTABILITY OF ANY TEST RESULT BY COMPARISON OF THE RESULT WITH THE SPECIFICATION LIMITS, WITHOUT ANY ADDITIONAL CONSIDERATION OF THE MEASUREMENT UNCERTAINTY. WHEN REQUESTED, CARPENTER TECHNOLOGY CORPORATION WILL PROVIDE UNCERTAINTY BUDGETS FOR ANY TEST RESULT THAT IS NOT ADDRESSED BY THE INDUSTRY STANDARD.

JEFFREY HALE /WI 48787 DIGITALLY SIGNED BY JASON M RAYMOND
ADMINISTRATOR - QUALITY
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W51573/HEAT 760529/LOT 01,02



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SELLER / VERKÄUFER / VENDEUR **PAGE 1 OF 5**

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4505313004	W54156		28707

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760937**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED COLD DRAWN
PART NUMBER: SSD-HB-087500

SPECIFICATION: SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQC-03998 REV A (01/26/18)
SWAGELOK COMPANY SQS-00226 REV (08/23/17)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)
SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. I (07/28/22)
ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-22 (09/01/22)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 8 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
SWAGELOK COMPANY SVS-00012 (02/23/01)
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)

SIZE 0.875000 IN.(22.23 MM) HEX BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.021	1.20	0.54	0.029	0.023	17.66

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.18	2.09	0.37	0.30	0.03

MELT DATE: 09/28/23

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Certification ID:001319045

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CUSTOMER / BESTELLER / CLIENT

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SWAGELOK COMPANY
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RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505313004	W54156		28707

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760937**

INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND INDUSTRIE SERVICE GMBH, NO. 01 202 USA/Q-03 8928, IN ACCORDANCE WITH PED 2014/68/EU ANNEX I PARA. 4.3 + AD 2000 W0
MATERIAL VISUAL AND DIMENSIONAL INSPECTED - ACCEPTABLE.
THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL REVISION 38, DATED 08/21/2022 "AS ACCEPTED BY SWAGELOK COMPANY" IN COMPLIANCE WITH ASME B & P V CODE SECTION III, DIVISION 1 SUBSECTION NCA 3800 2017 EDITION.
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
100% COMPARATOR TESTED TO DETECT/SORTOUT HIGH IRON/LOW ALLOY INCLUSIONS.
ULTRASONIC INSPECTED (IMMERSION) PER CTC PROCEDURE - ACCEPTABLE.
CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
EDDY CURRENT TESTED AND APPROVED AT FINISH
IT IS HEREBY CERTIFIED THAT THE SPECIALTY METALS SUPPLIED HEREUNDER HAVE BEEN PRODUCED IN THE UNITED STATES.
NO WELD REPAIR.
THIS MATERIAL HAS BEEN SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND MEETS ALL SPECIFICATION REQUIREMENTS.
INSPECTION CERTIFICATE 3.1 IN ACCORDANCE WITH EN 10204 AND DIN 50049
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
PROVISIONS OF 10 CFR PART 21 & 10 CFR PART 50 - APPENDIX B APPLY.
IN PRODUCTION OR TESTING OF MATERIAL SHIPPED AGAINST THIS ORDER, NO DIRECT CONNECTED MERCURY MANOMETER, MERCURY PUMPS, MERCURY SEALS, OR MERCURY IN GLASS THERMOMETERS HAVE BEEN USED. NOR IN SUCH PRODUCTION OR TESTING HAS MERCURY BEEN HANDLED IN THE IMMEDIATE VICINITY OF SUCH MATERIAL.
THIS CERTIFICATE AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY US, OR OUR SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE ORDER REQUIREMENTS AS MAY HAVE BEEN MODIFIED BY PRIOR CORRESPONDENCE BETWEEN THE PARTIES.
THIS MATERIAL WAS MANUFACTURED FREE FROM MERCURY, RADIUM AND ALPHA SOURCE CONTAMINATION.
ALL TESTS AND INSPECTIONS PERFORMED VERIFY CONFORMANCE TO SPECIFICATION REQUIREMENTS AND THE MATERIAL COMPLIES WITH ALL REQUIREMENTS OF THE PURCHASE ORDER.
INTERGRANULAR CORROSION TESTED PER ISO 3651
MATERIAL IS COMPLIANT TO REACH; THE E.U.'S EVALUATION, AUTHORIZATION, AND REGISTRATION OF CHEMICALS LEGISLATION.
MATERIAL IS COMPLIANT TO 2015/863/EU (ROHS3) DIRECTIVE.
THIS HEAT MELTED BY THE ELECTRIC ARC/AOD PROCESSES
MELT DATE OF HEAT: 09/28/2023
THE MATERIAL COMPLIES WITH EN 10272, AD 2000 W2, AND AD 2000 W10

FORM E2-366

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CUSTOMER / BESTELLER / CLIENT

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

SELLER / VERKÄUFER / VENDEUR **PAGE 3 OF 5**

RDG

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4505313004	W54156		28707

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760937**

MILL HEAT TREATMENT:
TYPE SOLUTION ANNEAL
TEMP 1951F (1066C)
TIME AT TEMP CONTINUOUS FURNACE
QUENCH WATER

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (2H).

ORDER LENGTH REQUIREMENT: 144"

HARDNESS AS SHIPPED, HRC - 23
***-->TESTED AT READING**

	(T)RANSVERSE	(L)ONGITUDINAL	L	L
YIELD STRENGTH, (0.20 %) KSI(MPA)	77.5(534)		89.0(614)	
YIELD STRENGTH, (1.00 %) KSI(MPA)	100.0(689)		101.0(696)	
TENSILE STRENGTH, KSI(MPA)	104.0(717)		105.0(724)	
ELONGATION IN 2.00", % (4D)	34.0		32.0	
ELONGATION IN 2.50", % (5D)	29.0		28.0	
REDUCTION OF AREA, %	73.0		73.0	

***-->TESTED AT READING**

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
***-->TESTED AT READING**

INTERGRANULAR CORROSION TEMP(F)1292 HR:0 MN:30 QUENCH:WATER
SPECIMEN SENSITIZATION *-->TESTED AT READING

INSPECTION: ACCEPTABLE

ALLOY ID: ACCEPTABLE

FORM E2-366

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101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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- MATERIAL IS MANUFACTURED FREE FROM MERCURY, RADIUM, ALPHA AND GAMMA SOURCE CONTAMINATION.
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15 NOV 23

CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 5 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505313004	**W54156**		**28707**

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760937**

DECISION RULE: UNLESS OTHERWISE SPECIFIED IN A CUSTOMER/INDUSTRY SPECIFICATION, CARPENTER TECHNOLOGY CORPORATION WILL DETERMINE ACCEPTABILITY OF ANY TEST RESULT BY COMPARISON OF THE RESULT WITH THE SPECIFICATION LIMITS, WITHOUT ANY ADDITIONAL CONSIDERATION OF THE MEASUREMENT UNCERTAINTY. WHEN REQUESTED, CARPENTER TECHNOLOGY CORPORATION WILL PROVIDE UNCERTAINTY BUDGETS FOR ANY TEST RESULT THAT IS NOT ADDRESSED BY THE INDUSTRY STANDARD.

THOMAS PIERANTOZZI /WI 25770 DIGITALLY SIGNED BY GARY BROWN
MANAGER - SPECIFICATIONS/CERTIFICATIONS
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W54156/HEAT 760937/LOT 01,02

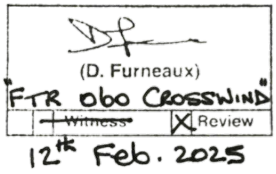
Gary Brown

FORM E2-366

This certification is made to the customer printed on this form. Carpenter neither makes, nor assumes responsibility for, any representation or certification to other parties.
Die vorliegende Zertifizierung ist nur für den in diesem Formular genannten Kunden gültig. Carpenter übernimmt gegenüber Dritten keinerlei Haftung für die ausgewiesenen Daten oder Zertifizierungen.
Ce certificat est uniquement valable pour le client dont le nom est imprimé sur ce formulaire. Carpenter n'assume pas de responsabilité pour une certification vis-à-vis d'une tierce personne.

MATERIAL CERTIFICATION

Material	**Heat No.**
Transducer head - Cover	CC576



Baker Hughes Confidential

Metallics
Nasmyth Doughty
Nasmyth Doughty Ltd
Unit 4-6, 100 Sherbrook Road
Daybrook, Nottingham NG5 6AB
United Kingdom
Tel: +44 (0) 1159 660600
Fax: +44 (0) 1159 660601
www.nasmythgroup.com

CERTIFICATE OF CONFORMITY

CUSTOMER : PANAMETRICS LLC
1100 TECHNOLOGY PARK DRIVE
BILLERICA
USA
MA 01821

C OF C NO : 54313
ADVICE NO : 49412
OUR WO NO : D36869/1/1
OUR CONTRACT NO : D36869
YOUR ORDER NO : 5052189151

DATE ENTERED 24-Jan-2024

QTY	PART NO.	DESCRIPTION	DRAWING NO / REVISION	SERIAL NO.	BATCH NO.	CAST / HEAT NO.
12	175M2244-04-REV-	180 DEG HEAD, FOR T5 4 STACK XDCR	175M2244-REV- /	151427	D36869/1/1	CC576

SPECIFICATIONS AND TESTS : SPECIFICATION TESTS	RESULT

DEVIATIONS :	CONCESSIONS :

Certified that the suppliers/services detailed hereon have been inspected and tested in accordance with the conditions and requirements of ISO 9001:2015 and AS9100-REV-D and is ROHS compliant. They comply with the contract or purchase order, and unless otherwise noted below conform in all respects to the specification(s), drawing(s) relevant thereto.

Parts conform to NACE MR0175 and NACE MR0103

Signed _____

(QUALITY INSPECTION)

Baker Hughes Panametrics
Documentation Reviewed by:
Marco A. Adar
8:22 am, Jan 29 2024

151427

CERTIFICATE OF CONFORMITY / TEST CERTIFICATE

CUSTOMER:

Nasmyth Doughty Limited
Units 4-6
100 Sherbrook Road
Daybrook
Nottingham
NG5 6AB

DATE: 15th September *2022*

ORDER NUMBER: 28010

DELIVERY NUMBER: *65004*

OUR REFERENCE: *65682*

COUNTRY OF ORGIN: *Italy*

SIZE: *7/8"dia x 1mtr lengths*

SPECIFICATION: *S/S BS EN10088-3 1.4404 (316L)*

CAST NUMBER: *CC576*

We certify that the whole of the supplies detailed hereon, unless otherwise stated, are covered by the sources Certificate of Conformity / Test Certificate referenced hereon And have been subject to the Quality System Requirements, in accordance with the conditions of our Bureau Veritas Certification UK Limited to BS/EN/ISO 9001:2015.

Signature

Sharon Roberts
Quality Control & Certification

Chase Alloys Ltd
Littleton Business Park, Cocksparrow Lane,
Huntington, Cannock, Staffs, WS12 4TR, UK
Tel: (044) 01543 573200 Fax: (044) 01543 573298
Registered Company No. 02509180

Baker Hughes Panametrics
Documentation Reviewed by:
Marco A. Adar
8:22 am, Jan 29 2024

CHASE ALLOYS LIMITED

MARCEGAGLIA SPECIALTIES

Sede Legale e amministrativa:
via Bresciani 16
46040 Gazoldo degli Ippoliti
Mantova-Italy
Tel. +39 - 0376 685 1
Fax. +39 - 0376 685 600
www.marcegaglia.com

CHASE ALLOYS LIMITED,
LITTLETON BUSINESS PARK,
COCKSPARROW LANE,
HUNTINGTON, CANNOCK,
STAFFS, WS12 4TR,
TELEPHONE: 01543 573200
FACSIMILE: 01543 573298
WWW.CHASEALLOYS.CO.UK

Type	Inspection Certificate 3.1 AD-2000 EN10204
Number	10222447222
Issued On	08/07/2022

Delivery Nn	8042484331	Quality Control
Of	08/07/2022	Q.M.D. A.Dal Prato
Delivery note nr	2502000072	Plant Of Contino

Identification Nr	Quantity	Heat	C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	Mo (%)	Cu (%)	N (%)	Co (%)	Rm MPa	Rp 0.2 MPa	RP 1 MPa	A (%)	HB
								16.5	10	2				600	200		30	
			0.03	1	2	0.045	0.03	18.5	13	2.5	1	0.11	0.19	830				

55200435 UXS 22.225(7/8")x3000 A316L EN 1.4404 h9/ 1.4404 - 1.4401 ASTM A276/A479 AISI316L - AISI316 h9 EN100883 1591874803/30 C62838 MARCH Date 07/03/2022
COLD CENTERLESS GROUND BARS TOLERANCE EN 10278 UXS=2H

22QB505607	508 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	666	436	513	42.1	206
22QB505615	508 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	666	436	513	42.1	206
22QB505616	498 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	667	437	514	41.6	206
22QB505617	498 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	667	437	514	41.6	206
22QB505630	508 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	666	437	514	41.8	206

55200435 UXS 22.225(7/8")x3000 A316L EN 1.4404 h9/ 1.4404 - 1.4401 ASTM A276/A479 AISI316L - AISI316 h9 EN100883 1591874806/10 C62841 APRIL Date 01/12/2021
COLD CENTERLESS GROUND BARS TOLERANCE EN 10278 UXS=2H

22QB505598	508 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	665	435	510	42.3	209
22QB505618	518 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	665	434	511	42.7	209

55200435 UXS 22.225(7/8")x3000 A316L EN 1.4404 h9/ 1.4404 - 1.4401 ASTM A276/A479 AISI316L - AISI316 h9 EN100883 1591877207/90 C63306 JUNE Date 06/06/2022
COLD CENTERLESS GROUND BARS TOLERANCE EN 10278 UXS=2H

22QB505597	498 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	665	435	510	42.3	209
22QB505599	508 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	668	437	516	40.9	209
22QB505600	512 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	668	437	516	40.9	209
22QB505602	508 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	668	438	517	40.9	209
22QB505603	480 KG	CC576	.018	.480	1.530	.0400	.0230	16.58010.0302.050	.480	.0760	.1600	667	437	516	41.4	209

Remarks:
- According to AD-W2/AD-W10 DIN 17440 cooling at 1050°C, water cooling
- AD2000Merkblatt W0/TRD100, EN 10272, ASTM A276 + A479, ASME SA479
- The material is resistant to the intergranular corrosion according to iso 3651-2
- DIN 50914 and IC Test acc. ASTM A262 E
- An antmixing test has been effected.
- Dimensional and visual check OK

- We certify that material supplied complies with the requirements agreed on order

Issued in agreement with
TUV SUD Industrie Service GmbH (02/2003)
QMS approved acc.to PED 2014/68/EU.
Annex I, Para. 4.3 Notified Body 0036
(Certification no.DGR-0036-QS-W 180/2003/MUC)

C. Certified Checked
A.P 82039
L. Signed

CHASE ALLOYS LIMITED
certified true copy of
mill certificate

Baker Hughes Panametrics
Documentation Reviewed by:
Marco A. Adar
8:32 am, Jan 29 2024

Baker Hughes

CERTIFICATION OF COMPLIANCE WITH EU/UK STEEL IMPORTS

Nasmyth Doughty LTD (hereafter, the "Supplier") certifies and warrants that all products listed below comply with Article 3g of Council Regulation (EU) 833/2014 and Chapter 4CA of the UK Russia Sanctions Regulation 2023 (comprehensively identified hereafter as the "Regulation"). Specifically, the Supplier certifies that all iron and steel products supplied to Baker Hughes (Panametrics LLC) (hereafter identified as the "Importer") and identified in this certification which are listed in EU Annex XVII or UK Schedule 3B of the Regulation (the "Listed Items") do not:

a. originate from Russia; nor
b. incorporate restricted iron and steel products or material from Russia.

The Supplier further assures the Importer that Mill Test Certificates ("MTCs") will be available upon request to verify these certifications, and that these MTCs will include the name of the production facility, country of the heat number, and classification to the subheading level of the product. For finished products, it will additionally include the name of the country(ies) and facility(ies) where any of the following operations are performed: hot or cold rolling, hot dipped or electrolytic metal coating, organic coating, welding (including laser welding), piercing, extruding, drawing, pilgering, ERW, SAW, or HFI.

This certificate covers (select one option):

☐ All products sourced from the Supplier
☑ All products on the POs listed below

PO505218915I - Qty - 12 - Part No - 175M2244-04-REV DELIVERY 12

Certification provided by:

Supplier Name: Nasmyth Doughty LTD

Address: Unit 5A-6 100 Sherbrook Road NG5 6AB Nottingham United Kingdom

Authorized official: Graham Field
Full Name

Dispatch Organiser
Title

Signature

Date 24/01/2024

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Baker Hughes Panametrics
Documentation Reviewed by:
Marco A. Adar
8:33 am, Jan 29 2024

MATERIAL CERTIFICATION

Material	**Heat No.**
Transducer head - Cap	36SGA330A

(D. Furneaux)
FTR 060 CROSSWIND
~~Witness~~ X Review
12th Feb. 2025

Baker Hughes Confidential

Metallics
Nasmyth Doughty
Nasmyth Doughty Ltd
Unit 4-6, 100 Sherbrook Road
Daybrook, Nottingham NG5 6AB
United Kingdom
Tel: +44 (0) 1159 660600
Fax: +44 (0) 1159 660601
www.nasmythgroup.com

CERTIFICATE OF CONFORMITY

CUSTOMER : PANAMETRICS LLC
1100 TECHNOLOGY PARK DRIVE
BILLERICA
USA
MA 01821

C OF C NO :	**52706**
ADVICE NO :	47933
OUR WO NO :	D36326/1/1
OUR CONTRACT NO :	D36326
YOUR ORDER NO :	5052052030

DATE ENTERED 02-Feb-2023

QTY	PART NO.	DESCRIPTION	DRAWING NO / REVISION	SERIAL NO.	BATCH NO.	CAST / HEAT NO.
6	531-318-04-REV-L	ADAPTER, FOR 180 DEGREE HEAD T5 TRANSDUCER, ALTERNATE 1	531-318-REV-L /	150115	D36326/1/1	36SGA330A

SPECIFICATIONS AND TESTS : SPECIFICATION TESTS	RESULT

DEVIATIONS :	CONCESSIONS :

Certified that the suppliers/services detailed hereon have been inspected and tested in accordance with the conditions and requirements of ISO 9001:2015 and AS9100-REV-D and is ROHS compliant. They comply with the contract or purchase order, and unless otherwise noted below conform in all respects to the specification(s), drawing(s) relevant thereto.

Parts conform to NACE MR0175 and NACE MR0103

Signed Am Croft

(QUALITY INSPECTION)

GE Oil & Gas
Measurement & Control
Documentation Reviewed by:
ED COLLINS on Feb 07, 2023

Isolis

CERTIFICATE OF CONFORMITY / TEST CERTIFICATE

CUSTOMER:

Nasmyth Doughty Limited
Units 4-6
100 Sherbrook Road
Daybrook
Nottingham
NG5 6AB

DATE: 1st August 2022

ORDER NUMBER: 27822

DELIVERY NUMBER: 63947

OUR REFERENCE: 64611

COUNTRY OF ORGIN: Italy

SIZE: 7/8"dia x 1mtr lengths

SPECIFICATION: Stainless Steel Grade 316/316L (1.4401/1.4404)

CAST NUMBER: 36SGA330A

We certify that the whole of the supplies detailed hereon, unless otherwise stated, are covered by the sources Certificate of Conformity / Test Certificate referenced hereon And have been subject to the Quality System Requirements, in accordance with the conditions of our Bureau Veritas Certification UK Limited to BS/EN/ISO 9001:2015.

Signature

Sharon Roberts
Quality Control & Certification

Chase Alloys Ltd
Littleton Business Park, Cocksparrow Lane,
Huntington, Cannock, Staffs, WS12 4TR, UK
Tel: (044) 01543 573200 Fax: (044) 01543 573298
Registered Company No. 02509180

GE Oil & Gas
Measurement & Control
Documentation Reviewed by:
ED COLLINS on Feb 07, 2023

CHASE ALLOYS LIMITED

DPS 123 INSP 'Solis

MARCEGAGLIA SPECIALTIES

Sede Legale e amministrativa:
via Bresciani 16
46040 Gazzolo degli Ippoliti
Mantova-Italy
Tel +39 - 0376 685 1
Fax. +39 - 0376 685 600
www.marcegaglia.com

CHASE ALLOYS LIMITED,
LITTLETON BUSINESS PARK,
COCKSPARROW LANE,
HUNTINGTON, CANNOCK,
STAFFS, WS12 4TR,
TELEPHONE: 01543 573200
FACSIMILE: 01543 573298
WWW.CHASEALLOYS.CO.UK

Type	Inspection Certificate 3.1 AD-2000 EN10204
Number	1022217[illegible]02
Issued On	15/03/2022
Delivery Nn	8042468753
Of	15/03/2022
Delivery note nr	2502000030
Quality Control	Q.M.O. A.Dal Prato
Plant Of Contino	

Identification Nr	Quantity	Heat	C (%)	Si (%)	Mn (%)	P (%)	S (%)	Cr (%)	Ni (%)	Mo (%)	Cu (%)	N (%)	Co (%)	Rm MPa	Rp 0.2 MPa	RP 1 MPa	A (%)	HB
								16.5	10	2				500	200		30	
			0.03	1	2	0.045	0.03	18.5	13	2.5	1	0.11	0.19	630				
55200074 UXS 20.00x3000 A316L EN 1.4404 h9/ 1.4404 - 1.4401 ASTM A276/A479 AISI316L - AISI316 h9 EN100883 1591871682/80 C62061 OCTOBER Date 10/4/2021 COLD CENTERLESS GROUND BARS TOLERANCE EN 10278 UXS=2H																		
21QB502169	508 KG	S43842	.017	.328	1.870	.0347	.0028	16.64410.0422.036	.463		.0143	.1200	663	433	506	42.8	207	
21QB502170	502 KG	S43842	.017	.328	1.870	.0347	.0028	16.64410.0422.036	.463		.0143	.1200	663	433	506	43.2	207	
55200435 UXS 22.225(7/8")x3000 A316L EN 1.4404 h9/ 1.4404 - 1.4401 ASTM A276/A479 AISI316L - AISI316 h9 EN100883 1591872901/70 C62318 NOVEMBER Date 11/5/2021 COLD CENTERLESS GROUND BARS TOLERANCE EN 10278 UXS=2H																		
22QB502159	516 KG	36SGA330A	.017	.370	1.320	.0350	.0280	16.66010.0202.030	.340		.0388	.1200	661	430	501	43.9	209	
22QB502160	508 KG	36SGA330A	.017	.370	1.320	.0350	.0280	16.66010.0202.030	.340		.0388	.1200	661	430	501	43.9	209	
55200434 UXS 19.05(3/4")x3000 A316L EN 1.4404 h9/ 1.4404 - 1.4401 ASTM A276/A479 AISI316L - AISI316 h9 EN100883 1591872906/100 C62328 DECEMBER Date 12/6/2021 COLD CENTERLESS GROUND BARS TOLERANCE EN 10278 UXS=2H																		
22QJ500101	502 KG	1KNK	.028	.397	1.462	.0250	.0270	16.67510.3852.057	.319		.0410	.1510	663	433	505	42.9	210	
22QJ500102	501 KG	1KNK	.028	.397	1.462	.0250	.0270	16.67510.3852.057	.319		.0410	.1510	662	433	505	43.4	210	
22QJ500104	501 KG	1KNK	.028	.397	1.462	.0250	.0270	16.67510.3852.057	.319		.0410	.1510	662	433	505	43.4	210	
22QJ500113	502 KG	1KNK	.028	.397	1.462	.0250	.0270	16.67510.3852.057	.319		.0410	.1510	662	432	505	43.4	210	
22QJ500114	885 KG	1KNK	.028	.397	1.462	.0250	.0270	16.67510.3852.057	.319		.0410	.1510	662	433	506	43.5	210	
55200435 UXS 22.225(7/8")x3000 A316L EN 1.4404 h9/ 1.4404 - 1.4401 ASTM A276/A479 AISI316L - AISI316 h9 EN100883 1591872906/120 C62328 DECEMBER Date 12/6/2021 COLD CENTERLESS GROUND BARS TOLERANCE EN 10278 UXS=2H																		
22QB502151	526 KG	36SGA330A	.017	.370	1.320	.0350	.0280	16.66010.0202.030	.340		.0388	.1200	662	432	503	43.4	211	
22QB502152	526 KG	36SGA330A	.017	.370	1.320	.0350	.0280	16.66010.0202.030	.340		.0388	.1200	662	432	503	43.4	211	
22QB502153	518 KG	36SGA330A	.017	.370	1.320	.0350	.0280	16.66010.0202.030	.340		.0388	.1200	662	431	503	43.5	211	

Remarks.
- According to AD-W2/AD-W10 DIN 17440 cooling at 1050°C, water cooling
- AD2000Merkblatt W0/TRD100, EN 10272, ASTM A276 + A479, ASME SA479
- The material is resistant to the intergranular corrosion according to Iso 3651-2
- DIN 50914 and IC Test acc. ASTM A262 E
- An antimixing test has been effected.
- Dimensional and visual check OK

- We certify that material supplied complies with the requirements agreed on order

Issued in agreement with
TUV SUD Industrie Service GmbH (02/2003)
QMS approved acc.to PED 2014/68/EU.
Annex I, Para. 4.3 Notified Body 0036
(Certification nó.DGR-0038-QS-W 180/2003/MUC)

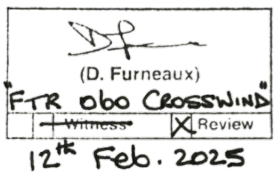
C. Certified Checked
A.P .....
L. Signed .....

CHASE ALLOYS LIMITED
certified true copy of
mill certificate

GE Oil & Gas
Measurement & Control
Documentation Reviewed by:
ED COLLINS on Feb 07, 2023

MATERIAL CERTIFICATION

Material	**Heat No.**
Isolation Valve	RAAX/RAAZ
	RAAX/RAAZ



Baker Hughes Confidential

B.F.E. S.r.l.
BONNEY FORGE
HEAD OFFICE • SALES OFFICE
FORGED VALVE PLANT
Via Tonale, 70/A - 24061 Albano S. Alessandro (BG) Italy
Phone 0039 035 584.111 - Fax 0039 035 583.022
e-mail: sales@bfe.it - web site: www.bfe.it

INSPECTION CERTIFICATE & DECLARATION OF CONFORMITY

NUMBER 24/05757 | REVISION |

CUSTOMER CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N. 1165470 | YOUR PURCHASE ORDER DATE 23/01/2024 | X PARTIAL ORDER | BALANCE ORDER

OUR JOB N. 240470 | REMARKS:

X API 598 | EN12266-1/2 | X EN 10204 3.1

MATERIAL TESTED

TEST BAR — HYDROSTATIC: SHELL; SEATS & BACK SEAT; PNEUM SEATS

ITEM CUSTOMER / BFE	QTY	PART N.	DESCRIPTION	SHELL	SEATS & BACK SEAT	SEATS	COMPONENT / HEAT CODE MATERIAL / HEAT NR SUPPLIER	TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	IMPACT TEST 2 JOULE	IMPACT TEST 3 JOULE	TEST TEMP °C	HARDNESS HB	HARDNESS HB	C.E.
								CHEMICAL ANALYSIS %	%	%	%	%	%	%	%	%	%	%
								MECHANICAL PROPERTIES										
2	15	153955		29	21	6	BONNET A182	C	MN	SI	P	S	CR	NI	MO	N		
002			GATE VALVE OS&Y BB FB FLG				RAAX F316-L	0,017	1,710	0,460	0,030	0,013	16,720	10,050	2,060	0,087		
			1-108B RFS RFS				289782 VALBRUNA	555,00	263,00	53,60	71,30	144,00	150,00	115,00	-196	185,00	146,00	
			2" F316-L/F316-L* -NACE- CL150				BODY A182	C	MN	SI	P	S	CR	NI	MO	N		
			NACE				RAAZ F316-L	0,023	1,900	0,470	0,029	0,014	16,820	10,400	2,050	0,093		
							435949 VALBRUNA	560,00	244,00	55,10	71,40	124,00	136,00	115,00	-196	182,00	145,00	
							WEDGE A182	C	MN	SI	P	S	CR	NI	MO	N		
							269025 F316-L	0,020	1,460	0,500	0,032	0,026	17,060	10,040	2,010	0,070		
							269025 VALBRUNA	599,00	383,00	49,50	74,20	164,00	219,00	185,00	-196	174,00		
							SEAT A182	C	MN	SI	P	S	CR	NI	MO	N		
							269025 F316-L	0,020	1,460	0,500	0,032	0,026	17,060	10,040	2,010	0,070		
							269025 VALBRUNA	599,00	383,00	49,50	74,20	164,00	219,00	185,00	-196	225,00		
							STEM A182	C	MN	SI	P	S	CR	NI	MO	N		
							292442 F316-L	0,019	1,490	0,480	0,032	0,013	16,760	10,070	2,000	0,060		
							292442 VALBRUNA	625,00	309,00	53,60	76,30	258,00	248,00	215,00	-196	226,00		
							BOLT A320	C	MN	SI	P	CR	NI	MO				
							942004 B8M CL.1	0,018	0,575	0,508	0,024	16,623	11,059	2,033				
							942004 M. MORANDI	749,00	622,00	41,30	62,50					236,00		
3	4	357755		390	285	6	BOLT A193	C	MN	SI	P	S	CR	MO	V	AL		
003			GATE VALVE OS&Y BB FB				-30835 B16	0,388	0,523	0,201	0,010	0,006	0,871	0,541	0,276	0,012		
			15H 103B/F.B SCH160 F.BSCH160				3083532 STAMPINOX	956,00	843,00	24,00	59,00					286,00	296,00	
			1/2" F22/F316-L* -NACE- CL1500				BONNET A182	C	MN	SI	P	S	CR	NI	MO	CU	SN	XBAR
			NACE				ZOA F22/CL3	0,130	0,530	0,200	0,005	0,003	2,340	0,200	1,030	0,170	0,010	9,900
							209502 SIDENOR	525,00	334,00	28,60	74,55	178,00	190,00	164,00	-29	178,00	159,20	
							BODY A182	C	MN	SI	P	S	CR	NI	MO	CU	SN	J.F.
							ZOB F22/CL3	0,121	0,417	0,157	0,006	0,004	2,289	0,099	0,973	0,191	0,010	91,840
							641632 SIDENOR	519,00	336,00	35,60	78,40	117,00	124,00	170,00	-29	168,00	170,60	
							BODY A182	XBAR										
							ZOB F22/CL3	11,500										
							641632 SIDENOR											

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

date | third | authority | date | client | inspector

INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. E.AZZOLA

date 28/08/24

B.F.E. S.r.l.
BONNEY FORGE
HEAD OFFICE - SALES OFFICE
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e-mail: sales@bfe.it - web site: www.bfe.it

INSPECTION CERTIFICATE & DECLARATION OF CONFORMITY

NUMBER 24/05757 | REVISION |

CUSTOMER CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N. 1165470 | YOUR PURCHASE ORDER DATE 23/01/2024 | X PARTIAL ORDER | BALANCE ORDER

OUR JOB N. 240470 | REMARKS:

X API 598 | EN12266-1/2 | X EN 10204 3.1

MATERIAL TESTED

TEST: BAR — HYDROSTATIC: SHELL / SEATS & BACK SEAT — PNEUM: SEATS

ITEM CUSTOMER / BFE	QTY	PART N.	DESCRIPTION	COMPONENT HEAT CODE MATERIAL HEAT NR SUPPLIER	CHEMICAL ANALYSIS %	%	%	%	%	%	%	%	%	%	%
					MECHANICAL PROPERTIES										
					TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	2 JOULE	3 JOULE	TEST TEMP °C	HARDNESS HB	HB	C.E.
				STEM A182	C	MN	SI	P	S	CR	NI				
				292830 F6A CL.2	0,137	0,730	0,520	0,016	0,023	12,490	0,220				
				292830 VALBRUNA	656,00	473,00	28,00	67,00				-46	222,00		
						STANDARD MATERIAL SPECIFICATION									
						**********	**********	**********	**********	**					
					C	MN	P	S	SI	CU	NI	CR	MO	V	NB
				ASTM A105-23 MIN.		0,600			0,100						
				MAX.	0,350	1,050	0,035	0,040	0,350	0,400	0,400	0,300	0,120	0,080	0,020
				MIN.	485,00	250,00	22,00	30,00							
				MAX.									187,00		
					C	MN	SI	CR	S	P	MO	V	AL		
				ASTM A193-23 MIN.	0,360	0,450	0,150	0,800			0,500	0,250			
				B16 MAX.	0,470	0,700	0,350	1,150	0,040	0,035	0,650	0,350	0,015		
				MIN.	860,00	720,00	18,00	50,00							
				MAX.									321,00		
					C	MN	P	S	SI	CR	MO				
				ASTM A193-23 MIN.	0,370	0,650			0,150	0,750	0,150				
				B7M MAX.	0,490	1,100	0,035	0,040	0,350	1,200	0,250				
				MIN.	690,00	550,00	18,00	50,00							

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

date third authority | date client inspector

INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. EAZZOLA

date 28/08/24

B.F.E. S.r.l.
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INSPECTION CERTIFICATE & DECLARATION OF CONFORMITY

NUMBER 24/05757 | REVISION |

CUSTOMER CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N. 1165470

YOUR PURCHASE ORDER DATE 23/01/2024

X PARTIAL ORDER
BALANCE ORDER

OUR JOB N. 240470

REMARKS:

X API 598
EN12266-1/2

X EN 10204 3.1

MATERIAL TESTED

TEST: BAR — HYDROSTATIC: SHELL; SEATS & BACK SEAT — PNEUM: SEATS

ITEM CUSTOMER / BFE	QTY	PART N.	DESCRIPTION	COMPONENT HEAT CODE MATERIAL HEAT NR SUPPLIER	CHEMICAL ANALYSIS %	%	%	%	%	%	%	%	%	%	%
					MECHANICAL PROPERTIES TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	2 JOULE	3 JOULE	TEST TEMP °C	HARDNESS HB	HB	C.E.
				MAX.									235,00		
					C	MN	P	S	SI	CR	NI	MO			
				ASTM A320-22A MIN.						16,000	10,000	2,000			
				B8M MAX.	0,080	2,000	0,045	0,030	1,000	18,000	14,000	3,000			
				MIN.	515,00	205,00	30,00	50,00							
				MAX.									223,00		
					C	MN	SI	P	S	CR	MO				
				ASTM A182-23 MIN.	0,050	0,300				2,000	0,870				
				F22 CL.3 MAX.	0,150	0,600	0,500	0,040	0,040	2,500	1,130				
				MIN.	515,00	310,00	20,00	30,00					156,00		
				MAX.									207,00		
					C	MN	SI	P	S	CR	NI	MO	N		
				ASTM A182-23 MIN.						16,000	10,000	2,000			
				F316-L MAX.	0,030	2,000	1,000	0,045	0,030	18,000	14,000	3,000	0,100		
				MIN.	515,00	205,00	35,00	50,00	27,00	27,00	27,00				
				MAX.											

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

date third authority

date client inspector

INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. E.AZZOLA

date 28/08/24

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INSPECTION CERTIFICATE & DECLARATION OF CONFORMITY

NUMBER 24/05757 | REVISION |

CUSTOMER CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N. 1165470 | YOUR PURCHASE ORDER DATE 23/01/2024 | X PARTIAL ORDER | BALANCE ORDER

OUR JOB N. 240470 | REMARKS:

X API 598 | EN12266-1/2 | X EN 10204 3.1

MATERIAL TESTED

TEST: BAR — HYDROSTATIC: SHELL / SEATS & BACK SEAT — PNEUM: SEATS

ITEM CUSTOMER / BFE	QTY	PART N.	DESCRIPTION	COMPONENT HEAT CODE MATERIAL HEAT NR SUPPLIER	CHEMICAL ANALYSIS %	%	%	%	%	%	%	%	%	%	%
					MECHANICAL PROPERTIES				IMPACT TEST			TEST	HARDNESS		C.E.
					TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	1 JOULE	2 JOULE	3 JOULE	TEMP °C	HB	HB	
					C	MN	P	S	SI	NI	CR	MO	N		
				ASTM A182-23 MIN.						4,500	22,000	3,000	0,150		
				F51 MAX.	0,030	2,000	0,030	0,020	1,000	6,500	23,000	3,500	0,200		
				MIN.	655,00	450,00	25,00		45,00	45,00	45,00	-50°CC			33,00
				MAX.									290,00		
					C	MN	P	S	SI	NI	CR				
				ASTM A182-23 MIN.							11,500				
				F6A CL.2 MAX.	0,150	1,000	0,040	0,030	1,000	0,500	13,500				
				MIN.	585,00	380,00	18,00	35,00					167,00		
				MAX.									229,00		
					C	MN	P	S	SI	CR	NI	MO			
				ASTM A194-23 MIN.						16,000	10,000	2,000			
				GR.8M MAX.	0,080	2,000	0,045	0,030	1,000	18,000	14,000	3,000			
				MIN.									126,00		
				MAX.									300,00		
					C	MN	P	S	SI	CU	NI	CR	MO	V	NB

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

date | third | authority | date | client | inspector

INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. EAZZOLA

date 28/08/24

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HEAD OFFICE • SALES OFFICE
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INSPECTION CERTIFICATE & DECLARATION OF CONFORMITY

NUMBER 24/05757 | REVISION |

CUSTOMER CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N. 1165470

YOUR PURCHASE ORDER DATE 23/01/2024

X PARTIAL ORDER
BALANCE ORDER

OUR JOB N. 240470

REMARKS:

X API 598
EN12266-1/2

X EN 10204 3.1

MATERIAL TESTED

TEST BAR — HYDROSTATIC: SHELL, SEATS & BACK SEAT; PNEUM: SEATS

ITEM CUSTOMER / BFE	QTY	PART N.	DESCRIPTION	COMPONENT HEAT CODE MATERIAL HEAT NR SUPPLIER	CHEMICAL ANALYSIS %	%	%	%	%	%	%	%	%	%	%
					MECHANICAL PROPERTIES										
					TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	IMPACT TEST 2 JOULE	IMPACT TEST 3 JOULE	TEST TEMP °C	HARDNESS HB	HARDNESS HB	C.E.
				ASTM A350-23 MIN.		0,600			0,150						
				LF2 MAX.	0,300	1,350	0,035	0,040	0,300	0,400	0,400	0,300	0,120	0,080	0,020
				MIN.	485,00	250,00	22,00	30,00	27,00	27,00	27,00	-50			
				MAX.	655,00								197,00		
					C	MN	P	S	SI	CR	MO				
				ASTM A320-22A MIN.	0,380	0,750			0,150	0,800	0,150				
				L7M MAX.	0,480	1,000	0,035	0,040	0,350	1,100	0,250				
				MIN.	690,00	550,00	18,00	50,00	27,00	20,00		-73	201,00		
				MAX.									235,00		
			FOR VALVES UP TO NPS DN25 (1"), INCLUDED: EU & UKCA DECLARATION OF COMPLIANCE (SEP) B.F.E. SRL, VIA TONALE 70/A, ALBANO S.A. (BG) ITALY DECLARE UNDER OUR SOLE RESPONSIBILITY THAT ABOVE DETAILED PRODUCTS HAVE BEEN MANUFACTURED ACCORDING TO: - SOUND ENGINEERING PRACTICE IN AN ENVIRONMENT ASSESSED AND CERTIFIED TO MODULE H OF "PED" PRESSURE EQUIPMENT DIRECTIVE 2014/68/EU AND MEETS THE REQUIREMENTS OF THE PED ACCORDING TO ARTICLE 4 PARAGRAPH 3; - SOUND ENGINEERING PRACTICE IN AN ENVIRONMENT ASSESSED AND CERTIFIED TO MODULE H OF "PESR" PRESSURE EQUIPMENT (SAFETY) REGULATIONS, 2016 NO. 1105.											

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

date third authority

date client inspector

INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. E.AZZOLA

date 28/08/24

B.F.E. S.r.l.
BONNEY FORGE
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Via Tonale, 70/A - 24061 Albano S. Alessandro (BG) Italy
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INSPECTION CERTIFICATE & DECLARATION OF CONFORMITY

NUMBER	REVISION	
24/05757		Page 13 of 19

CUSTOMER CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N.		YOUR PURCHASE ORDER DATE		
1165470		23/01/2024	X	PARTIAL ORDER
				BALANCE ORDER

OUR JOB N.	REMARKS:			
240470		X	API 598	X EN 10204 3.1
			EN12266-1/2	

MATERIAL TESTED

ITEM CUSTOMER / BFE	QTY	PART N.	DESCRIPTION

SIGNED.....

PLACE : ALBANO S.ALESSANDRO (BG) ITALY
PRINT NAME: A. SONZOGNI
TITLE : MANAGING DIRECTOR

****

FOR VALVES NPS DN32 (1 1/4") AND ABOVE:

EU DECLARATION OF CONFORMITY - "PED" 2014/68/EU
&
UKCA DECLARATION OF CONFORMITY - "PE(S)R" PRESSURE EQUIPMENT (SAFETY) REGULATIONS, 2016 NO. 1105

B.F.E. SRL,VIA TONALE 70/A, ALBANO S.A.(BG) ITALY ACCORDING TO ANNEX IV OF DIRECTIVE 2014/68/EU & REGULATION 2016 NO. 1105, DECLARE UNDER OUR SOLE RESPONSIBILITY THAT ABOVE DETAILED PRODUCTS ARE IN COMPLIANCE WITH DIRECTIVE 2014/68/EU & REGULATION 2016 NO. 1105 AND HAVE BEEN MANUFACTURED IN ACCORDANCE WITH CONFORMITY ASSESSMENT MODULE H AS APPROVED BY:

FOR "PED" 2014/68/EU:
DNV BUSINESS ASSURANCE ITALY S.R.L. (NOTIFIED BODY 0496)
VIA ENERGY PARK 14, 20871, VIMERCATE (MB) ITALY
CERTIFICATE N°: 112212-2012-CE-ITA-ACCREDIA

FOR "PESR" 2016 NO. 1105:

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

TEST			COMPONENT HEAT CODE MATERIAL HEAT NR SUPPLIER	CHEMICAL ANALYSIS										
	BAR			%	%	%	%	%	%	%	%	%	%	%
HYDROSTATIC		PNEUM		MECHANICAL PROPERTIES										
SHELL	SEATS & BACK SEAT	SEATS		TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	2 JOULE	3 JOULE	TEST TEMP °C	HARDNESS HB	HB	C.E.

date	third	authority	date	client	inspector	INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. EAZZOLA	date	28/08/24

B.F.E. S.r.l.
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INSPECTION CERTIFICATE
& DECLARATION OF CONFORMITY

NUMBER 24/05757 | REVISION |

CUSTOMER CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N. 1165470

YOUR PURCHASE ORDER DATE 23/01/2024

X PARTIAL ORDER
BALANCE ORDER

OUR JOB N. 240470

REMARKS:

X API 598
EN12266-1/2

X EN 10204 3.1

MATERIAL TESTED

TEST: BAR — HYDROSTATIC: SHELL, SEATS & BACK SEAT — PNEUM: SEATS

ITEM CUSTOMER / BFE	QTY	PART N.	DESCRIPTION	COMPONENT HEAT CODE MATERIAL HEAT NR SUPPLIER	CHEMICAL ANALYSIS %	MECHANICAL PROPERTIES TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	2 JOULE	3 JOULE	TEST TEMP °C	HARDNESS HB	HB	C.E.
			DNV UK LIMITED (APPROVED BODY 0097) VIVO BUILDING, 30 STAMFORD STREET, LONDON, SE1 9LQ CERTIFICATE N°: 21-UK-PER-017-H CATEGORY: III FLUID GROUP: I APPLICABLE STDS. (MANUFACTURING): ASME B16.34, API602, BS 5352, ISO 15761, API 6D, ISO 14313, ISO 17292, EN 12516-1/2, EN 1984 (FOR GATE VALVES) & CUSTOMER SPECIFICATIONS. APPLICABLE STDS. (TESTING): ASME B16.34, API 598, EN ISO 15761, EN 12266-1/2, ISO5208 & CUSTOMER SPECIFICATIONS. SIGNED..... PLACE : ALBANO S.ALESSANDRO (BG) ITALY PRINT NAME: A. SONZOGNI TITLE : MANAGING DIRECTOR ********** EU DECLARATION OF CONFORMITY ATEX 2014/34/EU & EPS 2016:1107 ACCORDING TO ART. VIII OF DIRECTIVE 2014/34/EU (ATEX) AND EQUIPMENT AND PROTECTIVE SYSTEM INTENDED FOR USE IN IN POTENTIALLY EXPLOSIVE ATMOSPHERES REGULATIONS 2016:1107.														

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

date third authority

date client inspector

INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. E.AZZOLA

date 28/08/24

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INSPECTION CERTIFICATE
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CUSTOMER | CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N. 1165470

YOUR PURCHASE ORDER DATE 23/01/2024

X PARTIAL ORDER
BALANCE ORDER

OUR JOB N. 240470

REMARKS:

X API 598
EN12266-1/2

X EN 10204 3.1

MATERIAL TESTED

TEST — BAR

ITEM CUSTOMER / BFE	QTY	PART N.	DESCRIPTION	HYDROSTATIC SHELL	HYDROSTATIC SEATS & BACK SEAT	PNEUM SEATS	COMPONENT HEAT CODE MATERIAL HEAT NR SUPPLIER	CHEMICAL ANALYSIS %	%	%	%	%	%	%	%	%	%	%
								MECHANICAL PROPERTIES										
								TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	2 JOULE	3 JOULE	TEST TEMP °C	HARDNESS HB	HB	C.E.

BFE DECLARE UNDER OUR SOLE RESPONSIBILITY THAT ABOVE DETAILED PRODUCTS ARE MANUFACTURED AND EVALUATED ACCORDING TO HARMONIZED STANDARD EN ISO 80079-36 & EN ISO 80079-37 IN COMPLIANCE WITH THE DIRECTIVE 2014/34/EU & EPS 2016:1107 GROUP II CATEGORY 2GD.

- REF. TECHNICAL FILE 0004 (NOTIFIED BODY 2460) STORED BY DNV BUSINESS ASSURANCE ITALY S.R.L. VIA ENERGY PARK 14, 20871 VIMERCATE (MB) ITALY;
- REF. TECHNICAL FILE 0004 (APPROVED BODY 8501) STORED BY DNV UK LIMITED, VIVO BUILDING, 30 STAMFORD STREET LONDON, SE1 9LQ.

SIGNED.....

PLACE : ALBANO S.ALESSANDRO (BG) ITALY
PRINT NAME: A. SONZOGNI
TITLE : MANAGING DIRECTOR

****

2.1 DECLARATION OF COMPLIANCE NOTES:

- VISUAL, MARKING & DIMENSIONAL EXAMINATION HAS BEEN CARRIED OUT WITH SATISFACTORY RESULT.

- FUNCTIONAL TEST HAS BEEN CARRIED OUT WITH SATISFACTORY RESULT(EXCEPT FOR STRAINER).

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

date third authority

date client inspector

INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. E.AZZOLA

date 28/08/24

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CUSTOMER | CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N.: 1165470
YOUR PURCHASE ORDER DATE: 23/01/2024
X PARTIAL ORDER / BALANCE ORDER
OUR JOB N.: 240470
REMARKS:
X API 598 / EN12266-1/2
X EN 10204 3.1

MATERIAL TESTED

ITEM CUSTOMER / BFE	QTY	PART N.	DESCRIPTION
			- TRIM MATERIAL (OR INTERNALS), BOLTING, PACKING AND BODY/BONNET GASKET ARE ACCORDING TO THE P.O. AND MATERIAL SPECIFICATIONS. - WE HEREBY CERTIFY THAT ALL DATA DESCRIBED ARE IN COMPLIANCE WITH PURCHASE ORDER AND SPECIFICATION REQUIREMENTS. - MINIMUM FORGING RATIO 4:1. - WE HEREBY CERTIFY THAT PACKING AND PRESERVATION ACTIVITIES ARE IN COMPLIANCE WITH PURCHASE ORDER AND SPECIFICATION REQUIREMENTS. - HYDRAULIC TEST MEDIA: DEMINERALIZED WATER MAX 2PPM + CORROSION INHIBITOR. PH VALUE 6-9. - PNEUMATIC TEST MEDIA (IF APPLICABLE): AIR. - FOR BI-DIRECTIONAL VALVES: SEAT TEST PERFORMED WITH SATISFACTORY RESULT FROM BOTH SIDES. - VALVES HAVE BEEN DRAINED AND THOROUGHLY AIR DRIED. ********** - MANUFACTURER MARK "BONNEY FORGE" ********** FOR NACE ORDERED VALVES:

TEST (BAR)

HYDROSTATIC SHELL	HYDROSTATIC SEATS & BACK SEAT	PNEUM SEATS	COMPONENT HEAT CODE MATERIAL HEAT NR SUPPLIER

CHEMICAL ANALYSIS

%	%	%	%	%	%	%	%	%	%	%

MECHANICAL PROPERTIES

TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	IMPACT TEST 2 JOULE	IMPACT TEST 3 JOULE	TEST TEMP °C	HARDNESS HB	HARDNESS HB	C.E.

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

date third authority | date client inspector | INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. E.AZZOLA | date 28/08/24

B.F.E. S.r.l.
BONNEY FORGE
HEAD OFFICE - SALES OFFICE
FORGED VALVE PLANT
Via Tonale, 70/A - 24061 Albano S. Alessandro (BG) Italy
Phone 0039 035 584.111 - Fax 0039 035 583.022
e-mail: sales@bfe.it - web site: www.bfe.it

INSPECTION CERTIFICATE
& DECLARATION OF CONFORMITY

NUMBER 24/05757 | REVISION | Page 17 of 19

CUSTOMER | CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N.: 1165470

YOUR PURCHASE ORDER DATE: 23/01/2024

X PARTIAL ORDER
BALANCE ORDER

OUR JOB N.: 240470

REMARKS:

X API 598
EN12266-1/2

X EN 10204 3.1

MATERIAL TESTED

TEST: BAR — HYDROSTATIC: SHELL, SEATS & BACK SEAT — PNEUM: SEATS

COMPONENT HEAT CODE MATERIAL HEAT NR SUPPLIER

CHEMICAL ANALYSIS: % % % % % % % % % % %

MECHANICAL PROPERTIES

ITEM CUSTOMER / BFE	QTY	PART N.	DESCRIPTION	TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	IMPACT TEST 2 JOULE	IMPACT TEST 3 JOULE	TEST TEMP °C	HARDNESS HB	HARDNESS HB	C.E.
			- VALVES MATERIALS ACC. TO NACE MR0175:2021/ ISO15156-1-2-3:2020, NACE MR.0103/ISO17495-1 ED. 2016. FOR BALL FLOATING VALVES: - HYDRAULIC AND PNEUMATIC TEST HAS BEEN CARRIED OUT ACCORDING TO API 598 - EN ISO 17292 - EN 12266-1/2 ISO 5201 & CUSTOMER SPECIFICATIONS. - LEAKAGE RATE C FOR METAL SEATED BALL VALVES <= DN50 (2") - LEAKAGE RATE A FOR SOFT SEATED BALL VALVES <= DN50 (2") - VALVES FIRE TESTED ACCORDING TO API607-ISO10497 - BACK SEAT TEST APPLICABLE ONLY ON GATE AND GLOBE VALVE. FOR GATE VALVES: - HYDRAULIC AND PNEUMATIC TEST HAS BEEN CARRIED OUT ACCORDING TO API 598, EN ISO 15761, EN 12266-1/2 ISO 5208 & CUSTOMER SPECIFICATIONS TEST TIME FOR VALVE <= DN50 (2"): SHELL TEST: 15 SEC. BACKSEAT TEST: 15 SEC. SEAT TEST: 15 SEC. - LEAKAGE RATE A FOR GATE VALVES <= DN50 (2") FOR CHECK VALVES: - HYDRAULIC TEST HAS BEEN CARRIED												

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

date third authority

date client inspector

INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. E.AZZOLA

date 28/08/24

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CUSTOMER | CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N.		YOUR PURCHASE ORDER DATE		
1165470		23/01/2024	X	PARTIAL ORDER
				BALANCE ORDER

OUR JOB N.	REMARKS:				
240470		X	API 598	X	EN 10204 3.1
			EN12266-1/2		

MATERIAL TESTED			TEST				CHEMICAL ANALYSIS										
				BAR			%	%	%	%	%	%	%	%	%	%	%
ITEM			HYDROSTATIC		PNEUM		MECHANICAL PROPERTIES										
CUSTOMER	QTY PART N.	DESCRIPTION	SHELL	SEATS & BACK SEAT	SEATS	COMPONENT HEAT CODE MATERIAL HEAT NR SUPPLIER	TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	IMPACT TEST 2 JOULE	IMPACT TEST 3 JOULE	TEST TEMP °C	HARDNESS HB	HARDNESS HB	C.E.
BFE																	
		OUT ACCORDING TO API 598, EN ISO 15761, EN 12266-1/2 ISO 5208 & CUSTOMER SPECIFICATIONS.															
		TEST TIME FOR VALVE <= DN50 (2"):															
		SHELL TEST: 15 SEC.															
		SEAT TEST: 60 SEC.															
		- LEAKAGE RATE G FOR STANDARD METAL SEATED CHECK VALVES <= DN50 (2")															
		- LEAKAGE RATE C FOR FLAT SEATED METAL CHEK VALVES															
		- LEAKAGE RATE A FOR SOFT SEATED CHEK VALVES															
		- BACK SEAT TEST APPLICABLE ONLY ON GATE AND GLOBE VALVE.															
		- SEE ATTACHED P.M.I.TEST CERTIFICATE WHERE APPLICABLE.															
		- SEE ATTACHED NON DESTRUCTIVE TEST CERTIFICATE FOR LIQUID PENETRANT (WHERE APPLICABLE).															
		- F316-L MATERIAL HAS BEEN SOLUTION TREAT AND QUENCH ACCORDING TO ASTM A182: TEMP. 1040°C MIN. COOLING MEDIA WATER HEAT TREATMENT DURATION: 1 HOUR MIN. + 1 HOUR/INCH															
		- ASTM A262 PRACTICE E PASSED WITH SATISFACTORY RESULT.															
		- F22 CLASS 3 MATERIAL HAS BEEN NORMALIZED TO 900°C MIN AND TEMPERED TO 675°C MIN.ACCORDING TO ASTM A182. HEAT TREATMENT DURATION: 1 HOUR MIN. + 1 HOUR/INCH															
		- LF2 MATERIAL HAS BEEN QUENCH IN WATER AT 930°C AND															

	TEST RESULT	date	third	authority	date	client	inspector	INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. E.AZZOLA	date
	hydrostatic and pneumatic test: SATISFACTORY								28/08/24

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INSPECTION CERTIFICATE
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NUMBER 24/05757 | REVISION | Page 19 of 19

CUSTOMER CODE 1098

AIV EUROPE LTD.
UNIT A, BEADLE INDUSTRIAL ESTATE
CB5 8PD CAMBRIDGE
UNITED KINGDOM

YOUR PURCHASE ORDER N. 1165470

YOUR PURCHASE ORDER DATE 23/01/2024

X PARTIAL ORDER
BALANCE ORDER

OUR JOB N. 240470

REMARKS:

X API 598
EN12266-1/2

X EN 10204 3.1

MATERIAL TESTED

TEST: BAR — HYDROSTATIC: SHELL, SEATS & BACK SEAT — PNEUM: SEATS

COMPONENT — HEAT CODE MATERIAL — HEAT NR SUPPLIER

CHEMICAL ANALYSIS: % % % % % % % % % % %

MECHANICAL PROPERTIES

ITEM CUSTOMER BFE	QTY	PART N.	DESCRIPTION	TENSILE N/mm2	YIELD N/mm2	ELONGATION %	RED.OF AREA %	IMPACT TEST 1 JOULE	IMPACT TEST 2 JOULE	IMPACT TEST 3 JOULE	TEST TEMP °C	HARDNESS HB	HARDNESS HB	C.E.
			TEMPERED AT 640-670°C ACCORGING TO ASTM A350. HEAT TREATMENT DURATION: 1 HOUR MIN. + 1 HOUR/INCH - FULLY KILLED MATERIAL - F51 MATERIAL HAS BEEN SOLUBILIZED ACCORDING TO ASTM A182 SPECIFICATIONS: TEMP.1020°C MIN. HEAT TREATMENT DURATION: 1 HOUR MIN. + 1 HOUR/INCH WATER QUENCHING TO ROOM TEMPERATURE. - A105 MATERIAL HAS BEEN NORMALIZED ACCORDING TO ASTM A105 SPECIFICATIONS: 843-927°C AND COOLING IN STILL AIR. HEAT TREATMENT DURATION: 1 HOUR MIN. + 1 HOUR/INCH - FULLY KILLED MATERIAL											

TEST RESULT
hydrostatic and
pneumatic test: SATISFACTORY

date third authority

date client inspector

INSPECTION DEPT. B.F.E. S.r.l. BONNEY FORGE QA/QC DEPT. E.AZZOLA

date 28/08/24

DELIVERY
Goods delivered ex works unless otherwise agreed.
CONSEGNA
La merce è sempre resa Franco Fabbrica, salvo patto contrario.

WARRANTY
All B.F.E. products are warranted to be free from manufacturing defects for a period of one (1) year from date of shipment, and any product found to be defective within this period will be replaced free of charge, provided: (1) that the product was used as recommended and in accordance with approved installation and operating practice, (2) that its failure resulted from a manufacturing defect and not from damage due to corrosion, erosion, abrasion , or other wear normally to be expected in the services involved, (3) that the product was not modified or changed (unless written approval was given by B.F.E.). (4) that written notice of such defect is delivered to B.F.E. during such one (1) year period. No labour cost or other expense or liability will be assumed.
GARANZIA
Tutti i prodotti BFE sono garantiti esenti da difetti di fabbricazione per un periodo di un (1) anno dalla data di spedizione e ogni prodotto risultato essere difettoso durante questo periodo sarà sostituito gratuitamente, a condizione: (1) che il prodotto sia stato utilizzato come raccomandato e in accordo al manuale di uso e manutenzione, (2) che il danno sia il risultato di un difetto di fabbricazione e non da danni dovuti a corrosione, erosione, abrasione o altra usura normalmente presente nei servizi interessati, (3) che il prodotto non sia stato modificato o cambiato (a meno che non vi sia approvazione scritta da parte di BFE), (4) che una comunicazione scritta di tale difetto sia stata sottomessa a BFE durante tale periodo di un (1) anno. Nessun costo del lavoro o di altra spesa o impegno sarà corrisposto.

PARTIAL SHIPMENT AND PAYMENTS
B.F.E. reserves the right to make partial shipment from time to time, and to render invoices therefore which shall be due and payable as provided in said invoices. If the Purchaser becomes overdue in any such partial payment, B.F.E. shall be entitled to suspend work and/or avail itself of other legal remedies.

SPEDIZIONE PARZIALE E PAGAMENTI
BFE si riserva di effettuare spedizioni parziali di volta in volta, ed emettere quindi fatture pagabili come previsto in dette fatture. Se sussiste un ritardo da parte dell'acquirente su tali pagamenti parziali, BFE avrà il diritto di sospendere il lavoro e / o di avvalersi di altri mezzi di ricorso.

DELAYS
BFE will guarantee the maximum commitment for shipments in the promised timescales, while not assuming any responsibility for delays in deliveries which are always indicative and not binding.
RITARDI
BFE garantirà il massimo impegno per spedire nelle tempistiche promesse, pur non assumendosi alcuna responsabilità per ritardi nelle consegne che s'intendono sempre indicative e non vincolanti.

RETURN OF MATERIAL
No product of our manufacture may be returned without written consent. All goods returned are subject to a handling charge plus freight in both directions and charges for any required reconditioning, unless otherwise specified in writing by B.F.E.
RITORNO DI MATERIALE
Nessun prodotto della nostra produzione può essere restituito senza consenso scritto. Tutte le merci reimportate sono soggette ad una tassa di trattamento più trasporto in entrambe le direzioni e spese per qualsiasi ricondizionamento necessario, se non diversamente specificato per iscritto da BFE.

PATENTS
The Purchaser will indemnify and hold harmless B.F.E. against any claims, costs (including attorney fees) and liabilities arising from any suit alleging infringement of any United States patent by any product supplied by B.F.E. under the contract and in accordance with the design and/or specification furnished by the Purchaser to B.F.E.
BREVETTI
L'Acquirente accetta di risarcire e tenere indenne B.F.E. da reclami, costi (compresi quelli legali) e le responsabilità derivanti da qualsiasi pretesa relativa alla violazione di qualsiasi brevetto statunitense da parte di qualsiasi prodotto fornito da B.F.E. in conformità con il contratto e / o le specifiche di progetto fornite dall'Acquirente a B.F.E.

FORCE MAJEURE
Any delays of B.F.E. shall not constitute default or give rise to any claims for damages of and to the extent that such delay or failure is caused by occurrences beyond the control of B.F.E., including, but not limited to: acts of God or the public enemy, expropriation or confiscation of facilities, compliance with any order or request of any governmental authority, acts of war, rebellion or sabotage or damage resulting therefrom: embargoes or other export restrictions, fires, floods, explosions, accidents, breakdowns, riots or strikes or other concerted acts of workmen, whether direct or indirect; or any other causes whether or not of same class or kind as those specifically above named which are not within the control of B.F.E. and which, by the exercise of reasonable diligence, B.F.E. is unable to prevent or provide against.
FORZA MAGGIORE
Eventuali ritardi da parte di BFE non costituiranno inadempienza o motiveranno eventuali richieste di danni laddove tale ritardo o guasto è causato da circostanze fuori del controllo di BFE, compresi, ma non limitati a: atti divini o il nemico pubblico, esproprio o confisca di strutture, il rispetto di qualsiasi ordine o richiesta di qualsiasi autorità governativa, atti di guerra, ribellione o sabotaggio o danni che ne derivano: embarghi o altre restrizioni alle esportazioni, incendi, inondazioni, esplosioni, incidenti, guasti, sommosse o scioperi o altri atti concertati di operai, diretti o indiretti; o qualsiasi altra causa se non della stessa classe o tipo di quelli specificamente summenzionato che non sono sotto il controllo di BFE e che, per l'esercizio della normale diligenza, BFE non è in grado di prevenire o contrastare.

CLAIMS AND ORDER CANCELLATIONS
Claims will be considered only if made in writing 10 days from receipt of goods. Partial or complete cancellations of order can be accepted only upon previous agreement or by written consent and, in no case later than 15 days from order date. Any claims or disputes will be referred to the Court of Bergamo.
RECLAMI E CANCELLAZIONI ORDINE
I reclami saranno presi in considerazione solo se effettuati per iscritto entro 10 giorni dal ricevimento della merce. Cancellazioni parziali o complete di ordine possono essere accettate solo previo accordo precedente o con il consenso scritto e, in ogni caso non oltre 15 giorni dalla data dell'ordine. Per eventuali controversie il tribunale competente è quello di Bergamo.

VALVE DESCRIPTION SAMPLE: 1/2" F316-L/F316-L/F316-L* CL800						
1	2	3	4	5	6	7
½"	F316-L	F316-L	F316-L* (* = stellite)			CL800
Size	**Body/bonnet material**	**Disc material**	**Seat material** Not present if equal to 3	**Stem material** If different than 3-4	**Bellow material** If applicable	**Class**

ABBREVIATIONS/ *ABBREVIAZIONI*	DESCRIPTION	*DESCRIZIONE*
BB	Bolted Bonnet	*Coperchio bullonato*
BBRJ	Bolted Bonnet Ring Joint Type	*Coperchio bullonato tipo Ring Joint*
BEL	Bellows Sealed	*Soffietto di tenuta*
BW	Butt Weld	*Saldatura di testa*
PS	Pressure Seal	*Pressure seal*
CRY	Cryogenic Service	*Servizio Criogenico*
FB	Full Bore	*Passaggio Pieno*
FF	Flat Face Serrated Spiral Finish	Flat Face Serrated Spiral Finish
FLG	Integral Flanged	*Flange Integrali*
FPWB	Welded Bonnet Full Penetration	*Coperchio Saldato Piena Penetrazione*
IS	Inside Screw	*Vite Interna*
L.G.	Large Groove	*Incastro femmina largo*
MF	Male – Extended Body	*Maschio – Extended body*
NEED – INT	Integral Needle	*Spillo Integrale*
NEED – LOO	Loose Needle	*Spillo Snodato*
NPT	Threaded	*Filettato*
OS & Y	Outside Screw & Yoke	*Vite Esterna*
RB	Reduced Bore	*Passaggio Ridotto*
RFS	Raised Face Serrated Spiral Finish	Raised Face Serrated Spiral Finish
RJ	Ring Joint	*Anello di Giunzione*
SE	Side entry	*Ingresso laterale*
SM. GR.	Small Groove	*Incastro femmina stretto*
SW	Socket Weld	*Tasca a Saldare*
SWB	Seal Welded Bonnet	*Coperchio filettato con saldatura di sigillo*
TE	Top Entry	Ingresso dall'alto
WB	Welded Bonnet	*Coperchio Saldato*
WFLG	Welded Flanges	*Flange Saldate*
W	TCC (Tungsten/Wolfram carbide coating)	*TCC (Carburi di Tungsteno/Wolframio)*
C	CCC (Chrome carbide coating)	*CCC (Carburi di Cromo)*
*	Stellited	*Stellitato*
INT	Integral seat	*Seggio Integrale*
- L or - H	Dual certified (E.g.: F316 - L = F316/F316L)	*Doppia certificazione (Esempio: F316 - L = F316/F316L)*
LL	Live Loading	Live Loading

B.F.E. S.r.l.
BONNEY FORGE

BES Group

ESTº 1859

Report No:	PMI-AI6010-10
Purchase Order No:	SAC2678
Date:	19/11/2024
Pages:	1 of 1

POSITIVE MATERIAL IDENTIFICATION REPORT

Client & Address: AC Valves & Controls Limited, Unit 6 Interlink Way South, Bardon Hill, Coalville, Leicestershire, LE67 1PH			Procedure No: TP/PMI/LIBS Issue 2	
			Reference Standard: API RP578	
			Acceptance Standard: Factual	
			Visual Condition: As Seen	
Date Tested: 14/11/2024	Test Location: As Above			
Calibration Test Material: 59X G7075	Cert No: 59X G7075B			
Equipment: Hitachi Vulcan	Type:	Vulcan+	Serial No:	920381

Inspection details

Project: 2" Bonney Forge SS Gate Valve

** All reading is given as a %, this report is for PMI only and is not intended to replace a material certificate **

Serial No:	Item:	Heat No:	Alloy Verified As:	Cr%	Ni%	Mo%
240470-0002 (Valve 1)	Body	RAAZ	SS316	17.49	11.17	2.23
	Bonnet	RAAX	SS316	17.72	11.52	2.51
	Stem	292422	SS316	17.96	10.5	2.06
240470-0002 (Valve 2)	Body	RAAZ	SS316	17.3	11.98	2.36
	Bonnet	RAAX	SS316	17.08	10.21	2.44
	Stem	292422	SS316	17.62	10.08	2.85

BES Group Testing Alliance Ltd Representative:	Client Representative:
Signed: PCN SHAUN MARTIN PCN No: 302525 www.bindt.org/PCN RT - L3, MT, PT, VT - L2	Signed:
Name: Shaun Martin PCN Level 2 - 302525	Name:
Date: 19/11/2024	Date:

F . Allen & Son, **Coating Specialist**

UNIT 13
CHILLINGTON FIELDS
WOLVERHAMPTON
WEST MIDLANDS
WV1 2BY
PHONE : 01902 351190
FAX : 01902 871491
EMAIL : markallen20001@outlook.com

PROCEDURE FOR GRITBLASTING & PAINTING STAINLESS STEEL
CUSTOMER : A . C . VALVES LTD
PURCHASE ORDER No. : SAC0002677 (2 OFF VALVES)
COATING SPECIFICATION : NORSOK SYSTEM 6A

Painting Procedure for Painting System 6A (Piping with Fluids <120°C)

1. SCOPE

The client's specification or purchase order instructions shall rule in any case where there is conflict between it and this procedure.

2. STANDARDS

The following standards include provisions and guidelines which, through reference in this procedure, constitute provisions and guidelines in accordance with SYSTEM 6A

ISO 8501-1: 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.

ISO 8502-6: 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 8502-3: Preparation of steel substrate before application of paint and related products - Tests for the assessment of surface cleanliness - Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method).

ISO 8503-1: Preparation of steel substrate before application of paint and related products - Tests for the assessment of surface cleanliness - Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces.

ISO 19840: Paints and varnishes – Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces.

ISO 4624: Paints and varnishes - Pull-off test for adhesion.
NACE RP0287: Field measurement of surface profile of abrasive blast cleaned steel surfaces using replica tape.

SSPC-SP 1: Solvent Cleaning

ASTM 4285: Standard Test Method for Indicating Oil or Water in Compressed Air.

3. SURFACE PREPARATION

For adhesion testing purposes, one test panel / batch will accompany the part(s) through the below procedure.

NOTE: CUSTOMER SHALL SUPPLY TEST PANEL OF SAME BASE MATERIAL AS COMPONENT BEING PROCESSED FOR THE PURPOSES OF ADHESION TESTING. IF A TEST PANEL IS NOT SUPPLIED BY CUSTOMER, F . Allen & Son WILL UTILIZE THEIR STANDARD IN-HOUSE CARBON STEEL TEST PANEL *(100mm x 100mm x 5mm)*

3.1 Parts shall be visually checked for sharp edges, weld spatter, slivers, rust grade, etc as per ISO 8501-3 Grade 2
Anything which may appear to be unacceptable shall be reported to the Customer.

3.2 If present, heavy deposits of oil, grease, dirt etc shall be removed by solvent cleaning in accordance with SSPC-SP1.

3.3 Surface not to be coated shall be masked with a suitable material prior to abrasive blast cleaning.

3.4 Environmental conditions shall be taken and recorded. Blasting shall only take place if relative humidity is below 85%, steel temperature is more than 3°C above dew point and ambient temperatures above 5°C.

3.5 Compressed air shall be checked for oil, moisture or other contamination using the 'blotter test' as per ASTM D4285. Compressed air shall be dry and clean before processing.

3.6 Parts shall be blast cleaned before coating using aluminium oxide grit. Blast abrasives shall be dry, clean and free from contaminants that would be detrimental to the performance of the system. All coating surfaces of stainless-steel substrates shall be Sweep blasted finish with a roughness of Fine G. This is in accordance with ISO 8503-2.

3.7 Component will be blown clean using clean, dry filtered compressed air, to remove any residual abrasive blast material.

3.8 Surface impurities shall be measured using the Bresle sample method (ISO 8502-6) with the maximum concentration being 20mg/m_2 NaCl (ISO 8502-9).

3.9 The surface profile shall be measured and recorded using Testex Replica tape as per NACE RP0287.

3.10 Transparent adhesion sensitive tape will be used to test the blast cleaned surface for dust prior to paint application. This will be in accordance with ISO 8502-3 and shall not exceed a dust quality and size rating of 2.

3.11 Between the blasting and coating processes, the parts will be protected and not touched with bare hands. Paint shall be applied within 4 hours of blasting. Coating surface which exhibits rust, oxidation, or discolouration shall be re-blasted prior to coating application and retested.

4. APPLICATION PRIMER.

Product: SIGMACOVER 280 (GREENISH/YELLOW)

4.1 Environmental conditions shall be taken and recorded. Painting shall only take place if relative humidity is below 85%, steel temperature is more than 3°C above dew point and substrate temperature is between 5-40°C.

4.2 Stripe coating is permissible in areas that are difficult to reach with a spray gun. Batch number of paint used to be recorded.

4.3 Paint will be spray applied uniformly over areas to be coated using a conventional spray gun. Skips, runs, sags or drips to be eliminated. Wet Film thickness shall be determined and recorded and should be such that a nominal dry film thickness of 50µm is achieved. Batch Numbers of paint used to be recorded.

4.4 The minimum over coating time(s) stated in the manufacturers technical data sheet must be observed prior to proceeding to next coat.

5. APPLICATION MIDCOAT
Product: SIGMACOVER 410 (MIO)

5.1 Previous coating to be inspected to ensure coating is free from surface defects to the application of the subsequent paint system. Surface defects to be repaired and cured as per specification requirements. Dry Film thickness to be determined and recorded to ensure compliance with customer requirements.

5.2 Environmental conditions shall be taken and recorded. Painting shall only take place if relative humidity is below 85%, steel temperature is more than 3°C above dew point and substrate temperature is between 5-40°C.

5.3 Stripe coating is permissible in areas that are difficult to reach with a spray gun. Batch number of paint used to be recorded.

5.4 Paint will be spray applied uniformly over areas to be coated using a conventional spray gun. Skips, runs, sags or drips to be eliminated. Wet Film thickness shall be determined and recorded and should be such that a nominal dry film thickness of 100µm is achieved. Batch Numbers of paint used to be recorded.

5.5 The minimum over coating time(s) stated in the manufacturers technical data sheet must be observed prior to proceeding to next coat.

6. APPLICATION TOPCOAT
Product: SIGMADUR 550 (RAL 9002)

6.1 Previous coating to be inspected to ensure coating is free from surface defects to the application of the subsequent paint system. Surface defects to be repaired and cured as per specification requirements. Dry Film thickness to be determined and recorded to ensure compliance with customer requirements.

6.2 Environmental conditions shall be taken and recorded. Painting shall only take place if relative humidity is below 85%, steel temperature is more than 3°C above dew point and substrate temperature is between 5-40°C.

6.3 Stripe coating is permissible in areas that are difficult to reach with a spray gun. Batch numbers and BS 4800 number of paints used to be recorded.

6.4 Paint will be spray applied uniformly over areas to be coated using a using a conventional spray gun. Skips, runs, sags or drips to be eliminated. Wet Film thickness should be determined and recorded and should be such that a nominal dry film thickness of 75µm is achieved. Batch Numbers of paint used to be recorded.

6.5 The minimum curing time(s) stated in the manufacturer's technical data sheet must be observed and adhered to.

7. FINAL INSPECTION

7.1 Topcoat to be visually inspected to ensure coating is free from runs, sags, inclusions, pinholes, blisters, holidays etc. Surface defects shall be repaired and cured as per manufacturer's recommendations.

7.2 Wet sponge holiday testing (67½V) shall be performed on coated surface area to ensure a "holiday free" coating condition. If a holiday is detected, the non-conforming area will be isolated and locally repaired.

7.3 Paint thickness shall be determined, using the Elcometer 345, and recorded. Thickness measurement will be performed in compliance with ISO 19840 methodology and shall be a nominal of 225µm. The minimum, maximum and average results shall be recorded.

7.4 Unless otherwise requested by the Customer, the adhesion test will be performed on the accompanying test panel using an Elcometer SG 2014 to ISO 4624 procedure. Three dollies shall be attached, all adhesion tests shall meet a minimum value of 5MPa with an average of 7MPa or better. Failure mechanism shall be dolly-glue cohesive failure, cohesive failure within the coating or intercoat failure and not adhesive failure at the substrate.

8. PACKAGING AND CERTIFICATE OF CONFORMITY

8.1 All parts are to be rewrapped or otherwise protected from damage after inspection and before shipping. The minimum packaging requirements shall be as per original customer delivery.

8.2 A certificate of conformity and coating report shall be supplied after completion.

9. HEALTH AND SAFETY

The appropriate PPE shall be supplied by F. ALLEN & SON to the operator(s) performing this procedure, for instance protective clothing, protective shoes, safety glasses and filter mask.

10. REPAIR PROCEDURE

Repairs shall be performed in accordance with Manufacturers specifications

11. QUALIFICATION OF PERSONNEL

Inspection shall be performed by Mark Allen or Mike Norman NACE Level III

Appendix A: Table 1: Inspection and Testing (for reference) **No.**	**Type**	**Method**	**Frequency**	**Acceptance Criteria**	**Consequence**
1.	**Environmental Conditions**	Ambient and steel temperature. RH%, dew point.	Before start of each shift. Minimum twice per shift.	RH% <85%, Temperature >3°C above the dew point.	No blasting or coating.
2.	**Visual Examination**	Visual for sharp edges, weld splatter, slivers, rust grade etc.	100% of all surfaces.	No defects.	Defects to be repaired.
3.	**Cleanliness**	a) ISO 8501-1 b) ISO 8502-3	a) 100% visual of all surfaces. b) Spot checks *See note 1*	a) Sa2½ b) Maximum quantity and size rating 2.	a) Reblast b) Reclean and retesting until acceptable.
4.	**Salt Test**	ISO 8502-6, ISO 8502-9	One component per batch processed	< 20mg/m_2 NaCl.	Reclean and retesting until acceptable.
5.	**Roughness**	Testex Tape (NACE RP0287)	Each component or once per 10m_2	50-75µm	Reblasting
6.	**Visual examination**	Visual examination to determine curing, contamination, solvent retention, pinholes/popping , sagging, surface defects.	100% of each surface after each coat.	No defects.	Repair of defects.
7.	**Thickness**	ISO 19840	Each component	nom. 225µm	Repair, additional coats or recoating as appropriate.
8.	**Adhesion**	ISO 4624 using equipment with a hydraulic pulling force and carried out when system is fully cured.	One test panel per batch.	Min. 5MPa Ave > 7MPa Cohesive failures only.	Recoating.

F . Allen & Son Coating specialist

CERTIFICATE FOR GRITBLASTING & PAINTING STAINLESS STEEL

SHOT BLAST EQUIPMENT :	HODGE CLEMCO (96086A)
ABRASIVE SUPPLIER :	HODGE CLEMCO
ABRASIVE TYPE :	ALUMINIUM OXIDE
STANDARD OF BLASTING :	SA 2.5
SURFACE PROFILE REQUIRED :	50-75 MICRONS
SURFACE PROFILE ACHIEVED :	50 MICRONS

SURFACE COATING DETAILS

METHOD OF APPLICATION :	CONVENTIONAL
PAINT SUPPLIER :	PPG
PRIMER COAT :	SIGMACOVER 280
SEALER COAT :	N/A
INTERMEDIATE COAT :	SIGMACOVER 410
INTERMEDIATE COAT :	N/A
TOP COAT :	SIGMADUR 550
TOTAL MIN D.F.T :	225 MICRONS
FINISH COLOUR :	RAL 9002

DATES & TIMES

	BLAST/PRIME	SEALER	INTERMEDIATE	INTERMEDIATE	TOP COAT
DATE:	18/11/2024	N/A	19/11/2024	N/A	20/11/2024
START TIME:	8.00	N/A	8.00	N/A	8.00
FINISH TIME:	10.45	N/A	9.15	N/A	9.05

ENVIROMENTAL CONDITIONS

AIR TEMP °C DRY BULB	18/18/19/18	18/19/19/18	18/18/19/18	18/19/19/18
AIR TEMP °C WET BULB	17	16	17	16
HUMIDITY %	53	53	53	53
DEW POINT °C	8	9	8	9
STEEL TEMP °C	14	14	14	14
DATE	18/11/2024	19/11/2024	20/11/2024	21/11/2024

PAINT AND BATCH NUMBERS

	PAINT ID	BASE	CATALYST	COLOUR	EXPIRY DATE
PRIMER COAT 1	SIGMACOVER 280	P229378184	2230379002	YELLOW/GREEN	23/08/2025
SEALER COAT 2	N/A	N/A	N/A	N/A	N/A
INTERMEDIATE COAT 3	SIGMACOVER 410	P236398582	2151272740	MIO	21/07/2025
INTERMEDIATE COAT 4	N/A	N/A	N/A	N/A	N/A
TOP COAT COAT 5	SIGMADUR 550	2302451878	P235395230	RAL 9002	06/02/2026

	REQUIRED PAINT D.F.T	RECORDED W.F.T	RECORDED PAINT D.F.T
PRIMER COAT	50 MICRONS	80 MICRONS	70 MICRONS
TIE/SEALER COAT	N/A	N/A	N/A
INTERMEDIATE COAT	100 MICRONS	130 MICRONS	110 MICRONS
INTERMEDIATE COAT	N/A	N/A	N/A
TOP COAT	75 MICRONS	95 MICRONS	80 MICRONS
TOTAL	225 MICRONS	N/A	260 MICRONS

TEST RESULTS

BLOTTER TEST	NO STAINS
SOLVENT CLEANING	NO GREASE OR OIL
SALT TEST (MAX 20mg/m2 NaCl)	7mg/m2 NaCl
DUST TEST (MAX GRADE 2)	GRADE 1
HOLIDAY TEST	NO HOLIDAYS DETECTED
PULL TEST	10MPa / 9MPa / 9MPa

INSPECTOR COMMENTS: PASS

DATE : 26/11/2024

SIGNED : *M. Allen* (M . Allen)

MATERIAL CERTIFICATION

Material	**Heat No.**
Nozzle	N/A

(D. Furneaux)
FTR obo CROSSWIND
~~Witness~~ X Review
12th Feb. 2025

Baker Hughes Confidential

MATERIAL CERTIFICATION - SPARES
Start-up and commissioning - LINE 1100

Material	**Heat No.**
Top Compression fitting	9ET / 9CW

Baker Hughes Confidential

Swagelok Company
29500 Solon Rd
Solon, OH 44139 U.S.A.

440.349.5600

Inspection Certificate EN 10204-3.1

Distributor	Customer	Customer PO#
FST (Scotland) Ltd Silvertrees Drive Silvertrees Business Park Westhill Aberdeen Aberdeenshire, Scotland AB32 6BH	Baker Hughes EMEA Unlimited Company Baker Hughes EMEA Unlimited Company Sensing House Shannon Free Zone East Sh	5052344039

No.	Part Number	Qty	Prod ID/Batch Num	Mfg Order #	Reference #	Component	Heat Code
1	SS-810-1-0125	100	0005075097	111480	SS-810-1-0125-TF	Body	9ET
					(5201)	Nut	9CW

Swagelok products referenced above are manufactured from material purchased and certified as being in accordance with the specification(s) listed below.

Information contained in the above customer address column (marked as "Customer") and area marked "Reference" (when applicable) of this certification are for reference purposes only. Swagelok Company makes no stipulations, nor takes responsibility, for the accuracy or reliability of such information.

Swagelok products are manufactured under conditions which are free from mercury. No mercury bearing components have been used in the products of your order and no mercury bearing instruments or other equipment have been used in their manufacture, assembly, or testing in such a manner as might cause contamination.

No asbestos or asbestos-containing components are used in Swagelok brand products.

MATERIAL STANDARDS

Components	Material	Standards
Shaped Fittings	F316/F316L Stainless Steel Forgings	ASTM A182, ASME SA182
Straight Fittings	316/316L Stainless Steel Bar	ASTM A479, ASME SA479, ASTM A276 (exception of square and rectangular bar)

Type 316 Stainless Steel Bar material is in the Strain-Hardened Level 2 condition.

Specific chemistry obtained from analysis of product made from this material may vary from the batch values as provided with this certification.

Stainless steel material has passed the Intergranular Corrosion Test requirements of EN ISO 3651-2, Method A, and ASTM A-262 Practice E.

All parts were cleaned and packaged in accordance with Swagelok Specifications.

The Swagelok® products specified above were manufactured in accordance with Swagelok Company's Quality Manual (SQS-F latest revision, Revision O, dated February 7, 2024).

Swagelok Company's Quality System is approved to ISO:9001 (BSI Certificate # FM01729).

Annexes: Material Certificates

REVIEWED
By Martin McMahon at 10:31 am, Jan 11, 2025

Certifications Supervisor
Michael J. Zickes

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231406
Trace ID/Heat Code: 9ET

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104341024	SSD-HB-106250	1-1/16" HEX BAR	34,458

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), revision N, dated February 7, 2024, which satisfies the applicable requirements of NCA-3300 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and ASME NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and the 2015, 2017, 2019 and 2022 Editions. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), revision O, dated February 7, 2024 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 9 May 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 5/8/2024
P.O. No.: 4506182330
W/O No.: CRA002-24-05-00807-1
Date Received: 5/2/2024

MO:	000104341024 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ET
P/N:	SSD-HB-106250
Two (2) 1-1/16" HEX SS 316 Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	
1	9.98	94.6	652	99.9	689	104.6		721		33.5	27.5	73	Mid 50%
2	9.98	94.9	654	100.5	693	105.2		725		34.0	28.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	23	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#** 24E-088
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	

	Average Grain Size
Specimen 1	ASTM #3.0 – 4.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	5/8/2024
P.O. No.:	4506182330
W/O No.:	CRA002-24-05-00807-1
Date Received:	5/2/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/27/2024 9ET

HEAT E231406 ORDER 705322/ 01 BOL 0262433 * CERTIFICATION * 03/25/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259478 10/13/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 22 Total Weight 35064 Approx. Hot Red. Ratio 138:1

WO 2128961 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U, 1V SON= 355067

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891 Customer Order No 9973229 SMACC Order No 283517/1	Code 231011 Campaign 38282 Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Melt Date: 11 August 2023 Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.

Free from contamination by mercury or mercury compounds when despatched from SMACC.

No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2470-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit Stainless steel, hot rolled billets. Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling. Intended for further hot working and heat treatment. No mechanical tests performed. Not solution annealed.	Our order Unsere Auftrag Notre commande 83104	Advice of delivery Lieferschein Avie d'expedition 273457
Requirements-Prüfgrundlagen-Exigences OSB MS-1014 Rev.3 OSB Grade Codes for Material Procurement. ASTM A276, A479 ASME SA479 AD 2000-Merkblatt W2, W10 EN 10272 SWAGELOK SMS-10001 SWAGELOK SMS-10002 SWAGELOK SQS-00021	Purchaser-Besteller-Acheteur MARCEGAGLIA STAINLESS RICHBURG LLC (AVESB) 3043 CRENSHAW PARKWAY SC 29729 RICHBURG U.S.A	

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance 316LCM Rev.0 Type 316, 316L, UNS S31600, S31603. EN 1.4401, 1.4404 17-10-2L	Brand mark Herstellerzeichen Signe du producteur W	Inspectors stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion EAF AOD-Converter refining CC to bloom size (mm): 462x262

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-01	1	150x150	E231406	145080			1 634	915-2
01-02	1	150x150	E231406	145985			1 652	815-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais The requirements according to AMS-QQ-S-763D are fulfilled. The order requirements stipulated are satisfied. US-tested according to DLP OFP-222. Approved.	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel No remarks-Ohne Beanstandung-Pas de remarque PMI-test has been performed on every bar/billet with X-ray spectro, without remarks. No weld repair has been performed on the material. Free of known Mercury contamination at time of shipment.
EN ISO 9001:2015 and EN ISO 14001:2015. Certificate no. 5749-3027684-0102. Approved by TÜV NORD Scandinavia AB.	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. Certificate no. 07/203/9140/WP/0689/18 PED 2014/68/EU, approved by TÜV Nord Systems. Certificate no. 07/202/9140/WZ/0689/18	Degerfors Long Products AB Digitally signed by: Jörgen Johansson QA Head
Reg.No.:559332-4907 V.A.T.No.:SE559332490701 Registered office: Degerfors, Sweden	

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/13/2024 9ET

HEAT E231406 ORDER 711288/ 01 BOL 0262339 * CERTIFICATION * 03/13/24

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259477 3/13/24 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 21 Total Weight 34458 Approx. Hot Red. Ratio 138:1

WO 2128960 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U SON= 355066

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

APPROVED BY SARA MALIK 3/13/2024 9ET

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38262	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

.

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL.+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2471-23

DEGERFORS LONG PRODUCTS AB
S-693 81 DEGERFORS, SWEDEN
Ref.QA-Dept. Jörgen Johansson

Date-Datum-Date: 2023-11-21
Your order-Ihre Bestellung-Votre commande: 9320286

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d'expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**83104**	**273457**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel	Brand mark	Inspectors stamp	Melting process
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item	Quantity	Dimensions, mm	Cast No.	Lot No.	Test No	Heat treatm.Lot No	Weight Kg	Bloom No
01-03	1	150x150	E231406	145986	145986-1,2		1 608	815-1
01-04	1	150x150	E231406	145987	145987-1,2		1 616	915-1
01-05	1	150x150	E231406	145988	145988-1,2		1 782	803-1
01-06	1	150x150	E231406	145989	145989-1,2		1 820	905-1
01-07	1	150x150	E231406	145990	145990-1,2		1 816	914-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11
Ladle analysis attached

% Ferrite measured with ferritscope on samples from both billet ends. 8 points measured from half radius, in one line, cross the centre area to half radius on the other side of the centre.

	Billet end 1			Billet end 2			
Test No	min	max	average	min	max	average	Pit furnace no.
145986-1,2	0.0	0.13	0.02	0.0	0.26	0.10	2
145987-1,2	0.0	0.23	0.04	0.0	0.32	0.04	2
145988-1,2	0.0	0.20	0.06	0.0	0.10	0.01	2
145989-1,2	0.0	0.10	0.01	0.0	0.12	0.03	2
145990-1,2	0.0	0.11	0.01	0.0	0.10	0.02	2

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
The requirements according to AMS-QQ-S-763D are fulfilled. **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	**No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TÜV NORD Scandinavia AB.**	**No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Degerfors Long Products AB** Jörgen Johansson
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office: Degerfors, Sweden**	**Digitally signed by: Jörgen Johansson** **QA Head**

APPROVED BY SARA MALIK 05/22/2024 9ET

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231406
Trace ID/Heat Code: 9ET

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104340933	SSD-HB-106250	1-1/16" HEX BAR	35,064

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), revision N, dated February 7, 2024, which satisfies the applicable requirements of NCA-3300 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and ASME NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and the 2015, 2017, 2019 and 2022 Editions. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), revision O, dated February 7, 2024 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 9 May 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 5/21/2024
P.O. No.: 4506197413
W/O No.: CRA002-24-05-01484-1
Date Received: 5/14/2024

MO:	000104340933 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ET
P/N:	SSD-HB-106250
Two (2) 1-1/16" Hex SS 316 Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	-
1	9.98	95.5	658	101.0	696	105.7		729		33.5	28.0	73	Mid 50%
2	9.98	95.5	659	100.8	695	105.5		727		32.0	26.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	26	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#**
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	24E-271

	Average Grain Size
Specimen 1	ASTM #5.0 – 6.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	5/21/2024
P.O. No.:	4506197413
W/O No.:	CRA002-24-05-01484-1
Date Received:	5/14/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/27/2024 9ET

HEAT E231406 ORDER 705322/ 01 BOL 0262433 * CERTIFICATION * 03/25/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259478 10/13/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 22 Total Weight 35064 Approx. Hot Red. Ratio 138:1

WO 2128961 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U, 1V SON= 355067

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.

Free from contamination by mercury or mercury compounds when despatched from SMACC.

No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2470-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit Stainless steel, hot rolled billets. Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling. Intended for further hot working and heat treatment. No mechanical tests performed. Not solution annealed.	Our order Unsere Auftrag Notre commande 83104	Advice of delivery Lieferschein Avie d'expedition 273457
Requirements-Prüfgrundlagen-Exigences OSB MS-1014 Rev.3 OSB Grade Codes for Material Procurement. ASTM A276, A479 ASME SA479 AD 2000-Merkblatt W2, W10 EN 10272 SWAGELOK SMS-10001 SWAGELOK SMS-10002 SWAGELOK SQS-00021	Purchaser-Besteller-Acheteur MARCEGAGLIA STAINLESS RICHBURG LLC (AVESB) 3043 CRENSHAW PARKWAY SC 29729 RICHBURG U.S.A	

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance 316LCM Rev.0 Type 316, 316L, UNS S31600, S31603. EN 1.4401, 1.4404 17-10-2L	Brand mark Herstellerzeichen Signe du producteur W	Inspectors' stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion EAF AOD-Converter refining CC to bloom size (mm): 462x262

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-01	1	150x150	E231406	145080			1 634	915-2
01-02	1	150x150	E231406	145985			1 652	815-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais The requirements according to AMS-QQ-S-763D are fulfilled. The order requirements stipulated are satisfied. US-tested according to DLP OFP-222. Approved.	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel No remarks-Ohne Beanstandung-Pas de remarque PMI-test has been performed on every bar/billet with X-ray spectro, without remarks. No weld repair has been performed on the material. Free of known Mercury contamination at time of shipment.
EN ISO 9001:2015 and EN ISO 14001:2015. Certificate no. 5749-3027684-0102. Approved by TÜV NORD Scandinavia AB.	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. Certificate no. 07/203/9140/WP/0689/18 PED 2014/68/EU, approved by TÜV Nord Systems. Certificate no. 07/202/9140/WZ/0689/18	Degerfors Long Products AB Digitally signed by: Jörgen Johansson QA Head
Reg.No.:559332-4907 V.A.T.No.:SE559332490701 Registered office: Degerfors, Sweden	

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/13/2024 9ET

HEAT E231406 ORDER 711288/ 01 BOL 0262339 * CERTIFICATION * 03/13/24

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259477 3/13/24 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 21 Total Weight 34458 Approx. Hot Red. Ratio 138:1

WO 2128960 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U SON= 355066

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
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2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

APPROVED BY SARA MALIK 3/13/2024 9ET

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38262	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

.

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
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Europa Link
Sheffield
S9 1TZ

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MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL.+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2471-23

DEGERFORS LONG PRODUCTS AB
S-693 81 DEGERFORS, SWEDEN
Ref.QA-Dept. Jörgen Johansson

Date-Datum-Date: 2023-11-21
Your order-Ihre Bestellung-Votre commande: 9320286

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d'expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**83104**	**273457**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel	Brand mark	Inspectors stamp	Melting process
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item	Quantity	Dimensions, mm	Cast No.	Lot No.	Test No	Heat treatm.Lot No	Weight Kg	Bloom No
01-03	1	150x150	E231406	145986	145986-1,2		1 608	815-1
01-04	1	150x150	E231406	145987	145987-1,2		1 616	915-1
01-05	1	150x150	E231406	145988	145988-1,2		1 782	803-1
01-06	1	150x150	E231406	145989	145989-1,2		1 820	905-1
01-07	1	150x150	E231406	145990	145990-1,2		1 816	914-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11
Ladle analysis attached

% Ferrite measured with ferritscope on samples from both billet ends. 8 points measured from half radius, in one line, cross the centre area to half radius on the other side of the centre.

	Billet end 1			Billet end 2			
Test No	min	max	average	min	max	average	Pit furnace no.
145986-1,2	0.0	0.13	0.02	0.0	0.26	0.10	2
145987-1,2	0.0	0.23	0.04	0.0	0.32	0.04	2
145988-1,2	0.0	0.20	0.06	0.0	0.10	0.01	2
145989-1,2	0.0	0.10	0.01	0.0	0.12	0.03	2
145990-1,2	0.0	0.11	0.01	0.0	0.10	0.02	2

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
The requirements according to AMS-QQ-S-763D are fulfilled. **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	**No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TÜV NORD Scandinavia AB.**	**No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Degerfors Long Products AB**
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office: Degerfors, Sweden**	**Digitally signed by: Jörgen Johansson** **QA Head**

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001311935

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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22 SEP 23

CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 1 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED COLD
---------- DRAWN
PART NUMBER: SSD-HB-087500

SPECIFICATION: SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
---------- SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQC-03998 REV A (01/26/18)
SWAGELOK COMPANY SQS-00226 REV (08/23/17)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)
SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. I (07/28/22)
ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-22 (09/01/22)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 8 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
SWAGELOK COMPANY SVS-00012 (02/23/01)
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)

SIZE 0.875000 IN.(22.23 MM) HEX BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.021	1.14	0.50	0.034	0.026	17.60

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.12	2.04	0.37	0.45	0.02

MELT DATE: 07/18/23

CONTINUED ON NEXT PAGE

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FORM E2-366

REVIEWED
By Martin McMahon at 10:32 am, Jan 11, 2025

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001311935

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 2 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND INDUSTRIE SERVICE GMBH, NO. 01 202 USA/Q-03 8928, IN ACCORDANCE WITH PED 2014/68/EU ANNEX I PARA. 4.3 + AD 2000 W0
MATERIAL VISUAL AND DIMENSIONAL INSPECTED - ACCEPTABLE.
THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL REVISION 38, DATED 08/21/2022 "AS ACCEPTED BY SWAGELOK COMPANY" IN COMPLIANCE WITH ASME B & P V CODE SECTION III, DIVISION 1 SUBSECTION NCA 3800 2017 EDITION.
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
100% COMPARATOR TESTED TO DETECT/SORTOUT HIGH IRON/LOW ALLOY INCLUSIONS.
ULTRASONIC INSPECTED (IMMERSION) PER CTC PROCEDURE - ACCEPTABLE.
CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
EDDY CURRENT TESTED AND APPROVED AT FINISH
IT IS HEREBY CERTIFIED THAT THE SPECIALTY METALS SUPPLIED HEREUNDER HAVE BEEN PRODUCED IN THE UNITED STATES.
NO WELD REPAIR.
THIS MATERIAL HAS BEEN SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND MEETS ALL SPECIFICATION REQUIREMENTS.
INSPECTION CERTIFICATE 3.1 IN ACCORDANCE WITH EN 10204 AND DIN 50049
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
PROVISIONS OF 10 CFR PART 21 & 10 CFR PART 50 - APPENDIX B APPLY.
IN PRODUCTION OR TESTING OF MATERIAL SHIPPED AGAINST THIS ORDER, NO DIRECT CONNECTED MERCURY MANOMETER, MERCURY PUMPS, MERCURY SEALS, OR MERCURY IN GLASS THERMOMETERS HAVE BEEN USED. NOR IN SUCH PRODUCTION OR TESTING HAS MERCURY BEEN HANDLED IN THE IMMEDIATE VICINITY OF SUCH MATERIAL.
THIS CERTIFICATE AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY US, OR OUR SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE ORDER REQUIREMENTS AS MAY HAVE BEEN MODIFIED BY PRIOR CORRESPONDENCE BETWEEN THE PARTIES.
THIS MATERIAL WAS MANUFACTURED FREE FROM MERCURY, RADIUM AND ALPHA SOURCE CONTAMINATION.
ALL TESTS AND INSPECTIONS PERFORMED VERIFY CONFORMANCE TO SPECIFICATION REQUIREMENTS AND THE MATERIAL COMPLIES WITH ALL REQUIREMENTS OF THE PURCHASE ORDER.
INTERGRANULAR CORROSION TESTED PER ISO 3651
MATERIAL IS COMPLIANT TO REACH; THE E.U.'S REGISTRATION, EVALUATION, AUTHORIZATION, AND REGISTRATION OF CHEMICALS LEGISLATION.
MATERIAL IS COMPLIANT TO 2015/863/EU (ROHS3) DIRECTIVE.
THIS HEAT MELTED BY THE ELECTRIC ARC/AOD PROCESSES
MELT DATE OF HEAT: 07/18/23
MILL HEAT TREATMENT:
TYPE SOLUTION ANNEAL
TEMP 1951F (1066C)
TIME AT TEMP CONTINUOUS FURNACE
QUENCH WATER

CONTINUED ON NEXT PAGE

FORM E2-366

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Certification ID:001311935

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SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

HARDNESS AS SHIPPED, HRC - 20

***-->TESTED AT READING**

(T)RANSVERSE (L)ONGITUDINAL	L	L
YIELD STRENGTH, (0.20 %) KSI(MPA)	85.5(590)	86.5(596)
YIELD STRENGTH, (1.00 %) KSI(MPA)	96.5(665)	97.0(669)
TENSILE STRENGTH, KSI(MPA)	102.0(703)	102.0(703)
ELONGATION IN 2.00", %	37.0	37.0
ELONGATION IN 2.50", %	32.0	32.0
REDUCTION OF AREA, %	74.0	75.0

***-->TESTED AT READING**

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
***-->TESTED AT READING**

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (2H).

ORDER LENGTH REQUIREMENT: 144"

INTERGRANULAR CORROSION TEMP (F): 1292 HR: 0 MN: 30 QUENCH: WATER
***-->TESTED AT READING**

FORM E2-366

CONTINUED ON NEXT PAGE

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Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 4 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

ADDRESS OF TESTING LOCATIONS:
READING - 101 WEST BERN ST, READING, PA 19601

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FORM E2-366

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CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001311935

CARPENTER
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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 5 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

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CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	**W51462**		**29165**

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

DECISION RULE: UNLESS OTHERWISE SPECIFIED IN A CUSTOMER/INDUSTRY SPECIFICATION, CARPENTER TECHNOLOGY CORPORATION WILL DETERMINE ACCEPTABILITY OF ANY TEST RESULT BY COMPARISON OF THE RESULT WITH THE SPECIFICATION LIMITS, WITHOUT ANY ADDITIONAL CONSIDERATION OF THE MEASUREMENT UNCERTAINTY. WHEN REQUESTED, CARPENTER TECHNOLOGY CORPORATION WILL PROVIDE UNCERTAINTY BUDGETS FOR ANY TEST RESULT THAT IS NOT ADDRESSED BY THE INDUSTRY STANDARD.

AMANDA EVANS /WI 27993 DIGITALLY SIGNED BY JASON M RAYMOND
ADMINISTRATOR - QUALITY
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W51462/HEAT 760675/LOT 01



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MATERIAL CERTIFICATION - SPARES
LINE 1100

Material	**Heat No.**
Bottom Compression fitting	9BA / 9ET

(D. Furneaux)
FTR 060 CROSSWIND
~~Witness~~ X Review
12th Feb. 2025

Baker Hughes Confidential

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

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SELLER / VERKÄUFER / VENDEUR **PAGE 1 OF 5**

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4505211171	W51490		13504

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED COLD DRAWN
PART NUMBER: SSD-HB-087500

SPECIFICATION: SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQC-03998 REV A (01/26/18)
SWAGELOK COMPANY SQS-00226 REV (08/23/17)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)
SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. I (07/28/22)
ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-22 (09/01/22)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 8 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
SWAGELOK COMPANY SVS-00012 (02/23/01)
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)

SIZE 0.875000 IN.(22.23 MM) HEX BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.020	1.19	0.58	0.019	0.026	17.53

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.15	2.09	0.17	0.16	0.03

MELT DATE: 07/20/23

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Certification ID:001313511

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CUSTOMER / BESTELLER / CLIENT

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SELLER / VERKÄUFER / VENDEUR **PAGE 2 OF 5**

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4505211171	W51490		13504

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND INDUSTRIE SERVICE GMBH, NO. 01 202 USA/Q-03 8928, IN ACCORDANCE WITH PED 2014/68/EU ANNEX I PARA. 4.3 + AD 2000 W0
MATERIAL VISUAL AND DIMENSIONAL INSPECTED - ACCEPTABLE.
THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL REVISION 38, DATED 08/21/2022 "AS ACCEPTED BY SWAGELOK COMPANY" IN COMPLIANCE WITH ASME B & P V CODE SECTION III, DIVISION 1 SUBSECTION NCA 3800 2017 EDITION.
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
100% COMPARATOR TESTED TO DETECT/SORTOUT HIGH IRON/LOW ALLOY INCLUSIONS.
ULTRASONIC INSPECTED (IMMERSION) PER CTC PROCEDURE - ACCEPTABLE.
CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
EDDY CURRENT TESTED AND APPROVED AT FINISH
IT IS HEREBY CERTIFIED THAT THE SPECIALTY METALS SUPPLIED HEREUNDER HAVE BEEN PRODUCED IN THE UNITED STATES.
NO WELD REPAIR.
THIS MATERIAL HAS BEEN SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND MEETS ALL SPECIFICATION REQUIREMENTS.
INSPECTION CERTIFICATE 3.1 IN ACCORDANCE WITH EN 10204 AND DIN 50049
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
PROVISIONS OF 10 CFR PART 21 & 10 CFR PART 50 - APPENDIX B APPLY.
IN PRODUCTION OR TESTING OF MATERIAL SHIPPED AGAINST THIS ORDER, NO DIRECT CONNECTED MERCURY MANOMETER, MERCURY PUMPS, MERCURY SEALS, OR MERCURY IN GLASS THERMOMETERS HAVE BEEN USED. NOR IN SUCH PRODUCTION OR TESTING HAS MERCURY BEEN HANDLED IN THE IMMEDIATE VICINITY OF SUCH MATERIAL.
THIS CERTIFICATE AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY US, OR OUR SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE ORDER REQUIREMENTS AS MAY HAVE BEEN MODIFIED BY PRIOR CORRESPONDENCE BETWEEN THE PARTIES.
THIS MATERIAL WAS MANUFACTURED FREE FROM MERCURY, RADIUM AND ALPHA SOURCE CONTAMINATION.
ALL TESTS AND INSPECTIONS PERFORMED VERIFY CONFORMANCE TO SPECIFICATION REQUIREMENTS AND THE MATERIAL COMPLIES WITH ALL REQUIREMENTS OF THE PURCHASE ORDER.
INTERGRANULAR CORROSION TESTED PER ISO 3651
MATERIAL IS COMPLIANT TO REACH; THE E.U.'S REGISTRATION, EVALUATION, AUTHORIZATION, AND REGISTRATION OF CHEMICALS LEGISLATION.
MATERIAL IS COMPLIANT TO 2015/863/EU (ROHS3) DIRECTIVE.
THIS HEAT MELTED BY THE ELECTRIC ARC/AOD PROCESSES
MELT DATE OF HEAT: 07/20/2023

FORM E2-366

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SELLER / VERKÄUFER / VENDEUR **PAGE 3 OF 5**

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4505211171	W51490		13504

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (2H).

ORDER LENGTH REQUIREMENT: 144"

MILL HEAT TREATMENT:
TYPE SOLUTION ANNEAL
TEMP 1951F (1066C)
TIME AT TEMP CONTINUOUS FURNACE
QUENCH WATER

HARDNESS AS SHIPPED, HRC - 26

***-->TESTED AT READING**

(T)RANSVERSE (L)ONGITUDINAL	L	L
YIELD STRENGTH, (0.20 %) KSI(MPA)	85.5(590)	86.0(593)
YIELD STRENGTH, (1.00 %) KSI(MPA)	96.0(662)	97.5(672)
TENSILE STRENGTH, KSI(MPA)	101.0(696)	102.0(703)
ELONGATION IN 2.00", %	37.0	38.0
ELONGATION IN 2.50", %	32.0	32.0
REDUCTION OF AREA, %	74.0	73.0

***-->TESTED AT READING**

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
***-->TESTED AT READING**

INTERGRANULAR CORROSION TEMP(F)1292 HR:0 MN:30 QUENCH:WATER
SPECIMEN SENSITIZATION *-->TESTED AT READING

INSPECTION: ACCEPTABLE

ALLOY ID: ACCEPTABLE

FORM E2-366

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 5 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505211171	**W51490**		**13504**

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

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KIM MILLER /WI 40577 DIGITALLY SIGNED BY GARY BROWN
MANAGER - SPECIFICATIONS/CERTIFICATIONS
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W51490/HEAT 760684/LOT 01

Gary Brown

FORM E2-366

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Certification ID:001313511

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Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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4505211171	W51490		15233

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED COLD DRAWN
PART NUMBER: SSD-HB-087500

SPECIFICATION: SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQC-03998 REV A (01/26/18)
SWAGELOK COMPANY SQS-00226 REV (08/23/17)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)
SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. I (07/28/22)
ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-22 (09/01/22)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 8 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
SWAGELOK COMPANY SVS-00012 (02/23/01)
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)

SIZE 0.875000 IN.(22.23 MM) HEX BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.020	1.19	0.58	0.019	0.026	17.53

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.15	2.09	0.17	0.16	0.03

MELT DATE: 07/20/23

CONTINUED ON NEXT PAGE

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Certification ID:001313511

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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26 SEP 23

CUSTOMER / BESTELLER / CLIENT

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

SELLER / VERKÄUFER / VENDEUR **PAGE 2 OF 5**

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505211171	W51490		15233

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND INDUSTRIE SERVICE GMBH, NO. 01 202 USA/Q-03 8928, IN ACCORDANCE WITH PED 2014/68/EU ANNEX I PARA. 4.3 + AD 2000 W0
MATERIAL VISUAL AND DIMENSIONAL INSPECTED - ACCEPTABLE.
THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL REVISION 38, DATED 08/21/2022 "AS ACCEPTED BY SWAGELOK COMPANY" IN COMPLIANCE WITH ASME B & P V CODE SECTION III, DIVISION 1 SUBSECTION NCA 3800 2017 EDITION.
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
100% COMPARATOR TESTED TO DETECT/SORTOUT HIGH IRON/LOW ALLOY INCLUSIONS.
ULTRASONIC INSPECTED (IMMERSION) PER CTC PROCEDURE - ACCEPTABLE.
CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
EDDY CURRENT TESTED AND APPROVED AT FINISH
IT IS HEREBY CERTIFIED THAT THE SPECIALTY METALS SUPPLIED HEREUNDER HAVE BEEN PRODUCED IN THE UNITED STATES.
NO WELD REPAIR.
THIS MATERIAL HAS BEEN SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND MEETS ALL SPECIFICATION REQUIREMENTS.
INSPECTION CERTIFICATE 3.1 IN ACCORDANCE WITH EN 10204 AND DIN 50049
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
PROVISIONS OF 10 CFR PART 21 & 10 CFR PART 50 - APPENDIX B APPLY.
IN PRODUCTION OR TESTING OF MATERIAL SHIPPED AGAINST THIS ORDER, NO DIRECT CONNECTED MERCURY MANOMETER, MERCURY PUMPS, MERCURY SEALS, OR MERCURY IN GLASS THERMOMETERS HAVE BEEN USED. NOR IN SUCH PRODUCTION OR TESTING HAS MERCURY BEEN HANDLED IN THE IMMEDIATE VICINITY OF SUCH MATERIAL.
THIS CERTIFICATE AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY US, OR OUR SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE ORDER REQUIREMENTS AS MAY HAVE BEEN MODIFIED BY PRIOR CORRESPONDENCE BETWEEN THE PARTIES.
THIS MATERIAL WAS MANUFACTURED FREE FROM MERCURY, RADIUM AND ALPHA SOURCE CONTAMINATION.
ALL TESTS AND INSPECTIONS PERFORMED VERIFY CONFORMANCE TO SPECIFICATION REQUIREMENTS AND THE MATERIAL COMPLIES WITH ALL REQUIREMENTS OF THE PURCHASE ORDER.
INTERGRANULAR CORROSION TESTED PER ISO 3651
MATERIAL IS COMPLIANT TO REACH; THE E.U.'S REGISTRATION, EVALUATION, AUTHORIZATION, AND REGISTRATION OF CHEMICALS LEGISLATION.
MATERIAL IS COMPLIANT TO 2015/863/EU (ROHS3) DIRECTIVE.
THIS HEAT MELTED BY THE ELECTRIC ARC/AOD PROCESSES
MELT DATE OF HEAT: 07/20/2023

FORM E2-366

CONTINUED ON NEXT PAGE

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 3 OF 5**

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4505211171	W51490		15233

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (2H).

ORDER LENGTH REQUIREMENT: 144"

MILL HEAT TREATMENT:
TYPE SOLUTION ANNEAL
TEMP 1951F (1066C)
TIME AT TEMP CONTINUOUS FURNACE
QUENCH WATER

HARDNESS AS SHIPPED, HRC - 26

***-->TESTED AT READING**

(T)RANSVERSE (L)ONGITUDINAL	L	L
YIELD STRENGTH, (0.20 %) KSI(MPA)	85.5(590)	86.0(593)
YIELD STRENGTH, (1.00 %) KSI(MPA)	96.0(662)	97.5(672)
TENSILE STRENGTH, KSI(MPA)	101.0(696)	102.0(703)
ELONGATION IN 2.00", %	37.0	38.0
ELONGATION IN 2.50", %	32.0	32.0
REDUCTION OF AREA, %	74.0	73.0

***-->TESTED AT READING**

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
***-->TESTED AT READING**

INTERGRANULAR CORROSION TEMP(F)1292 HR:0 MN:30 QUENCH:WATER
SPECIMEN SENSITIZATION *-->TESTED AT READING

INSPECTION: ACCEPTABLE

ALLOY ID: ACCEPTABLE

FORM E2-366

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 4 OF 5**

SWAGELOK COMPANY
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4505211171	W51490		15233

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

ADDRESS OF TESTING LOCATIONS:
READING - 101 WEST BERN ST, READING, PA 19601

MATERIAL HAS BEEN MELTED AND MANUFACTURED IN THE USA WHICH IS A QUALIFYING COUNTRY TO DFARS REQUIREMENTS 252.225-7014 WITH ALTERNATE 1 FOR QUALIFYING COUNTRY 225.872.1, SUPERSEDED BY DFARS REQUIREMENTS DFARS 252.225-7008 AND 252.225-7009.

UNLESS OTHERWISE STATED, THE TEST WERE PERFORMED TO THE LATEST REVISION OF THE STANDARDS LISTED BELOW: 1) BEND TEST - ASTM E290, 2) CHARPY IMPACT - ASTM E23, 3)COEFFICIENT OF LINEAR THERMAL EXPANSION - ASTM E228, 4)FRACTURE TOUGHNESS - ASTM E399, 5) BRINELL HARDNESS - ASTM E10, 6)ROCKWELL HARDNESS-ASTM E18, 7)MICRO VICKERS HARDNESS-ASTM E92, 8)KNOOP HARDNESS-ASTM E92, 9)MACRO VICKERS HARDNESS-ASTM E92, 10)STRESS RUPTURE/CREEP RUPTURE-ASTM E139, 11)STRESS RUPTURE(COMBINATION)-ASTM E292, 12)ROOM TEMPERATURE TENSILE-ASTM E8, 13)ELEVATED ROOM TEMPERATURE TENSILE-ASTM E21, 14)DECARBURIZATION-ASTM E1077 15)DELTA FERRITE AMS 2315, 16)GRAIN SIZE-ASTM E112, 17)INCLUSION CONTENT/MICROCLEANLINESS-ASTM E45, 18) INTERGRANULAR ATTACH - ASTM A262, 19)INTERGRANULAR CORROSION-ASTM A262, 20)MACRO ETCH&TESTING - ASTM A604/E381, 21)PITTING CORROSION - ASTM A923, 22)CREVICE CORROSION-ASTM G48, 23) HARDNESS CONVERSIONS - ASTM E140, 24)XRF-ASTM E572/E1085/E2465, 25) OES - ASTM E415/E1086, 26)COM - ASTM E1019, 27)FUS - ASTM E1019, 28)MS - CARPENTER METHODS 206.8500/206.8530 29)CHEMISTRY RESULTS ARE ROUNDED IN ACCORDANCE WITH ASTM A751 WHICH CONFORMS TO ASTM E29 WITH ONE SPECIAL EXCEPTION THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL, REVISION 38 DATED 08/21/2022.

CARPENTER'S QUALITY MANAGEMENT SYSTEM IS REGISTERED TO ISO 9001, AS9100, AND AS9120. THIS CERTIFICATION OF TEST IS TYPE 3.1 PREPARED IN ACCORDANCE WITH EN 10204 (DIN 50049). WE HEREBY CERTIFY THAT THE ABOVE TEST DATA ARE IN ACCORDANCE WITH THE PURCHASE ORDER AND SPECIFICATION REQUIREMENTS, AS DOCUMENTED IN THIS CERTIFICATE OF TESTS.

TEST METHODS ARE PER THE ASTM STANDARDS ON FILE AND IN EFFECT AT TIME OF ORDER ACCEPTANCE, STANDARD PRACTICES, OR AS AGREED UPON BETWEEN CARPENTER & CUSTOMER.

THE ABSENCE OF A REPORTED TEST TEMPERATURE INDICATES THAT THE TEST WAS COMPLETED AT ROOM TEMPERATURE.

FORM E2-366

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KIM MILLER /WI 40577 DIGITALLY SIGNED BY GARY BROWN
MANAGER - SPECIFICATIONS/CERTIFICATIONS
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W51490/HEAT 760684/LOT 01

Gary Brown

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Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231406
Trace ID/Heat Code: 9ET

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104341024	SSD-HB-106250	1-1/16" HEX BAR	34,458

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), revision N, dated February 7, 2024, which satisfies the applicable requirements of NCA-3300 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and ASME NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and the 2015, 2017, 2019 and 2022 Editions. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), revision O, dated February 7, 2024 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 9 May 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 5/8/2024
P.O. No.: 4506182330
W/O No.: CRA002-24-05-00807-1
Date Received: 5/2/2024

MO:	000104341024 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ET
P/N:	SSD-HB-106250
Two (2) 1-1/16" HEX SS 316 Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	
1	9.98	94.6	652	99.9	689	104.6		721		33.5	27.5	73	Mid 50%
2	9.98	94.9	654	100.5	693	105.2		725		34.0	28.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	23	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#** 24E-088
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	

	Average Grain Size
Specimen 1	ASTM #3.0 – 4.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	5/8/2024
P.O. No.:	4506182330
W/O No.:	CRA002-24-05-00807-1
Date Received:	5/2/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/27/2024 9ET

HEAT E231406 ORDER 705322/ 01 BOL 0262433 * CERTIFICATION * 03/25/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer
OSB 8

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259478 10/13/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 22 Total Weight 35064 Approx. Hot Red. Ratio 138:1

WO 2128961 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U, 1V SON= 355067

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.

Free from contamination by mercury or mercury compounds when despatched from SMACC.

No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2470-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit Stainless steel, hot rolled billets. Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling. Intended for further hot working and heat treatment. No mechanical tests performed. Not solution annealed.	Our order Unsere Auftrag Notre commande 83104	Advice of delivery Lieferschein Avie d'expedition 273457
Requirements-Prüfgrundlagen-Exigences OSB MS-1014 Rev.3 OSB Grade Codes for Material Procurement. ASTM A276, A479 ASME SA479 AD 2000-Merkblatt W2, W10 EN 10272 SWAGELOK SMS-10001 SWAGELOK SMS-10002 SWAGELOK SQS-00021	Purchaser-Besteller-Acheteur MARCEGAGLIA STAINLESS RICHBURG LLC (AVESB) 3043 CRENSHAW PARKWAY SC 29729 RICHBURG U.S.A	

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance 316LCM Rev.0 Type 316, 316L, UNS S31600, S31603. EN 1.4401, 1.4404 17-10-2L	Brand mark Herstellerzeichen Signe du producteur W	Inspectors stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion EAF AOD-Converter refining CC to bloom size (mm): 462x262

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-01	1	150x150	E231406	145080			1 634	915-2
01-02	1	150x150	E231406	145985			1 652	815-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais The requirements according to AMS-QQ-S-763D are fulfilled. The order requirements stipulated are satisfied. US-tested according to DLP OFP-222. Approved.	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel No remarks-Ohne Beanstandung-Pas de remarque PMI-test has been performed on every bar/billet with X-ray spectro, without remarks. No weld repair has been performed on the material. Free of known Mercury contamination at time of shipment.
EN ISO 9001:2015 and EN ISO 14001:2015. Certificate no. 5749-3027684-0102. Approved by TÜV NORD Scandinavia AB.	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. Certificate no. 07/203/9140/WP/0689/18 PED 2014/68/EU, approved by TÜV Nord Systems. Certificate no. 07/202/9140/WZ/0689/18	Degerfors Long Products AB Digitally signed by: Jörgen Johansson QA Head
Reg.No.:559332-4907 V.A.T.No.:SE559332490701 Registered office: Degerfors, Sweden	

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/13/2024 9ET

HEAT E231406 ORDER 711288/ 01 BOL 0262339 * CERTIFICATION * 03/13/24

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259477 3/13/24 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 21 Total Weight 34458 Approx. Hot Red. Ratio 138:1

WO 2128960 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U SON= 355066

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
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Tin	(Sn)	.013	Cerium	(Ce)	.017
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Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
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2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38262	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

.

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

APPROVED BY SARA MALIK 3/13/2024 9ET

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465
Page 4 of 4

MARCEGAGLIA

Mill Certificate

9ET

To SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL.+4622345302	Cons. N/A HS Code Customer Order No 9973229 SMACC Order No 283517/1	Cast No. E231406 Code 231011 Campaign 38282 Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Cert Date: 04 October 2023 Melt Date: 11 August 2023 Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2471-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit **Stainless steel, hot rolled billets.** **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	Our order Unsere Auftrag Notre commande **83104**	Advice of delivery Lieferschein Avie d'expedition **273457**

Requirements-Prüfgrundlagen-Exigences **OSB MS-1014 Rev.3** **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	Purchaser-Besteller-Acheteur **MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel	Brand mark	Inspectors stamp	Melting process
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item	Quantity	Dimensions, mm	Cast No.	Lot No.	Test No	Heat treatm.Lot No	Weight Kg	Bloom No
01-03	1	150x150	E231406	145986	145986-1,2		1 608	815-1
01-04	1	150x150	E231406	145987	145987-1,2		1 616	915-1
01-05	1	150x150	E231406	145988	145988-1,2		1 782	803-1
01-06	1	150x150	E231406	145989	145989-1,2		1 820	905-1
01-07	1	150x150	E231406	145990	145990-1,2		1 816	914-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11
Ladle analysis attached

% Ferrite measured with ferritscope on samples from both billet ends. 8 points measured from half radius, in one line, cross the centre area to half radius on the other side of the centre.

	Billet end 1			Billet end 2			
Test No	min	max	average	min	max	average	Pit furnace no.
145986-1,2	0.0	0.13	0.02	0.0	0.26	0.10	2
145987-1,2	0.0	0.23	0.04	0.0	0.32	0.04	2
145988-1,2	0.0	0.20	0.06	0.0	0.10	0.01	2
145989-1,2	0.0	0.10	0.01	0.0	0.12	0.03	2
145990-1,2	0.0	0.11	0.01	0.0	0.10	0.02	2

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais **The requirements according to AMS-QQ-S-763D are fulfilled.** **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel **No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TÜV NORD Scandinavia AB.**	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Degerfors Long Products AB** Jörgen Johansson
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office: Degerfors, Sweden**	**Digitally signed by: Jörgen Johansson** **QA Head**

APPROVED BY SARA MALIK 05/22/2024 9ET

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231406
Trace ID/Heat Code: 9ET

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104340933	SSD-HB-106250	1-1/16" HEX BAR	35,064

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), revision N, dated February 7, 2024, which satisfies the applicable requirements of NCA-3300 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and ASME NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and the 2015, 2017, 2019 and 2022 Editions. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), revision O, dated February 7, 2024 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 9 May 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 5/21/2024
P.O. No.: 4506197413
W/O No.: CRA002-24-05-01484-1
Date Received: 5/14/2024

MO:	000104340933 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ET
P/N:	SSD-HB-106250
Two (2) 1-1/16" Hex SS 316 Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	-
1	9.98	95.5	658	101.0	696	105.7		729		33.5	28.0	73	Mid 50%
2	9.98	95.5	659	100.8	695	105.5		727		32.0	26.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	26	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#**
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	24E-271

	Average Grain Size
Specimen 1	ASTM #5.0 – 6.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	5/21/2024
P.O. No.:	4506197413
W/O No.:	CRA002-24-05-01484-1
Date Received:	5/14/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/27/2024 9ET

HEAT E231406 ORDER 705322/ 01 BOL 0262433 * CERTIFICATION * 03/25/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259478 10/13/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 22 Total Weight 35064 Approx. Hot Red. Ratio 138:1

WO 2128961 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U, 1V SON= 355067

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.

Free from contamination by mercury or mercury compounds when despatched from SMACC.

No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2470-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit Stainless steel, hot rolled billets. Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling. Intended for further hot working and heat treatment. No mechanical tests performed. Not solution annealed.	Our order Unsere Auftrag Notre commande 83104	Advice of delivery Lieferschein Avie d'expedition 273457
Requirements-Prüfgrundlagen-Exigences OSB MS-1014 Rev.3 OSB Grade Codes for Material Procurement. ASTM A276, A479 ASME SA479 AD 2000-Merkblatt W2, W10 EN 10272 SWAGELOK SMS-10001 SWAGELOK SMS-10002 SWAGELOK SQS-00021	Purchaser-Besteller-Acheteur MARCEGAGLIA STAINLESS RICHBURG LLC (AVESB) 3043 CRENSHAW PARKWAY SC 29729 RICHBURG U.S.A	

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance 316LCM Rev.0 Type 316, 316L, UNS S31600, S31603. EN 1.4401, 1.4404 17-10-2L	Brand mark Herstellerzeichen Signe du producteur W	Inspectors stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion EAF AOD-Converter refining CC to bloom size (mm): 462x262

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-01	1	150x150	E231406	145080			1 634	915-2
01-02	1	150x150	E231406	145985			1 652	815-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais The requirements according to AMS-QQ-S-763D are fulfilled. The order requirements stipulated are satisfied. US-tested according to DLP OFP-222. Approved.	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel No remarks-Ohne Beanstandung-Pas de remarque PMI-test has been performed on every bar/billet with X-ray spectro, without remarks. No weld repair has been performed on the material. Free of known Mercury contamination at time of shipment.
EN ISO 9001:2015 and EN ISO 14001:2015. Certificate no. 5749-3027684-0102. Approved by TÜV NORD Scandinavia AB.	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. Certificate no. 07/203/9140/WP/0689/18 PED 2014/68/EU, approved by TÜV Nord Systems. Certificate no. 07/202/9140/WZ/0689/18	Degerfors Long Products AB Digitally signed by: Jörgen Johansson QA Head
Reg.No.:559332-4907 V.A.T.No.:SE559332490701 Registered office: Degerfors, Sweden	

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/13/2024 9ET

HEAT E231406 ORDER 711288/ 01 BOL 0262339 * CERTIFICATION * 03/13/24

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259477 3/13/24 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 21 Total Weight 34458 Approx. Hot Red. Ratio 138:1

WO 2128960 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U SON= 355066

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38262	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

.

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465
Page 4 of 4

MARCEGAGLIA

Mill Certificate

9ET

To SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL.+4622345302	Cons. N/A HS Code	Cast No. E231406 Code 231011 Campaign 38282	Cert Date: 04 October 2023 Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2471-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit **Stainless steel, hot rolled billets.** **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	Our order Unsere Auftrag Notre commande **83104**	Advice of delivery Lieferschein Avie d'expedition **273457**

Requirements-Prüfgrundlagen-Exigences **OSB MS-1014 Rev.3** **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	Purchaser-Besteller-Acheteur **MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel **316LCM Rev.0** **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	Brand mark W	Inspectors stamp DJ 10	Melting process **EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item	Quantity	Dimensions, mm	Cast No.	Lot No.	Test No	Heat treatm.Lot No	Weight Kg	Bloom No
01-03	1	150x150	E231406	145986	145986-1,2		1 608	815-1
01-04	1	150x150	E231406	145987	145987-1,2		1 616	915-1
01-05	1	150x150	E231406	145988	145988-1,2		1 782	803-1
01-06	1	150x150	E231406	145989	145989-1,2		1 820	905-1
01-07	1	150x150	E231406	145990	145990-1,2		1 816	914-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11
Ladle analysis attached

% Ferrite measured with ferritscope on samples from both billet ends. 8 points measured from half radius, in one line, cross the centre area to half radius on the other side of the centre.

	Billet end 1			Billet end 2			
Test No	min	max	average	min	max	average	Pit furnace no.
145986-1,2	0.0	0.13	0.02	0.0	0.26	0.10	2
145987-1,2	0.0	0.23	0.04	0.0	0.32	0.04	2
145988-1,2	0.0	0.20	0.06	0.0	0.10	0.01	2
145989-1,2	0.0	0.10	0.01	0.0	0.12	0.03	2
145990-1,2	0.0	0.11	0.01	0.0	0.10	0.02	2

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais **The requirements according to AMS-QQ-S-763D are fulfilled.** **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel **No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TÜV NORD Scandinavia AB.**	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Degerfors Long Products AB** Jörgen Johansson
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office: Degerfors, Sweden**	**Digitally signed by: Jörgen Johansson** **QA Head**

MATERIAL CERTIFICATION - SPARES
LINE 1100

Material	**Heat No.**
Stop Ring	190206T09

(D. Furneaux)
FTR obo CROSSWIND
Witness | X Review
12th Feb. 2025

Baker Hughes Confidential

硬度检验报告

Hardness Inspection Report

零件号/Part No.	563-002-01	技术要求 Technique require: 根据 NACE MR 0 1 7 5 &MR 0 1 0 3 HBW: ≤237 As per NACE MR0175 &MR 0 10 3 HBW: ≤237
炉号/Heat No	190206T09	
零件名称/Part Name	Ring For Packing Gland Standard Stop Ring	
材料/Material	316L ASTM-A312	技术要求： Technique require: HRC：
加工数量/Qtys	1580 pcs	

检验结果 Inspection result	试样编号 Sample code	实测硬度值（HBW） Test hardness value（HBW）			实测硬度值（HRC） Test hardness value（HRC）		
	1#	140	144	141			
	2#	139	142	144			
	3#	145	140	141			
	4#	142	146	143			

结论：

Conclusion：

合格

检验员：徐秋红 2024 年 05 月 30 日

Inspector： Date：

上海东方精密机械设备有限公司 检验专用章

表单编号：DL4-094

List code: DL4-094

SD 上海东洛精密机械设备有限公司（SHANGHAI DONGLUO PRECISE MACHINE INDUSTRIAL CO..LTD）

最终检验报告（Final Inspection Report）

7240013-QC-DB-00014 REV 00

合同号 PO#	5052257983#-10 5052267105#-10 5052279911#-10	零件号 P/N	563-002-01	零件名称 Part Name	垫圈	材料 Material	316L ASTM-A312		
炉号 Heat No.	190206T09	总数量 Lot Qty	生产 1580 PCS 出货 300 PCS	抽样标准 Sampling AQL=1.0 AC=0	抽检数量 Spot-check Qty	42 PCS	检验结果 Inspection Result	OK	

序号 Item	图纸尺寸 Size in the draws	检验数据（Dates of Inspection）										判定 Judgment	备注 Remark
		1	2	3	4	5	6	7	8	9	10		
1	¢41.28±0.25	41.37	41.32	41.39	41.28	41.34	41.31	41.30	41.26	41.29	41.34	OK	
2	¢26.97±0.25	27.02	27.05	27.00	26.96	27.01	27.04	26.99	26.95	26.92	26.98	OK	
3	4.57±0.25	4.62	4.55	4.63	4.56	4.61	4.59	4.66	4.59	4.61	4.57	OK	
4	打标:	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	

上海东洛精密机械设备有限公司 检验专用章

生产日期 Manufacturing date:	2024.05.10	检验日期 Inspection date:	2024.05.30	检验员 Inspector:	XU QIU HONG 徐秋红	质量经理 QC Manager:	HU YA JU 胡亚菊
表单编号 Code list:		DL4-047		表单版本号 REV:		2.0	

产品质量证明书
CERTIFICA OF QUALITY

签发日期
DATE OF ISSUE
2023.02.16

合同号 Contrac No.		订货单位 purchaser	上海荣协		产品名称 Name of product	不锈钢管
钢号 steel Grade	炉号 Heat No	规格（mm） Size	数量（kg） Qty	件数 piece	交货状态 Condition of Delivery	执行标准 standard
316L	190206T09	45*10	131.5	7	固溶（抛光）	GB/T14976-2012

化学成份（%）Chemicaical Composition

C	Si	Mn	P	S	Cr	Ni	Cu	Mo	Al	Fe	Ti	Nb	Co	备注 Remarks
0.03	0.75	1.54	0.035	0.029	16.5	10.02	/	2.01	/	/	/	/	/	

力学成份（%）Mechanical Property　　物理性能 Physical property

屈服强度 Yield Strength (Mpa)	抗拉强度 Tensile Strength (Mpa)	伸长率 Elongation (%)	断面收缩率 Reduction of Area (%)	冲击值 Impact AKV(J)	硬度 Hardness (HB)	尺寸检验 Dimensin Inspection	表面质量 Surface Quality Inspection	Material Comply with EN 10204 3.1
205	515	40	合格	合格	200	合格	合格	合格

备注 Remarks

1. 本正书涂改（复印）无效：This certificate is invalid:
2. 用户提出质量异议时，请在收到产品一个星期内提供本质量证明书、合同号、钢号、炉号、规格、重量等信息。User propose qualityobjec Tion,please offers us the Contract No、 Designation、HeatNo、size、Weight and other information of this certificate within a month After receiving our probuts。

质量部印章 Seal:　　签发 Signature: 王者沦　　制表 Lister: 陈欣

MATERIAL CERTIFICATION - SPARES
Two Year operational - LINE 2030

Material	Heat No.
CONN,MALE ½ "COMP. X 3/4"MNPT BORED TH	9BA/9ET

(D. Furneaux)
FTR 060 CROSSWIND
~~Witness~~ X Review
12th Feb. 2025

Baker Hughes Confidential

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001313511

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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CUSTOMER / BESTELLER / CLIENT

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

SELLER / VERKÄUFER / VENDEUR **PAGE 1 OF 5**

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505211171	W51490		13504

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED COLD DRAWN
PART NUMBER: SSD-HB-087500

SPECIFICATION: SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQC-03998 REV A (01/26/18)
SWAGELOK COMPANY SQS-00226 REV (08/23/17)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)
SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. I (07/28/22)
ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-22 (09/01/22)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 8 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
SWAGELOK COMPANY SVS-00012 (02/23/01)
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)

SIZE 0.875000 IN.(22.23 MM) HEX BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.020	1.19	0.58	0.019	0.026	17.53

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.15	2.09	0.17	0.16	0.03

MELT DATE: 07/20/23

CONTINUED ON NEXT PAGE

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FORM E2-366

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001313511

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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26 SEP 23

CUSTOMER / BESTELLER / CLIENT

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

SELLER / VERKÄUFER / VENDEUR **PAGE 2 OF 5**

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505211171	W51490		13504

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND INDUSTRIE SERVICE GMBH, NO. 01 202 USA/Q-03 8928, IN ACCORDANCE WITH PED 2014/68/EU ANNEX I PARA. 4.3 + AD 2000 W0
MATERIAL VISUAL AND DIMENSIONAL INSPECTED - ACCEPTABLE.
THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL REVISION 38, DATED 08/21/2022 "AS ACCEPTED BY SWAGELOK COMPANY" IN COMPLIANCE WITH ASME B & P V CODE SECTION III, DIVISION 1 SUBSECTION NCA 3800 2017 EDITION.
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
100% COMPARATOR TESTED TO DETECT/SORTOUT HIGH IRON/LOW ALLOY INCLUSIONS.
ULTRASONIC INSPECTED (IMMERSION) PER CTC PROCEDURE - ACCEPTABLE.
CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
EDDY CURRENT TESTED AND APPROVED AT FINISH
IT IS HEREBY CERTIFIED THAT THE SPECIALTY METALS SUPPLIED HEREUNDER HAVE BEEN PRODUCED IN THE UNITED STATES.
NO WELD REPAIR.
THIS MATERIAL HAS BEEN SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND MEETS ALL SPECIFICATION REQUIREMENTS.
INSPECTION CERTIFICATE 3.1 IN ACCORDANCE WITH EN 10204 AND DIN 50049
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
PROVISIONS OF 10 CFR PART 21 & 10 CFR PART 50 - APPENDIX B APPLY.
IN PRODUCTION OR TESTING OF MATERIAL SHIPPED AGAINST THIS ORDER, NO DIRECT CONNECTED MERCURY MANOMETER, MERCURY PUMPS, MERCURY SEALS, OR MERCURY IN GLASS THERMOMETERS HAVE BEEN USED. NOR IN SUCH PRODUCTION OR TESTING HAS MERCURY BEEN HANDLED IN THE IMMEDIATE VICINITY OF SUCH MATERIAL.
THIS CERTIFICATE AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY US, OR OUR SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE ORDER REQUIREMENTS AS MAY HAVE BEEN MODIFIED BY PRIOR CORRESPONDENCE BETWEEN THE PARTIES.
THIS MATERIAL WAS MANUFACTURED FREE FROM MERCURY, RADIUM AND ALPHA SOURCE CONTAMINATION.
ALL TESTS AND INSPECTIONS PERFORMED VERIFY CONFORMANCE TO SPECIFICATION REQUIREMENTS AND THE MATERIAL COMPLIES WITH ALL REQUIREMENTS OF THE PURCHASE ORDER.
INTERGRANULAR CORROSION TESTED PER ISO 3651
MATERIAL IS COMPLIANT TO REACH; THE E.U.'S REGISTRATION, EVALUATION, AUTHORIZATION, AND REGISTRATION OF CHEMICALS LEGISLATION.
MATERIAL IS COMPLIANT TO 2015/863/EU (ROHS3) DIRECTIVE.
THIS HEAT MELTED BY THE ELECTRIC ARC/AOD PROCESSES
MELT DATE OF HEAT: 07/20/2023

FORM E2-366

CONTINUED ON NEXT PAGE

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Certification ID:001313511

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26 SEP 23

CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 3 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505211171	W51490		13504

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (2H).

ORDER LENGTH REQUIREMENT: 144"

MILL HEAT TREATMENT:
TYPE SOLUTION ANNEAL
TEMP 1951F (1066C)
TIME AT TEMP CONTINUOUS FURNACE
QUENCH WATER

HARDNESS AS SHIPPED, HRC - 26
__ ________
***-->TESTED AT READING**

(T)RANSVERSE (L)ONGITUDINAL	L	L
YIELD STRENGTH, (0.20 %) KSI(MPA)	85.5(590)	86.0(593)
YIELD STRENGTH, (1.00 %) KSI(MPA)	96.0(662)	97.5(672)
TENSILE STRENGTH, KSI(MPA)	101.0(696)	102.0(703)
ELONGATION IN 2.00", %	37.0	38.0
ELONGATION IN 2.50", %	32.0	32.0
REDUCTION OF AREA, %	74.0	73.0

***-->TESTED AT READING**

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
***-->TESTED AT READING**

INTERGRANULAR CORROSION TEMP(F)1292 HR:0 MN:30 QUENCH:WATER
SPECIMEN SENSITIZATION *-->TESTED AT READING

INSPECTION: ACCEPTABLE

ALLOY ID: ACCEPTABLE

FORM E2-366

CONTINUED ON NEXT PAGE

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SELLER / VERKÄUFER / VENDEUR **PAGE 4 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

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4505211171	W51490		13504

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

ADDRESS OF TESTING LOCATIONS:
READING - 101 WEST BERN ST, READING, PA 19601

MATERIAL HAS BEEN MELTED AND MANUFACTURED IN THE USA WHICH IS A QUALIFYING COUNTRY TO DFARS REQUIREMENTS 252.225-7014 WITH ALTERNATE 1 FOR QUALIFYING COUNTRY 225.872.1, SUPERSEDED BY DFARS REQUIREMENTS DFARS 252.225-7008 AND 252.225-7009.

UNLESS OTHERWISE STATED, THE TEST WERE PERFORMED TO THE LATEST REVISION OF THE STANDARDS LISTED BELOW: 1) BEND TEST - ASTM E290, 2) CHARPY IMPACT - ASTM E23, 3)COEFFICIENT OF LINEAR THERMAL EXPANSION - ASTM E228, 4)FRACTURE TOUGHNESS - ASTM E399, 5) BRINELL HARDNESS - ASTM E10, 6)ROCKWELL HARDNESS-ASTM E18, 7)MICRO VICKERS HARDNESS-ASTM E92, 8)KNOOP HARDNESS-ASTM E92, 9)MACRO VICKERS HARDNESS-ASTM E92, 10)STRESS RUPTURE/CREEP RUPTURE-ASTM E139, 11)STRESS RUPTURE(COMBINATION)-ASTM E292, 12)ROOM TEMPERATURE TENSILE-ASTM E8, 13)ELEVATED ROOM TEMPERATURE TENSILE-ASTM E21, 14)DECARBURIZATION-ASTM E1077 15)DELTA FERRITE AMS 2315, 16)GRAIN SIZE-ASTM E112, 17)INCLUSION CONTENT/MICROCLEANLINESS-ASTM E45, 18) INTERGRANULAR ATTACH - ASTM A262, 19)INTERGRANULAR CORROSION-ASTM A262, 20)MACRO ETCH&TESTING - ASTM A604/E381, 21)PITTING CORROSION - ASTM A923, 22)CREVICE CORROSION-ASTM G48, 23) HARDNESS CONVERSIONS - ASTM E140, 24)XRF-ASTM E572/E1085/E2465, 25) OES - ASTM E415/E1086, 26)COM - ASTM E1019, 27)FUS - ASTM E1019, 28)MS - CARPENTER METHODS 206.8500/206.8530 29)CHEMISTRY RESULTS ARE ROUNDED IN ACCORDANCE WITH ASTM A751 WHICH CONFORMS TO ASTM E29 WITH ONE SPECIAL EXCEPTION THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL, REVISION 38 DATED 08/21/2022.

CARPENTER'S QUALITY MANAGEMENT SYSTEM IS REGISTERED TO ISO 9001, AS9100, AND AS9120. THIS CERTIFICATION OF TEST IS TYPE 3.1 PREPARED IN ACCORDANCE WITH EN 10204 (DIN 50049). WE HEREBY CERTIFY THAT THE ABOVE TEST DATA ARE IN ACCORDANCE WITH THE PURCHASE ORDER AND SPECIFICATION REQUIREMENTS, AS DOCUMENTED IN THIS CERTIFICATE OF TESTS.

TEST METHODS ARE PER THE ASTM STANDARDS ON FILE AND IN EFFECT AT TIME OF ORDER ACCEPTANCE, STANDARD PRACTICES, OR AS AGREED UPON BETWEEN CARPENTER & CUSTOMER.

THE ABSENCE OF A REPORTED TEST TEMPERATURE INDICATES THAT THE TEST WAS COMPLETED AT ROOM TEMPERATURE.

FORM E2-366

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CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001313511

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 5 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505211171	**W51490**		**13504**

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

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KIM MILLER /WI 40577 DIGITALLY SIGNED BY GARY BROWN
MANAGER - SPECIFICATIONS/CERTIFICATIONS
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W51490/HEAT 760684/LOT 01

Gary Brown

FORM E2-366

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4505211171	W51490		15233

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED COLD DRAWN
PART NUMBER: SSD-HB-087500

SPECIFICATION: SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQC-03998 REV A (01/26/18)
SWAGELOK COMPANY SQS-00226 REV (08/23/17)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)
SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. I (07/28/22)
ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-22 (09/01/22)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 8 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
SWAGELOK COMPANY SVS-00012 (02/23/01)
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)

SIZE 0.875000 IN.(22.23 MM) HEX BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.020	1.19	0.58	0.019	0.026	17.53

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.15	2.09	0.17	0.16	0.03

MELT DATE: 07/20/23

CONTINUED ON NEXT PAGE

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26 SEP 23

CUSTOMER / BESTELLER / CLIENT

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

SELLER / VERKÄUFER / VENDEUR **PAGE 2 OF 5**

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505211171	W51490		15233

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND INDUSTRIE SERVICE GMBH, NO. 01 202 USA/Q-03 8928, IN ACCORDANCE WITH PED 2014/68/EU ANNEX I PARA. 4.3 + AD 2000 W0
MATERIAL VISUAL AND DIMENSIONAL INSPECTED - ACCEPTABLE.
THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL REVISION 38, DATED 08/21/2022 "AS ACCEPTED BY SWAGELOK COMPANY" IN COMPLIANCE WITH ASME B & P V CODE SECTION III, DIVISION 1 SUBSECTION NCA 3800 2017 EDITION.
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
100% COMPARATOR TESTED TO DETECT/SORTOUT HIGH IRON/LOW ALLOY INCLUSIONS.
ULTRASONIC INSPECTED (IMMERSION) PER CTC PROCEDURE - ACCEPTABLE.
CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
EDDY CURRENT TESTED AND APPROVED AT FINISH
IT IS HEREBY CERTIFIED THAT THE SPECIALTY METALS SUPPLIED HEREUNDER HAVE BEEN PRODUCED IN THE UNITED STATES.
NO WELD REPAIR.
THIS MATERIAL HAS BEEN SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND MEETS ALL SPECIFICATION REQUIREMENTS.
INSPECTION CERTIFICATE 3.1 IN ACCORDANCE WITH EN 10204 AND DIN 50049
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
PROVISIONS OF 10 CFR PART 21 & 10 CFR PART 50 - APPENDIX B APPLY.
IN PRODUCTION OR TESTING OF MATERIAL SHIPPED AGAINST THIS ORDER, NO DIRECT CONNECTED MERCURY MANOMETER, MERCURY PUMPS, MERCURY SEALS, OR MERCURY IN GLASS THERMOMETERS HAVE BEEN USED. NOR IN SUCH PRODUCTION OR TESTING HAS MERCURY BEEN HANDLED IN THE IMMEDIATE VICINITY OF SUCH MATERIAL.
THIS CERTIFICATE AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY US, OR OUR SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE ORDER REQUIREMENTS AS MAY HAVE BEEN MODIFIED BY PRIOR CORRESPONDENCE BETWEEN THE PARTIES.
THIS MATERIAL WAS MANUFACTURED FREE FROM MERCURY, RADIUM AND ALPHA SOURCE CONTAMINATION.
ALL TESTS AND INSPECTIONS PERFORMED VERIFY CONFORMANCE TO SPECIFICATION REQUIREMENTS AND THE MATERIAL COMPLIES WITH ALL REQUIREMENTS OF THE PURCHASE ORDER.
INTERGRANULAR CORROSION TESTED PER ISO 3651
MATERIAL IS COMPLIANT TO REACH; THE E.U.'S REGISTRATION, EVALUATION, AUTHORIZATION, AND REGISTRATION OF CHEMICALS LEGISLATION.
MATERIAL IS COMPLIANT TO 2015/863/EU (ROHS3) DIRECTIVE.
THIS HEAT MELTED BY THE ELECTRIC ARC/AOD PROCESSES
MELT DATE OF HEAT: 07/20/2023

FORM E2-366

CONTINUED ON NEXT PAGE

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 3 OF 5**

SWAGELOK COMPANY
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4505211171	W51490		15233

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (2H).

ORDER LENGTH REQUIREMENT: 144"

MILL HEAT TREATMENT:
TYPE SOLUTION ANNEAL
TEMP 1951F (1066C)
TIME AT TEMP CONTINUOUS FURNACE
QUENCH WATER

HARDNESS AS SHIPPED, HRC - 26

***-->TESTED AT READING**

(T)RANSVERSE (L)ONGITUDINAL	L	L
YIELD STRENGTH, (0.20 %) KSI(MPA)	85.5(590)	86.0(593)
YIELD STRENGTH, (1.00 %) KSI(MPA)	96.0(662)	97.5(672)
TENSILE STRENGTH, KSI(MPA)	101.0(696)	102.0(703)
ELONGATION IN 2.00", %	37.0	38.0
ELONGATION IN 2.50", %	32.0	32.0
REDUCTION OF AREA, %	74.0	73.0

***-->TESTED AT READING**

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
***-->TESTED AT READING**

INTERGRANULAR CORROSION TEMP(F)1292 HR:0 MN:30 QUENCH:WATER
SPECIMEN SENSITIZATION *-->TESTED AT READING

INSPECTION: ACCEPTABLE

ALLOY ID: ACCEPTABLE

FORM E2-366

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 4 OF 5**

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4505211171	W51490		15233

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760684**

ADDRESS OF TESTING LOCATIONS:
READING - 101 WEST BERN ST, READING, PA 19601

MATERIAL HAS BEEN MELTED AND MANUFACTURED IN THE USA WHICH IS A QUALIFYING COUNTRY TO DFARS REQUIREMENTS 252.225-7014 WITH ALTERNATE 1 FOR QUALIFYING COUNTRY 225.872.1, SUPERSEDED BY DFARS REQUIREMENTS DFARS 252.225-7008 AND 252.225-7009.

UNLESS OTHERWISE STATED, THE TEST WERE PERFORMED TO THE LATEST REVISION OF THE STANDARDS LISTED BELOW: 1) BEND TEST - ASTM E290, 2) CHARPY IMPACT - ASTM E23, 3)COEFFICIENT OF LINEAR THERMAL EXPANSION - ASTM E228, 4)FRACTURE TOUGHNESS - ASTM E399, 5) BRINELL HARDNESS - ASTM E10, 6)ROCKWELL HARDNESS-ASTM E18, 7)MICRO VICKERS HARDNESS-ASTM E92, 8)KNOOP HARDNESS-ASTM E92, 9)MACRO VICKERS HARDNESS-ASTM E92, 10)STRESS RUPTURE/CREEP RUPTURE-ASTM E139, 11)STRESS RUPTURE(COMBINATION)-ASTM E292, 12)ROOM TEMPERATURE TENSILE-ASTM E8, 13)ELEVATED ROOM TEMPERATURE TENSILE-ASTM E21, 14)DECARBURIZATION-ASTM E1077 15)DELTA FERRITE AMS 2315, 16)GRAIN SIZE-ASTM E112, 17)INCLUSION CONTENT/MICROCLEANLINESS-ASTM E45, 18) INTERGRANULAR ATTACH - ASTM A262, 19)INTERGRANULAR CORROSION-ASTM A262, 20)MACRO ETCH&TESTING - ASTM A604/E381, 21)PITTING CORROSION - ASTM A923, 22)CREVICE CORROSION-ASTM G48, 23) HARDNESS CONVERSIONS - ASTM E140, 24)XRF-ASTM E572/E1085/E2465, 25) OES - ASTM E415/E1086, 26)COM - ASTM E1019, 27)FUS - ASTM E1019, 28)MS - CARPENTER METHODS 206.8500/206.8530 29)CHEMISTRY RESULTS ARE ROUNDED IN ACCORDANCE WITH ASTM A751 WHICH CONFORMS TO ASTM E29 WITH ONE SPECIAL EXCEPTION THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL, REVISION 38 DATED 08/21/2022.

CARPENTER'S QUALITY MANAGEMENT SYSTEM IS REGISTERED TO ISO 9001, AS9100, AND AS9120. THIS CERTIFICATION OF TEST IS TYPE 3.1 PREPARED IN ACCORDANCE WITH EN 10204 (DIN 50049). WE HEREBY CERTIFY THAT THE ABOVE TEST DATA ARE IN ACCORDANCE WITH THE PURCHASE ORDER AND SPECIFICATION REQUIREMENTS, AS DOCUMENTED IN THIS CERTIFICATE OF TESTS.

TEST METHODS ARE PER THE ASTM STANDARDS ON FILE AND IN EFFECT AT TIME OF ORDER ACCEPTANCE, STANDARD PRACTICES, OR AS AGREED UPON BETWEEN CARPENTER & CUSTOMER.

THE ABSENCE OF A REPORTED TEST TEMPERATURE INDICATES THAT THE TEST WAS COMPLETED AT ROOM TEMPERATURE.

FORM E2-366

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KIM MILLER /WI 40577 DIGITALLY SIGNED BY GARY BROWN
MANAGER - SPECIFICATIONS/CERTIFICATIONS
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W51490/HEAT 760684/LOT 01

Gary Brown

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APPROVED BY SARA MALIK 5/10/2024 9ET

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231406
Trace ID/Heat Code: 9ET

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104341024	SSD-HB-106250	1-1/16" HEX BAR	34,458

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), revision N, dated February 7, 2024, which satisfies the applicable requirements of NCA-3300 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and ASME NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and the 2015, 2017, 2019 and 2022 Editions. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), revision O, dated February 7, 2024 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 9 May 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 5/8/2024
P.O. No.: 4506182330
W/O No.: CRA002-24-05-00807-1
Date Received: 5/2/2024

MO:	000104341024 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ET
P/N:	SSD-HB-106250
Two (2) 1-1/16" HEX SS 316 Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	
1	9.98	94.6	652	99.9	689	104.6		721		33.5	27.5	73	Mid 50%
2	9.98	94.9	654	100.5	693	105.2		725		34.0	28.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	23	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#** 24E-088
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	

	Average Grain Size
Specimen 1	ASTM #3.0 – 4.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	5/8/2024
P.O. No.:	4506182330
W/O No.:	CRA002-24-05-00807-1
Date Received:	5/2/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara
Digitally Signed by Britney Bahara
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/27/2024 9ET

HEAT E231406 ORDER 705322/ 01 BOL 0262433 * CERTIFICATION * 03/25/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259478 10/13/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 22 Total Weight 35064 Approx. Hot Red. Ratio 138:1

WO 2128961 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U, 1V SON= 355067

---------- SPECIFICATIONS ----------
ASTM A479/A479M-23a
ASTM A751 21
EN 10272 Grade 1.4401
10-CFR-21
Swagelok SQS-00012 Rev AK
Produced according to -
ASME B&PV Code Section III
Subsection NCA3800
MSR QPM-101 R14, 1/11/23
Approved by Swagelok Company
ASME SA-479/479M 2023 Ed
Bars are 100% UT inspected

ASTM A484/A484M 23a
DIN 50049/EN 10204 Type 3.1
EN ISO 3651-2 Method A
10CFR50-Appendix B
Swagelok SQS-00020 Rev N
Swagelok SQS-00021 Rev Q
1.4401/1.4404, 316/316L
Exception to SQS-00171 Rev F
Swagelok SMS-00833 Rev D
Swagelok SQC-03992 init. rel
ASTM E1001

---------- MECHANICAL & OTHER TESTS ----------
Micro OK
Intergranular corrosion

Tensile strength,KSI (MPa)	.0 (0)
0.2% Yield Strngth,KSI(MPa)	.0 (0)
Elongation % in 4D	.0
Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			

De-long Ferrite

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.

Free from contamination by mercury or mercury compounds when despatched from SMACC.

No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2470-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit Stainless steel, hot rolled billets. Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling. Intended for further hot working and heat treatment. No mechanical tests performed. Not solution annealed.	Our order Unsere Auftrag Notre commande 83104	Advice of delivery Lieferschein Avie d'expedition 273457
Requirements-Prüfgrundlagen-Exigences OSB MS-1014 Rev.3 OSB Grade Codes for Material Procurement. ASTM A276, A479 ASME SA479 AD 2000-Merkblatt W2, W10 EN 10272 SWAGELOK SMS-10001 SWAGELOK SMS-10002 SWAGELOK SQS-00021	Purchaser-Besteller-Acheteur MARCEGAGLIA STAINLESS RICHBURG LLC (AVESB) 3043 CRENSHAW PARKWAY SC 29729 RICHBURG U.S.A	

Marking-Kennzeichnung-Marquage

Type of steel Werkstoff Nr. Nuance 316LCM Rev.0 Type 316, 316L, UNS S31600, S31603. EN 1.4401, 1.4404 17-10-2L	Brand mark Herstellerzeichen Signe du producteur W	Inspectors stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion EAF AOD-Converter refining CC to bloom size (mm): 462x262

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-01	1	150x150	E231406	145080			1 634	915-2
01-02	1	150x150	E231406	145985			1 652	815-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais The requirements according to AMS-QQ-S-763D are fulfilled. The order requirements stipulated are satisfied. US-tested according to DLP OFP-222. Approved.	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel No remarks-Ohne Beanstandung-Pas de remarque PMI-test has been performed on every bar/billet with X-ray spectro, without remarks. No weld repair has been performed on the material. Free of known Mercury contamination at time of shipment.
EN ISO 9001:2015 and EN ISO 14001:2015. Certificate no. 5749-3027684-0102. Approved by TÜV NORD Scandinavia AB.	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. Certificate no. 07/203/9140/WP/0689/18 PED 2014/68/EU, approved by TÜV Nord Systems. Certificate no. 07/202/9140/WZ/0689/18	Degerfors Long Products AB Digitally signed by: Jörgen Johansson QA Head
Reg.No.:559332-4907 V.A.T.No.:SE559332490701 Registered office: Degerfors, Sweden	

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/13/2024 9ET

HEAT E231406 ORDER 711288/ 01 BOL 0262339 * CERTIFICATION * 03/13/24

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259477 3/13/24 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 21 Total Weight 34458 Approx. Hot Red. Ratio 138:1

WO 2128960 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U SON= 355066

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

APPROVED BY SARA MALIK 3/13/2024 9ET

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

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____ Batch Heat Treatment @ F / minutes, water quench.

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PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38262	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

.

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL.+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2471-23

DEGERFORS LONG PRODUCTS AB
S-693 81 DEGERFORS, SWEDEN
Ref.QA-Dept. Jörgen Johansson

Date-Datum-Date: 2023-11-21
Your order-Ihre Bestellung-Votre commande: 9320286

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d'expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**83104**	**273457**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel	Brand mark	Inspectors stamp	Melting process
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item	Quantity	Dimensions, mm	Cast No.	Lot No.	Test No	Heat treatm.Lot No	Weight Kg	Bloom No
01-03	1	150x150	E231406	145986	145986-1,2		1 608	815-1
01-04	1	150x150	E231406	145987	145987-1,2		1 616	915-1
01-05	1	150x150	E231406	145988	145988-1,2		1 782	803-1
01-06	1	150x150	E231406	145989	145989-1,2		1 820	905-1
01-07	1	150x150	E231406	145990	145990-1,2		1 816	914-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11
Ladle analysis attached

% Ferrite measured with ferritscope on samples from both billet ends. 8 points measured from half radius, in one line, cross the centre area to half radius on the other side of the centre.

	Billet end 1			Billet end 2			
Test No	min	max	average	min	max	average	Pit furnace no.
145986-1,2	0.0	0.13	0.02	0.0	0.26	0.10	2
145987-1,2	0.0	0.23	0.04	0.0	0.32	0.04	2
145988-1,2	0.0	0.20	0.06	0.0	0.10	0.01	2
145989-1,2	0.0	0.10	0.01	0.0	0.12	0.03	2
145990-1,2	0.0	0.11	0.01	0.0	0.10	0.02	2

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
The requirements according to AMS-QQ-S-763D are fulfilled. **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	**No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TÜV NORD Scandinavia AB.**	**No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Degerfors Long Products AB**
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office: Degerfors, Sweden**	**Digitally signed by: Jörgen Johansson** **QA Head**

APPROVED BY SARA MALIK 05/22/2024 9ET

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231406
Trace ID/Heat Code: 9ET

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104340933	SSD-HB-106250	1-1/16" HEX BAR	35,064

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), revision N, dated February 7, 2024, which satisfies the applicable requirements of NCA-3300 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and ASME NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and the 2015, 2017, 2019 and 2022 Editions. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), revision O, dated February 7, 2024 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 9 May 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 5/21/2024
P.O. No.: 4506197413
W/O No.: CRA002-24-05-01484-1
Date Received: 5/14/2024

MO:	000104340933 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ET
P/N:	SSD-HB-106250
Two (2) 1-1/16" Hex SS 316 Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	-
1	9.98	95.5	658	101.0	696	105.7		729		33.5	28.0	73	Mid 50%
2	9.98	95.5	659	100.8	695	105.5		727		32.0	26.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	26	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#**
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	24E-271

	Average Grain Size
Specimen 1	ASTM #5.0 – 6.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	5/21/2024
P.O. No.:	4506197413
W/O No.:	CRA002-24-05-01484-1
Date Received:	5/14/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara
Digitally Signed by Britney Bahara
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/27/2024 9ET

HEAT E231406 ORDER 705322/ 01 BOL 0262433 * CERTIFICATION * 03/25/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer
OSB 8

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259478 10/13/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 22 Total Weight 35064 Approx. Hot Red. Ratio 138:1

WO 2128961 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U, 1V SON= 355067

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.

Free from contamination by mercury or mercury compounds when despatched from SMACC.

No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2470-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit Stainless steel, hot rolled billets. Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling. Intended for further hot working and heat treatment. No mechanical tests performed. Not solution annealed.	Our order Unsere Auftrag Notre commande 83104	Advice of delivery Lieferschein Avie d'expedition 273457
Requirements-Prüfgrundlagen-Exigences OSB MS-1014 Rev.3 OSB Grade Codes for Material Procurement. ASTM A276, A479 ASME SA479 AD 2000-Merkblatt W2, W10 EN 10272 SWAGELOK SMS-10001 SWAGELOK SMS-10002 SWAGELOK SQS-00021	Purchaser-Besteller-Acheteur MARCEGAGLIA STAINLESS RICHBURG LLC (AVESB) 3043 CRENSHAW PARKWAY SC 29729 RICHBURG U.S.A	

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance 316LCM Rev.0 Type 316, 316L, UNS S31600, S31603. EN 1.4401, 1.4404 17-10-2L	Brand mark Herstellerzeichen Signe du producteur W	Inspectors' stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion EAF AOD-Converter refining CC to bloom size (mm): 462x262

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-01	1	150x150	E231406	145080			1 634	915-2
01-02	1	150x150	E231406	145985			1 652	815-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais The requirements according to AMS-QQ-S-763D are fulfilled. The order requirements stipulated are satisfied. US-tested according to DLP OFP-222. Approved.	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel No remarks-Ohne Beanstandung-Pas de remarque PMI-test has been performed on every bar/billet with X-ray spectro, without remarks. No weld repair has been performed on the material. Free of known Mercury contamination at time of shipment.
EN ISO 9001:2015 and EN ISO 14001:2015. Certificate no. 5749-3027684-0102. Approved by TÜV NORD Scandinavia AB.	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. Certificate no. 07/203/9140/WP/0689/18 PED 2014/68/EU, approved by TÜV Nord Systems. Certificate no. 07/202/9140/WZ/0689/18	Degerfors Long Products AB Digitally signed by: Jörgen Johansson QA Head
Reg.No.:559332-4907 V.A.T.No.:SE559332490701 Registered office: Degerfors, Sweden	

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/13/2024 9ET

HEAT E231406 ORDER 711288/ 01 BOL 0262339 * CERTIFICATION * 03/13/24

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259477 3/13/24 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 21 Total Weight 34458 Approx. Hot Red. Ratio 138:1

WO 2128960 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U SON= 355066

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

APPROVED BY SARA MALIK 3/13/2024 9ET

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38262	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

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We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

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W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
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Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

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Inspection certificate according to EN10204:2004 3.1

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Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

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Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL.+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2471-23

DEGERFORS LONG PRODUCTS AB
S-693 81 DEGERFORS, SWEDEN
Ref.QA-Dept. Jörgen Johansson

Date-Datum-Date: 2023-11-21
Your order-Ihre Bestellung-Votre commande: 9320286

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d'expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**83104**	**273457**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel	Brand mark	Inspectors stamp	Melting process
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item	Quantity	Dimensions, mm	Cast No.	Lot No.	Test No	Heat treatm.Lot No	Weight Kg	Bloom No
01-03	1	150x150	E231406	145986	145986-1,2		1 608	815-1
01-04	1	150x150	E231406	145987	145987-1,2		1 616	915-1
01-05	1	150x150	E231406	145988	145988-1,2		1 782	803-1
01-06	1	150x150	E231406	145989	145989-1,2		1 820	905-1
01-07	1	150x150	E231406	145990	145990-1,2		1 816	914-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11
Ladle analysis attached

% Ferrite measured with ferritscope on samples from both billet ends. 8 points measured from half radius, in one line, cross the centre area to half radius on the other side of the centre.

	Billet end 1			Billet end 2			
Test No	min	max	average	min	max	average	Pit furnace no.
145986-1,2	0.0	0.13	0.02	0.0	0.26	0.10	2
145987-1,2	0.0	0.23	0.04	0.0	0.32	0.04	2
145988-1,2	0.0	0.20	0.06	0.0	0.10	0.01	2
145989-1,2	0.0	0.10	0.01	0.0	0.12	0.03	2
145990-1,2	0.0	0.11	0.01	0.0	0.10	0.02	2

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
The requirements according to AMS-QQ-S-763D are fulfilled. **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	**No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TÜV NORD Scandinavia AB.**	**No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Degerfors Long Products AB**
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office: Degerfors, Sweden**	**Digitally signed by: Jörgen Johansson** **QA Head**

MATERIAL CERTIFICATION - SPARES
Two Year operational - LINE 2030

Material	Heat No.
STOP RING 316SS	190206T09

(D. Furneaux)
FTR obo CROSSWIND
~~Witness~~ X Review
12th Feb. 2025

Baker Hughes Confidential

硬度检验报告

Hardness Inspection Report

零件号/Part No.	563-002-01	技术要求 Technique require: 根据 NACE MR 0 1 7 5 &MR 0 1 0 3 HBW: ≤237 As per NACE MR0175 &MR 0 10 3 HBW: ≤237
炉号/Heat No	190206T09	
零件名称/Part Name	Ring For Packing Gland Standard Stop Ring	
材料/Material	316L ASTM-A312	技术要求： Technique require: HRC：
加工数量/Qtys	1580 pcs	

检验结果 Inspection result	试样编号 Sample code	实测硬度值（HBW） Test hardness value（HBW）			实测硬度值（HRC） Test hardness value（HRC）		
	1#	140	144	141			
	2#	139	142	144			
	3#	145	140	141			
	4#	142	146	143			

结论：
Conclusion：

合格

检验员：徐秋红 2024 年 05 月 30 日
Inspector： Date：

上海东方精密机械设备有限公司 检验专用章 (3)

表单编号：DL4-094
List code: DL4-094

SD 上海东洛精密机械设备有限公司（SHANGHAI DONGLUO PRECISE MACHINE INDUSTRIAL CO..LTD）

最终检验报告（Final Inspection Report）

7240013-QC-DB-00014

合同号 PO#	5052257983#-10 5052267105#-10 5052279911#-10	零件号 P/N	563-002-01	零件名称 Part Name	垫圈	材料 Material	316L ASTM-A312	
炉号 Heat No.	190206T09	总数量 Lot Qty	生产 1580 PCS 出货 300 PCS	抽样标准 Sampling AQL=1.0 AC=0	抽检数量 Spot-check Qty	42 PCS	检验结果 Inspection Result	OK

序号 Item	图纸尺寸 Size in the draws	检验数据（Dates of Inspection）										判定 Judgment	备注 Remark
		1	2	3	4	5	6	7	8	9	10		
1	¢41.28±0.25	41.37	41.32	41.39	41.28	41.34	41.31	41.30	41.26	41.29	41.34	OK	
2	¢26.97±0.25	27.02	27.05	27.00	26.96	27.01	27.04	26.99	26.95	26.92	26.98	OK	
3	4.57±0.25	4.62	4.55	4.63	4.56	4.61	4.59	4.66	4.59	4.61	4.57	OK	
4	打标:	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	

上海东洛精密机械设备有限公司 检验专用章

生产日期 Manufacturing date:	2024.05.10	检验日期 Inspection date:	2024.05.30	检验员 Inspector:	XU QIU HONG 徐秋红	质量经理 QC Manager:	HU YA JU 胡亚菊
表单编号 Code list:		DL4-047		表单版本号 REV:		2.0	

REV 00

产品质量证明书
CERTIFICA OF QUALITY

签发日期 DATE OF ISSUE 2023.02.16

合同号 Contrac No.		订货单位 purchaser	上海荣协		产品名称 Name of product	不锈钢管
钢号 steel Grade	炉号 Heat No	规格（mm） Size	数量（kg） Qty	件数 piece	交货状态 Condition of Delivery	执行标准 standard
316L	190206T09	45*10	131.5	7	固溶（抛光）	GB/T14976-2012

化学成份（%）Chemicaical Composition

C	Si	Mn	P	S	Cr	Ni	Cu	Mo	Al	Fe	Ti	Nb	Co	备注 Remarks
0.03	0.75	1.54	0.035	0.029	16.5	10.02	/	2.01	/	/	/	/	/	

力学成份（%）Mechanical Property　　物理性能 Physical property

屈服强度 Yield Strength (Mpa)	抗拉强度 Tensile Strength (Mpa)	伸长率 Elongation (%)	断面收缩率 Reduction of Area (%)	冲击值 Impact AKV(J)	硬度 Hardness (HB)	尺寸检验 Dimensin Inspection	表面质量 Surface Quality Inspection	Material Comply with EN 10204 3.1
205	515	40	合格	合格	200	合格	合格	合格

备注 Remarks

1. 本正书涂改（复印）无效：This certificate is invalid:
2. 用户提出质量异议时，请在收到产品一个星期内提供本质量证明书、合同号、钢号、炉号、规格、重量等信息。User propose qualityobjec Tion,please offers us the Contract No、 Designation、HeatNo、size、Weight and other information of this certificate within a month After receiving our probuts。

质量部印章 Seal:　　签发 Signature: 王者沦　　制表 Lister: 陈欣

MATERIAL CERTIFICATION - SPARES
Two Year operational - LINE 2030

Material	Heat No.
FITG,½ðCOMP-¾"NPTFITG,	9ET/9CW

(D. Furneaux)
FTR 060 CROSSWIND
Witness Review
12th Feb. 2025

Baker Hughes Confidential

Swagelok Company
29500 Solon Rd
Solon, OH 44139 U.S.A.

440.349.5600

Inspection Certificate EN 10204-3.1

Distributor	Customer	Customer PO#
FST (Scotland) Ltd Silvertrees Drive Silvertrees Business Park Westhill Aberdeen Aberdeenshire, Scotland AB32 6BH	Baker Hughes EMEA Unlimited Company Baker Hughes EMEA Unlimited Company Sensing House Shannon Free Zone East Sh	5052344039

No.	Part Number	Qty	Prod ID/Batch Num	Mfg Order #	Reference #	Component	Heat Code
1	SS-810-1-0125	100	0005075097	111480	SS-810-1-0125-TF	Body	9ET
					(5201)	Nut	9CW

Swagelok products referenced above are manufactured from material purchased and certified as being in accordance with the specification(s) listed below.

Information contained in the above customer address column (marked as "Customer") and area marked "Reference" (when applicable) of this certification are for reference purposes only. Swagelok Company makes no stipulations, nor takes responsibility, for the accuracy or reliability of such information.

Swagelok products are manufactured under conditions which are free from mercury. No mercury bearing components have been used in the products of your order and no mercury bearing instruments or other equipment have been used in their manufacture, assembly, or testing in such a manner as might cause contamination.

No asbestos or asbestos-containing components are used in Swagelok brand products.

MATERIAL STANDARDS

Components	Material	Standards
Shaped Fittings	F316/F316L Stainless Steel Forgings	ASTM A182, ASME SA182
Straight Fittings	316/316L Stainless Steel Bar	ASTM A479, ASME SA479, ASTM A276 (exception of square and rectangular bar)

Type 316 Stainless Steel Bar material is in the Strain-Hardened Level 2 condition.

Specific chemistry obtained from analysis of product made from this material may vary from the batch values as provided with this certification.

Stainless steel material has passed the Intergranular Corrosion Test requirements of EN ISO 3651-2, Method A, and ASTM A-262 Practice E.

All parts were cleaned and packaged in accordance with Swagelok Specifications.

The Swagelok® products specified above were manufactured in accordance with Swagelok Company's Quality Manual (SQS-F latest revision, Revision O, dated February 7, 2024).

Swagelok Company's Quality System is approved to ISO:9001 (BSI Certificate # FM01729).

Annexes: Material Certificates

REVIEWED
By Martin McMahon at 10:31 am, Jan 11, 2025

Certifications Supervisor
Michael J. Zickes

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231406
Trace ID/Heat Code: 9ET

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104341024	SSD-HB-106250	1-1/16" HEX BAR	34,458

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), revision N, dated February 7, 2024, which satisfies the applicable requirements of NCA-3300 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and ASME NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and the 2015, 2017, 2019 and 2022 Editions. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), revision O, dated February 7, 2024 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 9 May 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 5/8/2024
P.O. No.: 4506182330
W/O No.: CRA002-24-05-00807-1
Date Received: 5/2/2024

MO:	000104341024 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ET
P/N:	SSD-HB-106250
Two (2) 1-1/16" HEX SS 316 Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	
1	9.98	94.6	652	99.9	689	104.6		721		33.5	27.5	73	Mid 50%
2	9.98	94.9	654	100.5	693	105.2		725		34.0	28.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	23	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#**
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	24E-088

	Average Grain Size
Specimen 1	ASTM #3.0 – 4.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	5/8/2024
P.O. No.:	4506182330
W/O No.:	CRA002-24-05-00807-1
Date Received:	5/2/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/27/2024 9ET

HEAT E231406 ORDER 705322/ 01 BOL 0262433 * CERTIFICATION * 03/25/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer
OSB 8

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259478 10/13/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 22 Total Weight 35064 Approx. Hot Red. Ratio 138:1

WO 2128961 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U, 1V SON= 355067

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.

Free from contamination by mercury or mercury compounds when despatched from SMACC.

No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2470-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit Stainless steel, hot rolled billets. Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling. Intended for further hot working and heat treatment. No mechanical tests performed. Not solution annealed.	Our order Unsere Auftrag Notre commande 83104	Advice of delivery Lieferschein Avie d'expedition 273457
Requirements-Prüfgrundlagen-Exigences OSB MS-1014 Rev.3 OSB Grade Codes for Material Procurement. ASTM A276, A479 ASME SA479 AD 2000-Merkblatt W2, W10 EN 10272 SWAGELOK SMS-10001 SWAGELOK SMS-10002 SWAGELOK SQS-00021	Purchaser-Besteller-Acheteur MARCEGAGLIA STAINLESS RICHBURG LLC (AVESB) 3043 CRENSHAW PARKWAY SC 29729 RICHBURG U.S.A	

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance 316LCM Rev.0 Type 316, 316L, UNS S31600, S31603. EN 1.4401, 1.4404 17-10-2L	Brand mark Herstellerzeichen Signe du producteur W	Inspectors stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion EAF AOD-Converter refining CC to bloom size (mm): 462x262

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-01	1	150x150	E231406	145080			1 634	915-2
01-02	1	150x150	E231406	145985			1 652	815-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No. Schmelze Nr. Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais The requirements according to AMS-QQ-S-763D are fulfilled. The order requirements stipulated are satisfied. US-tested according to DLP OFP-222. Approved.	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel No remarks-Ohne Beanstandung-Pas de remarque PMI-test has been performed on every bar/billet with X-ray spectro, without remarks. No weld repair has been performed on the material. Free of known Mercury contamination at time of shipment.
EN ISO 9001:2015 and EN ISO 14001:2015. Certificate no. 5749-3027684-0102. Approved by TÜV NORD Scandinavia AB.	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. Certificate no. 07/203/9140/WP/0689/18 PED 2014/68/EU, approved by TÜV Nord Systems. Certificate no. 07/202/9140/WZ/0689/18	Degerfors Long Products AB Digitally signed by: Jörgen Johansson QA Head
Reg.No.:559332-4907 V.A.T.No.:SE559332490701 Registered office: Degerfors, Sweden	

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/13/2024 9ET

HEAT E231406 ORDER 711288/ 01 BOL 0262339 * CERTIFICATION * 03/13/24

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259477 3/13/24 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 21 Total Weight 34458 Approx. Hot Red. Ratio 138:1

WO 2128960 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U SON= 355066

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

APPROVED BY SARA MALIK 3/13/2024 9ET

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38262	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

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We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465
Page 4 of 4

MARCEGAGLIA

Mill Certificate

9ET

To SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL.+4622345302	Cons. N/A HS Code Customer Order No 9973229 SMACC Order No 283517/1	Cast No. E231406 Code 231011 Campaign 38282 Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Cert Date: 04 October 2023 Melt Date: 11 August 2023 Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2471-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit **Stainless steel, hot rolled billets.** **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	Our order Unsere Auftrag Notre commande **83104**	Advice of delivery Lieferschein Avie d'expedition **273457**

Requirements-Prüfgrundlagen-Exigences **OSB MS-1014 Rev.3** **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	Purchaser-Besteller-Acheteur **MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel **316LCM Rev.0** **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	Brand mark W	Inspectors stamp DJ 10	Melting process **EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item	Quantity	Dimensions, mm	Cast No.	Lot No.	Test No	Heat treatm.Lot No	Weight Kg	Bloom No
01-03	1	150x150	E231406	145986	145986-1,2		1 608	815-1
01-04	1	150x150	E231406	145987	145987-1,2		1 616	915-1
01-05	1	150x150	E231406	145988	145988-1,2		1 782	803-1
01-06	1	150x150	E231406	145989	145989-1,2		1 820	905-1
01-07	1	150x150	E231406	145990	145990-1,2		1 816	914-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11
Ladle analysis attached

% Ferrite measured with ferritscope on samples from both billet ends. 8 points measured from half radius, in one line, cross the centre area to half radius on the other side of the centre.

	Billet end 1			Billet end 2			
Test No	min	max	average	min	max	average	Pit furnace no.
145986-1,2	0.0	0.13	0.02	0.0	0.26	0.10	2
145987-1,2	0.0	0.23	0.04	0.0	0.32	0.04	2
145988-1,2	0.0	0.20	0.06	0.0	0.10	0.01	2
145989-1,2	0.0	0.10	0.01	0.0	0.12	0.03	2
145990-1,2	0.0	0.11	0.01	0.0	0.10	0.02	2

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais **The requirements according to AMS-QQ-S-763D are fulfilled.** **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel **No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.** **No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TÜV NORD Scandinavia AB.**	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Degerfors Long Products AB** Jörgen Johansson
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office: Degerfors, Sweden**	**Digitally signed by: Jörgen Johansson** **QA Head**

APPROVED BY SARA MALIK 05/22/2024 9ET

Swagelok Processing Corporation (Koppel)
7544 Rt. 18 North P.O. Box Q
Koppel, PA 16136

Inspection Certificate EN 10204-3.1

Delivered to: Swagelok

Article: Strain Hardened Level 2 Bar

Material –: X5CrNiMo17-12-2/X2CrNiMo17-12-2
F316/F316L UNS S31600/S31603 (1.4401/1.4404)

Technical Specifications/Requirements:

SMS-10001 Rev. K	AD 2000 W0
ASTM A479/A479M-21	AD 2000 W2
ASME SA-479 2021	AD 2000 W10
ASTM A262 Practice A or E	EN ISO 3651-2
ASTM A370	EN ISO 6892-1
ASTM E8/E8M	EN 10272 - 2016

Mill Heat Number: E231406
Trace ID/Heat Code: 9ET

Testing: Material Verification
Production Comparator
Immersion Ultrasonic Inspection
Visual and Dimensional Inspection

Results: Acceptable

Order No. -	Part No. -	Description	Weight
104340933	SSD-HB-106250	1-1/16" HEX BAR	35,064

Condition: Solution annealed at 1950°F, water quenched, and cold drawn

This manufacturing was performed in accordance with Swagelok Company's Nuclear Quality Assurance Manual (SQS-F-A2), revision N, dated February 7, 2024, which satisfies the applicable requirements of NCA-3300 and NCA-4000 and is the basis for issuance of ASME NPT Certificate N-3101 which expires on June 18, 2026. This Quality Assurance Manual meets the requirements of 10CFR50 Appendix B and ASME NQA-1-1994 Edition, 2008 Edition with 2009 Addenda, and the 2015, 2017, 2019 and 2022 Editions. Applicable rules and regulations of 10CFR21 apply.

This manufacturing was performed in accordance with Swagelok Company's Quality Manual (SQS-F), revision O, dated February 7, 2024 and is also approved to ISO 9001 (BSI Certificate # FM01729). No weld repair was performed.

This certificate is issued under a quality system approved to Pressure Equipment Directive 2014/68/EU Annex I, Paragraph 4.3.

This certificate affirms the contents of this report are correct and accurate, and that all test results and operations performed by Swagelok Processing Corporation (Koppel) or our subcontractors are in compliance with the above specifications.

Annexes:
1) Mechanical and corrosion test results
2) Certificate of Raw Material Supplier

The Works Inspector

Ardie Blackburn

Ardie Blackburn

Stamp Number: SPK4

Date: 9 May 2024

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date: 5/21/2024
P.O. No.: 4506197413
W/O No.: CRA002-24-05-01484-1
Date Received: 5/14/2024

MO:	000104340933 0090
Raw Material or Component:	SSD-AR-126400-H
Heat Code:	9ET
P/N:	SSD-HB-106250
Two (2) 1-1/16" Hex SS 316 Bar Samples, Material: 316/316L, Test per SMS-10001-A, Rev K, SMS-10001, Rev K and SQS-00226, Rev -	

Room Temp Tensile - Round

Test Method	EN 10002-1

Specimen	Initial Dia. (mm)	0.2% Offset Yield Strength (ksi)	0.2% Offset Yield Strength (MPa)	1.0% Offset Yield Strength (ksi)	1.0% Offset Yield Strength (MPa)	Ultimate Tensile Strength (ksi)		Ultimate Tensile Strength (MPa)		Elongation in 4D (%)	Elongation in 5D (%)	Reduction of Area (%)	Fracture Location
		Min	Min	Min	Min	Min	Max	Min	Max	Min	Min	Min	
Requirements	-	**75**	**517**	-	-	**95**	**131**	**655**	**900**	**25**	**20**	**40**	-
1	9.98	95.5	658	101.0	696	105.7		729		33.5	28.0	73	Mid 50%
2	9.98	95.5	659	100.8	695	105.5		727		32.0	26.5	73	Mid 50%

Hardness Testing - Rockwell

Test Method	ASTM E 18
Location	1/3 the distance from surface to center

Specimen	Hardness Value	Hardness Scale
1	26	HRC

GRAIN SIZE PER ASTM E112, ASTM E3, ASTM E407

Direction	Transverse	**Location**	1/3 the distance from surface to center	**Plate**	II	**Mount#**
Method	Comparison	**Etchant**	10% Ammonium Persulfate	**Magnification**	100x	24E-271

	Average Grain Size
Specimen 1	ASTM #5.0 – 6.0
Requirement	ASTM #3.0 – 7.0

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara

Digitally Signed by Britney Bahara
Quality Administrator

Element Materials Technology
5405 E Schaaf Road
Cleveland, OH
44131-1337 USA

P 216 524 1450
F 216 524 1459
T 888 786 7555
info.cleveland@element.com
element.com

TEST REPORT — EAR-CONTROLLED DATA

Swagelok Co.
31400 Aurora Rd.
SOLON, OH 44139

Date:	5/21/2024
P.O. No.:	4506197413
W/O No.:	CRA002-24-05-01484-1
Date Received:	5/14/2024

INTERGRANULAR CORROSION TEST PER EN ISO 3651-2, METHOD A
Prior to testing, the samples were heat treated as shown below:

Cycle	Atmosphere	Temperature, °C	Time at Temperature	Quench
1	Air	700±10	30 minutes	Water

The test coupon was immersed in a boiling solution of copper-copper sulfate/16% sulfuric acid for 20 hours. Subsequent bending did not cause cracking of the sample. The sample is acceptable per EN ISO 3651-2.

CONFORMANCE
These tests meet the requirements of SMS-10001, Rev. K.

10CFR21 and 10CFR50 Appendix B apply to this order.

Unless otherwise specified, measurement uncertainty was not taken into consideration when making statements of conformity to specifications.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

The above testing was performed in accordance with the latest revision of the applicable commercial, military and/or International test method unless otherwise noted. The above services were performed in accordance with Element Materials Technology Cleveland's Quality Manual, Edition 1, Revision 6, dated April 12, 2023, as approved by Swagelok. Information and statements in this report are derived from material, information and/or specifications furnished by the client and exclude any expressed or implied warranties as to the fitness of the material tested or analyzed for any particular purpose or use. This laboratory does not perform sampling as sampling is done by the customer. The results of all tests reported apply only to the sample material(s) received and tested. This report is the confidential property of our client and may not be used for advertising purposes. This report shall not be reproduced except in full, without written approval of this laboratory. The recording of false, fictitious or fraudulent statements or entries on this document may be punished as a felony under Federal Statutes. Sample remnants are held for a minimum of 6 months following issuance of test results, at which point they will be discarded unless notified in writing by the client. This material was not contaminated by mercury or chlorinated solvents during the handling and processing at Element Materials Technology Cleveland.

Britney Bahara
Digitally Signed by Britney Bahara
Quality Administrator

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/27/2024 9ET

HEAT E231406 ORDER 705322/ 01 BOL 0262433 * CERTIFICATION * 03/25/24

TUV approved Works Inspector, digitally signed
Joseph Butler
Quality Engineer
OSB 8

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259478 10/13/22 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 22 Total Weight 35064 Approx. Hot Red. Ratio 138:1

WO 2128961 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U, 1V SON= 355067

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a
ASTM A751 21
EN 10272 Grade 1.4401
10-CFR-21
Swagelok SQS-00012 Rev AK
Produced according to -
ASME B&PV Code Section III
Subsection NCA3800
MSR QPM-101 R14, 1/11/23
Approved by Swagelok Company
ASME SA-479/479M 2023 Ed
Bars are 100% UT inspected

ASTM A484/A484M 23a
DIN 50049/EN 10204 Type 3.1
EN ISO 3651-2 Method A
10CFR50-Appendix B
Swagelok SQS-00020 Rev N
Swagelok SQS-00021 Rev Q
1.4401/1.4404, 316/316L
Exception to SQS-00171 Rev F
Swagelok SMS-00833 Rev D
Swagelok SQC-03992 init. rel
ASTM E1001

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			

De-long Ferrite

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

M.F. Marcanio

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.

Free from contamination by mercury or mercury compounds when despatched from SMACC.

No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN	N/A	Code 231011	
KYRKVÄGEN	HS Code 721891	Campaign 38282	Melt Date: 11 August 2023
737 25 FAGERSTA, SWEDEN	Customer Order No 9973229	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK
E MAIL R.LINDFORS@OUTOKUMPU.COM	SMACC Order No 283517/1		
TEL +4622345302			

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL:+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2470-23

DEGERFORS LONG PRODUCTS AB S-693 81 DEGERFORS, SWEDEN Ref.QA-Dept. Jörgen Johansson	Date-Datum-Date 2023-11-21	Your order-Ihre Bestellung-Votre commande 9320286

Product-Erzeugnisform-Produit Stainless steel, hot rolled billets. Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling. Intended for further hot working and heat treatment. No mechanical tests performed. Not solution annealed.	Our order Unsere Auftrag Notre commande 83104	Advice of delivery Lieferschein Avie d'expedition 273457
Requirements-Prüfgrundlagen-Exigences OSB MS-1014 Rev.3 OSB Grade Codes for Material Procurement. ASTM A276, A479 ASME SA479 AD 2000-Merkblatt W2, W10 EN 10272 SWAGELOK SMS-10001 SWAGELOK SMS-10002 SWAGELOK SQS-00021	Purchaser-Besteller-Acheteur MARCEGAGLIA STAINLESS RICHBURG LLC (AVESB) 3043 CRENSHAW PARKWAY SC 29729 RICHBURG U.S.A	

Marking-Kennzeichnung-Marquage :

Type of steel Werkstoff Nr. Nuance 316LCM Rev.0 Type 316, 316L, UNS S31600, S31603. EN 1.4401, 1.4404 17-10-2L	Brand mark Herstellerzeichen Signe du producteur W	Inspectors' stamp Abnahmestempel Poincon de l'expert DJ 10	Melting process Erschmelzungsart Procède de fusion EAF AOD-Converter refining CC to bloom size (mm): 462x262

Extent of delivery-Lieferumfang-Etendue de livrasion

Item Pos. Pos.	Quantity Anzahl Nombre	Dimensions, mm Abmessungen, mm Dimensions, mm	Cast No. Schmelze Nr. Coulée n.	Lot No. Los Nr. Lot no.	Test No Probe Nr Eprouvette no	Heat treatm.Lot No Wärmebeh.Los Nr Traitem.Lot no	Weight Kg Gewicht Kg Poid Kg	Bloom No
01-01	1	150x150	E231406	145080			1 634	915-2
01-02	1	150x150	E231406	145985			1 652	815-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11

Note. Ladle analysis attached.

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais The requirements according to AMS-QQ-S-763D are fulfilled. The order requirements stipulated are satisfied. US-tested according to DLP OFP-222. Approved.	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel No remarks-Ohne Beanstandung-Pas de remarque PMI-test has been performed on every bar/billet with X-ray spectro, without remarks. No weld repair has been performed on the material. Free of known Mercury contamination at time of shipment.
EN ISO 9001:2015 and EN ISO 14001:2015. Certificate no. 5749-3027684-0102. Approved by TÜV NORD Scandinavia AB.	
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. Certificate no. 07/203/9140/WP/0689/18 PED 2014/68/EU, approved by TÜV Nord Systems. Certificate no. 07/202/9140/WZ/0689/18	Degerfors Long Products AB Digitally signed by: Jörgen Johansson QA Head
Reg.No.:559332-4907 V.A.T.No.:SE559332490701 Registered office: Degerfors, Sweden	

MARCEGAGLIA Certificate of Test

APPROVED BY SARA MALIK 3/13/2024 9ET

HEAT E231406 ORDER 711288/ 01 BOL 0262339 * CERTIFICATION * 03/13/24

SHIP TO:
SWAGELOK NON VMI (INVOICE)
7544 ROUTE 18 NORTH

KOPPEL 161360000

---------- YOUR ORDER & DATE ----------
4505259477 3/13/24 CUST# 1910000 CUST TAG#SSD-AR-126400-H

---------- ITEM DESCRIPTION ----------
GRADE 316LCM Ship Condition CONDA
Size316LCM RND CFA CONDA 1.2640 x 232.000-238.000
Country of Melt: UNITED KINGDOM Country of Mfg.:

Total Bundles 21 Total Weight 34458 Approx. Hot Red. Ratio 138:1

WO 2128960 Bundles: 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N, 1O, 1P, 1Q, 1R, 1S, 1T, 1U SON= 355066

---------- SPECIFICATIONS ----------

ASTM A479/A479M-23a	ASTM A484/A484M 23a
ASTM A751 21	DIN 50049/EN 10204 Type 3.1
EN 10272 Grade 1.4401	EN ISO 3651-2 Method A
10-CFR-21	10CFR50-Appendix B
Swagelok SQS-00012 Rev AK	Swagelok SQS-00020 Rev N
Produced according to -	Swagelok SQS-00021 Rev Q
ASME B&PV Code Section III	1.4401/1.4404, 316/316L
Subsection NCA3800	Exception to SQS-00171 Rev F
MSR QPM-101 R14, 1/11/23	Swagelok SMS-00833 Rev D
Approved by Swagelok Company	Swagelok SQC-03992 init. rel
ASME SA-479/479M 2023 Ed	ASTM E1001
Bars are 100% UT inspected	

---------- MECHANICAL & OTHER TESTS ----------

		Tensile strength,KSI (MPa)	.0 (0)
Micro	OK	0.2% Yield Strngth,KSI(MPa)	.0 (0)
Intergranular corrosion			
		Elongation % in 4D	.0
		Reduction of area %	.0

---------- CHEMICAL COMPOSITION ----------

Carbon	(C)	.025	Manganese	(Mn)	1.600
Phosphorus	(P)	.034	Sulphur	(S)	.025
Silicon	(Si)	.610	Chromium	(Cr)	17.210
Nickel	(Ni)	12.150	Cobalt	(Co)	.371
Copper	(Cu)	.500	Moly	(Mo)	2.050
Nitrogen	(N)	.045	Columbium	(Cb)	.020
Titanium	(Ti)	.005	Aluminum	(Al)	.004
Tin	(Sn)	.013	Cerium	(Ce)	.017
Boron	(B)	.001	Tantalum	(Ta)	.001
Vanadium	(V)	.080	Tungsten	(W)	.142
Columbium/ Tantalum	(Cb+Ta)	.021			
Iron	(Fe)	Balance			
Melt Practice		EAF			
Refining Practice		AOD			
De-long Ferrite					

Knowingly & willfully falsifying or concealing a material act on this form, or making false, fictitious or fraudulent statements or representations herein could constitute a felony punishable under federal statutes. We hereby certify that the test results shown in this report are correct and accurate as contained in the records of the company and are in compliance with the specifications, codes, and standards listed above.

Digitally Signed by M.F. Marcanio, Quality Manager

ATI Materials, Richburg Rolling Mill Certificate of Compliance for Marcegaglia Stainless Richburg for Nuclear Quality Orders

Address: 4374 Lancaster Hwy
Richburg, SC 29729

The following orders were processed in accordance with purchase order requirements and under a Quality System in compliance with NCA 3800, 10CFR21 and 10CFR50 Appendix B in accordance with ATI Materials Quality Manual IBMS-001 Dated 11/16/2022 as audited approved by Swagelok. We certify that the content of this report is accurate and correct and that the identity and traceability of the material has been maintained. No weld repair has been performed.

Processing Performed.

__*__ Rolling billet to Coil

____ Rotary Heat Treatment @ °F minutes/slot, water quench.

____ Batch Heat Treatment @ F / minutes, water quench.

____ Shot blast and pickle

PO#	Lot (SON	Heat No.	Size	# Bundles	Ship Weight
2128956	355065	E230889	1.312"	11	42,230#
2128960	355066	E231406	1.312"	11	43,811#
2128961	355067	E231406	1.312"	11	42,484#
2128954	355068	E230889	1.312"	11	42,428#
2128955	355069	E230889	1.312"	11	42,876#

By **George Gunter** Date **3/4/2024**

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38262	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

Chemical composition wt%

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	52		BLOOM	462*260*2270	107660

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

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We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

APPROVED BY SARA MALIK 3/13/2024 9ET

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

MARCEGAGLIA

9ET

Mill Certificate

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL +4622345302	N/A HS Code 721891	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

Chemical composition wt% CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

Cast No	No of Items	No of Pack	Product	Dimensions (mm)	Weight (kg)
E231406	2		BLOOM	462*260*2250	4180

Certification Text:

Inspection certificate according to EN10204:2004 3.1

Melting Process: EAF melting, AOD refining.
Free from contamination by mercury or mercury compounds when despatched from SMACC.
No weld repairs.

Certified Material Test Report.

The contents of the report are correct and accurate. All test results and operations performed by Marcegaglia Stainless Sheffield Ltd or its Subcontractors are in compliance with the ordered material specification.

Specification ASME SA-479 (*).

(*) Chemical analysis only. Latest edition unless ordered otherwise.

Material processed and certified in accordance with SMACC Quality Programme Manual rev 5 date 28/8/16 .

Material meets Type 316/316L UNS S31600/S31603 (*), EN 10272:2000 1.4401/1.4404 (*) and AD2000 Merkblatt W 0 / TRD 100 / Directive PED 2014/68/EU

Digitally signed by Dave Brooks, Technical Manager, SMACC

Marcegaglia Stainless Sheffield Ltd. Address
SMACC Meltshop
Europa Link
Sheffield
S9 1TZ

Telephone
+44 (114) 261 6000

Ref: 202303465
Page 4 of 4

MARCEGAGLIA

Mill Certificate

9ET

To	Cons.	Cast No. E231406	Cert Date: 04 October 2023
SÖDRA PORTEN KYRKVÄGEN 737 25 FAGERSTA, SWEDEN E MAIL R.LINDFORS@OUTOKUMPU.COM TEL.+4622345302	N/A HS Code	Code 231011 Campaign 38282	Melt Date: 11 August 2023
	Customer Order No 9973229 SMACC Order No 283517/1	Specification DEGSTA 231011-F 17-10-2L - Chemical Analysis Only	Ordered Supply Condition FULLY BLACK

CONTINUOUSLY CAST STAINLESS BLOOMS

C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Sn	Nb
0.025	0.61	1.60	0.034	0.025	17.21	2.05	12.15	0.004	0.50	0.013	0.02
W	**V**	**Co**	**Ti**	**As**	**B**	**N**	**Pb**	**Ca**	**Ta**	**O**	
0.142	0.08	0.371	0.005	0.005	0.0010	0.045	0.0002	0.0020	0.001		

We certify that the above material has been tested in accordance with the order specification and that the results comply with the order and specification (note that where more than one specification is involved, only the mechanical properties and cast chemical composition are certified to the requirements of each individual specification).

This material has been manufactured in accordance with a Quality system approved to ISO 9001:2015 by TUV UK Ltd, certificate number GB01471, and in accordance with the SMACC Integrated Management System manual SPO-1748-v.2.0 published 28/02/2023

Country of Origin - United Kingdom
Country of Melting/Pouring - United Kingdom

Signed for **Marcegaglia Stainless Sheffield Ltd.**

D Brooks

D. Brooks. Technical Manager SMACC.

COGNE
Degerfors Long Products

INSPECTION CERTIFICATE
EN 10204/3.1

No. LP 2471-23

DEGERFORS LONG PRODUCTS AB
S-693 81 DEGERFORS, SWEDEN
Ref.QA-Dept. Jörgen Johansson

Date-Datum-Date: 2023-11-21
Your order-Ihre Bestellung-Votre commande: 9320286

Product-Erzeugnisform-Produit	Our order Unsere Auftrag Notre commande	Advice of delivery Lieferschein Avie d'expedition
Stainless steel, hot rolled billets. **Soaked at 2228°F (1220°C)/≥10h and heated at 2282°F (1250°C) before rolling.** **Intended for further hot working and heat treatment.** **No mechanical tests performed.** **Not solution annealed.**	**83104**	**273457**

Requirements-Prüfgrundlagen-Exigences	Purchaser-Besteller-Acheteur
OSB MS-1014 Rev.3 **OSB Grade Codes for Material Procurement.** **ASTM A276, A479** **ASME SA479** **AD 2000-Merkblatt W2, W10** **EN 10272** **SWAGELOK SMS-10001** **SWAGELOK SMS-10002** **SWAGELOK SQS-00021**	**MARCEGAGLIA STAINLESS RICHBURG LLC** **(AVESB)** **3043 CRENSHAW PARKWAY** **SC 29729 RICHBURG** **U.S.A**

Marking-Kennzeichnung-Marquage :

Type of steel	Brand mark	Inspectors stamp	Melting process
316LCM Rev.0 **Type 316, 316L, UNS S31600, S31603.** **EN 1.4401, 1.4404** **17-10-2L**	W	DJ 10	**EAF** **AOD-Converter refining** **CC to bloom size (mm):** **462x262**

Extent of delivery-Lieferumfang-Etendue de livrasion

Item	Quantity	Dimensions, mm	Cast No.	Lot No.	Test No	Heat treatm.Lot No	Weight Kg	Bloom No
01-03	1	150x150	E231406	145986	145986-1,2		1 608	815-1
01-04	1	150x150	E231406	145987	145987-1,2		1 616	915-1
01-05	1	150x150	E231406	145988	145988-1,2		1 782	803-1
01-06	1	150x150	E231406	145989	145989-1,2		1 820	905-1
01-07	1	150x150	E231406	145990	145990-1,2		1 816	914-2

Chemical composition-Chemische Zusammensetzung-Composition Chimique (Weight %)

Cast No.
Schmelze Nr.

Coulee no	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Co	N
E231406	0.025	0.61	1.60	0.034	0.025	17.21	12.15	2.05	0.503	0.37	0.045

Manufacture date: 2023-08-11
Ladle analysis attached

% Ferrite measured with ferritscope on samples from both billet ends. 8 points measured from half radius, in one line, cross the centre area to half radius on the other side of the centre.

	Billet end 1			Billet end 2			
Test No	min	max	average	min	max	average	Pit furnace no.
145986-1,2	0.0	0.13	0.02	0.0	0.26	0.10	2
145987-1,2	0.0	0.23	0.04	0.0	0.32	0.04	2
145988-1,2	0.0	0.20	0.06	0.0	0.10	0.01	2
145989-1,2	0.0	0.10	0.01	0.0	0.12	0.03	2
145990-1,2	0.0	0.11	0.01	0.0	0.10	0.02	2

Certified according to the Nuclear Regulatory Commission Rules and Regulations 10CFR21 and 10CFR50 Appendix B.
ASME Boiler and Pressure Code Part III Section NCA 3800.
Material produced in accordance with Degerfors Stainless Quality Manual KHB-E/S Edition 1, Rev.3, approved by SWAGELOK COMPANY, January 23, 2017.
The requirements stipulated in Spec. SMS-10001 and SMS-10002 are fulfilled.

Other tests-Sonstige Prüfungen-Autres essais	Inspection and gauge measurement-Ausmessung und Besichtigung-Contrôle visuel et dimensionel
The requirements according to AMS-QQ-S-763D are fulfilled. **The order requirements stipulated are satisfied.** **US-tested according to DLP OFP-201. Approved.**	**No remarks-Ohne Beanstandung-Pas de remarque** **PMI-test has been performed on every bar/billet with X-ray spectro, without remarks.**
EN ISO 9001:2015 and EN ISO 14001:2015. **Certificate no. 5749-3027684-0102.** **Approved by TÜV NORD Scandinavia AB.**	**No weld repair has been performed on the material.** **Free of known Mercury contamination at time of shipment.**
AD 2000-Merkblatt W0, approved by TÜV Nord Systems. **Certificate no. 07/203/9140/WP/0689/18** **PED 2014/68/EU, approved by TÜV Nord Systems.** **Certificate no. 07/202/9140/WZ/0689/18**	**Degerfors Long Products AB**
Reg.No.:559332-4907 **V.A.T.No.:SE559332490701** **Registered office: Degerfors, Sweden**	**Digitally signed by: Jörgen Johansson** **QA Head**

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001311935

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

- THE RECORDING OF FALSE, FICTICIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHED AS A FELONY UNDER FEDERAL STATUTES INCLUDING FEDERAL LAW, TITLE 18, CHAPTER 47.
- THE VALUES AND OTHER TECHNICAL DATA REPRESENT THE RESULTS OF ANALYSES AND TESTS MADE ON SAMPLES COLLECTED FROM THE TOTAL LOT. ORIGINAL DATA RECORDS CAN BE TRACED BY REFERENCE TO THE CARPENTER ORDER NUMBER.
- MATERIAL IS MANUFACTURED FREE FROM MERCURY, RADIUM, ALPHA AND GAMMA SOURCE CONTAMINATION.
- THIS DOCUMENT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN CONSENT OF CARPENTER TECHNOLOGY CORPORATION.

22 SEP 23

CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 1 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

PRUFGRUNDLAGEN/ANFORDERUNGEN - TECHNIQUES/EXIGENCES
PRODUCT DESCRIPTION: CARPENTER STAINLESS TYPE 316/316L STRAIN HARDENED COLD DRAWN
PART NUMBER: SSD-HB-087500

SPECIFICATION: SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQC-00196 REV J (03/21/22)
SWAGELOK COMPANY SQC-03998 REV A (01/26/18)
SWAGELOK COMPANY SQS-00226 REV (08/23/17)
SWAGELOK COMPANY SQS-00012 REV AI (06/08/22)
SWAGELOK COMPANY SQS-00115 REV C (09/06/16)
SWAGELOK COMPANY SQS-00020 REV M (08/25/21)
SWAGELOK COMPANY SQS-00021 REV. P (12/21/21)
SWAGELOK COMPANY SMS-10001 1.4401/1.4404 REV. I (07/28/22)
ASTM-A262-15 PRACTICE E (REAPPROVED 2021)
ASTM A276/A276M-17 CONDITION S
ASTM-A479/A479M-21 SH LEVEL 2 (11/01/21) STRAIN HARDENED LEVEL 2
ASTM A484/A484M-22 (09/01/22)
ASTM-A751-21 (11/01/21)
DIN EN 10204 TYPE 3.1 (01/01/05) TYPE 3.1
ASME-SA484/SA-484M SA484 TABLE 8 2019 EDITION
ASTM-E18-22 (05/01/22)
ASTM A370-21 (11/01/21)
ISO 3651-2 2ND EDITION (05/15/98)
ASME SA-479/SA-479M LEVEL 2 316 2019 EDITION STRAIN HARDENED LEVEL 2
AD-2000 MERKBLT W2 1.4401 01.2020 EDITION
ASTM-E112-13 (REAPPROVED 2021)
AD 2000 MERKBLATT W0 (07/01/06)
EN 10002 PART 1 (03/ /90)
EN 10204 3.1 (10/01/04) TYPE 3.1
EN 10045 PART 1 (03/01/90) EXCPT LTR (11/09/15) PENDING
AD-2000 MERKBLT W10 1.4401 CHEM ONLY 01.2020 EDITION MATERIAL NO. 1.4401/1.4404
SWAGELOK COMPANY SVS-00012 (02/23/01)
BS EN 10272:2016 1.4401 MECH PROPS PER SMS-10001
ASTM-E1001-21 (11/01/21)

SIZE 0.875000 IN.(22.23 MM) HEX BAR

CHEMISTRY IN PERCENT/SCHMELZENANALYSE (TEST METHOD IS SHOWN IN PARENTHESIS)

C (COM)	MN(XRF)	SI(XRF)	P (XRF)	S (COM)	CR(XRF)
0.021	1.14	0.50	0.034	0.026	17.60

NI(XRF)	MO(XRF)	CU(XRF)	CO(XRF)	N (FUS)
12.12	2.04	0.37	0.45	0.02

MELT DATE: 07/18/23

CONTINUED ON NEXT PAGE

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Ce certificat est uniquement valable pour le client dont le nom est imprimé sur ce formulaire. Carpenter n'assume pa[illegible] de responsabilité pour une certification vis-à-vis d'une tierce personne.

FORM E2-366

REVIEWED
By Martin McMahon at 10:32 am, Jan 11, 2025

CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001311935

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

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- MATERIAL IS MANUFACTURED FREE FROM MERCURY, RADIUM, ALPHA AND GAMMA SOURCE CONTAMINATION.
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22 SEP 23

CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 2 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1.
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
CARPENTER TECHNOLOGY CORPORATION, HOLDS A CERTIFICATE ISSUED BY TÜV RHEINLAND INDUSTRIE SERVICE GMBH, NO. 01 202 USA/Q-03 8928, IN ACCORDANCE WITH PED 2014/68/EU ANNEX I PARA. 4.3 + AD 2000 W0
MATERIAL VISUAL AND DIMENSIONAL INSPECTED - ACCEPTABLE.
THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL REVISION 38, DATED 08/21/2022 "AS ACCEPTED BY SWAGELOK COMPANY" IN COMPLIANCE WITH ASME B & P V CODE SECTION III, DIVISION 1 SUBSECTION NCA 3800 2017 EDITION.
THE REQUIREMENTS OF EN ISO 3651-2 METHOD A AND ASTM A262 PRACTICE E HAVE BEEN SATISFIED
100% COMPARATOR TESTED TO DETECT/SORTOUT HIGH IRON/LOW ALLOY INCLUSIONS.
ULTRASONIC INSPECTED (IMMERSION) PER CTC PROCEDURE - ACCEPTABLE.
CAPABLE OF MEETING A MAXIMUM AVERAGE FERRITE VALUE OF 1.5%, WITH NO SINGLE READING OVER 2.0%
EDDY CURRENT TESTED AND APPROVED AT FINISH
IT IS HEREBY CERTIFIED THAT THE SPECIALTY METALS SUPPLIED HEREUNDER HAVE BEEN PRODUCED IN THE UNITED STATES.
NO WELD REPAIR.
THIS MATERIAL HAS BEEN SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND MEETS ALL SPECIFICATION REQUIREMENTS.
INSPECTION CERTIFICATE 3.1 IN ACCORDANCE WITH EN 10204 AND DIN 50049
INSPECTION CERTIFICATE EN 10204 (DIN 50049) 3.1
ALLOY IDENTIFICATION HAS BEEN VERIFIED.
PROVISIONS OF 10 CFR PART 21 & 10 CFR PART 50 - APPENDIX B APPLY.
IN PRODUCTION OR TESTING OF MATERIAL SHIPPED AGAINST THIS ORDER, NO DIRECT CONNECTED MERCURY MANOMETER, MERCURY PUMPS, MERCURY SEALS, OR MERCURY IN GLASS THERMOMETERS HAVE BEEN USED. NOR IN SUCH PRODUCTION OR TESTING HAS MERCURY BEEN HANDLED IN THE IMMEDIATE VICINITY OF SUCH MATERIAL.
THIS CERTIFICATE AFFIRMS THAT THE CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND THAT ALL TEST RESULTS AND OPERATIONS PERFORMED BY US, OR OUR SUBCONTRACTORS, ARE IN COMPLIANCE WITH THE ORDER REQUIREMENTS AS MAY HAVE BEEN MODIFIED BY PRIOR CORRESPONDENCE BETWEEN THE PARTIES.
THIS MATERIAL WAS MANUFACTURED FREE FROM MERCURY, RADIUM AND ALPHA SOURCE CONTAMINATION.
ALL TESTS AND INSPECTIONS PERFORMED VERIFY CONFORMANCE TO SPECIFICATION REQUIREMENTS AND THE MATERIAL COMPLIES WITH ALL REQUIREMENTS OF THE PURCHASE ORDER.
INTERGRANULAR CORROSION TESTED PER ISO 3651
MATERIAL IS COMPLIANT TO REACH; THE E.U.'S REGISTRATION, EVALUATION, AUTHORIZATION, AND REGISTRATION OF CHEMICALS LEGISLATION.
MATERIAL IS COMPLIANT TO 2015/863/EU (ROHS3) DIRECTIVE.
THIS HEAT MELTED BY THE ELECTRIC ARC/AOD PROCESSES
MELT DATE OF HEAT: 07/18/23
MILL HEAT TREATMENT:
TYPE SOLUTION ANNEAL
TEMP 1951F (1066C)
TIME AT TEMP CONTINUOUS FURNACE
QUENCH WATER

CONTINUED ON NEXT PAGE

FORM E2-366

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CERTIFICATE OF TESTS **ABNAHMEPRUEFZEUGNIS** **CERTIFICAT DE CONTROLE**

Certification ID:001311935

CARPENTER
Carpenter Technology Corporation
101 West Bern Street, Reading, Pa. 19601
Tel: (610) 208-2000 (800) 338-4592

- THE RECORDING OF FALSE, FICTICIOUS OR FRAUDULENT STATEMENTS OR ENTRIES ON THIS DOCUMENT MAY BE PUNISHED AS A FELONY UNDER FEDERAL STATUTES INCLUDING FEDERAL LAW, TITLE 18, CHAPTER 47.
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22 SEP 23

CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 3 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

HARDNESS AS SHIPPED, HRC - 20

***-->TESTED AT READING**

(T)RANSVERSE (L)ONGITUDINAL	L	L
YIELD STRENGTH, (0.20 %) KSI(MPA)	85.5(590)	86.5(596)
YIELD STRENGTH, (1.00 %) KSI(MPA)	96.5(665)	97.0(669)
TENSILE STRENGTH, KSI(MPA)	102.0(703)	102.0(703)
ELONGATION IN 2.00", %	37.0	37.0
ELONGATION IN 2.50", %	32.0	32.0
REDUCTION OF AREA, %	74.0	75.0

***-->TESTED AT READING**

GRAIN SIZE PER ASTM E112: 4 (KALLINGS NO.2)
***-->TESTED AT READING**

MATERIAL HAS BEEN SOLUTION ANNEALED AND WATER QUENCHED, SURFACE CONDITION PER EN 10272, TABLE 6, SYMBOL (2H).

ORDER LENGTH REQUIREMENT: 144"

INTERGRANULAR CORROSION TEMP (F): 1292 HR: 0 MN: 30 QUENCH: WATER
***-->TESTED AT READING**

FORM E2-366

CONTINUED ON NEXT PAGE

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 4 OF 5**

SWAGELOK COMPANY
P.O.BOX 0629
MEDINA ,OH 44258

RDG

CUSTOMER ORDER NO./BESTELL-NR./N° DE COMMANDE	CARPENTER NO./WERKS-NR./N° DE REFERENCE INTERNE	DATE/DATUM/DATE	WEIGHT/GEWICHT/POIDS
4505207307	W51462		29165

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

ADDRESS OF TESTING LOCATIONS:
READING - 101 WEST BERN ST, READING, PA 19601

MATERIAL HAS BEEN MELTED AND MANUFACTURED IN THE USA WHICH IS A QUALIFYING COUNTRY TO DFARS REQUIREMENTS 252.225-7014 WITH ALTERNATE 1 FOR QUALIFYING COUNTRY 225.872.1, SUPERSEDED BY DFARS REQUIREMENTS DFARS 252.225-7008 AND 252.225-7009.

UNLESS OTHERWISE STATED, THE TEST WERE PERFORMED TO THE LATEST REVISION OF THE STANDARDS LISTED BELOW: 1) BEND TEST - ASTM E290, 2) CHARPY IMPACT - ASTM E23, 3)COEFFICIENT OF LINEAR THERMAL EXPANSION - ASTM E228, 4)FRACTURE TOUGHNESS - ASTM E399, 5) BRINELL HARDNESS - ASTM E10, 6)ROCKWELL HARDNESS-ASTM E18, 7)MICRO VICKERS HARDNESS-ASTM E92, 8)KNOOP HARDNESS-ASTM E92, 9)MACRO VICKERS HARDNESS-ASTM E92, 10)STRESS RUPTURE/CREEP RUPTURE-ASTM E139, 11)STRESS RUPTURE(COMBINATION)-ASTM E292, 12)ROOM TEMPERATURE TENSILE-ASTM E8, 13)ELEVATED ROOM TEMPERATURE TENSILE-ASTM E21, 14)DECARBURIZATION-ASTM E1077 15)DELTA FERRITE AMS 2315, 16)GRAIN SIZE-ASTM E112, 17)INCLUSION CONTENT/MICROCLEANLINESS-ASTM E45, 18) INTERGRANULAR ATTACH - ASTM A262, 19)INTERGRANULAR CORROSION-ASTM A262, 20)MACRO ETCH&TESTING - ASTM A604/E381, 21)PITTING CORROSION - ASTM A923, 22)CREVICE CORROSION-ASTM G48, 23) HARDNESS CONVERSIONS - ASTM E140, 24)XRF-ASTM E572/E1085/E2465, 25) OES - ASTM E415/E1086, 26)COM - ASTM E1019, 27)FUS - ASTM E1019, 28)MS - CARPENTER METHODS 206.8500/206.8530 29)CHEMISTRY RESULTS ARE ROUNDED IN ACCORDANCE WITH ASTM A751 WHICH CONFORMS TO ASTM E29 WITH ONE SPECIAL EXCEPTION THIS ORDER WAS MANUFACTURED IN ACCORDANCE WITH CARPENTER SPECIALTY ALLOYS OPERATIONS QUALITY PROGRAM MANUAL, REVISION 38 DATED 08/21/2022.

CARPENTER'S QUALITY MANAGEMENT SYSTEM IS REGISTERED TO ISO 9001, AS9100, AND AS9120. THIS CERTIFICATION OF TEST IS TYPE 3.1 PREPARED IN ACCORDANCE WITH EN 10204 (DIN 50049). WE HEREBY CERTIFY THAT THE ABOVE TEST DATA ARE IN ACCORDANCE WITH THE PURCHASE ORDER AND SPECIFICATION REQUIREMENTS, AS DOCUMENTED IN THIS CERTIFICATE OF TESTS.

TEST METHODS ARE PER THE ASTM STANDARDS ON FILE AND IN EFFECT AT TIME OF ORDER ACCEPTANCE, STANDARD PRACTICES, OR AS AGREED UPON BETWEEN CARPENTER & CUSTOMER.

THE ABSENCE OF A REPORTED TEST TEMPERATURE INDICATES THAT THE TEST WAS COMPLETED AT ROOM TEMPERATURE.

FORM E2-366

CONTINUED ON NEXT PAGE

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CUSTOMER / BESTELLER / CLIENT

SELLER / VERKÄUFER / VENDEUR **PAGE 5 OF 5**

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4505207307	**W51462**		**29165**

HEAT NUMBER / SCHMELZE-NR. / N° DE COULEE : **760675**

DECISION RULE: UNLESS OTHERWISE SPECIFIED IN A CUSTOMER/INDUSTRY SPECIFICATION, CARPENTER TECHNOLOGY CORPORATION WILL DETERMINE ACCEPTABILITY OF ANY TEST RESULT BY COMPARISON OF THE RESULT WITH THE SPECIFICATION LIMITS, WITHOUT ANY ADDITIONAL CONSIDERATION OF THE MEASUREMENT UNCERTAINTY. WHEN REQUESTED, CARPENTER TECHNOLOGY CORPORATION WILL PROVIDE UNCERTAINTY BUDGETS FOR ANY TEST RESULT THAT IS NOT ADDRESSED BY THE INDUSTRY STANDARD.

AMANDA EVANS /WI 27993 DIGITALLY SIGNED BY JASON M RAYMOND
ADMINISTRATOR - QUALITY
THE WORKS INSPECTOR CARPENTER TECHNOLOGY CORPORATION
MATERIAL IDENTIFIED VIA CARPENTER W51462/HEAT 760675/LOT 01



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SECTION 2.10

CERTIFICATE OF CONFORMANCE

BakerHughes EMEA

Sensing House, Shannon Free Zone East,
Shannon, Co Clare, Ireland, V14 V992

T +353 61 470200

CERTIFICATE OF CONFORMANCE to EN 10204.2.1

Customer : ROSETTI MARINO SPA	
Purchase Order: 1724001317 123A90A	
Internal Order: 1706864	

BAKERHUGHES EMEA – SHANNON HEREBY CERTIFY THAT THE MATERIAL SUPPLIED ON THE ABOVE REFERENCED ORDER HAS BEEN MANUFACTURED, TESTED AND INSPECTED. ALL ITEMS ARE IN COMPLIANCE WITH THE REQUIREMENTS OF ALL APPLICABLE SPECIFICATIONS.

Signed : _____ Date: 13/02/25.

on behalf of BakerHughes EMEA

Material	Material Description	Qty	Tag Number:
XGF868I	EP XMTR STYLE FIXED INST FLARE FM 1OR2P	1	43-FT-001
255-1184	REDUCER STAINLESS STEEL, 3/4" NPT X M20	5	43-FT-001
712-1455	Mounting Bracket Kit - stainless steel	1	43-FT-001
SS NAMEPLATE	SS ENGRAVED TAG (MULTIPLE LINES OF DATA)	1	43-FT-001
FLOWMETER CABLE	FLOWMETER Cable	1	43-FT-001
T5MAXS	T5 Max Flare Gas Transducer	2	43-FT-001
IMA72	2IN_PACK GLAND&BRRL WITH FITT & WRENCH	2	43-FT-001
IVA	2IN & 3IN ISOLATION VALVE	2	43-FT-001

(D. Furneaux)
FTR obo CROSSWIND
Witness X Review
12th Feb. 2025

Material	Material Description	Qty	Tag Number:
RSPKIT-FLOW-02	Comm Spare Prts: Fuses; Terminal Blocks	1	Start-up and commissioning Spare Parts
RSPKIT-FLOW-IMA	Comm Spare Prts: Stop Ring 316LSS, Male	2	Start-up and commissioning Spare Parts
703-1284-03	ASSY RECEIVER (100K NB)	1	Two Years operational Spare Parts
703-1354-02	UNIV DC POWER SUPPLY HV TRANSMIT PCB	1	Two Years operational Spare Parts
XAMP	PREAMPLIFIR FOR GAS FM,MOUNTABLE,XDCR JB	2	Two Years operational Spare Parts
RSPKIT-FLOW-IMA	Comm Spare Prts: Stop Ring 316LSS, Male	2	Two Years operational Spare Parts
PANAVIEW	PanaView Software complete with manual W	1	Special tools for Installation / Maintenance
704-662-12	RS232 cable, computer to xx868 series	1	Special tools for Installation / Maintenance

(D. Furneaux)
FTR obo CROSSWIND
~~Witness~~ X Review
12th Feb. 2025