Heat Straightening Procedure

Heat Straightening Procedure

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Revision / Change Log

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1 INTRODUCTION

1.1 PROJECT OVERVIEW

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

1.1.1 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

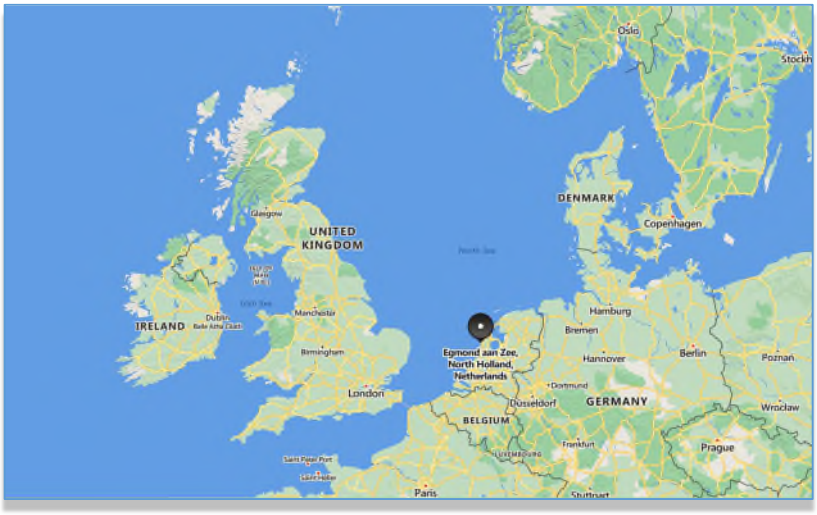


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

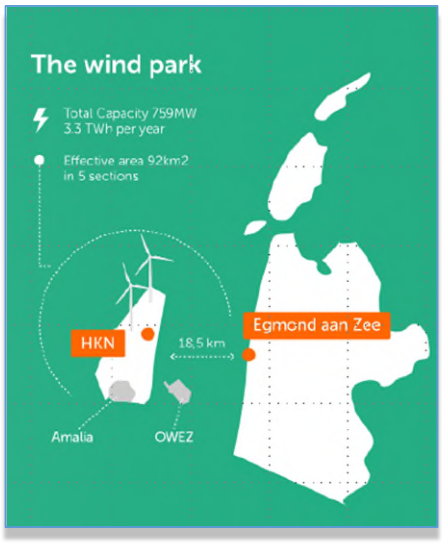


Figure 2 - Wind Park Details

The wind farm will consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile located on coordinates E 590719.1, N 5841602.3 is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

1.1.2 Project Concept

All components included in the BLPH will be integrated onshore on a topsides and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice. It is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

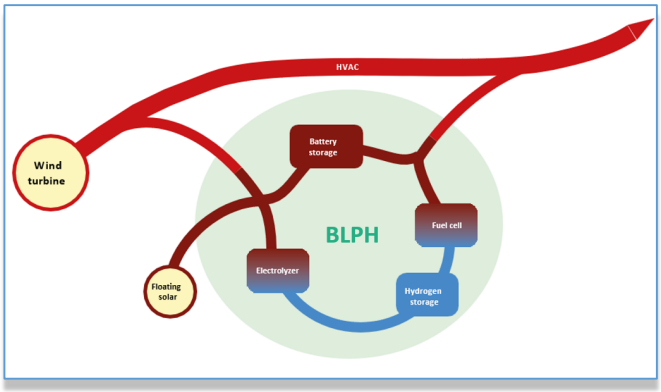


Figure 3 – BLPH Concept

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting

wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

The purpose of the BLPH s to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

2 DOCUMENT SCOPE

The scope of this procedure is to list the phases activities for plate Carbon Steel material Heat Straightening of Base Load Power Hub (BLPH).

2.1 REFERENCES

Doc. No.	Rev.	Date	Description - Title
K559-2254-MT-SPE-001	01	06/03/2023	Structural Fabrication Specification
EEMUA 158	Third ededition	2014	Construction Specification for Fixed Offshore Structures.
ISO 19902	Second edition	2020-11	Petroleum and Natural Gas Industries - Fixed Steel Offshore Structures.
ISO 19901-3	Dec-2014	Dec-2014	Petroleum and Natural Gas Industries - Specific Requirements for Offshore Structures - Topsides Structure.

Table 1 - Reference Documents

2.2 DEFINITIONS AND ABBREVIATIONS

COMPANY or Client (CPY):	Crosswind
CONTRACTOR (CTR):	ROSETTI MARINO S.p.A.
PROJECT:	HOLLANDSE KUST NOORD WIND PARK Project
CA	Certifying Authority
DP	Dye Penetrant
ITP	Inspection and Test Plan
MPI	Magnetic Particle Inspection
NDT	Non-Destructive Testing
QA	Quality Assurance
QC	Quality Control
UT	Ultrasonic Testing
WI	Welding Inspector
WS	Welding Supervisor
WT	Wall Thickness

3 RESPONSIBILITIES AND TASKS

Welding Engineer:
He is responsible for the development and update of present procedure and relevant attachments.

Workshop Manager / Workshop Supervisor:
He shall verify that during the different phases, the coordination, execution and all concerns relevant to HSE and safety.
To instruct personnel in the application of the Heat Straightening procedure.
To inform QC about Heat Straightening to be performed.
Dimensional Check after HS.

QC Personnel / QC Inspector:
He shall verify that during the different phases, that all the steps mentioned in present procedure are correctly implemented.
Inform CPY representative whenever Heat Straightening is required.
To control temperature during Heat Straightening.
Test after HS when required.

WS/WI Personnel / Inspector:
Record the activity with the monitoring report and perform the VI Inspection.

Dimensional Control Operator:
Final Dimensional Control on items subject to DC Control.

HS Operator:
Only dedicated personnel shall be able to perform HS process after TBT held by QC and WS/WI

4 HSE CONDITIONS

Welders, Welding Inspectors, Foreman, QC personnel, Customer and CA shall all have PPE and proper equipment to access workshop and monitor near hot works areas.

The fuel used in heat straightening is volatile and dangerous. Fuel tanks should always be handled with extreme care.
The technician using the torch must be safety conscious at all times.
Precautions include:

1) Wear protective goggles while heating;
2) Be careful of where the lighted torch is pointed at all times;
3) Wear protective gloves and clothing;
4) Always be in a stable, secure position prior to opening valves and lighting the torch;
5) Follow proper procedures when using scaffolding and use safety harnesses when working above the ground;
6) Secure tanks and hoses in safe positions prior to heat straightening.

5.1 GENERAL

Heat-straightening may be carried out in case of distortions on primary steel / secondary, tertiary, category items in accordance with this procedure only after CPY approval. CPY shall be given prior notice when heat straightening operations are going to take place. Heat-straightening will be performed by oxy-propane or oxy-acetylene (except cutting torches).
Heat straightening it can be applied for material grade S460G2+M and lower grades.

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As per documents applicable to this project, EEMUA 158 section 5.2.5 “Forming and straightening” it’s applicable.
The heated area shall not treated more than twice.

During straightening, the temperature shall be continuously controlled with thermal sticks or with a contact thermometer.
The sharp inner zone of the flame shall be maintained at set distance of 8 to 10 mm from the steel surface. The heating nozzle(s) shall be constantly moving across the steel at an even speed. Cooling will take place by air cooling after heating, with wet rag cooling just after heating, Air cooling and subsequent water cooling after heating (direct water use only when item temp is below 310°C). Welds shall not be heated directly.

When used, cooling water shall be at room temperature (20°C ±15°C).
Personnel conducting the heat straightening shall be instructed in the use of the procedure and made aware of the effects of overheating. Maximum temperature achieved during the operation shall be recorded on documentation of the heat straightening. Temperature should be check at intervals at no more than 10 Minutes
Heat straightening temperature shall not exceed value detailed at para 7.3.1. Heat Straightening Personnel must be instructed accordingly. Rosetti Supervisors have to ensure the correct execution.
During heat straightening it may happen that in order to obtain the correct dimension a mechanical deformation shall be applied to the items under correction.
Production items subject to heat straightening shall be maximum 100mm WT.
As general use, this procedure may be aimed to thin WT items that may suffer deformation from weld shrinkage. (items with WT ≤ 40 mm).

Personnel involved:
The personel perfoming this activity shall be limited and have past experience on Flame straightening process.
A record of the personel perfoming this activity shall be available at site.
Personnel shall be Toolboxed before activity and only toolboxed and verified personnel will be involved.

4.2 HEATING TECHNIQUES FOR HS

Heat straightening is a repair procedure in which controlled heat is applied, with specific techniques, to plastically deformed regions of steel elements.

The following Heating technique shall be used.

4.3 LINE HEATING

Heating in straight lines is used to correct angular distortion (for example in fillet welds). The component is heated along the line of the welded joint but on the opposite side to the weld so the induced stresses will pull the flange flat.– See **Errore. L'origine riferimento non è stata trovata.**

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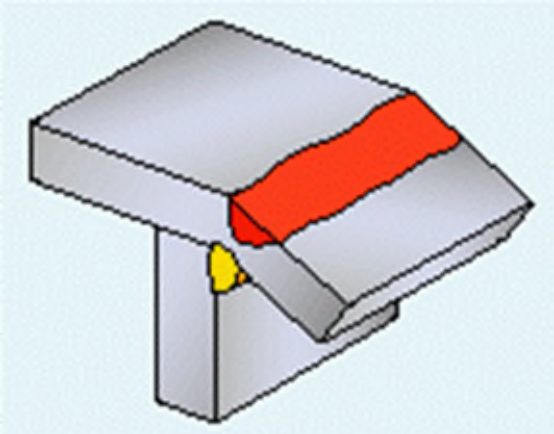


Figure 1. Heating lines

4.4 WEDGE-SHAPED HEATING

To correct distortion in larger complex fabrications it may be necessary to heat whole areas in addition to employing line heating.

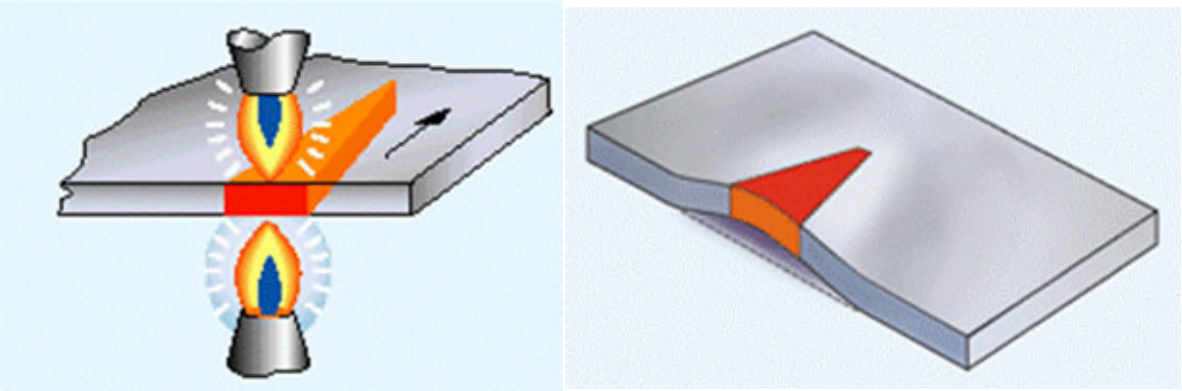


Figure 2. Wedge-shaped heating

4.5 STRIP HEATING

Strip heats, are used to remove a bulge in a plate element or to complement a wedge heat. Beginning at the initiation point, the torch is moved back and forth in a serpentine fashion across a strip for a desired length. The strip heat may be initiated at the midpoint and moved toward both edges simultaneously using two torches – See Figure 3.

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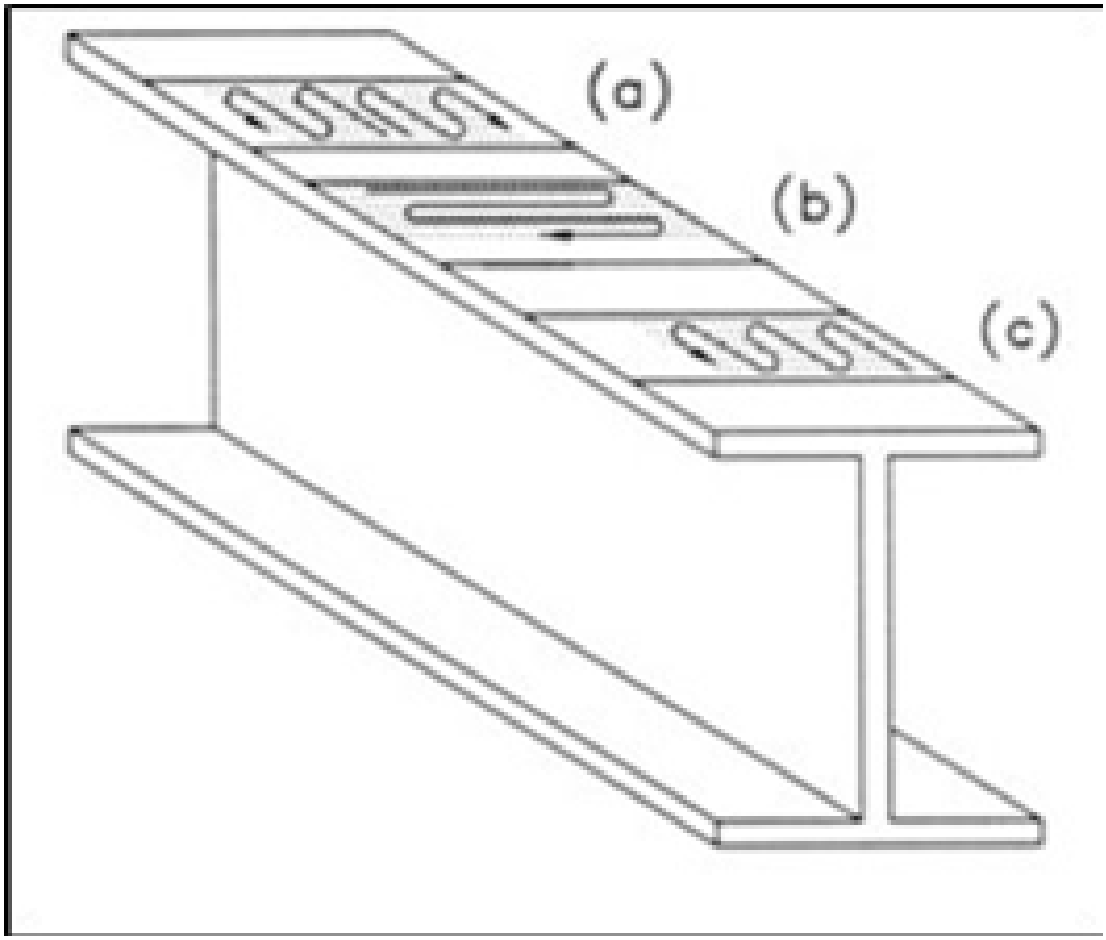


Figure 3. Strip heating

4.6 SPOT HEATING

Spot heating is used to remove buckling, for example when a relatively thin sheet has been welded to a stiff frame. Distortion is corrected by spot heating on the convex side. If the buckling is regular, the spots can be arranged symmetrically, starting at the centre of the buckle and working outwards. For a spot heat, a small round area of the metal is heated by moving the torch in a slow circular motion increasing the diameter until the entire area of the metal is heated. During a spot heat, the torch should not be held at a particular point for too long, as the spot may get too hot and buckling may occur due to excessive thermal expansion on the heated side of the member.– See See Figure 4

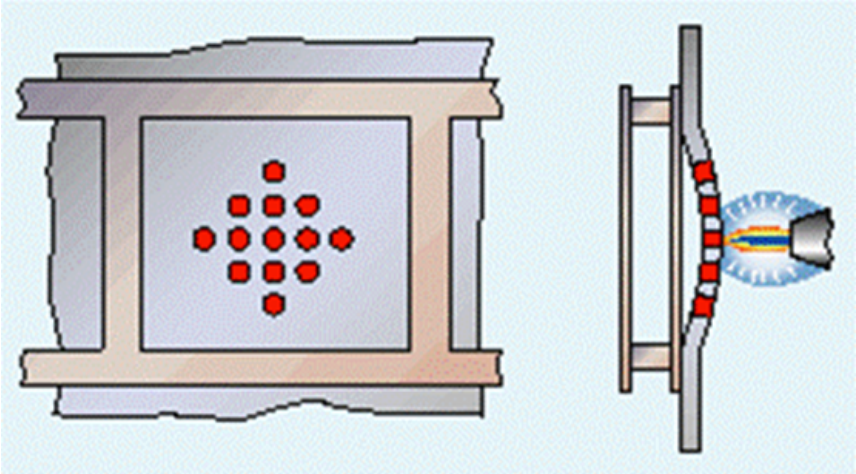


Figure 4. Spot heating

6 EQUIPMENT AND ITS USE

The primary equipment utilized for heat straightening is a oxy-propane or oxy-acetylene torch (excluding cutting torches).
Either a single or a multiple orifice tip may be used. The size and type is dictated by the fuel selected and thickness of material to be heated. A No. 8 single orifice tip is generally satisfactory for thicknesses up to 20–25 mm (3/4 or 1 in) with acetylene. For thinner material a smaller tip is recommended. If heavy sections are being heated, a single orifice tip may not be adequate. For such cases a rosebud or multiple orifice tip is recommended.

- Oxy / acetylene torch with "rose bud" tip-nozzle.
- Calibrated Digital thermometers/ pyrometers.
- Hydraulic Jack (size and force to be applied depends on the extent of damaged area).

7 HS APPLICATION

Typically example of application are showed in the following para. Others solution may be occurred during production.

The heating area shall have a minimum distance from the welds of 10 mm.

7.1 REPAIR OF LOCALIZED DEFORMATION OF THE BEAMS IN ACCORDANCE WITH FIGURE 5

1- Install the jacking device as shown in Figure 5.

2- Heat the damaged areas. Bring the steel up to temperature as quickly as possible using a heating torch with appropriate tip. Do not exceed temperature at para 7.3.1.
3- The temperature of the steel during the heating process shall be checked by calibrated digital thermometer or pyrometer not less than once every 10 minutes.
4- Once the entire damaged area is up to temperature, use the jack to bring the upper flange as close as possible to its original position.
5- Leave the jacking device in place until the steel cools to ambient temperature.
6- Once the steel cools remove the jacking device.
7- Cooling can be managed also by:
8- Air cooling after heating;
9- with wet rag cooling just after heating;
10- Air cooling and subsequent water cooling after heating (water only with item at temp. <310°C);
11- On completion of the heat straightening the repaired area shall be subjected to a final inspection to confirm that the repaired area meets project requirements. The final inspection shall be in accordance to para 8

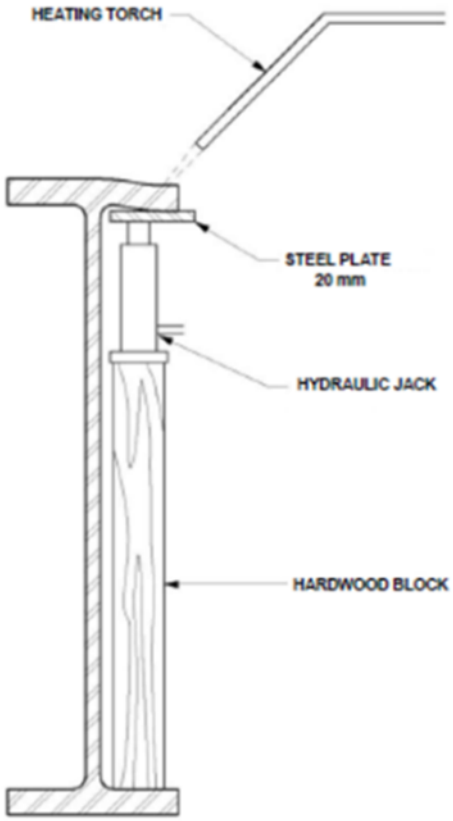


Figure 5. Repair of localized deformation of the beams option 1

7.2 REPAIR OF LOCALIZED DEFORMATION OF THE BEAMS IN ACCORDANCE WITH FIGURE 6

1- Position the jacking fixture over the deformed area of flange, as shown in figure 6.
2- Pump the jack until the bottom flange moves, but no more than 6 mm;

3- Heat the perimeter of the deformation. Do not exceed temperature at para 7.3.1;
4- The temperature of the steel during the heating process shall be checked by calibrated digital thermometer or pyrometer not less than once every 10 minutes;
5- Maintain pressure on the jack as the steel cools to ambient temperature;
6- Repeat steps 2, 3, 4 and 5 until the deformation is flattened as close as possible to its original position;
7- Leave the jacking fixture in place until the steel cools to ambient temperature
8- Cooling can be managed also by:
• Air cooling after heating;
• with wet rag cooling just after heating;
• Air cooling and subsequent water cooling after heating (water only with item temp <310°C);
9- Once the steel cools remove the jacking fixture;
10- On completion of the heat straightening the repaired area shall be subjected to a final inspection to confirm that the repaired area meets project requirements. The final inspection shall be in accordance to para 8.

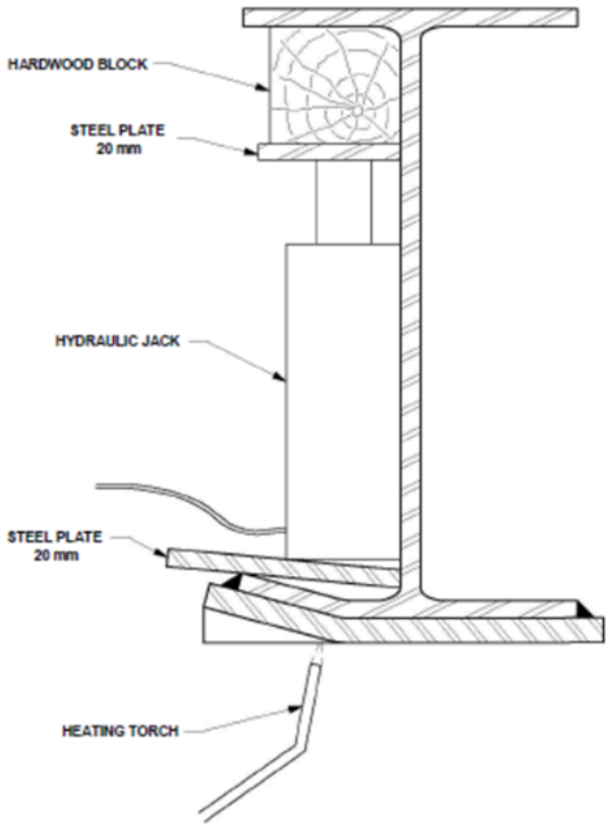


Figure 6. Repair of localized deformation of the beams option 2

7.3 REPAIR OF LOCALIZED DEFORMATION OF THE PLATES

All methods showed on para 7 may be used for recover distortion on plates. For less thick material spot heating shall be used. For thicker plate wedge-shaped and strip heating shall be used. If necessary use heating method in conjunction with hydraulic jack.

7.3.1 TEMPERATURE CONTROL

One of the most affecting issues of heat straightening is the temperature of the heated metal.
The maximum temperatures are:

- 600°C for TMCP and +N steels.
- 590°C or tempering temperature minus 50°C (the lowest temperature) for quenching and tempering steels

  To control the temperature it shall be used calibrated digital thermometer or temperature sensing crayons.

Maximum exposure shall not be more than 4 minutes at peak temperature.

8 INSPECTION

After completion of HS, the following tests are to be performed:

1. A dimensional check shall be carried out to confirm that the size tolerances of the beam and repaired area are in accordance with 3417-000-Q-PT-SAI-11081- Dimensional control procedure.
2. If there are welds located in the area affected by heat, they shall be re-checked with the same Non Destructive Technique originally used to check the weld.
3. 100% of MT check on base material subject to HS, to ensure, no surface defect on heated zone.
4. The dimensions map of MPI area, shall be reported.
5. Hardness Test has to be done on at least 3 measurements on each heated area, inside and outside the threated area. The surface test has to be prepared accordingly using Grinding and flap disk (sandpaper). Maximum acceptance value shall be 350 HV10.

Reports of test performed shall be issued and shall be included in final documentation.
Reporting shall be done with the report provided in the final section (deleting unnecessary fields with a line).

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9 COUPONS TESTS

1- Coupons tests for HS performed with 650°C and water cooling are attached for reference.

On coupons tested tensile, hardness and impact testing to low temperature was performed.

ATTACHED REPORT no. 0067-00040-17 dated 2017-02-27th.

Testing was conducted with witness of GE Grid GmbH.

6mm & 10mm SMYS 355MPa +N condition

2- Coupon test for HS performed with 650°C and water cooling are attached for reference.

On coupons tested tensile, hardness and impact testing to low temperature was performed.

ATTAHED REPORT no. 422-00103-21 dated 2022-11-23rd.

20mm SMYS 460MPa +TMC condition

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INSPECTA S.R.L.

TEST REPORT
RAPPORTO DI PROVA
N° 0067-00040-17 Rev.00
Data: 27/02/2017

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
LAB N°1607

Object: *Oggetto:* **HS1 & HS2**	☐ WPQR / PQR : ☐ WPQ : ☒ OTHER/*Altro:* **AWS D1.1 Ed. 2015**		Pag. 1 di 6
Specimen: *Saggio:* **See remarks**	**Base Material:** *Materiale Base:* **See remarks**		
Customer: ROSETTI MARINO SPA *Committente:* **Address: Via Trieste, 230 48122 Ravenna (RA)** *Indirizzo:*	**Witnessed by:** *Presenziato da:* **GE GRID & TCO / PJV**		
Reference Yours bill of lading: n° n° **1YPB170044** *Vs. DDT di consegn*	**Date:** *Data:* **08/02/2017**	**MDS2** *MD 52* **26/17**	**Date:** *Data:* **14/02/2017**
Start of activities:: *Inizio prove :*	**Date:** *Data:* **23/02/2017**	**End of activities:** *Fine prove:*	**Date:** *Data:* **27/02/2017**

PROVE RICHIESTE

☒ **TENSILE TEST**/*Trazione*	☐ Trasversal/*Trasversale*	☒ Longitudinal/*Longitudinale*	
☐ **BEND TEST**/*Piega*	☐ Trasversal/*Trasversale* ☐ Longitudinal/*Longitudinale*	☐ Face/Root /*Dritto/Rovescio* ☐ Side/ *Laterale*	
☒ **IMPACT TEST**/*Resilienza*	☐ Trasversal/ *Trasversale*	☒ Longitudinal/ *Longitudinale*	
☐ **MACROEXAMINATION TEST** / *Macrografia*			
☒ **HARDNESS TEST**/ *Durezza*	☐ HV 5	☒ HV 10	
☐ **FRACTURE TEST**/ *Frattura*	☐ Plate on Plate/ *Piastra su Piastra*	☐ Pipe on Plate/*Tubo su Piastra*	
☐ ***CHEMICAL ANALYSIS**/*Analisi Chimica*			
☐ **OTHER (Specify)**/*Altro/(Specificare)*			

ALLEGATI /Attachments:NONE

NOTE/ Remarks:

Speciment	Costumer identification	Material	Thickness	Heat
89/17 A	HS1	EN 10028-3:2009; P355NL2	6,00 mm	817229
90/17 A	HS2	EN 10028-3:2009; P355NL2	10,00 mm	819567

*** Prova non accreditata da ACCREDIA**

Laboratory Technician *Tecnico di Laboratorio*	Laboratory Responsible *Responsabile Laboratorio*	Customer Inspector *Ispettore del cliente*	Third part inspector *Ispettore Terza parte*
Sig. Mauro Galdieri INSPECTA 27-02-2017 Laboratory Technician	- INSPECTA srl - Francesco Tesdi Service Responsible 28/02/17	ROSETTI MARINO SpA A. Khalifa Welding Dept.	

I risultati contenuti nel presente rapporto di prova si riferiscono unicamente al campione sottoposto a prova.. Il committente si impegna a riprodurre integralmente il rapporto di prova. La riproduzione in forma di riproduzione parziale. L'accreditamento ACCREDIA non significa approvazione del prodotto da parte dell'organismo di accreditamento e del laboratorio. I campionamenti sono eseguiti dal cliente. Ove indicato l'incertezza di misura è da intendersi incertezza estesa, corrispondente ad un fattore di copertura Ku= 2 equivalente ad un livello di fiducia pari a 95%

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GE Grid GmbH
Quality Assurance
An der Eisenbahn 5
01099 Dresden
☐ INSPECTED
☐ REVIEWED
☒ WITNESSED
Date/Signature:
27.02.17

INSPECTA S.R.L.

RAPPORTO DI PROVA
TEST REPORT

N°0067-00040-17	Date:27/02/2017	Rev.00	Pag. 2 of 6

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LONGITUDINAL TENSILE TEST METHOD
Prova di trazione longitudinale

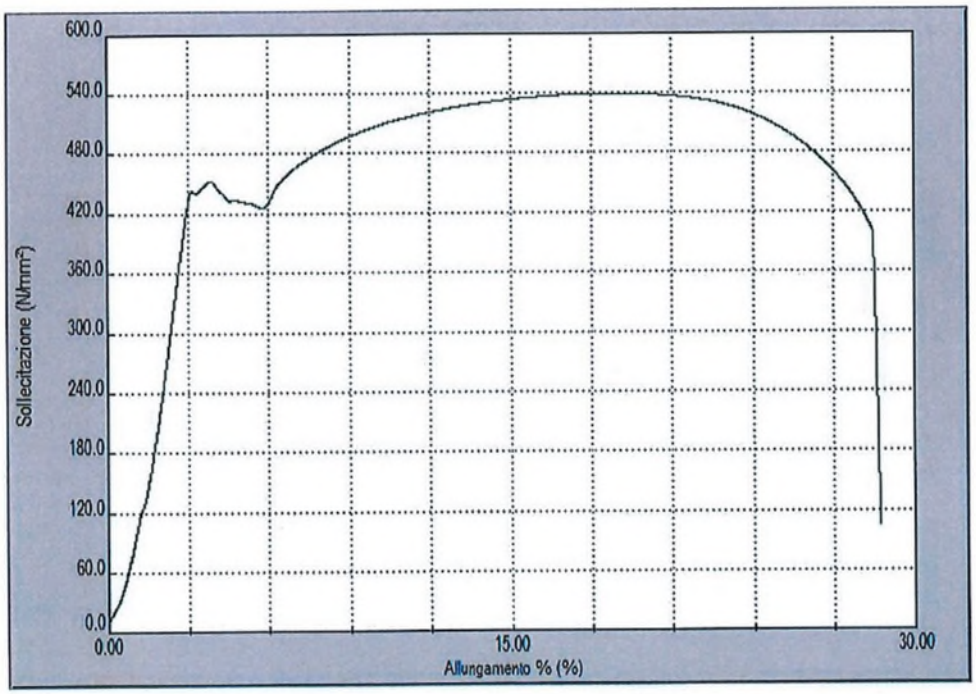
Date of Testing: 27/02/2017
Data esecuzione prova:

☐ UNI EN ISO 5178: 2011 ☐ ASTM A370 – 17
☐ UNI EN ISO 6892-1: 2016 metod B ☐ ASTM E8 / E8M 16a
☒ AWS D1.1:2015

Serial N. VAUP 01

Internal procedure *Procedura interna* : **PP08 versione corrente**

Specimen id. *Identificazione provino*	Dimension *Dimensioni (mm)*	Section *Sezione (mm2)*	Test Temp. *Temp. test*	Feh N	Reh Mpa	U	Rp 0,2% Mpa	U	Fm N	Rm Mpa	U	Elong. *Allung.* A (%)	Red. of area *Strizione* Z (%)	Remarks *Note*
Value Required *Valori Richiesti*	☒ Standards		☐ Client Spec.		≥ 355					490÷630				
89/17 A TL	5,68x20,00	113,60	21,2°C	//	443	/	//	/	61.228	539	/	//	//	With Heat Straighening



Remarks / *Note:* //

Legend / *Legenda*: TL = Longitudinal Tension/*Trazione longitudinale* | TWL = Longitudinal Weld Tension/*Trazione longitudinale saldatura*

Laboratory Technician *Tecnico di Laboratorio*	Laboratory Responsible *Responsabile Laboratorio*	Customer Inspector *Ispettore del cliente*	Third-part-Inspector *Ispettore Terza parte*
Sig. Matteo Galdieri - INSPECTA srl - 27-02-2017 Laboratory Technician	- INSPECTA srl - Francesca Tesei Service Responsible 27/02/17	ROSETTI MARINO SpA A. Khalifa Welding Dept.	☐ INSPECTED ☐ REVIEWED ☒ WITNESSED Date/Signature: 27.02.17 GE Grid GmbH Quality Assurance An der Eisenbahn 5 01099 Dresden

INSPECTA srl

RAPPORTO DI PROVA
TEST REPORT

N°0067-00040-17	Date:27/02/2017	Rev.00	Pag. 3 of 6

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO — LAB N°1607

LONGITUDINAL TENSILE TEST METHOD
Prova di trazione longitudinale

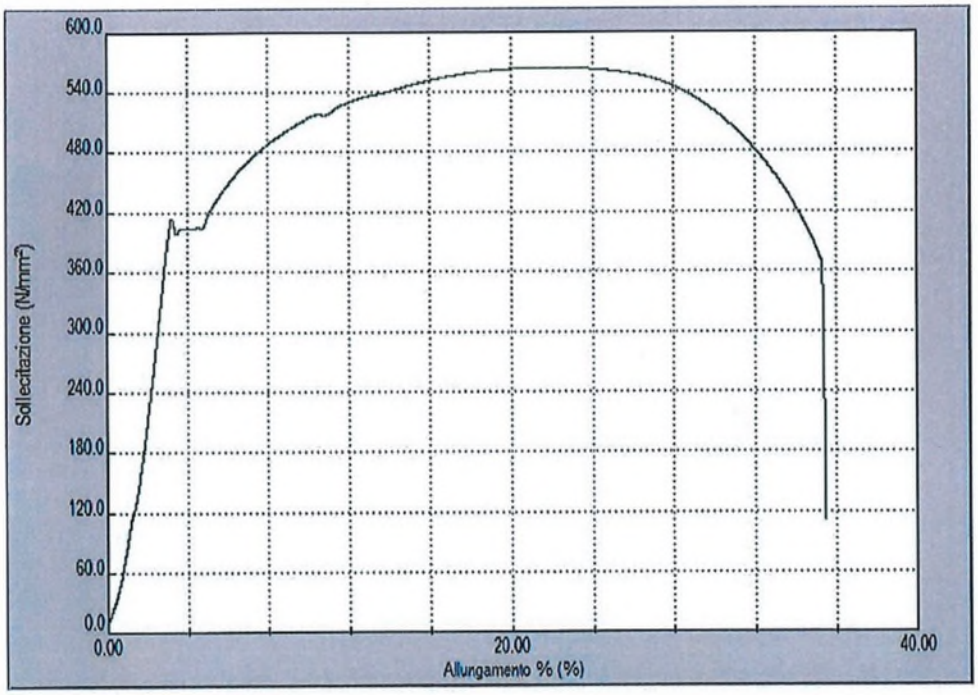
Date of Testing: 27/02/2017 *Data esecuzione prova:*

☐ UNI EN ISO 5178: 2011 ☐ UNI EN ISO 6892-1: 2016 metod B ☒ AWS D1.1:2015
☐ ASTM A370 – 17 ☐ ASTM E8 / E8M 16a

Serial N. VAUP 01

Internal procedure *Procedura interna* : **PP08 versione corrente**

Specimen Id. *Identificazione provino*	Dimension *Dimensioni (mm)*	Section *Sezione (mm2)*	Test Temp. *Temp. test*	Feh N	Reh Mpa	U	Rp 0,2% Mpa	U	Fm N	Rm Mpa	U	Elong. *Allung.* A (%)	Red. of area *Strizione* Z (%)	Remarks *Note*
Value Required *Valori Richiesti* ☐ Standards ☐ Client Spec.					≥ 355					490÷630				
90/17 A TL	10,28x20,00	205,50	21,2°C	//	414	/	//	/	115.848	564	/	//	//	With Heat Straighening



Remarks / Note:

Legend / Legenda: TL = Longitudinal Tension/*Trazione longitudinale* — TWL = Longitudinal Weld Tension/*Trazione longitudinale saldatura*

Laboratory Technician *Tecnico di Laboratorio*	Laboratory Responsible *Responsabile Laboratorio*	Customer Inspector *Ispettore del cliente*	Third part Inspector *Ispettore Terza parte*
Sig. Matteo Goldieri - INSPECTA srl - 27-02-2017 Laboratory Technician	- INSPECTA srl - Francesca Tassi Service Responsible 29/02/17	ROSETTI MARINO SpA K. Khalifa Welding Dept.	☐ INSPECTED ☐ REVIEWED ☒ WITNESSED Date/Signature: 27.02.17 GE Grid GmbH Quality Assurance An der Eisenbahn 5 01099 Dresden

INSPECTA S.R.L.

RAPPORTO DI PROVA
TEST REPORT

N°0067-00040-17	Date:27/02/2017	Rev.00	Pag. 4 of 6

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO — LAB N°1607

IMPACT TEST METHOD
Prova di resilienza

Date of Testing: 27/02/2017
Data esecuzione prova:

☐ UNI EN ISO 148-1: 2016 | ☐ UNI EN ISO 9016: 2012 | ☐ ASTM E23: 16b | ☐ ASME IX QW-170: 2015 | ☒ AWS D1.1:2015

Seriol N. VAUP / 02

Internal procedure *Procedura interna* :PP09 versione corrente

Specimen id. *Identificazione provino*	Direction *Direzione*	Dimension *Dimensioni (mm)*	Test Temp. *Temp .test*	Notch Type *Intaglio*	Knife / coltello	Requirement / Requisiti: Energy absorbed / Energia assorbita – Individual *Individuale Joule* 1	2	3	Average *Media Joule*	U	Lateral Expansion *Espansione laterale (mm)* 1	2	3	Shear Area % 1	2	3	Remarks *Note*
89/17 A BM	L	5.0x10x55	-50°C	V	8	63	91	54	69	/	/	/	/	/	/	/	With Heat Straighening
90/17 A BM	L	7.5x10x55	-53°C	V	8	170	88	152	137	/	/	/	/	/	/	/	With Heat Straighening

Remarks *Note:*
REQUIRED VALUE:
-14 J FOR TEST SPECIMENT 89-17 A
-20 J FOR TEST SPECIMENT 90-17 A

Legend *Legenda*

L= Longitudinal / Longitudinale
T= Trasversal / Trasversale
VWT 0/2 = Impact Test on Weld Metal/ *Resilienza trasversale in saldatura*
VHT 0/2 = Impact Test on Fusion Line / *Resilienza Trasversale in linea di fusione*
VHT 1/2 = Impact Test at 1 mm from Fusion Line / *Resilienza trasversale a 1 mm dalla linea di fusione*
VHT 2/2 = Impact Test at 2 mm from Fusion Line / *Resilienza trasversale a 2 mm dalla linea di fusione*
VHT 5/2 = Impact Test at 5 mm from Fusion Line / *Resilienza trasversale a 5 mm dalla linea di fusione*
WM = Impact Test on Weld Metal/ *Resilienza trasversale in saldatura*
HAZ = Impact Test on Heat Affected Zone / *Resilienza Trasversale in zona termicamente alterata*
BM = Impact Test on Base Metal / *Resilienza Trasversale in materiale base*
FL = Fusion Line/ *Linea di fusione*
FL+1 = Fusion Line + 1mm/ *Linea di fusione + 1mm*
FL +2= Fusion Line + 2mm/ *Linea di fusione +2mm*
FL +5= Fusion Line + 5mm/ *Linea di fusione +5mm*

Laboratory Technician *Tecnico di Laboratorio*	Laboratory Responsible *Responsabile Laboratorio*	Customer Inspector *Ispettore del cliente*	Third part Inspector *Ispettore Terza parte*
Sig. Matteo Galdieri - INSPECTA srl - 27-02-2017 Laboratory Technician	- INSPECTA srl - Francesca Tesei Service Responsible 28/02/17	ROSETTI MARINO SpA Khalifa Welding Dept.	☐ INSPECTED ☐ REVIEWED ☒ WITNESSED Date/Signature: 27.02.17 GE Grid GmbH Quality Assurance An der Eisenbahn 5 01099 Dresden

INSPECTA S.R.L.

RAPPORTO DI PROVA
TEST REPORT

N°0067-00040-17	Date:27/02/2017	Rev.00	Pag. 5 of 6

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO — LAB N°1607

HARDNESS TEST METHOD
Prova di durezza

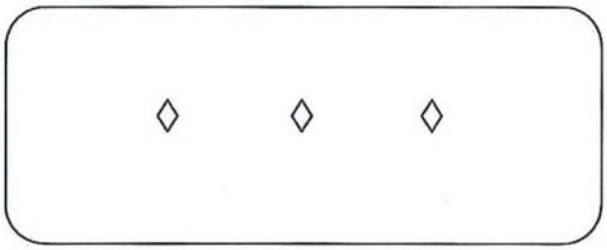
Date of Testing: 23/02/2017
Data esecuzione prova:

☒ UNI EN ISO 6507-1: 2006 ☐ UNI EN ISO 9015-1: 2011 ☐ ASTM E 92-16 ☐ _____

Serial N. 43030614C

Internal procedure *Procedura interna*	PP10 v.c.	Sample Identification *Identificazione provino*	89/17 A	Hardness test type *Tipo di durezza*	HV 10

Sketch for reference points
Schema punti di riferimento



Sample Identification *Identificazione provino*	89/17 A Without Heat Straighening			Sample Identification *Identificazione provino*	89/17 A With Heat Straighening		
Reference points *Punto di riferimento*	Values measured *Valori misurati*	Conversion according To ASTM A370 tab. 2 *Conversione in Accordo a ASTM A 370 tab.2*	U	Reference points *Punto di riferimento*	Values measured *Valori misurati*	Conversion according To ASTM A370 tab. 2 *Conversione in Accordo a ASTM A 370 tab.2*	U
-	HV 10	HB	///	-	HV 10	HB	//
1	168	//	//	1	165	//	//
2	161	//	//	2	160	//	//
3	162	//	//	3	167	//	//
AVERAGE	164	//	//	AVERAGE	164	//	//
//	//	//	//	//	//	//	//
//	//	//	//	//	//	//	//
//	//	//	//	//	//	//	//
//	//	//	//	//	//	//	//
//	//	//	//	//	//	//	//
//	//	//	//	//	//	//	//

Remarks/ *Note:* For information: Average hardness value of test piece with Heat Straighening shall be within 10% of average hardness value of test piece without Heat Straighening.

Laboratory Technician *Tecnico di Laboratorio*	Laboratory Responsible *Responsabile Laboratorio*	Customer Inspector *Ispettore del cliente*	Third part Inspector *Ispettore Terza Parte*
Sig. Matteo Goldieri - INSPECTA srl - 27-02-2017 Laboratory Technician	- INSPECTA srl - Francesca Tassi Service Responsible 28/02/17	ROSETTI MARINO S.p. A. Khalifa Welding Dept	☐ REVIEWED ☒ WITNESSED Date/Signature: 27.02.17 GE Grid GmbH Quality Assurance An der Eisenbahn 5 01099 Dresden

INSPECTA S.R.L.

RAPPORTO DI PROVA
TEST REPORT

N°0067-00040-17	Date:27/02/2017	Rev.00	Pag. 6 of 6

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO — LAB N°1607

HARDNESS TEST METHOD
Prova di durezza

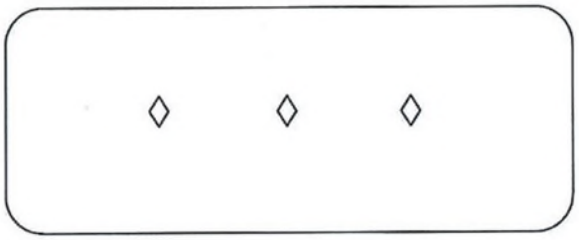
Date of Testing: 23/02/2017
Data esecuzione prova:

☒ UNI EN ISO 6507-1: 2006 ☐ UNI EN ISO 9015-1: 2011 ☐ ASTM E 92-16 ☐ _____

Serial N. 43030614C

Internal procedure *Procedura interna*	PP10 v.c.	Sample Identification *Identificazione provino*	90/17 A	Hardness test type *Tipo di durezza*	HV 10

Sketch for reference points
Schema punti di riferimento



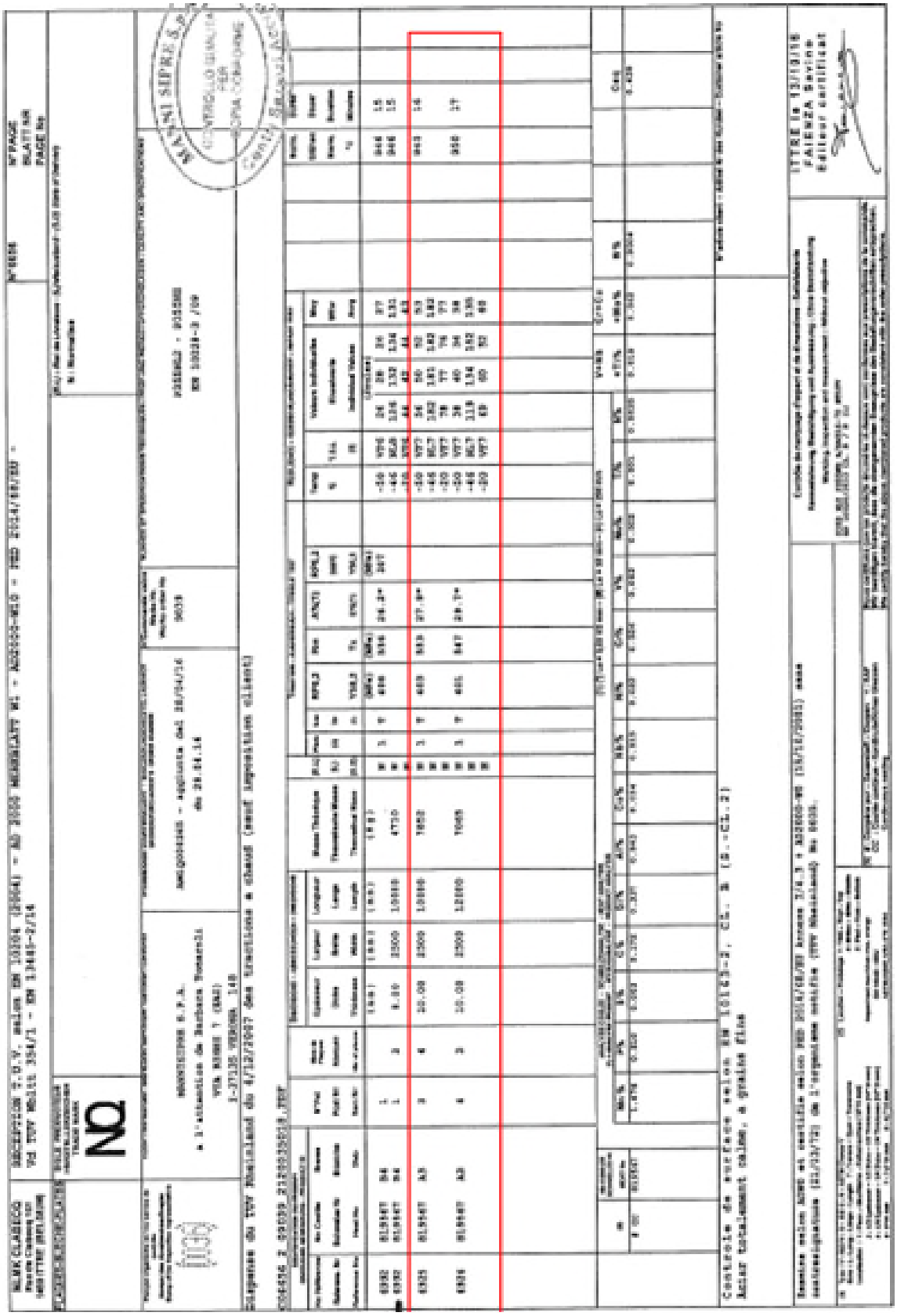
Sample Identification *Identificazione provino*	90/17 A Without Heat Straighening			Sample Identification *Identificazione provino*	90/17 A With Heat Straighening		
Reference points *Punto di riferimento*	Values measured *Valori misurati*	Conversion according To ASTM A370 tab. 2 *Conversione in Accordo a ASTM A 370 tab.2*	U	Reference points *Punto di riferimento*	Values measured *Valori misurati*	Conversion according To ASTM A370 tab. 2 *Conversione in Accordo a ASTM A 370 tab.2*	U
-	HV 10	HB	///	-	HV 10	HB	//
1	159	//	//	1	169	//	//
2	158	//	//	2	165	//	//
3	158	//	//	3	162	//	//
AVERAGE	158	//	//	AVERAGE	165	//	//
//	//	//	//	//	//	//	//
//	//	//	//	//	//	//	//
//	//	//	//	//	//	//	//
//	//	//	//	//	//	//	//
//	//	//	//	//	//	//	//
//	//	//	//	//	//	//	//
Remarks/ *Note:*	For information: Average hardness value of test piece with Heat Straighening shall be within 10% of average hardness value of test piece without Heat Straighening.						

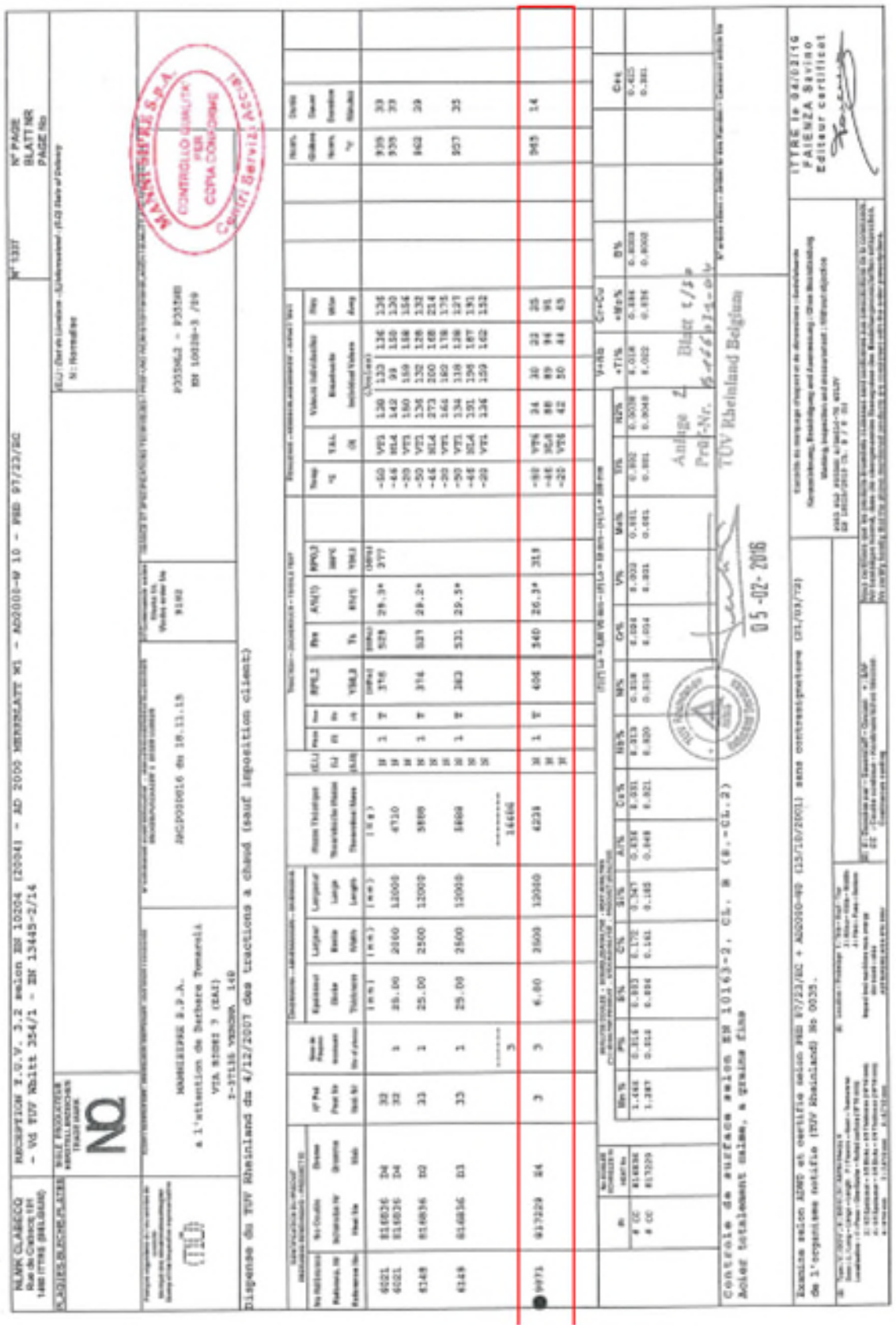
Laboratory Technician *Tecnico di Laboratorio*	Laboratory Responsible *Responsabile Laboratorio*	Customer Inspector *Ispettore del cliente*	Third part Inspector *Ispettore terza parte*
INSPECTA Nicola Gianni Calderi 27-02-2017 Laboratory Technician	- INSPECTA srl - Francesca Tondi Service Responsible 28/02/17	ROSETTI MARINO SpA Khalifa Welding Dept.	☐ REVIEWED ☒ WITNESSED Date/Signature: 27.02.17 GE Grid GmbH Quality Assurance An der Eisenbahn 5 01099 Dresden

Headquarter: Via Giolitti 10 – 48123 Ravenna (RA) Italy – Phone /Fax + 39 0544 451424
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Mobile +39 393 9374013 - e-mail: inspectasrl@inspectasrl.com - www.inspectasrl.com - P.iva 03944480403
Capital Stock € 10.000 - Chamber of Commerce registration Forlì/Cesena No. 03944480403 - R.E.A. No. 323199

MD 34A Rev.03 data 20-12-2016

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ROSETTI MARINO

PQR - AS- RUN PARAMETER SHEET

HEAT STRAIGHTENING

SAMPLES HS1 AND HS2

Date: 30/01/2017 Page: 1_ of _1

Welder Name(s):	N.A.	Welder Id No(s):	N.A.		
Welding Process(es):	N.A.	Type(s):	N.A.		
Welding Position:	N.A.	Progression:	N.A.		
Base Materials:	EN 10028 P355 NL2	Wall Thickness:	HS1: 6mm H817229 / HS2: 10mm H819567	Diameter:	/
Heat No(s):	817229-819567	Joint Type:	N.A.		

WELD PREPARATION | WELDING SEQUENCE / PASS LOCATION

WELDING CONSUMABLES:

LAYER:	DIA:	BATCH NO:	SUPPLIER & TYPE:
Root	N.A.	N.A.	N.A.
Hot Pass	N.A.		
Filling Runs	N.A.		
Filling Runs	N.A.		
Cap	N.A.		
	N.A.		
R passes	N.A.		

GAS:

Shielding Gas:	NA
Composition:	NA
Flow:	NA
Gas Backing:	NA
Flow:	NA
Gas Size Nozzle:	NA
Tungsten Type:	NA
O2 Content of Back Purge:	NA

Max Weld Bead Width:	String or Weave:		No of Passes:	Multiple or Single Electrodes:
N.A.	N.A.	N.A.	N.A.	N.A.

Preheat °C:	Preheat Method:	Max Interpass Temperature:	Check / Control Method:	Heat Treatment Required	Holding Temperature	Holding Time °c	Heating Rate °C	Cooling Rate °C
650°C	PROPANE TORCH	N.A.	CONTACT DIGITAL THERMOMETHER	NA	NA	NA	NA	NA

AFTER HEATING AT 650°C PLATES WHERE COOLED BY FRESH WATER

Side No. (For 2 Welders)	Layer No.	Welding Process	Pass	Layer Thk. Mm	FILLER METAL AWS Spec.	FILLER METAL Dia. mm	Electrode Polarity	Current Amperage Range Min	Current Amperage Range Max	Current Amperage Range Av.	Voltage Range Min	Voltage Range Max	Voltage Range Av.	Bead Length (mm)	Arc Time (Seconds)	Welding Speed Range (cm/Min)	Heat Input Range (kJ/mm) Average	Arc Thermal Efficieny Factor As per EN 1011-1 (kJ/mm)	Interpass Temperature °C	REMARKS

SIGNED BY REPRESENTATIVE:			
Name: Signature: Date:			

INSPECTA S.R.L.

TEST REPORT
RAPPORTO DI PROVA

N° 422-00103-21 **Rev.00**
Data: 23/11/2021

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO
LAB N°1607 L

Object: *Oggetto:*	**MECHANICAL TEST ON BASE METAL**						Pag. 1 di 5
Specimen: *Saggio:*	**551/21**	**#Base Material:** *Materiale Base:*	**EN 10225 S460G2+M**		**PLATE THK 20,00 mm**		
		# Informazione fornita dal cliente/ Information provided by the customer					
Customer: *Committente:*	**ROSETTI MARINO S.p.A.**						
Address: *Indirizzo:*	**Via Trieste, 230 - 48122 Ravenna (RA)**						
Final customer:. *Cliente finale:*	//						
Your delivery note n°: *Vs. DDT di consegna*	**n°** // *n°*	**Date:** *Data:* //		**MD52** *MD 52*	**129/2021**	**Date:** *Data:*	**09/11/2021**
Start of activities:: *Inizio prove :*	**Date:** *Data:* **16/11/2021**	**End of activities:** *Fine prove:*				**Date:** *Data:*	**23/11/2021**

PROVE RICHIESTE		
☒ **TENSILE TEST**/*Trazione*	☐ Trasversal/*Trasversale*	☒ Longitudinal/*Longitudinale*
☐ **BEND TEST**/*Piega*	☐ Trasversal/*Trasversale* ☐ Longitudinal/*Longitudinale*	☐ Face/Root /*Dritto/Rovescio* ☐ Side/ *Laterale*
☒ **IMPACT TEST**/*Resilienza*	☐ Trasversal/ *Trasversale*	☒ Longitudinal/ *Longitudinale*
☐ **MACROEXAMINATION TEST** / *Macrografia*		
☒ **HARDNESS TEST**/ *Durezza*	☐ HV 5	☒ HV 10
☐ **FRACTURE TEST**/ *Frattura*	☐ Plate with/on Plate/ *Piastra con/su Piastra* ☐ Pipe with/on Pipe/*Tubo con/ su Tubo*	☐ Pipe on Plate/*Tubo su Piastra*
☐ **CHEMICAL ANALYSIS**/*Analisi Chimica*		
☐ **MICROEXAMINATION TEST** / *Micrografia*		
☐ **OTHER (Specify)**/*Altro/(Specificare)*		

Allegati /Attachments: NONE

NOTE/ Remarks: **REFERENCE CODE FROM CUSTOMER REQUEST: RINA RULES + RMRS ND No.2-020101-015 + RMRS ND No.2-020101-138 + RMRS ND No.2-020101-139 + GOST R ISO 15614-1-2009**
TEST WITNESSED BY CENACCHI DAVIDE (ROSETTI MARINO SPA) – ALEKSEY LAZAREV (RS-CLASS)

Specimen ID	Certificate No.	Base material	Heat n°	Plate n°
551/21	Q0498596	EN 10225:2009 S460G2+M	843494	305836/2

Informazioni aggiuntive fornite dal cliente:
Additional information provided by the customer

Laboratory Responsible *Responsabile Laboratorio* *Sig. Giulio Bagnara*	Customer Inspector *Ispettore del cliente*	Third part Inspector *Ispettore Terza parte*
- INSPECTA s.r.l - 23-11-2021	ROSETTI MARINO SpA Welding Dept. D.Cenacchi	

I risultati contenuti nel presente Rapporto di prova si riferiscono unicamente al campione sottoposto a prova. Il committente si impegna a riprodurre integralmente il rapporto di prova. E' vietata ogni forma di riproduzione parziale. L'accreditamento ACCREDIA non significa approvazione del prodotto da parte dell'organismo di accreditamento e del laboratorio. I risultati di prova si riferiscono al campione così come ricevuto, essendo il campionamento eseguito dal cliente. Ove indicato l'incertezza di misura è da intendersi incertezza estesa, corrispondente ad un fattore di copertura Ku= 2 equivalente ad un livello di fiducia pari a 95%. Quando emesso il Report in revisione, l'oggetto revisionato è identificabile mediante barra verticale posta sul lato sinistro e dal testo in formato corsivo sottolineato.
The results in this test report refers only to the specimen that has been tested. The customer undertakes to print out/reproduce the test report. Any partial reproduction is prohibited. Accredia's accreditation does not imply the product approval neither by the accreditation body or the laboratory. The test results refer to the sample as received, since the sampling is performed by the customer. Where indicated the measurement uncertainty is to be understood expanded uncertainty corresponding to a coverage factor Ku=2 equivalent to a level of confidence of 95 %. When the Report under review is issued, the revised object can be identified by the vertical bar on the left side and by the text in italics underlined.

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INSPECTA S.R.L.

RAPPORTO DI PROVA
TEST REPORT

N°422-00103-21	Date:23/11/2021	Rev.0	Pag. 2 of 5

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO — LAB N°1607 L

LONGITUDINAL TENSILE TEST AT ROOM TEMPERATURE
Prova di trazione longitudinale a temperatura ambiente

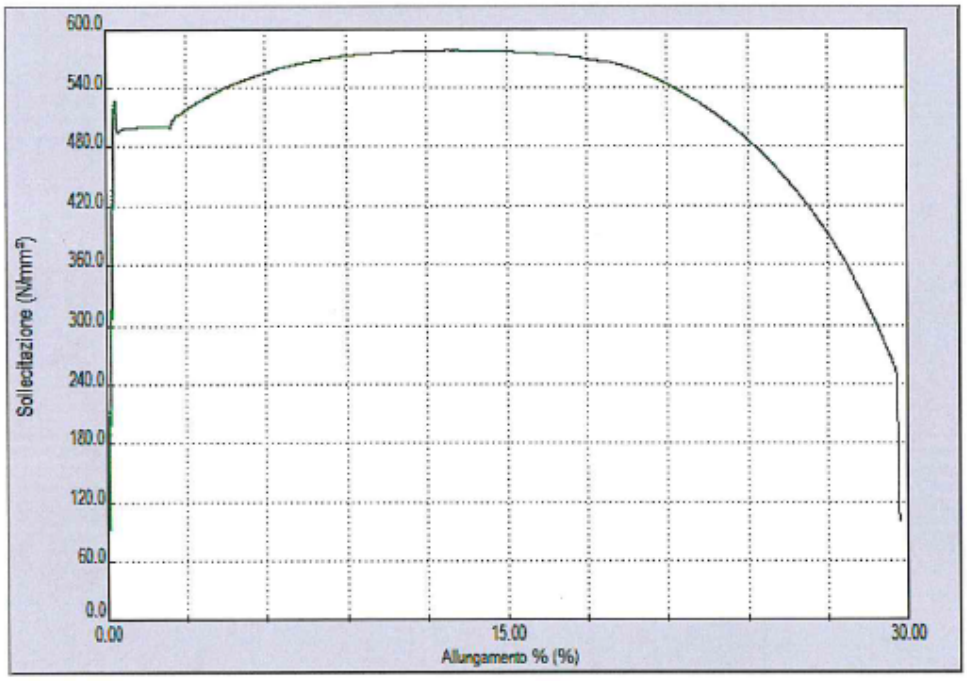
Date of Testing:23/11/2021
Data esecuzione prova:

performed in accordance with the standard / *eseguita in conformità alla norma* UNI EN ISO 6892-1:2020

The test was performed using the Galdabini testing materials machine, model Quasar 600, s.n. VAUP/01 (2014)
La prova è stata eseguita utilizzando la macchina per prove materiali Galdabini, modello Quasar 600, s.n. VAUP/01 (2014)

Internal procedure *Procedura interna* : *PP08 rev.14*

Specimen id. *Identificazione provino*	Dimension *Dimensioni (mm)*	Section *Sezione (mm2)*	Test Temp. *Temp. test*	Feh N	Reh Mpa	U	Rp 0,2% Mpa	U	Fm N	Rm Mpa	U	Elong. *Allung.* A (%)	Red. of area *Strizione* Z (%)	Remarks *Note*
Value Required *Valori Richiesti*		☐ Standards	☐ Client Spec.											
551/21 A TL	Ø10,00	78,54	22,4°C	41476	528	/	//	/	45403	578	/	30,5	82,4	//



Remarks / *Note:*	HEATED	
Legend / *Legenda*	TL = Longitudinal Tension/*Trazione longitudinale*	TWL = Longitudinal Weld Tension/*Trazione longitudinale saldatura*

Laboratory Technician *Tecnico di Laboratorio* Dott. Ing. Mauro Buschetti	Laboratory Responsible *Responsabile Laboratorio* Sig. Giulio Bagnara	Customer Inspector *Ispettore del cliente*	Third part Inspector *Ispettore Terza parte*
- INSPECTA S.r.l. - Laboratory Technician 23/11/2021	- INSPECTA s.r.l. - 23-11-2021 Service Responsible	ROSETTI MARINO S.p.A. Welding Dept. As Customer	

Headquartar: Via Giolitti 10 – 48123 Ravenna (RA) Italy – Phone /Fax +39 0544 451424
Registered Office: Via Ravegnana 379/A - 47122 Forlì (FC) Italy - Phone +39 0543 559027 - Phone/Fax +39 0543 724366
Mobile +39 393 9374013 - e-mail: inspectasrl@inspectasrl.com - www.inspectasrl.com - P.Iva 03944480403
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MD 37 Rev.24 data 02-08-2021

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INSPECTA S.R.L.

RAPPORTO DI PROVA
TEST REPORT

N°422-00103-21	Date:23/11/2021	Rev.0	Pag. 3 of 5

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO — LAB N°1607 L

LONGITUDINAL TENSILE TEST AT ROOM TEMPERATURE
Prova di trazione longitudinale a temperatura ambiente

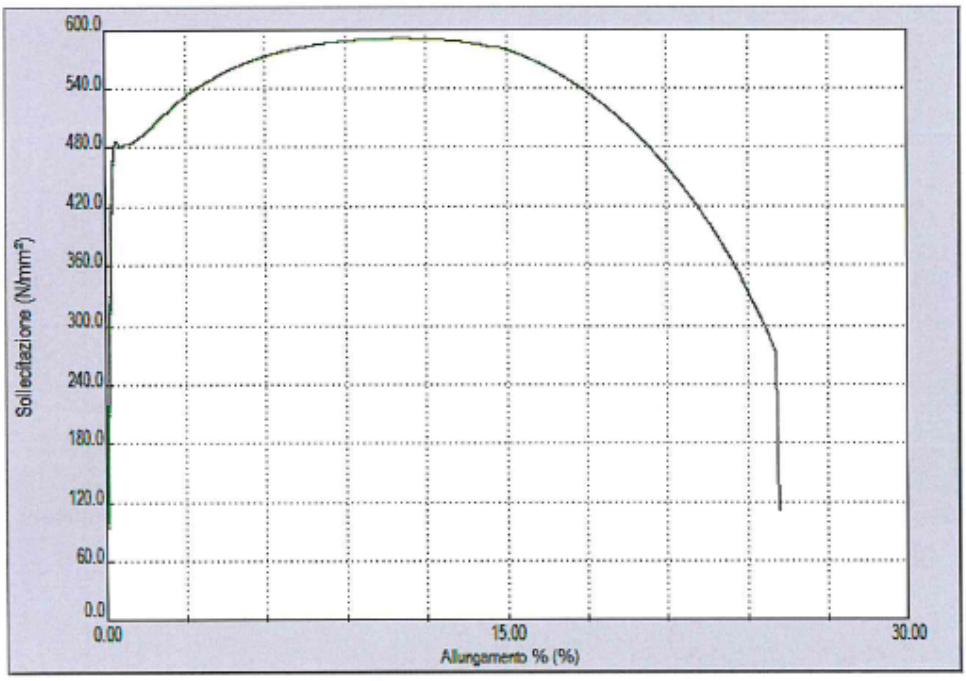
Date of Testing::23/11/2021
Data esecuzione prova:

performed in accordance with the standard / *eseguita in conformità alla norma*: UNI EN ISO 6892-1:2020

The test was performed using the Galdabini testing materials machine, model Quasar 600, s.n. VAUP/01 (2014)
La prova è stata eseguita utilizzando la macchina per prove materiali Galdabini, modello Quasar 600, s.n. VAUP/01 (2014)

Internal procedure *Procedura interna* : **PP08 rev.14**

Specimen id. *Identificazione provino*	Dimension *Dimensioni (mm)*	Section *Sezione (mm2)*	Test Temp. *Temp. test*	Feh N	Reh Mpa	U	Rp 0,2% Mpa	U	Fm N	Rm Mpa	U	Elong. *Allung.* A (%)	Red. of area *Strizione* Z (%)	Remarks *Note*
Value Required *Valori Richiesti*		☐ Standards	☐ Client Spec.											
551/21 B TL	Ø9,99	78,38	22,4°C	38102	486	/	//	/	46299	591	/	26,6	80,5	//



Remarks / *Note*:	NOT HEATED	
Legend / *Legenda*	TL = Longitudinal Tension/*Trazione longitudinale*	TWL = Longitudinal Weld Tension/*Trazione longitudinale saldatura*

Laboratory Technician *Tecnico di Laboratorio*	Laboratory Responsible *Responsabile Laboratorio*	Customer Inspector *Ispettore del cliente*	Third part Inspector *Ispettore Terza parte*
Dott. Ing. Marco Bacchiocchi	Sig. Giulio Bagnara INSPECTA s.r.l. 23-11-2021	ROSETTI MARINO Welding Dept.	

Headquarter: Via Giolitti 10 – 48123 Ravenna (RA) Italy – Phone /Fax + 39 0544 451424
Registered Office: Via Ravegnana 379/A - 47122 Forlì (FC) Italy - Phone +39 0543 559927 - Phone/Fax +39 0543 724366
Mobile +39 393 9374013 - e-mail inspectasrl@inspectasrl.com - www.inspectasrl.com - P.iva 03944480403
Capital Stock € 50.000 - Chamber of Commerce registration Forlì/Cesena No. 03944480403 - R.E.A. No. 323199

MD 37 Rev.24 data 02-08-2021

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RAPPORTO DI PROVA
TEST REPORT

N°422-00103-21	Date:23/11/2021	Rev.0	Pag. 4 of 5

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO — LAB N°1607 L

IMPACT TEST
Prova di resilienza

Date of Testing:23/11/2021
Data esecuzione prova:

performed in accordance with the standard / *eseguita in conformità alla norma* UNI EN ISO 148-1:2016

The test was performed using the Galdabini Charpy pendulum machine, model Impact 450, s.n. VAUP/02
La prova è stata eseguita utilizzando macchina pendolo Charpy marca Galdabini, modello Impact 450, s.n. VAUP/02

Internal procedure *Procedura interna* : *PP09 rev.08*

Specimen id. *Identificazione provino*	Direction *Direzione*	Dimension *Dimensioni (mm)*	Test Temp. *Temp. Acri*	Notch Type *Intaglio*	Knife / *coltello*	Requirement / Requisiti: Energy absorbed / Energia assorbita — Individual *Individuale* Joule 1	2	3	Average *Media* Joule	U	Lateral Expansion *Espansione laterale (mm)* 1	2	3	Shear Area *Area fragile* % 1	2	3	Remarks *Note*
551/21 BM	L	10x10x55	-60°C	V	2	371	383	375	376	/	//	//	//	//	//	//	HEATED
551/21 BM	L	10x10x55	-60°C	V	2	344	332	325	328	/	//	//	//	//	//	//	NOT HEATED

Remarks *Note:*	//
Legend *Legenda*	**L= Longitudinal / Longitudinale** **T= Trasversal / Trasversale** **VWT 0/2 = Impact Test on Weld Metal/** *Resilienza trasversale in saldatura* **VHT 0/2 = Impact Test on Fusion Line /** *Resilienza Trasversale in linea di fusione* **VHT 1/2 = Impact Test at 1mm from Fusion Line /** *Resilienza trasversale a 1 mm dalla linea di fusione* **VHT 2/2 = Impact Test at 2 mm from Fusion Line /** *Resilienza trasversale a 2 mm dalla linea di fusione* **VHT 5/2 = Impact Test at 5 mm from Fusion Line /** *Resilienza trasversale a 5 mm dalla linea di fusione* **WM = Impact Test on Weld Metal/** *Resilienza trasversale in saldatura* **HAZ = Impact Test on Heat Affected Zone /** *Resilienza Trasversale in zona termicamente alterata* **BM = Impact Test on Base Metal /** *Resilienza Trasversale in materiale base* **FL = Fusion Line/** *Linea di fusione* **FL+1 = Fusion Line + 1mm/** *Linea di fusione+ 1mm* **FL+2 = Fusion Line + 2mm/** *Linea di fusione+ 2mm* **FL +5= Fusion Line + 5mm/** *Linea di fusione + 5mm*

NB) I valori al di sopra di 360 Joule sono superiori all'80% del fondo scala della macchina.
Values above 360 Joule are exceeding 80% of the machine capacity

Laboratory Technician *Tecnico di Laboratorio*	Laboratory Responsible *Responsabile Laboratorio* *Sig. Giulio Bagnara*	Customer Inspector *Ispettore del cliente*	Third part Inspector *Ispettore Terza parte*
INSPECTA Dott. Ing. Luca Pasqui Paschi Laboratory Technician 23/11/2021	- INSPECTA srl - 23-11-2021 Service Responsible	ROSETTI MARINO S.p.A. Welding Dept. D. Cenacchi	

Headquarter: Via Giolitti 10 – 48123 Ravenna (RA) Italy – Phone /Fax +39 0544 451424
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MD 38 rev.19 data 02-08-2021

INSPECTA S.R.L.

RAPPORTO DI PROVA
TEST REPORT

N°422-00103-21	Date:23/11/2021	Rev.0	Pag. 5 of 5

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO — LAB N°1607 L

VICKERS HARDNESS TEST METHOD
Prova di durezza Vickers

Date of Testing:16/11/2021
Data esecuzione prova:

performed in accordance with the standard / *eseguita in conformità alla norma*: UNI EN ISO 6507-1:2018

The test was performed using Innovatest durometer machine, model 4303, s.n. 43030614C
La prova è stata eseguita utilizzando macchina durometro marca Innovatest, modello 4303, s.n. 43030614C

Internal procedure / Procedura interna	PP10 rev.06	Sample Identification / Identificazione provino	551/21	Hardness test type / Tipo di durezza	HV10	Test Temp. / Temp.test	24,4°C

Sketch for reference points
Schema punti di riferimento

Base Material : HEATED SIDE — **Base Material : NOT HEATED SIDE**



Sample Identification / Identificazione provino	551/21 HEATED			Sample Identification / Identificazione provino	551/21 NOT HEATED		
Reference points / Punto di riferimento	Values measured / Valori misurati	Conversion according To ASTM A370 tab. 2 / Conversione in accordo a ASTM A 370 tab.2	U	Reference points / Punto di riferimento	Values measured / Valori misurati	Conversion according To ASTM A370 tab. 2 / Conversione in Accordo a ASTM A 370 tab.2	U
-	HV 10	HB	///	-	HV 10	HB	//
1	175	//	//	1	196	//	//
2	174	//	//	2	193	//	//
3	169	//	//	3	195	//	//
4	//	//	//	4	//	//	//
5	//	//	//	5	//	//	//
6	//	//	//	6	//	//	//
7	//	//	//	7	//	//	//
8	//	//	//	8	//	//	//
9	//	//	//	9	//	//	//

Remarks/ *Note:* //

Laboratory Technician *Tecnico di Laboratorio*	Laboratory Responsible *Responsabile Laboratorio* *Sig. Giulio Bagnara*	Customer Inspector *Ispettore del cliente*	Third part Inspector *Ispettore Terza parte*
Dott. Ing. Marco Bacchetti Laboratory Technician 23/11/2021	- INSPECTA srl - 23-11-2021 Service Responsible	ROSETTI MARINO SpA Welding Dept. D. Cenacchi	

END OF TEST REPORT
FINE DEL RAPPORTO DI PROVA

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voestalpine Grobblech GmbH **A02**

Inspection certificate

EN 10204 - 3.1

Page 1 of 6
Z02 06-09-2021
Date

voestalpine-Straße 3
4020 Linz, Austria
www.voestalpine.com/grobblech

A03 Document number	Q0498596	A08 Order-No.	1501222	A07 OrderDat.	02-07-2021	Date of dispatch	02-09-2021	400F
A06 Customer	Rosetti Marino Spa Via Trieste 230 I-48122 RAVENNA	B01 Product	Plate					
		B02 Material	S460G2+M			B03 Standard	EN 10225 : 2009	
A07 OrderNo.	1721001468 121A01C	B04 Delivery condition	thermomechanical rolled + accelerated cooled					
A06 Consignee	Rosetti Marino Spa Via Trieste 230 I-48122 RAVENNA	B03 - Supplementary requirements	MATERIAL IS FINE GRAINED, VACUUM DEGASSED AND FULLY KILLED, PRODUCED BY BOF // FINAL ROLLING DIRECTION IS PERPENDICULAR TO DIE STAMPING // MATERIAL IS ACCORDING TO EN10225 OPTIONS 12					
A16 - Supplementary information EPCIC WHP D33								

D01 - Visual Examination and dimensional checking: satisfactory. The results of tests performed are in compliance with the requirements.

Detail of supply

B07 Heat No.	B06 Plate No	Dimensions B09 Item	Thickness mm	B10 Width mm	B11 Length mm	B08 Piece	B12 theor. Mass kg	B13 A09 net. Mass kg	Dim-No 130 42	reference no.
738494	306740/1	100	25,00	3000,0	10500	1		6.332	56543	1PLATCS25043
843494	305834/2	120	20,00	3000,0	10500	1		5.119	56543	1PLATCS20034
843494	305836/1	120	20,00	3000,0	10500	1		5.118	56543	1PLATCS20034
843494	305836/2	120	20,00	3000,0	10500	1		5.117	56543	1PLATCS20034
		Sum				4		21.686		

B14 - Supplementary information
Flatness acc. EN 10029/11 class S
Dimensional tolerances acc. EN 10029/11
EN10163-2: Class B3 - Repair-welding not permitted
Thicknesstolerance acc. EN 10029/11 tab.1 class C

Z02
Inspection representative voestalpine
Grobblech
Kogler Franz

A04
Symbol of the manufacturer's work

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A08 Document number: Q0498596 — A08 Order-No.: 1501222 — Z02 Date: 06-09-2021 — Page 2 of 6

Chemical composition (Heat analysis) - part 1 of 2

B07

Heat No.	C %	Si %	Mn %	P %	S %	Al %	Cr %	Ni %	Mo %	Cu %	V %	Nb %	Ti %	N %	B %	Sn %	Ca %	As %	Sb %	Pb %	Cae %	Pcm %
>=		.150				.015																
Set values <=	.140	.550	1.650	.020	.0070	.055	.250	.700	.250	.300	.080	.040	.025	.0100	.0005	.0200	.0050	.0300	.0100	.010	.43	.22
738494	.031	.339	1.620	.007	.0008	.037	.183	.180	.005	.161	.004	.036	.012	.0046	.0002	.0020	.0017	.0030	.0020	.002	.36	.15
843494	.029	.350	1.650	.005	.0008	.039	.170	.160	.004	.157	.005	.038	.013	.0041	.0002	.0020	.0016	.0020	.0020	.002	.36	.14

Chemical composition (Heat analysis) - part 2 of 2

B07

Heat No.	LF01 %	LF02 %	LF03 %
>=			
Set values <=	.090	.110	.900
738494	.040	.052	.529
843494	.043	.056	.491

C99 - Supplementary information
Bi <= 0,01%
C99 - Supplementary information
Cae: C+(Mn/6)+(Cr+Mo+V)/5+(Ni+Cu)/15
Pcm: C+((Mn+Cu+Cr)/20)+(Si/30)+(Ni/60)+(Mo/15)+(V/10)+(B*5)
LF03: Cr+Ni+Cu+Mo
LF02: Nb+V+Ti
LF01: Nb+V

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A03 Document number: Q0498596 A08 Order-No.: 1501222 Z02 Date: 06-09-2021 Page 3 of 6

Test results: C10-C29 Tensile Test at room temperature acc. EN ISO 6892-1

B07 Heat No.	C41 Width	C01 loc.	PosTh.	C02 Dir	C11 Rp0,2 MPa	C12 Rm MPa	L0	C13 E %	C11 Rp0,2/Rm %
	SpThickn mm								
>=					440	530		17.0	
Set values <=						690			90.00
738494	30,0	25.98	F	O	T	533	601 A5	22.8	88.73
843494	30,0	20.70	F	O	T	552	616 A5	20.5	89.58
	30,0	20.77	F	O	T	555	629 A5	23.3	88.17

SpThickn: specimen thickness
C01;loc.:
F: Bottom
PosTh.: Pos Thickness
O: surface
C02;Dir:
T: transverse
C12; Rm: Tensile Strength
L0: gauge
A5: Length = 5.65 * sqr (area) mm
C13;E: elongation

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A03 Document number Q0498596 A08 Order-No.: 1501222 Z02 Date 06-09-2021 Page 4 of 6

Test results: C40-C49 Impact Test acc. EN ISO 148-1

B07	C40	C01		C02	C03	C42	C42	C42	C43		
Heat No.	shape	loc.	PosTh.	Dir	temp	SV	SV	SV	AV		samp.cond.
					°C	J	J	J	J		
>=					-40	29	29	29	46		
Set values <=											
738494	CV 10x10	E	ZB2	T	-40	345	342	333	340	strain aged 5%, 60 min. at 250°C	
843494	CV 10x10	E	ZB2	T	-40	345	337	339	341	strain aged 5%, 60 min. at 250°C	
>=					-55	42	42	42	60		
Set values <=											
738494	CV 10x10	E	O	T	-55	346	360	354	353		
843494	CV 10x10	E	O	T	-55	331	348	327	335		
	CV 10x10	E	O	T	-55	351	346	363	353		

C40;shape:
CV 10x10: Test shape , Dimensions
C01;loc.:
E: Bottom
PosTh.: Pos Thickness
O: surface
ZB2: 2mm below surface
C02;Dir:
T: transverse
C42;SV: single value
C43;AV: average value
samp.cond.: sample condition

Chemical composition (Product analysis) - part 1 of 2

B07																								
Heat No.	C	Si	Mn	P	S	Al	Cr	Ni	Mo	Cu	V	Nb	Ti	N	B	Sn	Ca	As	Sb	Pb	Cae	Pcm
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
>=		.150				.015																
Set values <=	.140	.550	1.650	.020	.0070	.055	.250	.700	.250	.300	.080	.040	.025	.0100	.0005	.0200	.0050	.0300	.0100	.010	.43	.22
738494	.031	.335	1.610	.008	.0008	.037	.182	.180	.005	.157	.004	.037	.012	.0050	.0002	.0020	.0017	.0020	.0020	.002	.36	.14
843494	.033	.355	1.640	.007	.0006	.041	.178	.170	.006	.155	.004	.038	.013	.0047	.0002	.0020	.0017	.0020	.0020	.002	.37	.15

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Chemical composition (Product analysis) - part 2 of 2

B07

Heat No.	LF01 %	LF02 %	LF03 %
Set values <=	.090	.110	.900
738494	.041	.053	.524
843494	.042	.055	.509

C99 - Supplementary information
Bi <= 0,01%
C99 - Supplementary information
Cae: C+(Mn/6)+(Cr+Mo+V)/5+(Ni+Cu)/15
Pcm: C+(Mn+Cu+Cr)/20)+(Si/30)+(Ni/60)+(Mo/15)+(V/10)+(B*5)
LF03: Cr+Ni+Cu+Mo
LF02: Nb+V+Ti
LF01: Nb+V

Remarks

We confirm that the above-mentioned delivery corresponds to the order (and standard).

C70 - Method of steelmaking: Basic oxygen furnace (BOF) steelmaking, continuous casting, steel is fully killed, vacuum degassed and melted by fine grain practice, austenitic grain size 5 or finer.

The signature of the inspection representative from voestalpine Grobblech GmbH is substituted by a electronic Signature, because the certificates of voestalpine Grobblech GmbH are prepared by a suitable data processing system (EN 10204, Pt.5).

Z02 Inspection representative voestalpine Grobblech
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D02-D50 - ULTRASONIC EXAMINATION PLATE(S)

SPECIFICATION

Ultrasonic test acc. EN 10160, EN 10160 class S2/Body, Grid 100 mm, EN 10160 class E3/Edge Zone, Edge zone longitudinal 50 mm, Edge zone transverse 50 mm; satisfactory

VALID TEST EQUIPMENT
mechanized ultrasonic "in-Line testing system" (Manufacturer: NDT-Systems & Services) and
mechanized ultrasonic "off-line - testing system" (manufacturer: Windhoff Bahn- und Anlagentechnik GmbH) and
MUT (optional): Sonatest D20 no. 90006523 or Sonatest D20 no. 90007346 or Sonatest Masterscan 380 no. 90007347 or Sonatest Masterscan 380 no. 90006522 or Sonatest D50 no. 90010231 or GE - USM 36 no. 90010775

PROBE
(in-line AUT): 3STSE 18.3/8 P5, SE25R10RS, SE3 18.3/10 5A, (5MHz)
(off-line AUT): S140 (4MHz) 3t/1R
(MUT): SEB4E (4MHz), SEB4E0° (4MHz), MSEB4E (4MHz), B2S0 (2MHz)
watergapcoupling

SURFACE CONDITION
Scaled surface - cleaned surface and free of loose scale.

RESULT
Plate(s) comply with the specification.

INSPECTION OPERATOR
Operators Level 1 or 2: qualified and certified according EN ISO 9712 (since 01.01.2013) respectively according the Written Practice „NDT-WP" (in accordance to Recommended Practice SNT-TC-1A). Operators Level 2 for ASME/ASTM.

INSPECTION SUPERVISOR
Responsible Level 3: Bindreiter Erich

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8 FORM TO BE USED FOR RECORDS

REPORT DEFORMAZIONE A CALDO
Heat Straightening Check List

COMMESSA
Job Number
DATA
Date

SUBCONTRATTISTA Subcontractor	UBICAZIONE Location	ESEGUITO DA Performed by:

	DESCRIZIONE ATTIVITA' / Activities Description	Dati / Data		COMMENTI Remarks
1	Disegno e marca del particolare Drawing number and Item Mark			
2	Tipo / sigla materiale sottoposto a ripristino con deformazione a caldo Material Type to be heat straight			
3	Temperatura massima raggiunta per la deformazione Max temperature recorded during heat straightening activities			
	Lista controlli / Check List	CONFORME Conforming	NON CONFORME Not conforming	
4	Verifica Temperatura con cadenza minima ogni 10 minuti. Temperature check with minimum reading frequency of 10 minutes			
5	Verifica Dimensionale Dimensional Check			
6	Esito controlli non distruttivi NDE Results			
7	Risultato controllo Durezza Hardness test Result			

NOTE GENERALI
General note

Rosetti	Total	TPI
Signature	Signature	Signature
Date	Date	Date