



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS PVV 614

Welding of Duplex and Superduplex stainless steel

02	10/03	Change of Group name and logo
01	10/02	New revision
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Rev.	Date	Notes



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1. Scope

This specification summarises basic requirements for fabrication and welding of duplex (typically 22 Cr - 05 Ni) and superduplex (typically 25 Cr – 07 Ni) stainless steel pressure vessels and piping networks.

This specification is to be considered as a supplement to either:

- Pressure vessel code (ASME or BSI PD 5500)
- ASME B 31-3 and API RP 14E for piping

and their respective associated standards.

This specification applies to all welding activities on pressure vessels and piping including prefabrication, site and field installation of tubes, fittings, flanges and other equipment installed in the piping systems (valves, etc.).

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
ASTM G 48	Test Method for Pitting and Crevice Corrosion Resistance of Stainless Steel
ASTM E 562	Standard Test Method for Determining Volume Fraction by Systematic Manual point Count
ISO 9002	Quality systems-Model for quality assurance in production, installations and servicing
EN 287	Approval testing of welders - Fusion welding
EN 288	Specification and approval of welding procedures for metallic materials
EN 473	General principles for qualification and certification of NDT personnel

Professional Documents

Reference	Title
SNT-TC-1A	American Society for Non-destructive Testing Recommended Practice
API RP 14E	Design and Installation of Offshore Production Platform Piping Systems

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
ASME B 31.3	Process piping
ASME Section VIII	Boiler and Pressure Vessel Code
ASME Section V	Non Destructive Methods of Examination
ASME Section IX	Qualification Standard for Welding and Brazing, Welders, Brazers, and Welding and Brazing Operators
PD 5500	Specification for unfired fusion welded pressure vessels

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS COR 460	Chemical cleaning of equipment and piping networks
GS COR 560	Physical and chemical treatment of hydrostatic test water
GS PVV 112	Piping material classes
GS PVV 171	Steel piping fabrication
GS PVV 211	Design and fabrication of pressure vessels according to ASME VIII div. 1 or div. 2
GS PVV 212	Design and fabrication of pressure vessels according to PD 5500

3. Quality Assurance and Quality Control

The Contractor shall maintain an effective Quality System that complies with the requirements of ISO 9002 and associated guides.

4. General production fabrication and welding requirements

Manufacture shall not commence until the COMPANY has reviewed and approved the Contractor's Quality Plan and the Manufacture and Inspection Procedure Specification. The Manufacturing and Inspection Procedure Specification shall include all factors which influence the quality and reliability of the piping.



The Contractor shall transmit all fabrication procedures to the COMPANY for review. A tentative list of documents is defined in Appendix 1 of this specification.

Materials shall be inspected after delivery on site. All damage shall be reported to the COMPANY representative.

Correlation between marking on materials and materials certificates shall be checked by the Contractor, prior fabrication.

Contact between stainless steel and carbon steel is prohibited.

The workshop, which shall be clean and free from oil and grease, shall be dedicated for fabrication of stainless steel only. The workshop shall be sufficiently draught free to ensure adequate gas shielding. A reception workshop certificate shall be filled-in before the start of fabrication and shall be periodically reviewed to follow the fabrication quality. A form of document is proposed in Appendix 2.

All the tools, except machining tools, shall not have been used on either carbon steel or any other grade of stainless steel. The following precautions shall be implemented:

- Grinding disks shall be free from iron and carbon
- Brush shall be stainless steel
- Earth connection of welding and cutting equipment shall be stainless steel
- Cutting shall be carried out only by plasma or by mechanical sawing¹.

In case of condensation on materials, humidity shall be eliminated by using hot air blowers and/or by controlled induction heating. To prevent any oxidation the use of air/gas torch is prohibited.

Oil, moisture, rust, scale, paint or other foreign matter shall be removed from the weld surface and at least 50 mm of adjacent base metal prior welding.

Contamination of surface, weld bevel and surrounding areas with low melting point metals such as Copper, Zinc, etc., are not acceptable.

Inner and outer surface of weld preparation shall be thoroughly:

- Cleaned by wire brushing using a stainless steel wire brush
- Followed by de-greasing with solvent free from chloride and in accordance with local health and safety regulations.

Paint and markers containing zinc or chloride are prohibited.

Stringer beads shall be used. Minor arc oscillation to ensure side wall fusion is permitted.

Correction of deflexion by flame straightening is prohibited.

Grinding of all start/stop is required.

The bevels shall be prepared by machining¹, but a preparation by automatic plasma cutting is acceptable. The heat affected zone shall then be removed by grinding.

¹ Chloride content in machining oil shall be limited to 1.0 ppm



4.1 Backing gas protection

The back purge shall be made with argon or appropriate mixture approved by the COMPANY before starting qualification tests.

The oxygen level in the backing gas protection shall be less than 500 ppm.

Backing gas protection during qualification tests as well as during fabrication must be maintained until completion of the first three passes or a minimum of 5 mm of deposited weld metal.

The oxygen level in the backing gas protection shall be checked and recorded during the qualification tests until the end of weld performance.

During the fabrication, the oxygen level shall be checked until completion of the first three passes or of 5 mm of deposited metal.

In production, the oxygen level shall be in accordance with the level obtained during the qualification tests. The oxygen level taken as a reference for the qualification and fabrication will be the oxygen level measured at the start of the qualification weld.

Internal checking point of oxygen level shall be located in the upper quadrant (12 o'clock position) of the pipe, unless proved technically impossible.

Before production start, the Contractor shall send to the COMPANY, for approval, back purging and oxygen level measurement methods to be applied. This proposed method could be continuous or discontinuous with a minimum frequency to be agreed by the COMPANY.

5. Welding documents

5.1 Welding Book

Prior fabrication of piping components, a welding book shall be submitted to the COMPANY for review.

The welding book including repair procedures shall be submitted as soon as possible after the award of work and sufficiently ahead of the actual welding for the review of the COMPANY.

Only the COMPANY signed WPS shall be used for fabrication.

The welding book shall be fully transmitted each time a new revision is issued.

5.2 Welding Procedure Specifications (WPS)

Applicable welding procedure specifications shall make reference to the relevant piping classes and shall indicate the diameter, and thickness range as appropriate

A welding procedure is defined as the method and sequences to be adopted to achieve a satisfactory welded joint when carried out by a competent workman under the expected conditions of manufacture. All welding procedures submitted to the COMPANY shall include the actual welding details including all of the essential and non-essential variables and in particular the weld preparation and the bead sequence.

The actual job welding parameters shall be within the range used for the procedure qualification.

Weld procedures shall state the actual consumable or flux trade name and type as well as the code designation.

The welding procedure shall be issued on **ASME IX** form QW-482 or equivalent.

5.3 Welding Procedure Record (PQR)

All welding procedures shall be qualified in accordance with the requirements of **ASME IX** form QW 482 or equivalent. Previous welding qualifications shall not be accepted, and all welding procedures shall be qualified for the job concerned unless previously agreed by the COMPANY.

Welding procedure qualification with a duplex stainless steel base metal does not qualify welding procedure on superduplex stainless steel and converse.

For superduplex stainless steel, UNS number shall be considered as an essential variable. Change from one UNS number to another will require a new weld procedure qualification.

5.3.1 General

The weld procedure qualification program shall include the following essential variables and range:

- Heat input: any increase the heat input greater than 10% of that used in the qualification
- Welding process or any change in welding process for any pass
- Weld consumable (electrode, wire or flux) including changing from one brand name to another
- Change of flux (if any) in GTAW process.

Unless otherwise specified in Purchase Order, all PQR tests shall be witnessed and certified by an Inspection Authority recognised by the COMPANY.

Sufficient advance notice should be given to allow the COMPANY representative to witness the tests at the laboratory testing centre upon his request.

In addition to the requirements of **ASME IX** or **EN 288**, each welding procedure qualification shall include the tests detailed here below. Location of specimens is defined in Figure 1. Tests shall be made not less than twenty four hours after the total completion of the weld.

If any test result is not acceptable, resetting on double quantity of originally required test samples shall be done. If the result is acceptable on all test pieces from resetting, the relevant test weld is accepted. Conversely if any additional test result fails, the test weld is considered as not acceptable.

All the weld test coupons shall be taken from concerned job bulk.

5.3.2 Guide bend test

Transverse bend test shall consist of two face bends and two root bends for wall thickness < 10 mm, and four side bends for wall thickness ≥ 10 mm. The jig diameter shall be four times the wall thickness of the test plate. Acceptance criteria shall be in accordance with relevant chapter of **ASME IX** or **EN 288**.

5.3.3 Impact test

Impact tests shall be carried out either at the temperature stated below (for piping), or at the temperature defined for the specific job based on the design temperature (whichever is the lower).

Two sets of three Charpy-V specimens shall be tested at minus 46°C for duplex steel and minus 20°C for superduplex steel. One set shall be located in the weld metal and one set shall be located in the heat affected zone (FL + 2 mm).

The acceptance criteria for 10 x 10 mm specimens shall be as follow:

- Average for three specimens: 40 joules
- Individual value: 28 joules.

Subsize specimens are only acceptable where full size specimens cannot be extracted. The largest possible subsize specimens shall be taken. Materials with a wall thickness equal or less than 6 mm may not be impact tested.

5.3.4 Metallographic examination

Four transverse macrographic examinations and four micrographic examinations (magnification x 100 minimum) shall be carried out.

The microstructure of the weld shall be free from carbides, nitrides and intermetallic phases, especially sigma phase (total maximum content of 0.05%).

5.3.5 Ferrite content

Ferrite content shall be measured on metallographic specimens.

The ferrite range shall be within 30 to 60% for duplex and 35 to 65% for superduplex as measured by metallographic method using a point count technique in accordance with [ASTM E 562](#) in order to include the weld metal and the heat affected zone.

The measures shall be carried out as defined in Figure 4

A minimum of two measures shall be carried out on each.

5.3.5.1 Hardness test on macrography

Vickers HV10 hardness test shall be carried out on hardness lines (See Figure no. 4).

In the weld metal, a minimum of six measurement points are taken in the cap pass and a minimum of three measurement points in the root pass. The measurement points shall be equally spaced.

In the heat affected zone, the measurement points are spaced at 0.5 mm intervals, beginning on the fusion line.

In the base metal, three measurement points are taken at 1 mm intervals.

The maximum acceptable hardness value in the weld metal and in heat affected zone is 320 HV10 for duplex and 350 HV10 for superduplex.

5.3.6 Pitting corrosion resistance

The corrosion test procedure shall conform to [ASTM G 48](#) method A.

The procedure shall be submitted to the COMPANY for approval.

The test specimen shall be machined perpendicular to the weld axis. The specimen dimensions shall be full wall thickness by 10 mm along the weld and 50 mm across the weld.

The test shall expose the external and internal surface and a cross section surface including the weld zone in full wall thickness.

All surfaces, not subjected to the test, shall be electrolytically polished or be surface finished with 600-grit abrasive paper.

All the surfaces shall be degreased in acetone bath, cleaned by ultrasound, pickled (17% HNO_3 + 4% HF, 60°C, 5 minutes) and rinsed in ethanol, dried and weighed.

The tests are performed at a temperature of $25 \pm 1^\circ\text{C}$ for duplex steel and $40 \pm 1^\circ\text{C}$ for superduplex steel.

Exposure time is 24 hours.

The acceptance criteria are:

- No evidence of pitting, under visual examination with a magnification of x20
- Weight loss shall be recorded for information.

6. Welder performance qualification

6.1 General

Welders and welding operators shall be qualified in accordance with [ASME Section IX](#) or [EN 287](#) by a recognised Inspection Authority

All welders and welding operators shall be qualified for all welding positions in which they will undertake production work. For piping, position 6G or 2G and 5G will qualify all positions.

Welders and welding operators shall be qualified on the same P number material as for the work to be done.

Existing qualifications are not acceptable to the COMPANY. Welders and welding operators shall be re-qualified for the job.

For piping, welder qualification for welded branch connections or for welds of special configurations shall include special requirements and testing as directed by the Inspection Agency. Only welders qualified for groove welds in the 6G (inclined, fixed) position may be submitted to particular qualification for welded branch connections.

Welders and welding operators shall only be qualified if they successfully pass visual, radiographic and mechanical examinations.

A record of the results of each test weld shall be jointly signed by the Contractor and the Inspection Agency. The record shall indicate the symbol or number given to each welder for identification of his work.

Welders and welding operators are subject to re-qualification when the quality of their work, during fabrication, appears to be repeatedly below the requirements of this specification.

6.2 Welder identification stamp

Each qualified welder and welding operator shall be assigned an identification number, letter or symbol as follows:

- For each weld, the welder symbol shall be provided, except for filets joints. For this purpose, on completion of the weld, the welder shall stamp his identification symbol on two diametrically opposite zones besides the weld with a low stress stamp or by painting. In any case, these marks shall be used for the traceability of welders.

- If the welder performs only the filling passes, such zones shall be close to the ones marked by the welder who performed the root pass.

7. Welding electrodes and consumables

7.1 General

Welding consumable shall be purchased from a recognised well-known Manufacturers.

3.1B test certificates of welding consumable with actual values (chemical and mechanical properties) shall be required for each batch (rods, electrodes and wire/flux combination).

Superduplex consumables shall not be used for weld filling on duplex base metal.

The addition of hydrogen in shielding and backing gas is prohibited.

Gas bottles for duplex and superduplex stainless steel shall be clearly identified, and hoses shall be checked to ensure that all connections are tight and there are no leaks.

All filler materials shall be individually and clearly stamped, flagged or stencilled to ensure tractability and correct usage on site. The identification shall state Manufacturer, grade and batch number. Unidentifiable welding consumable shall not be used.

7.2 Consumables storage

Welding consumables shall be stored with care on a specific separate area, under dry conditions in their original unopened packing. After opening of containers, storage and handling of electrodes, fluxes and other welding materials shall be as specified in the Manufacturer's recommendations.

Electrode, filler wire or flux that are damaged, damp, greasy or oxidised must not be used.

Temperature and humidity shall be controlled and recorded on a daily basis in welding consumables storage room.

Low hydrogen electrodes should be vacuum packed.

Welding electrodes shall be stored in calibrated ovens at the temperature between 120°C and 150°C. When issued for production they are placed in heated quivers capable of maintaining a minimum temperature of 70°C.

Flux shall be stored in calibrated ovens at the temperature between 120°C and 150°C after opening of the packing. Submerged arc flux shall not be recycled.

All welding consumable which have been in direct contact with water shall be definitively rejected.

All in coming and outgoing consumables shall be recorded on specific data log on a daily basis.

8. Welding

8.1 General

Anything which results in the weld metal or HAZ being overheated or heated for prolonged periods, e.g. the welder pausing or weaving, slow welding speed, welding without continuous filler addition, excessive slope up/downtime for craters elimination, excessive inter pass temperature, will affect and reduce corrosion properties and shall be avoid.



Before welding, bevels and adjacent inner and outer surfaces and TIG wires shall be cleaned with acetone and fluffless fabric.

The oxidised end of partly used filler wire shall be snipped off prior to re-use.

Stringer beads with maximum width is three times the core diameter, shall be used. Fit up

The COMPANY preferred method for fit-up is external or internal clamp.

If not possible, tack welding could preferably be done with controlled backing gas protection. Tack welding procedure shall be submitted to the COMPANY for approval.

Tack welds shall be done with qualified procedure and by qualified welder.

If filler metal is not used, tack welds shall not be melted in the root pass but shall be completely eliminated by grinding before root pass finishing.

8.2 Welding process

Only the following welding processes are authorised:

- Shield Metal Arc Welding (SMAW)
- Manual and automatic Gas Tungsten Arc Welding (GTAW)
- Automatic Submerged Arc Welding (SAW).

Any other process which a Fabricator would intend to use should be subject to prior approval by the COMPANY. This approval would be based on the submission of a complete file detailing past experience and quality achieved with the process.

Autogenous welding, e.g. welding without the addition of filler metal, shall not be carried out under any circumstances except tack welding.

Whichever the welding process used for filling on no back welding sequence, the two first passes shall be carried out using the GTAW process.

All manual GTAW shall use a high frequency start and a post-purge gas flow for the torch. Whenever the welder stops welding, the welding current shall be gradually decreased by use of the remote current control. The torch shall be held in position close to the weld pool until the gas shielding post-purge flow is completed to prevent oxidation.

Permanent backing material is not allowed.

9. Preheat

Preheat is not required, however, the pipe wall temperature shall be such that the pipe is free from condensation.

10. Interpass temperature

Maximum interpass temperature as recorded on the PQR shall be considered as an essential variable. In no case shall the interpass temperature be greater than 150°C, and measured at the point of the each restart welding.

The interpass temperature shall be monitored to confirm compliance with the limit established by the PQR.

11. Heat input

For superduplex, welding with low heat input is preferable (less than 1.2 kJ/mm). In case of the root pass deposited with an heat input more than 1.2 kJ/mm, this first pass shall be followed by a second pass with low heat input approx. of 1.0 kJ/mm.

For production weld, the welding parameters shall be monitored in order to confirm compliance with the heat input required by the WPS.

12. Weld monitoring

The welding of duplex and superduplex materials shall be monitored by a Quality Control representative from Contractor on a regular basis, e.g.:

- For the first production weld of each welder, welding parameters of root, hot and filling passes shall be monitored and recorded.
- Every five prefabrication production weld of each welder welding parameters of root, hot and filling passes shall be monitored and recorded
- For each installation weld welding parameters of root, hot and filling passes shall be monitored and recorded off all materials
- Reference shall be made to the relevant weld procedure, and the check list in Appendix 3 for weld monitoring of all materials.
- Measuring equipment used for weld monitoring shall be calibrated.
- Monitoring check list shall be used to record the findings of all weld monitoring. It is mandatory that actual values are recorded.
- Whilst the monitoring of welding is being carried out particular attention must be paid to the cleanliness of weld preps and consumables, content of oxygen back purge, all pass temperatures measured by Digital Contact Thermometer with close monitoring of root and hot passes and actual recorded heat input values, and run-out-lengths.
- All completed weld monitoring check lists (see Appendix 3) shall be issued to the Contractor welding department for the COMPANY review.
- Welders found to be working out of the welding procedure parameters or unable to maintain the required heat input values shall be immediately replaced. Immediate corrective action shall be taken and the COMPANY shall be informed.

13. Post Weld Heat Treatment (PWHT)

PWHT is not required.

14. Non-Destructive Examination (NDE)

14.1 General

NDE shall be carried out in accordance with methods as described in the applicable Code (ASME or PD 5500). Written procedures shall be submitted to the COMPANY for review before the start of fabrication.

Personnel performing non destructive testing other than visual shall be qualified in accordance with ASNT Practice No. [SNT-TC-1A](#) or [EN 473](#). The equivalency must be documented. Only individuals qualified for NDE Level I and working under the NDE Level II or individuals qualified for NDE Level II may perform NDE.

14.2 Ultrasonic Testing (UT) when RT is impracticable

The equipment shall be capable of locating longitudinal and transverse flaws at all depth in the weld and heat affected zone.

All butt and all full penetration welds shall be 100% inspected by UT examination.

The probes shall include normal compression wave and 45 degree, 60 degree and 70 degree shear wave angle probes, single and twin crystals 4-5 MHz.

For wall thickness above 20 mm, a specific reference sensitivity block shall be used. This block shall contain a weld representative of those to be examined.

The reference standards shall consist of cylindrical holes ($\varnothing 1.5 \text{ mm} \pm 0.1 \text{ mm}$) drilled in the heat affected zone through the entire thickness of the block and parallel to the surface of examination (as shown in Figure 5).

14.3 Radiographic Testing (RT)

All butt and all full penetration welds shall be 100% inspected by RT examination.

Penetration of X and γ -rays in duplex and superduplex materials is lower than in carbon steel. Practicability of RT examination shall thus be questioned for thicknesses above 35 mm.

14.3.1 Quality of Radiographs

- Fin grain films shall be used (Kodak MX, Agfa D7 or equivalent)
- Density shall be:
 - For single-film viewing 2.0 minimum for gamma rays and 1.8 for X-rays
 - For composite viewing of multiple film 1.3 minimum on each radiograph
 - Maximum density 4.0 for either single or composite viewing
- A specific procedure for demonstration of penetrameter resolution shall be made.

14.4 Acceptance criteria for UT and RT examinations

Acceptance criteria shall be according to [ASME B 31.3](#). Level of severity pertaining to cyclic conditions shall apply and with the following additions:

- No lack of fusion is permitted
- No lack of root fusion is permitted
- No lack of penetration is permitted.

14.5 Dye Penetrant examination (DP)

All the fillet and incomplete penetration welds shall be 100% inspected by DP (chloride free) examination.

14.6 Ferrite measurement

The ferrite content of completed welds shall be conducted on a 20% random sampling of all production welds. Per weld, the average of three measurements shall be done and both the welds metal and HAZ shall be tested.

It shall be within the range of 30 to 60% ferrite for Duplex and 35 to 65% ferrite for Super duplex or using the appropriate Ferrite Number () of Magne Gage System.

15. Repair welding procedure

Open root repairs are forbidden. The minimum remaining ligament (distance between the inner surface and the bottom of excavation) shall be 3 mm.

For all repair, the excavation shall be subject to dye penetrant (chloride free) examination which shall be completely removed and cleaned thoroughly prior repair welding.

Re-repair in the same area is forbidden.

The back gas protection requirements shall be the same for the repair procedure as for the main welding procedure for all thickness ligament thinner than 5 mm.

Cap repair could be qualified by partial repair procedure but the converse is not acceptable.

In all cases, one of repairs shall be qualified with a 3 mm ligament.

In case of a WT greater than 12 mm, a mid thickness repair qualification is required.

Repair qualification type	WT ≤ 12 mm	WT ≥ 12 mm
Cap repair	Required	Required
Mid Thickness repair	Not required	Required
Partial repair (3 mm ligament)	Required	Required

All repairs shall be subject to 100% non-destructive examination as the main weld procedure.

Repair welding procedures shall be qualified by tests as defined in Figures 2 and 3.

16. Pickling and passivation

Any ground surface, external weld surface and adjacent base metal shall be pickled and passivated after grinding or welding, according to a procedure submitted to the COMPANY for approval.

In case of oxidation of the inner surface (for example: root pass made by SMAW or SAW process), internal pickling and passivation should be required by the COMPANY. **GS COR 460** shall be applicable for internal pickling and passivation.

17. Testing

Testing shall be performed in accordance with the requirement of **GS PVV 171**. Hydrostatic test shall be performed with water in accordance with **GS COR 560** and containing less than 2 ppm (2 mg/l) of total iron.

18. Final documentation

The Fabricator shall, at the end of the project, supply the following documents in their latest versions:

- Quality Plan
- Manufacturing and Inspection Procedure Specification
- Requested procedures and documentation
- Reception workshop certificate
- Materials certificates (base metal and consumable)
- Welding book
- Welders qualification tests results
- Monitoring check lists
- Identification on isometric drawings of materials, welds and welders, and NDE
- Reports of Non-destructive Examination
- Pickling and passivation reports
- Non conformance reports (if any)
- Hydraulic test report.

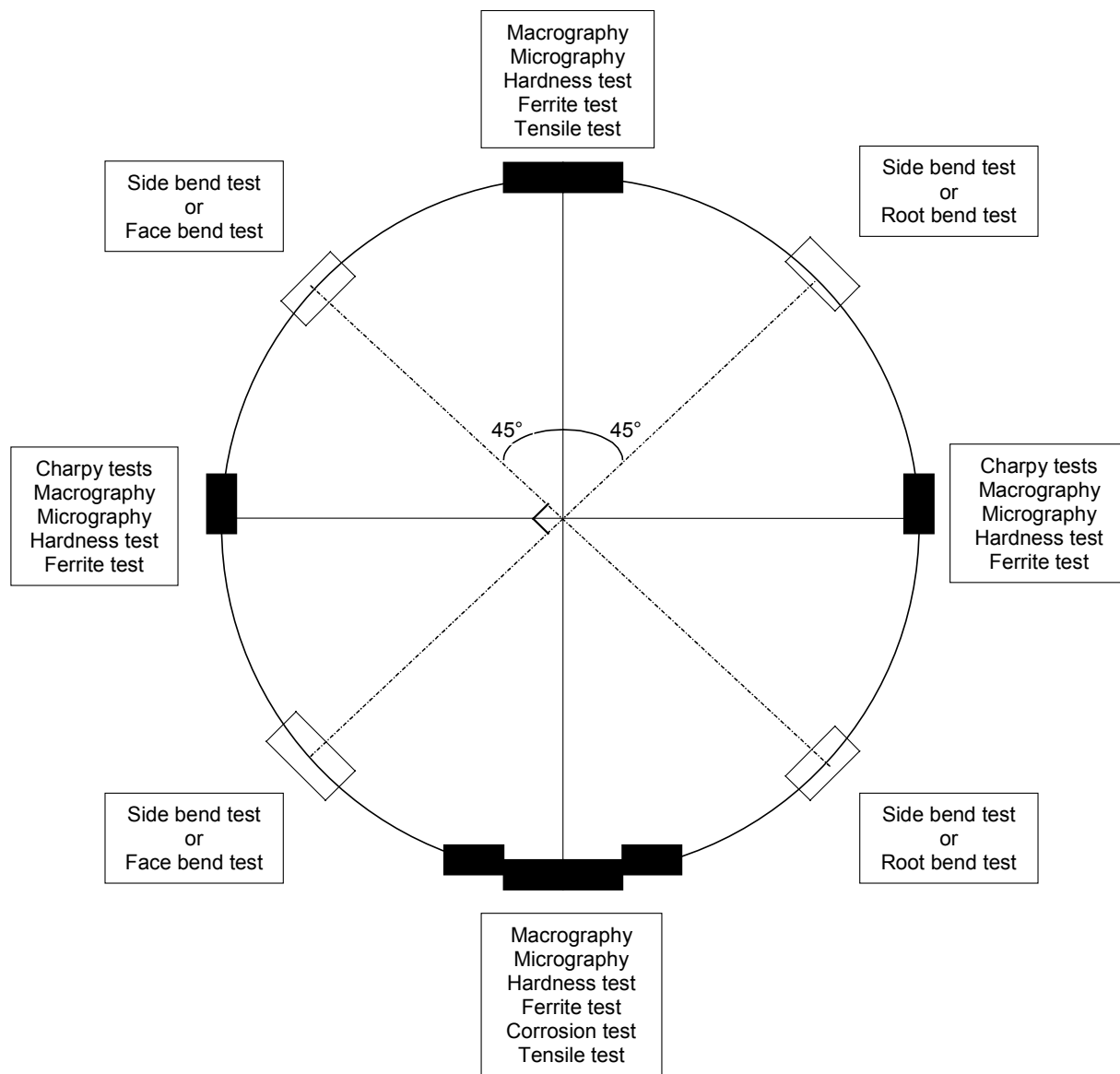
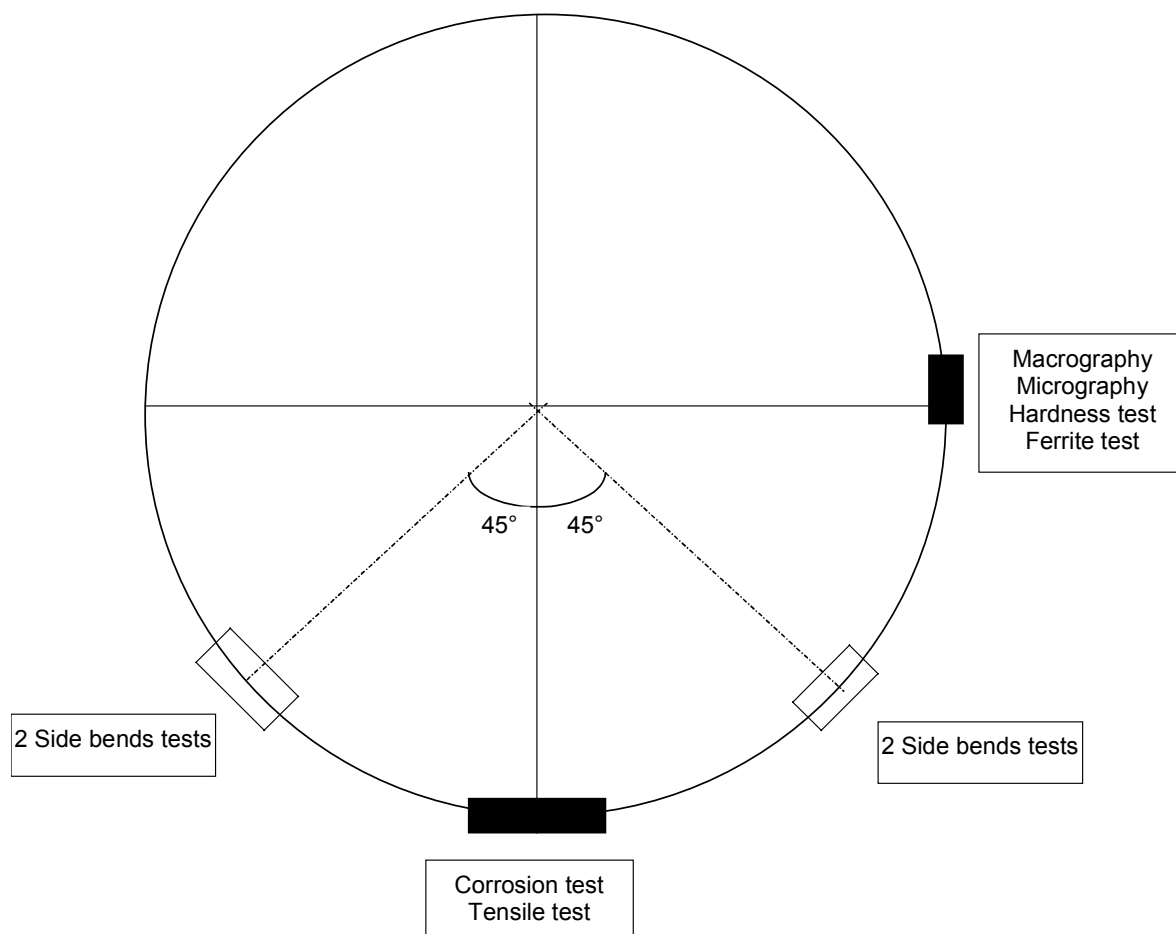


Figure 1 - Location of Tests Specimens (main weld qualification)



**Figure 2 - Location of Tests Specimens
(3 mm ligament and partial weld repair qualification)**

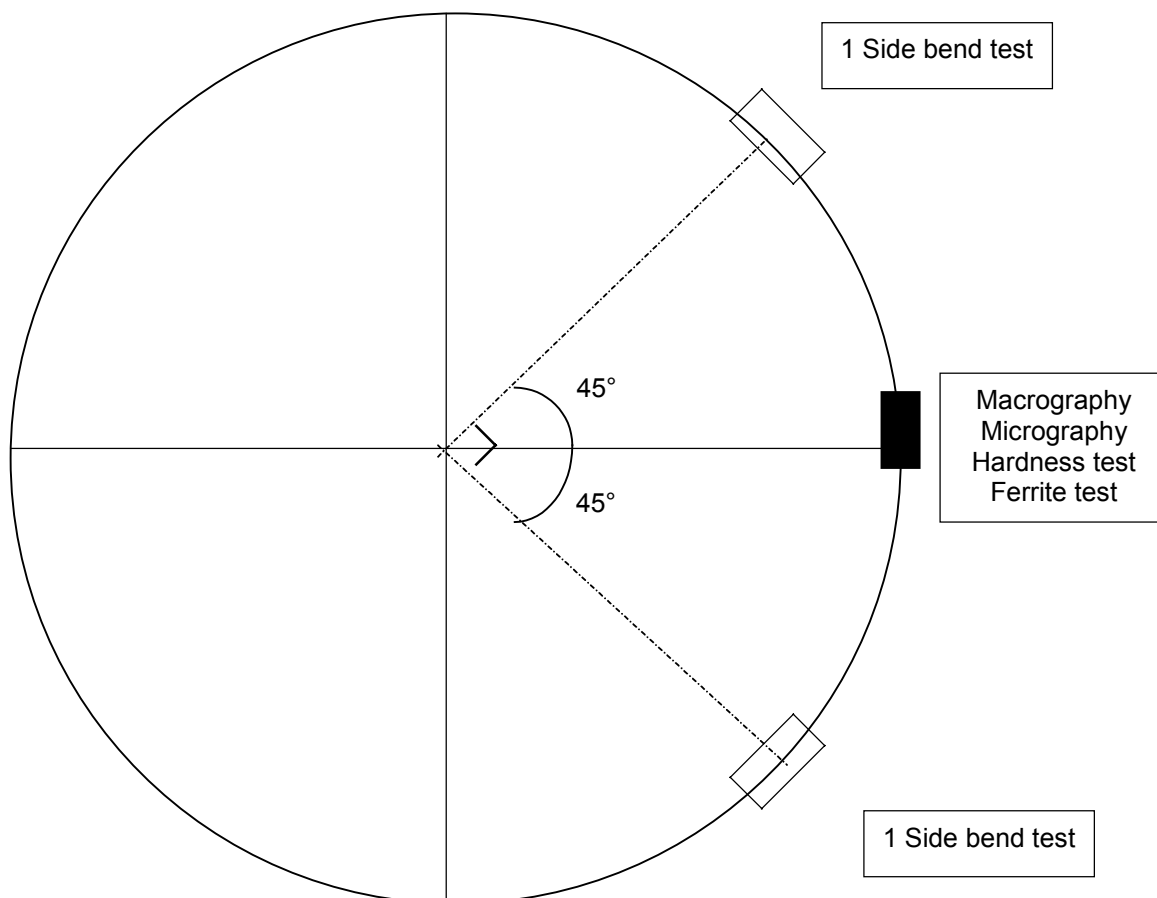
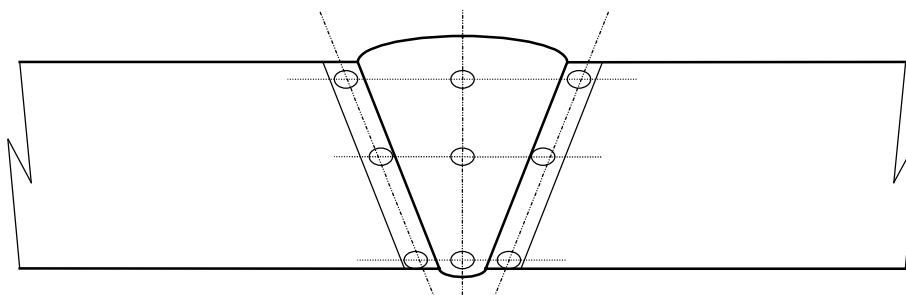
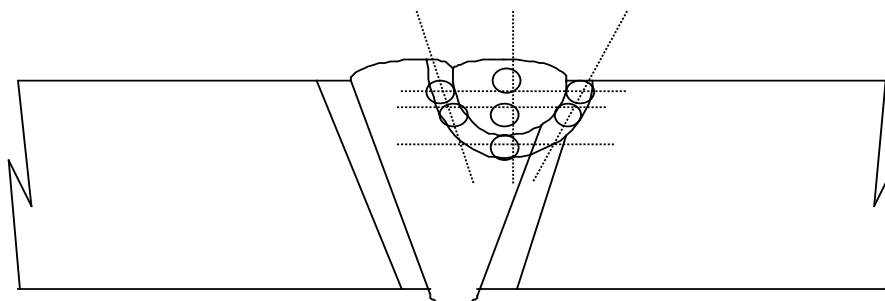


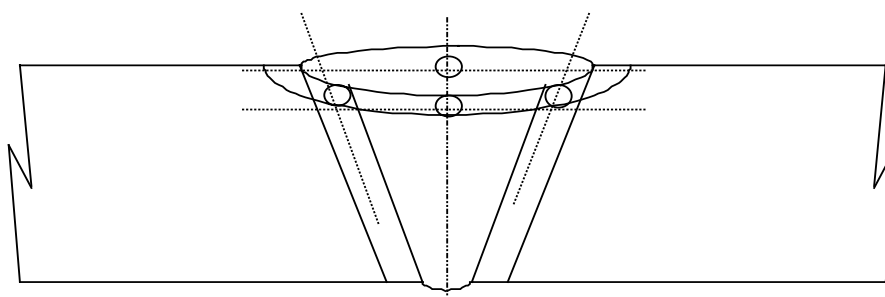
Figure 3 - Location of Tests Specimens (cap weld repair qualification)



4A - Original weld and 3mm ligament repair



4B - Partial penetration repair



4C - Cap repair

Figure 4 - Hardness and Ferrite Surveys Locations

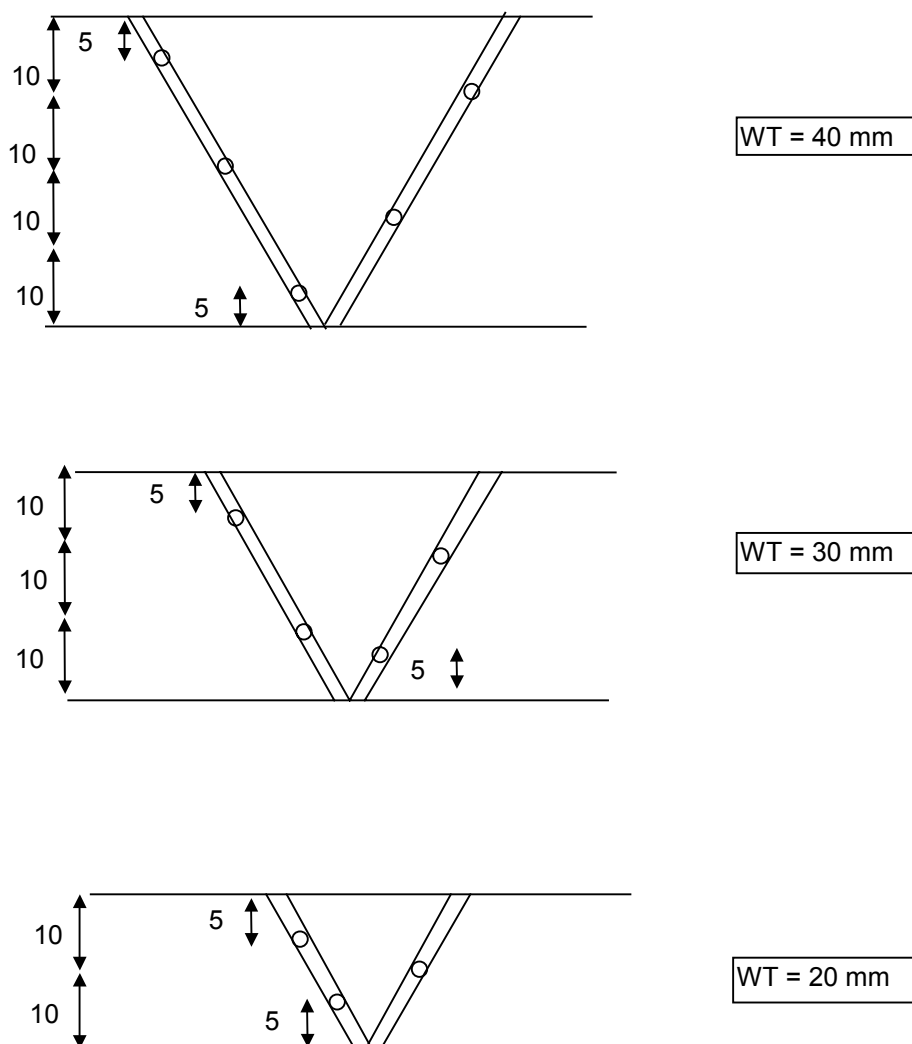


Figure 5 - U-trasonic testing - Reference sensitivity block
Location of drilled holes (values en mm)

Appendix 1 Requested documentation

Requested procedures and documentation for Duplex and Superduplex works		
Rev:		Date:
Fabrication procedure No. & Rev.		
1		Inspection and Test Plan for Material
2		Quality Control Plan
3		Reception Workshop Certificate
4		Colour Identification Tools
5		General Fabrication Procedure for Work
6		Storage and Handling Procedure for Material
7		General Procedure for Welding
8		Socket Weld Preparation and Control
9		Calibration of Welding Set, Gas Shielding Flow Rate, Thermometer, Ferrite Control Set
10		Receipt, Storage, Handling and Drying-up of Welding Consumables
11		Piping Welding Book (WPS and PQR)
12		Welders Qualification List and Certificates
13		O2 Control and Purge Chamber Calibration
14		Tack Welding
15		Controlling and Repairing Arc-strikes
16		Repair for Defective Weld
17		Iron Detection and Decontamination
18		Pickling and Passivation of Weld Surface and Base Metal Surface
Nde procedure for welds No. & Rev.		
19		Spools Storage and Manutention during NDE
20		NDE Organisation Chart and NDE Operators List
21		Extent of NDE
22		Visual Examination
23		Dye Penetrate Examination
24		Radiographic Examination
25		Demonstration of Pentameter Resolution and Radiographic Qualification after Root and Hot Passes
26		Ultrasonic Examination
27		In-progress Control System for Each Isometric
Documentation		
28		Dye Penetrant Product (Cl-free)
29		Marker and Paint Documentation (Cl and metal ions-free)
30		Machining Oil (Cl-free)
31		Analysis Device of Chloride and Iron for Hydro testing and Analysis Certificate
32		Ferrite Calibration Probes
33		Analysis of Argon Certificate for Each Bottle Delivery
34		O ₂ Analyser
Other necessary procedures		
35		



Appendix 2 Reception Workshop Certificate

Workshop (*)	Reception workshop certificate					Contract Nb
	Duplex and superduplex piping - (*) project					
Item	Designation	Check (X)	Reserve Nr	Fabricator	(*)	COMPANY
1	Warehouse					
	Storage					
	Cleanliness					
2	Preparation Hall					
	Environment					
	Bridge Crane					
	Hoist					
	Tools					
	Plasma Cutting Set					
	Disk Cutting Set					
	Bevelling Set					
	Cleanliness					
	Contamination Protection					
3	Welding Hall					
	Environment					
	Tack Welding					
	Arc Welding Set					
	Purge Gas Chamber					
	Drying Oven					
	Tools					
	Thermometer					
	Ferrite Content Measuring Set					
	O ₂ Analyseur and Probe					
	Welding Procedures					
	Instructions					
	Cleanliness					
	Contamination Protection					



Exploration & Production

General Specification

Date: 10/03

GS PVV 614

Rev: 02

Appendix 2

Workshop (*)	Reception workshop certificate					Contract Nb
	Duplex and superduplex piping - (*) project					
Item	Designation	Check (X)	Reserve Nr	Fabricator	(*)	COMPANY
4	NDE					
	Signalization					
	Dark Room					
	NDE Device					
	Spool Storage					
	Cleanliness					
	Contamination Protection					
5	Hydrostatic Test					
	Test Pump					
	Pressure Recorder					
	Contamination Protection					
6	Finish Parts Storage/Handling					
	Contamination Protection					
7	Miscellaneous					
Reserves:						
Visas: (*) Fabricator Contractor COMPANY						
Rev.:			Date:			



Appendix 3 Monitoring Check List

Monitor Equipment:		AmMeter No.	Volt Meter No.	or MonArc
Project:		Contract No.		Item/Spool No.
Weld N°		Welder No.		WPS Ref:
Check for the following			✓	Remarks
1	Welding Procedure	Material Type/Grade Correct?		
		Thickness Correct?		
		WPS Correct?		
2	Degrease prep's and filler wire			State measured gap: Actual recorded State: Actual recorded Actual recorded
3	Weld prep's dressed and degreased			
4	Argon hoses general condition			
5	Joint fit up in accordance with WPS			
6	Bullets/Bridge tacks where appropriate/Tack Welding			
7	Monitoring check at 20.9% and 0% O ₂			
8	Backpurge O ₂ content			
9	Purge flow rate			
10	Filler wire snipped where applicable			
11	Gas lens where applicable			
12	Interpass temperature and mid-pass temperatures measured using a Digital Contact Thermometer			Actual recorded
13	TIG/SMAW run length			Actual recorded
14	Tempilsticks are available and in use			Measure and record heat input $A \times V \times T / ROL =$
15	Heat quivers are operating			
16	Weld consumables used are in accordance with WPS			
17	Welding sequence and welding parameters are in accordance with WPS 1) Current 2) Volts 3) Welding speed			
18	Preheat is applied correctly and in accordance with WPS			
19	Welder is qualified to weld to WPS			
Approvals				
Inspection		Welding dept		
Name:				
Sign:				
Date:				