



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS EP PVV 619

Piping or pressure vessel components in duplex and superduplex stainless steel

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1. Scope

This specification covers specific requirements applicable to pieces of materials other than plates used either on equipment such as pressure vessels or heat exchangers, or as piping materials, and which are made of duplex 22-05 or superduplex 25-07 stainless steel. Piping materials include in particular: pipes, fittings (tees, elbows, reducers, weldolets, etc.), flanges, valves, etc., either in the form of wrought products or powder Hot Isostatic Pressing (HIP) products.

The present document applies to the actual manufacturing procedure requirements of individual pieces, and does not cover assembly of these pieces to each other by welding (welding is only considered if part of the fabrication of individual pieces such as welded pipes or fittings).

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 A 182M	Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A 240M	Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 370M	Mechanical testing of steel products
ASTM A 388M	Standard practice for ultrasonic examination of heavy steel forgings
ASTM A 473	Standard Specification for Stainless Steel Forging
ASTM A 479	Standard Specification for Stainless Steel Bars and Shapes for Use in boilers and Other Pressure Vessels
ASTM A 745M	Standard Practice for Ultrasonic Examination of Austenitic Steel Forgings
ASTM A 789	Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service
ASTM A 790M	Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Pipe
ASTM A 815M	Wrought Ferritic, Ferritic Austenitic and Martensitic Stainless Steel Piping Fittings
ASTM A 923	Standard Test Methods for Detecting Detrimental Intermetallic Phase in Duplex Austenitic/Ferritic Stainless Steels
ASTM A 928M	Standard Specification for Ferritic/Austenitic Stainless Steel Pipe Electric Fusion Welded with Addition of Filler Metal



Reference	Title
ASTM A 960M	Standard specification for Common Requirements for Wrought Steel Piping Fittings
ASTM A 988	Standard specification for Hot Isostatically-Pressed Stainless Steel Flanges, Fittings, Valves, and Parts for High Temperature Service
ASTM A 999M	Standard Specification for General Requirements for Alloy and Stainless Steel Pipe
ASTM E 165	Standard Test Method for Liquid Penetrant Examination
ASTM E 213	Standard Practice for Ultrasonic Examination of Metal Pipe and Tubing
ASTM E 309	Standard Practice for Eddy-Current Examination of Steel Tubular Products using Magnetic Saturation
ASTM E 384	Standard Test Method for Knoop and Vickers Hardness of Materials
ASTM E 562	Standard Test Method for Determining Volume Fraction by Systematic Manual point Count
ASTM G 48	Test Method for Pitting and Crevice Corrosion Resistance of Stainless Steel
EN 473	Non-destructive testing - Qualification and certification of NDT personnel
EN 584	Non Destructive Testing – Industrial Radiographic Films
EN 10002	Metallic materials - Tensile testing
EN 10204	Metallic products - Types of inspection documents
ISO 148	Metallic materials - Charpy pendulum impact test

Professional Documents

Reference	Title
SNT-TC-1A	American Society for Non-destructive Testing Recommended Practice

Regulations

Reference	Title
Not applicable	



Codes

Reference	Title
ASME B 16.5	Steel Pipe Flanges
ASME B 16.9	Factory-made Wrought Butt-welding Fittings
ASME B 16.11	Forged Steel Fitting, Socket Welding and Threaded
ASME B 16.25	Butt welding ends
ASME B 36.10M	Welded and Seamless Wrought Steel Pipe
ASME B 36.19M	Stainless Steel Pipe
ASME B 31.3	Process piping
ASME Section VIII	Boiler and Pressure Vessel Code
ASME Section V	Non Destructive Methods of Examination

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP COR 560	Physical and chemical treatment of hydrostatic test water
GS EP PVV 112	Piping material classes
GS EP PVV 143	Metallic pipes
GS EP PVV 144	Fittings
GS EP PVV 175	Cleaning of piping and vessels
GS EP PVV 614	Welding of duplex and superduplex stainless steel

3. General

3.1 Quality Assurance/Quality Control

The Supplier Quality Assurance Manual (QAM) shall be submitted to Company.

Three weeks prior to commencement of pipe manufacture, the Supplier shall prepare and submit to Company a written Quality Control Plan (QCP) which describes the inspections to be performed during the supply of components at any stage. The QCP shall set forth "witness", "hold", "review" and "monitor" points.



4. Inspection by the Company

All procedures shall have prior approval of the Company. All qualification tests shall take place under the supervision of the Inspector.

The Supplier shall notify the Inspector sufficiently in advance to enable him to be present at qualification tests and at all other tests or stages of manufacture subject to acceptance in accordance with this specification and QCP.

The Supplier shall ensure that the Inspector has full and free access to all parts of the Mill during all stages.

The Company reserves the right to re-check tests carried out by the Supplier. For this purpose, the Company may request the delivery of samples or specimens for analyse in an independent laboratory chosen by the Company.

5. General requirements

All duplex and superduplex stainless steels shall be subject to secondary refining, details of which shall be included at the bid stage.

The steel making process shall include alloy refining by Argon Oxygen Decarburization (AOD) or Vacuum Oxygen Decarburization (VOD) process.

All components shall be delivered in solution annealed water quenched condition. Annealing solution heat treatment shall take place after completion of **all** fabrication steps (forming, welding including repair, etc.) but before the final machining of the components (if applicable).

A furnace loading sketch shall be submitted to Company.

All duplex stainless steel bids shall state the nominated Supplier of the raw material and of the final components.

All components shall be delivered in conformance with the requirements of the referenced standard and the requirements of the present specification.

Forged components shall be forged to shape.

All fabrication and control operations shall be defined in a specification established by the Supplier. This specification shall be furnished to the Company with the following information:

- Steel making, casting and refining methods
- Chemical composition
- Manufacturing process with forming method, the extruded method is not permitted
- Heat treatment conditions (**solution annealing**)
- Destructive and non destructive testing
- Pickling and passivation
- Marking
- Transportation protection.

All components shall be delivered free of scale.

Finished products shall be white pickled, included machined surfaces.

All tests, such as mechanical, metallographic, corrosion, etc., shall be done in the final delivery conditions.

6. Testing

Each lot shall be subject to the range of testing as detailed here under.

Furthermore additional hardness and ferrite measurements shall be made on each component as detailed here under.

6.1 Lot definition

A lot shall be understood as having the same manufacturing method, the same heat number, the same heat treatment batch, the same forging rate, and the same welding procedure specification, etc.

6.1.1 Pipes

A lot of pipes shall consist of all pipes of the same nominal size and wall thickness (or schedule) which are produced from the same heat of steel and subject to the same finishing heat treatment as defined as follow:

- Continuous heat treatment furnace: the lot shall include all pipes heat treated in the same furnace at the same temperature, same soaking time, furnace speed and quenched in the same production run.
- Batch-type heat-treatment furnace (equipped with recording pyrometers and automatically controlled within a 28°C or smaller range): the lot shall be the larger of:
 - (a) Each 60 m or fraction thereof or
 - (b) Pipes heat treated in a same batch and quenched in a same production run.

6.1.2 Fittings

The supplementary requirement S2.2 of [ASTM A 815M](#) is applicable: a lot shall consist of all fittings of the same type, size, and wall thickness, manufactured from one heat of material, heat treated in the same batch furnace charge, and quenched in the same production run.

If welding is involved in fabrication of fittings, a lot shall also be restricted to components fabricated using the same lot number of electrodes or same heat of weld wire.

6.2 Sampling

Test samples shall be taken from prolongation on actual component. The testing shall be carried out on the component with heaviest wall thickness within the lot.

Test orientation and location shall be:

- For thickness up to 50 mm, the test specimens shall be taken at mid thickness and its mid length shall be at least at 50 mm from any second surface
- For thickness above 50 mm, the test specimen shall be taken at least at 1/2T from the nearest surface and at least T or 100 mm, whichever the less, from the second surface.

Sketches shall be established showing type, size and location of test samples and submitted to Company for approval.

6.3 Chemical composition

For pipes

An analysis of each heat of steel shall be made by the steel Manufacturer (plates or seamless pipes). The chemical analysis on product shall be determined by the Supplier on two pipes from each lot.

For fittings

The chemical analysis of the steel shall be determined for each heat of steel by the raw material Manufacturer (plates, pipes or forgings). The chemical analysis on product shall be determined by the Supplier on two items from each lot.

Chemical composition shall be in accordance with the requirements stated in **sections 15** and **16** respectively for duplex and superduplex materials.

6.4 Mechanical properties

6.4.1 Tensile test

The test shall be carried out in accordance with [EN 10002](#) or [ASTM A 370](#) standard.

For pipes

Transverse tension tests shall be made to represent each lot of finished pipe.

One tension test shall be made on one specimen from one pipe for lots of not more than 100 pipes. Tension tests shall be made on two specimens from two pipes for lots of more than 100 pipes.

For welded pipes the transverse tension specimen shall be taken across the welded joint.

Specimens shall be taken from the end of the finished pipes; the transverse tension test specimen shall be flattened cold before final machining to size.

For Fittings

The supplementary requirement S2 of [ASTM A 815M](#) is applicable:

One tension test shall be made on one fitting or representative test piece per lot of fittings. If the fittings are of welded construction, the tension specimen shall include the weld (perpendicular to the weld axis) and shall be prepared so that the weld is at the mid-length of the specimen.

Test results shall be in accordance with the requirements stated in **sections 15** and **16**.

6.4.2 Impact test

Impact tests shall be carried out in accordance with [ISO 148](#) or [ASTM A 923](#) method B.

Impact test specimens shall be Charpy V-notch Type, as per [ASTM A 370](#).

One set of three specimens shall be taken in the tube or fittings body. In case of WT greater than 20 mm, two sets of three specimens shall be taken.

Impact specimens shall be located parallel to the longitudinal axis of the tension test specimens.

The axis of the notch shall be normal to the nearest heat-treated surface of the component.

Additionally for welded pipes impact tests shall be made in the weld. Location of test specimen (weld metal centre line, fusion line +2 mm and +5 mm) shall be as per Appendix 2.