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TECHNICAL SPECIFICATION

Doc No : DSF-SPC-PIP-021

Rev. 1

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HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

SHOP AND FIELD FABRICATED PIPING

JUNE 2021

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1 SCOPE AND OBJECTIVES

This Specification covers the fabrication of piping in those sizes, which are normally shop-fabricated in a Contractor's shop or field shop or fabricated in place, as applicable.

2 REFERENCES

2.1 Reference Documents

- European Commission Directive 2014/68/EU (PED).
- Tech Spec. DSF-SPC-PIP-001 [Welding Requirements for Equipment and Piping]
- Tech Spec. DSF-SPC-PIP-006 [Pressure Testing]
- Tech Spec. DSF-SPC-PIP-012 [Welding]
- Tech Spec. DSF-SPC-PIP-020 [Piping Material]
- Tech Spec. DSF-SPC-PIP-033 [Flanges]
- Tech Spec. DSF-SPC-PIP-040 [Strength and Tightness Test for M/R Stations]
- Tech Spec. DSF-SPC-MEC-006 [External Painting]
- Tech Spec DSF-SPC-QAC-002 [Material Color Coding]

2.2 Reference Codes and Standards

- **ELOT EN ISO 17636-1** [Non-destructive testing of welds. Radiographic testing. X- and gamma-ray techniques with film]
- ELOT EN 13445 [Unfired pressure vessel]
- ELOT EN 13480 [Metallic industrial piping]

3 ACRONYMS

DN	Nominal Diameter
PN	Nominal Pressure Rating
NG	Natural Gas
PED	Pressure Equipment Directive



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4 DESIGN

LEGEND:

- T = T-JOINT or reduced T-JOINT**
- S = SOCKOLET or equivalent**
- W = WELDOLET or equivalent**
- H = HALF-COUPLING**

5 DATA FOR FABRICATION

The fabrication shall be made in compliance with:

- Piping Drawings (Isometrics and/or plan elevation drawings).
- Schedule of Fabricated Piping
- Applicable Piping Material Specifications

6 COMPLIANCE WITH LEGISLATION/CODES

Fabrication of piping shall conform to the latest revision of:

- Pressure Equipment Directive PED 97/23 (where applicable).
- ELOT EN 13480 or the relevant design codes applicable on the specific project.

7 PIPING TO BE FABRICATED

The "Schedule of Fabricated Piping", which accompanies the Piping drawings shall list by piece mark number all the piping that is to be shop fabricated, and all radiographic, magnetic, ultrasonic and visual examination to be executed.

Included in the fabrication shall be:

Standard flanges, orifice flanges, welding fittings, nozzles, couplings, pipe reinforcement, etc., which are welded to the pipe and form an integral part thereof.

8 PIPING NOT TO BE FABRICATED

Not included in the fabrication shall be:

- Valves, loose fittings such as traps, strainers, etc. blind flanges, Figure 8 steel blanks, paddle blinds, ring spacers, gaskets, and bolts.
- All lines not tabulated on the "Schedule of fabricated piping".



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9 SPECIFICATIONS

The specification of the materials to be used in the fabrication of piping shall be in accordance with Piping Material Specifications applicable to the contract. Wall thickness shall be in accordance with these specifications or as indicated on the Piping Drawings.

Material substitution shall not be allowed without written approval from the Owner.

10 FABRICATION

Unless otherwise specified on the Piping Drawing, backing rings shall not be used.

Where field fit welding (FFW) is required to joint the ends of two pieces of fabricated pipe, or a piece of pipe and a butt welding fitting or flange, Contractor shall allow 150 mm extra length of pipe with a plain end on one piece and furnish the adjacent piece of material with its end beveled for welding.

Where field welding (FW) is required to joint the ends of two pieces of fabricated pipe, or a piece of pipe and a welding fitting or flange, Contractor shall furnish both adjacent ends beveled for field welding and no extra pipe shall be added.

Contractor shall take all necessary provisions so that sections of prefabricated pipes will be thoroughly cleaned from any welding debris or other foreign bodies prior to their installation.

Inserts for thermowells and other branching will be welded on to pipe prior to drilling through the pipe thickness so as to attain the hole free from obstruction.

Exposed machined and threaded surfaces shall be protected from oxidation during heat treatment.

Galvanized pipe will not be bent or welded. Piping required to be bent or welded must be regalvanized.

10.1 FLANGED JOINTS

Unless otherwise noted on the Piping Drawings, flange bolt holes shall straddle the vertical and horizontal centerlines and shall match the orientation of matching flanges and equipment.

Orifice flanges shall be attached to the fabricated piece by the Contractor. A separate requisition specifying the orifice flanges and source of supply will be forwarded to the Contractor which shall refer to this requisition as well as to the Isometric Piping drawings for size, flange rating, and location of taps.



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All loose flanges etc, which require attachment by field welding, shall be shipped tack-welded to the piece to which they are to be welded at the point marked FFW or FW.

Finish of surface, which will contact gaskets, shall be per Tech. Specification No DSF-SPC-PIP-033, as applicable.

10.2 BENDS

Bends, where shown on drawings, may be made hot or cold by any procedure, which will not cause wrinkling or excessive thinning or flattening of the pipe. The radius of bend shall be as noted on the Piping Drawings; minimum radius specified shall be not less than five diameters.

10.3 CUTTING AND BEVELING

Cutting and beveling of pipe for welding may be done by machining, sawing, grinding or chipping. Flame cutting may be used for carbon steel but if used for beveling, the edges must be smooth and free of scale and slag.

10.4 WELDING

The requirements for shop and field welding are stated in AF Job Spec, for Welding Requirements for Equipment and Piping Job Specification No. DSF-SPC-PIP-001.

10.5 TOLERANCES

Tolerances for fabrication shall be as follows:

a) Length:

Center to Center	$\pm 3 \text{ mm}$
Center to Flange Face	$\pm 3 \text{ mm}$
Flange Face to Flange Face	$\pm 1.5 \text{ mm}$

b) Alignment of line joints $\pm 1.5 \text{ mm}$

c) Alignment of flange face $90^\circ \pm 1/2^\circ$ to pipe centerline.

d) Flattening: 8% of O.D. for internal pressure lines.
 3% of O.D. for external pressure lines.

11 FABRICATOR'S DETAILS & WELD PROCEDURES



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Where detail drawings are required for fabrication, they shall be provided by the Contractor, which must take full responsibility for the accuracy of all details. The Contractor must also prepare a cross-reference list showing the isometric drawing numbers and the corresponding numbers of his detail drawings.

Detailing is to begin when the "Schedule of Fabricated Piping" is received.

The fabrication of all carbon steel piping and alloys not requiring stress relief shall proceed without delay after Owner has approved the Contractor's weld procedures. The procedures shall be in accordance with ELOT EN 13480 or the applicable design code.

The fabrication of all piping requiring heat treatment after welding shall commence upon Owner approval of both the Contractor's weld procedures and his detailed drawings.

12 EXAMINATION AND INSPECTION OF SHOP AND FIELD WELDS

Inspectors representing Owner shall have access to the Contractor's shop or work area, with freedom to observe fabrication and inspect materials intended for fabrication as well as their mill reports.

Causes for rejection:

- Cracks of any size, either inside or outside a weld, are prohibited.
- Projections by grinding where into the pipe bore which exceed 1.5 mm shall be removed by grinding.
- Gaps or incomplete penetration in the first pass of a weld are prohibited.

All piping shall be radiographically examined as per **ELOT EN ISO 17636-1** only prior to Owner's approval.

Hydrostatic testing in the shop is required. Piping shall be capable of passing the field hydrostatic test after erection performed in accordance with **ELOT EN 13480**. Refer to Job Specification for Strength and Tightness Test for M/R Stations **Job Spec. No. DSF-SPC-PIP-040** as well as **Job Spec. No. DSF-SPC-PIP-006** for detailed instructions on pressure testing (where applicable).

Materials which require post-weld heat treatment shall be given a hardness test: hardness must be below the maximum specified for the material based on the applicable technical standards

Sample production welds shall be mechanically tested after agreement with the OWNER. Mechanical tests shall include Charpy – V impact testing for all materials with impact specified properties. Boiler external piping shall be fabricated, examined, inspected, and tested in



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accordance with **ELOT EN 13480** and **ELOT EN 13445**. All pressure equipment shall include the required CE declaration of conformity in accordance with the Pressure Equipment Directive (PED) where applicable.

The following examinations shall be conducted in addition to those required above:

- Welds in aluminum piping shall be subjected to 100% radiography.
- Welds in piping of any material whose design pressure is 100 bar or above and design temperature is 1000°F (538°C) or above shall be subject to 100% radiography.
- Welds in piping at cryogenic service shall also be subject to 100% radiography.

13 CLEANING AND PRESERVATION

All piping shall be cleaned of scale, welding spatter, slag, burrs and foreign matter. Burnt-on sand shall be cleaned out of hot bends and elbows.

Before piping is shipped from the point of fabrication to the jobsite, the following preservative measures must be taken:

- All flange faces, threaded ends, and other machined surfaces shall be coated with a grease type rust preservative.
- All flange faces shall be protected by a wood or metal cover wired or bolted to the flange. Male threads shall be provided with metal covers and female threads plugged.
- A coat of paint shall be applied in accordance with Job Specification for Painting **Job Spec. No. DSF-SPC-MEC-006**.
- Open-ended pipe shall be protected by a sheet metal cap or moulded plastic cap, tied to the pipe OD with weatherproof tape. **Important:** In capping, tagging or banding pipe ends of stainless steel piping do not use galvanized metal.

14 MARKING OF FABRICATED PIECES

Each piece of fabricated piping shall be marked with a piece mark or other identifying designation in two places:

- Painted in large block letters along pipe, preferably on a side, which has branches, if the pipe will not be sand blasted.



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- Stamped with steel dies on the edge of the flange, at the opposite end from the painted identification, if the pipe will be sand blasted.
- Flanges, etc, shipped tack welded for field welding shall bear the same piece marks as the pieces to which they are to be welded.
- All shipments of pipe spools to the field shall include a complete list of the spools shipped.

15 PIECE MARKING (PREPARED BY FABRICATOR)

For the arrangement of piece marking see Tech. Specification **DSF-SPC-PIP-012**.

Piece marks shall be shown on isometrics in a box, with letters 5 mm high. Each piece mark should appear only once.

Piece marks shall be listed separately for each plant section on the "Schedule of Fabricated Piping".

A separate "Schedule of Fabricated Piping" shall be prepared for alloy and carbon steel material for each Plant Section.

16 CE MARKING (AS APPLICABLE) SHALL BE PROVIDED AS REQUESTED BY PED 97/23. PIPING INSTALLED UNDERGROUND WILL NOT NEED PED CERTIFICATION. RESPONSIBILITIES

16.1 FABRICATION TOLERANCE

The Contractor is responsible for Fabricated piping conforming to Code, Specification, Drawing, and Purchase Order Requirements. Fabricated dimensions must agree with the piping drawings.

16.2 FABRICATION ACCURACY

Contractor shall be entirely responsible for dimensional accuracy and orientation of fabricated spools.

17 AUTHORIZATION FOR CHANGES

Contractor shall obtain written authorization from Owner before proceeding with work, which would result in any change to layout or dimensions shown on Owner drawings.



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18 COLOR CODE FOR RANDOM PIPE

All pipe material shall be color coded by Contractor in accordance with Job Specification for material color-coding Job Spec. No. DSF-SPC-QAC-002.