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## TECHNICAL SPECIFICATION

**Doc No: DSF-SPC-PIP-025**

**Rev. 2**

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### HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

## BALL VALVES DN > 50

**JUNE 2022**

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## **1 SCOPE**

### **1.1 ITEM**

Ball valves DN > 50

### **1.2 SERVICE**

Sweet, natural gas with sporadic passage of water and glycol.

### **1.3 APPLICATION**

Shut-off.

### **1.4 ADDITIONAL INFORMATION**

Additional information may be given in the Data Sheets and Material Requisition and these documents should be read in conjunction with this material Job Specification.

Any conflict between requirements of this Specification and drawings, Data Sheets and Material Requisition supplementary design data, or Standards codes shall be referred to DESFA for clarification, before proceeding with fabrication of concerned part.

Plug valve Manufacturer shall be responsible to design valves and their components in accordance with the requirements of applicable documents.

In no event, however, are thicknesses, dimensions etc. to be less than those shown on valve drawings unless specific written approval to the contrary is received from DESFA.

## **2 REFERENCES**

Items/equipment to be supplied under this Specification shall comply with the requirements of the latest edition of the Codes, Standards, Specifications and Practices as applicable, except if specifically, modified hereafter:

### **2.1 REFERENCE DOCUMENTS**

- Technical Specification DSF-SPC-MEC-009 [Plant Coating of Buried Valves for Pipeline]
- Technical Specification DSF-SPC-QAC-005 [Shop Inspection of Equipment and Materials for NGT Project]



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## **2.2 REFERENCE CODES AND STANDARDS**

- 2014/68/EU [Pressure Equipment Directive (PED) of the European Parliament and of the Council of 15 May 2014 on the harmonization of the laws of the Member States relating to the making available on the market of pressure equipment Text with EEA relevance]
- EN 14141 [Valves natural gas transportation in pipelines - Performance and tests]
- EN 10204 [Metallic Products – Types of Inspection Documents]
- EN 1092-1 [Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 1: Steel flanges]
- EN 1503-1 [Valves - Materials for bodies, bonnets and covers - Part 1: Steels specified in European standards]
- EN 1594 [Gas supply systems - Pipelines for maximum operating pressure over 16 bar - Functional requirements]
- EN 13942 [Petroleum and natural gas industries - Pipeline transportation systems - Pipeline valves]
- MSS SP-44 [Steel Pipeline Flanges]

## **3 GENERAL REQUIREMENTS**

### **3.1 UNITS**

Metric for all units.

### **3.2 PRESSURE RATING**

Refer to Data Sheet or Material Requisition.

### **3.3 PATTERN**

Refer to Data Sheet for short, regular or venture pattern requirement.

### **3.4 CONSTRUCTION**

#### **3.4.1 BALL**

Integrally cast or forged.



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### **3.4.2 BALL BEARING**

DN  $\geq$  100 trunnion mounted.

DN < 100 trunnion mounted or floating.

### **3.4.3 SEATS**

Double seated.

Double block and bleed shall only be provided when supplementary requirement

SR1 is specified on the Data Sheet.

### **3.4.4 SEAT SEALING**

Metal to metal with resilient inserts.

### **3.4.5 ANTI-STATIC**

If galvanic contact, between ball and valve body cannot be ensured, valves shall have spring loaded plungers for earthing of ball and stem.

### **3.4.6 PRESSURE RELIEF CONNECTION**

Required.

Refer to Data Sheet for type, either plugged or valved.

Plugged with DN  $\geq$  15, threaded solid hexagonal head safety plug which allows cavity pressure to escape prior to disengagement of thread.

Valved with PN 250 plug valves with metallic sealing mounted (by welding) directly to Ball Valve Body.

Plug valve lines shall be a minimum DN 15 for ball valve up to DN 400 and a minimum of DN 25 for ball valves DN 450 and above.

Plug valves shall be welded to valve line, but threaded at free end and fitted with a hexagonal head plug, alternatively screwed joints are acceptable providing they are fully engaged and seal welded.

For ball valves installed below ground (Refer to Data Sheet) the pressure relief line shall be valved as above and extended to a level close to the valve operator following closely the stem extension and terminating with an additional PN 250 plug valve fitted with a hexagonal head plug, all as specified above.

### **3.4.7 DRAIN CONNECTION**

Refer to Data Sheet for type, either plugged or valved.



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Construction requirements shall be as pressure relief connection above.

### **3.4.8 SEALANT INJECTION SYSTEM**

Only required when supplementary requirement SR2 is specified on the Data Sheet.

### **3.4.9 BODY DESIGN**

Valves installed below ground (Refer to Data Sheet) shall be of a fully welded design.

### **3.4.10 FLANGES**

Raised Face or Ring joint as per EN 1092-1. Refer to Data Sheet for type. Bore to be derived from abutting pipe dimensions, see Data Sheet.

### **3.4.11 WELDING ENDS**

Beveling as per EN 14141.

The minimum acceptable wall thickness of welding ends shall be determined by the formula:

$$WT_{\min} = (P \cdot D_e) / (2 \cdot \text{Yield Strength} \cdot F), \text{ where,}$$

P is the Design Pressure,

$D_e$  is the actual outside diameter of the welding end,

Yield Strength is the yield strength of the welding end material,

F is the Design Factor.

If  $WT_{\min}$  exceeds the wall thickness of the abutting pipe by more than 50%, the valve shall be furnished with transition pipes welded to the valve. Reference is made to Data Sheet for abutting pipe dimensions and materials.

Transition pipe length shall be at least 150 mm. End-to-end dimension of the valve assembly may exceed EN 14141 dimensional requirements by up to 2 \* transition pipes length.

### **3.4.12 DIMENSIONAL TOLERANCES**

The inside diameter of valves with welding ends shall match the abutting pipe inside diameter within a tolerance of  $\pm 1.6$  mm.

For valves  $DN \geq 300$  with welding ends the maximum allowed out-of-roundness shall be 0.5%. The out- of-roundness shall be defined by

$$200 * (D_{e,\max} - D_{e,\min}) / (D_{e,\max} + D_{e,\min}), \text{ where}$$





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$D_{e,max}$  is the maximum outside diameter measured at the welding ends.

$D_{e,min}$  is the minimum outside diameter measured at the welding ends

### **3.4.13 STEM SEALS**

Dual "O" rings or special design of equivalent or better quality.

### **3.4.14 STEM STOPS**

Required.

### **3.4.15 STEM EXTENSION HOUSING**

Housing shall be rigidly mounted to valve body by flanges (or similar joint). Housing design and its connections to valve and gear operator shall prevent any ingress of water, humid air or other substances which may affect valve operation, particularly during cold periods. Where air tightness cannot be ensured, filling of the housing with a suitable lubricant can be considered acceptable.

### **3.4.16 LIFTING EYES**

Required for valves DN  $\geq$  150.

### **3.4.17 SUPPORT RIBS OR LEGS**

Refer to Data Sheet for requirement. Where a support is required the size of the area actually transferring the load to a base below shall be at least 20 mm<sup>2</sup>/kg of valve weight.

### **3.4.18 POSITION INDICATORS**

Required.

### **3.4.19 PASSAGE OF SCRAPERS OR OTHER INSTRUMENTS**

Required with full bore valves.

Bore diameter shall be > 96% of abutting pipe nominal inside diameter.

### **3.4.20 VALVE OPERATION**

Refer to Data Sheet for method.

## **3.5 MATERIALS**

### **3.5.1 GENERAL**



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Only fully killed fine grain carbon steel (with exceptions to trim and ball) and conforming to EN 14141 and EN 1503-1 shall be used. When normalized and tempered materials are specified, the tempering shall be performed prior to any welding unless specifically otherwise authorized in writing by DESFA.

The tempering temperature shall be 10°C higher than that required for post weld heat treatment, unless otherwise specified.

Attention is drawn to section 5 detailing certifications requirements.

All parts containing pressure and butt welding ends shall have impact tests for each type of material used as per EN 14141 and EN 10045-1. The test temperature shall be -20°C or lower with an acceptance criterion of:

Mean value from the 3 tests 31 joules with the lowest single value 24 joules.

### **3.5.2 BODY (INCL. WELDING ENDS)**

Only fine grained steel suitable for field welding and with the specified minimum yield strength and chemical analysis as specified below are allowed.

DN Yield Strength not to exceed

up to 300                      290 N/mm<sup>2</sup>

350 to 450                    360 N/mm<sup>2</sup>

500 to 900                   420 N/mm<sup>2</sup>

1050                          490 N/mm<sup>2</sup>

Carbon content C shall be ≤ 0.21% on heat analysis.

Carbon equivalent (CEV)

≤0.45% for grades with SMYS ≤ 360 N/mm<sup>2</sup> and

≤0.48% for grades with SMYS > 360 N/mm<sup>2</sup>.

Sulfur content will be ≤ 0.030% on heat analysis.

### **3.5.3 BODY AND COVER**

Carbon steel according to EN 1503-1 or equivalent.

### **3.5.4 TRIM AND BALL**

Stainless steels according to EN 1503-1 or equivalent.



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Carbon steel or nodular cast iron as ISO 1083 may be used if coated with a minimum of 30 microns electroless nickel plate or equivalent, providing, adhesion (bend) test and porosity (ferroxyl) test as EN ISO 4527 or equivalent are carried out to sample plates coated with the same material as the balls and are without failure.

Mating seating surfaces shall have a hardness differential of at least 50 HB.

### **3.5.5 SEAT INSERTS STEM SEALS**

Suitable elastomer.

## **3.6 FABRICATION**

### **3.6.1 FORMING OF PLATE**

As per EN 13445-4. Subsequent heat treatment, if required, shall be by normalizing.

### **3.6.2 WELDING**

As per EN 13942.

Hardness of the weld seam and heat affected zone shall nowhere exceed 260 HV 10.

### **3.6.3 REPAIR BY WELDING**

Only permitted in welds and casting.

### **3.6.4 POSTWELD HEAT TREATMENT**

As per EN 13445-4.

Any heat treatment operations performed by valve fabricator and intended to enhance mechanical properties, shall obtain approval by DESFA.

## **3.7 NON DESTRUCTIVE EXAMINATION**

### **3.7.1 CASTING**

All items shall be examined as per EN 14141.

All castings shall be 100% visual inspected.

All valves shall be subject to 100% surface examination on all accessible internal and external areas by magnetic particle examination or penetrant testing.

All valves with  $DN \geq 200$  shall be examined radiographically.

### **3.7.2 PLATES AND WELDED PIPE**

All items shall be radiographically or ultrasonically examined according to EN 14141.



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### **3.7.3 WELDS**

All joints shall be examined in accordance with EN 14141 as follows:

All welds shall be 100% visual inspected.

- For DN<200 penetrant testing or magnetic particle testing.
- For DN≥200 ultrasonic or radiographic testing.

Where radiography or ultrasonic examination is unfit for detection then magnetic particle examination may be used. Radiographic films during shop inspection performed by Owner's TPI shall be available at request.

### **3.7.4 WELDING ENDS**

All welding ends made from plate, tubulars or forgings shall be ultrasonically examined to a minimum distance of 50 mm from, and including the bevel according to EN 14141.

Any discontinuity with a width exceeding 6 mm shall be cause for rejection.

### **3.7.5 SEALING AND SEAT RING SURFACES**

All sealing and seat ring surfaces shall be magnetic particle examined as per EN 14141.

However laminar defects are not acceptable.

Surfaces which are to be electroless nickel plated shall be examined prior to plating.

### **3.7.6 ELECTROLESS NICKEL PLATED BALLS**

Thickness test shall be carried out in accordance with EN ISO 4527 or equivalent.

## **3.8 FIRE TEST**

If so specified on the data sheet valve design shall have been qualified as per EN ISO 10497.

"Fire-safe" certification shall include "fire-safe" tests representing all sizes and pressure ratings for each valve model. "Fire-safe" tests shall be witnessed by the Inspector. Previous acceptance of certification by the Owner's Engineer is acceptable in lieu of requalification for identical valves.

## **3.9 FACTORY TEST**

### **3.9.1 STRENGTH AND TIGHTNESS TEST**

Air seat tests plus hydrostatic shell tests as per EN 14141 are required.

### **3.9.2 OPERATIONAL TORQUE TEST**



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Required after mounting of operating equipment and inclusive of operator functions.

### **3.10 SURFACE TREATMENT**

As per Data Sheet. Valves to be installed below ground shall be coated externally by Manufacturer. External coating for buried valves shall be in accordance with Technical Specification DSF-SPC-MEC-009. Valves to be installed above ground shall be primed and painted.

### **3.11 MARKING**

Valves to be installed below ground shall be marked on a welding end with valve serial number, Client contract number and material grade of welding end, and all marking shall be as per ELOT EN 13942 on the nameplate which shall be fixed at a point close to the actuator / operator.

Valves to be installed above ground shall be marked on their bodies with serial number and Client contract number. Welding ends shall be marked with material grade, and all marking shall be as per EN 13942 on the nameplate.

The nameplate shall additionally bear the Inspection Body stamp as per EN 10204 and Technical Specification DSF-SPC-QAC-005.

### **3.12 TAGGING**

All valves shall be tagged with the valve number (commodity code) as stated on the data sheet and be prefixed by the valve nominal size. This shall be clearly stamped on a non-corrodible metal tag which is to be securely attached to the valve with a non-corrodible metal wire.

### **3.13 DELIVERY**

When wrench is specified on the DATA SHEET, one piece shall be supplied with each valve.

Handle extension is required if valve is to be installed below ground.

Handwheels and wrenches may be shipped in accordance with the Manufacturer's standard procedure, otherwise the valve shall be delivered in fully assembled condition with all openings, pipe ends, nipples, etc. capped for protection. Open/ Close direction on handwheels must be clearly marked.

## **4 ADDITIONAL REQUIREMENTS FOR HYDROGEN USE**

### **4.1 General Remarks**

Valves shall be PED certified and comply also with EN 13942 and EN 14141.

Valves shall be designed and tested to minimize the leakage thru the stem packing.

Pressure relief system shall be carefully designed to avoid any leakage to the ambient.



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To minimize the risk of leakage, threaded connections for drain and vent on valve body should be avoided.

It will be necessary to specify some additional requirements on chemistry and on hardness of CS steel components, similar to those specified for the piping forged components in ASME B.31.12. The same requirements shall apply to the pup pieces used.

### **4.2 Materials**

The ball shall be manufactured from austenitic stainless-steel material X5CrNiM017-12-2 (SS 1.4401) or X2CrNiMnMoNb21.16.5.3 (SS 1.3964).

SEAT/RINGS: For Seals Viton material shall be AED (Anti-Explosive Decompression) type and suitable for 100% of H<sub>2</sub> (confirmed by Manufacturer). In alternative, PTFE Lip Seal material shall be used.

Spring material on X-750 can be considered provided the maximum hardness limited at 50 HRC.

Not all high strength materials such as martensitic stainless steels or high strength chrome nickel alloys normally adopted for the stem shaft are compatible with Hydrogen. Manufacturer shall confirm the suitability of the material used.

### **4.3 Testing**

Stem seals shall be fugitive emission tested in accordance with ISO 15848-2. Test shall be carried out at both ambient and maximum design temperature with helium as fluid. The fugitive emission tightness class shall be BH ( $\leq 1.78 \cdot 10^{-7}$  mbar·l·s<sup>-1</sup> per mm stem diameter ).

Valves purchased to API 6D requirements shall be capable of passing the pressure tests described in API 6D Annex H, para. H4, using helium as the test medium. Other valves shall be capable of passing the pressure tests described in API 598, using helium as the test medium.

## **5 SUPPLEMENTARY REQUIREMENTS**

The following Supplementary Requirements are also applicable.

### **SUPPLEMENTARY REQUIREMENT SR1**

Valve seats shall provide for double block and bleed which shall function under the lowest pressure differential.

### **SUPPLEMENTARY REQUIREMENT SR2**

Seat design shall incorporate a sealant injection system that shall allow for injection with valve under full line pressure. The system shall provide a tight shut-off even if seat sealing surfaces should become damaged.



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With earth-covered valves (refer to Data Sheet) injection lines shall be extended to near valve operator. A check valve shall be where the injection line is fixed to the body.

Screwed joints are only acceptable if fully engaged and seal welded.

## **6 TECHNICAL DOCUMENTATION**

### **6.1 QUANTITY**

Three (3) copies of each inclusive of original for all Documents and Certificates, except otherwise specified.

Three (3) of each inclusive of one reproducible for all drawings, except otherwise specified.

Also electronic files (word documents and/or AutoCAD documents as applicable and scanned PDF files) of all Documents and Certificates must be submitted by Vendor to the Owner.

All documents of final documentation package shall be checked and originally signed by Owner's TPI when required.

### **6.2 INSPECTION AND CERTIFICATION**

Inspection will be performed by an Independent Accredited Inspection Body or/and the Manufacturer's Authorized representative independent of the manufacturing department.

Inspection requirements are defined in the following documents:

- a. Material requisition
- b. Technical Specification DSF-SPC-QAC-005 "Shop inspection of equipment for NGT and material project"
- c. Relevant project specifications
- d. Inspection clauses of applicable Standards.

Inspection procedures to be followed are detailed in DESFA document "Inspection and Test instructions".

### **6.3 DOCUMENT REQUIREMENTS**

#### **WITH TENDER**

Proof of design either as certificate of approval or prototype test report issued by an Accredited certifying authority.

Statement of Manufacturer's type number for each item if standard product offered. Catalogues, general arrangement drawings and parts list covering all items inclusive of operating equipment.



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Statement regarding materials used for all principle component with reference to material standards herein.

Statement regarding materials for surface treatment.

Certificate confirming valve design has been qualified for Fire Test Approval, if required.

### **AFTER AWARD OF CONTRACT (BEFORE PRODUCTION)**

Dimensioned general Arrangement drawing of each item including support ribs, operating equipment etc., together with a material parts list detailing material standard and grade, item number and description as well as certification level of materials as a minimum.

Welding procedures specifications, Forming procedures, Testing procedures.

Recommended procedure for installation (welding) in pipeline to avoid excessive heat on valve.

Manufacturer's Detailed Test and Inspection plan. The plan shall additionally show the control points at which the Independent Inspectors witnessing /approval is required as per section 5.2 herein.

### **ON DELIVERY**

Comprehensive operation, maintenance and reconditioning manuals.

List of recommended tools, spare parts, lubricants etc., necessary for two years operation.

## **6.4 VALVE CERTIFICATION PACKAGE**

Valve drawings shall include the following information printed clearly in or adjacent to the title block:

- a. Contract No.
- b. Requisition No. and item No.
- c. Purchase Order No.
- d. Valve number (Commodity Code)
- e. The principle dimensions of the valve, any gear operator, the size, type, and style. Also the weight of the valve, per size, should be included.
- f. Materials of construction.
- g. Pressure-Temperature limitations.

Drawings shall be checked and certified by the Manufacturer as being an actual record of the valve being supplied against the Purchase Order.





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Drawings shall be sent to Owner accompanied by a transmittal note or letter, marked for attention Procurement Department.

Approval of Manufacturer's drawings shall not be considered as relieving the Manufacturer of any responsibility for detailed design, dimensions and construction of equipment or deviation from specification.

Manufacturer shall not commence final manufacture of valves until receipt Owner's approval of his drawings.

## **7 SHIPMENT / PROTECTIVE COATING AND END PROTECTION**

- Valves shall be shipped in the open position.
- Unmachined exterior surfaces of valves shall be painted as per Manufacturer's standard.
- Machined or threaded surfaces subject to atmospheric corrosion during shipment or subsequent storage shall be coated with easily removable rust preventive.
- Valves with screwed or socket weld parts shall have the ends protected with metal, or plastic plugs.
- Valves with flanged ends shall have the gasket surface protected by means of a suitable disc wired on.
- Valves with butt-weld ends shall have the bevels covered with a suitable close fitting protector.
- When lifting the valves, the slingers must be wrapped around the body only and not around the spindle lever.
- Packing is to be in wood cases.
- The valves to be transported must be firmly fixed to the case load-bearing bottom.
- For valves with a weight greater than 0.6 tons fastening is performed with wooden saddles and joists nailed to the side walls. The saddles two for each valve, must ensure a uniform distribution of the valve weight over the case bottom. For valves with a weight lighter than 0.6 tons only the joists nailed to the side walls are required. For the valve actuator units and the valve components (e.g. extensions) the fastening will depend upon their shape, weight and dimensions.
- The packing shall be mechanically protected i.e. from impact caused by falls during handling, vibration caused by transport etc.
- Manufacturer's Quality Plan shall include details about lifting, support during transportation, preservation, etc.