Base Load Power Hub (BLPH)

TSS - Manual Valves & Strainers

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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.

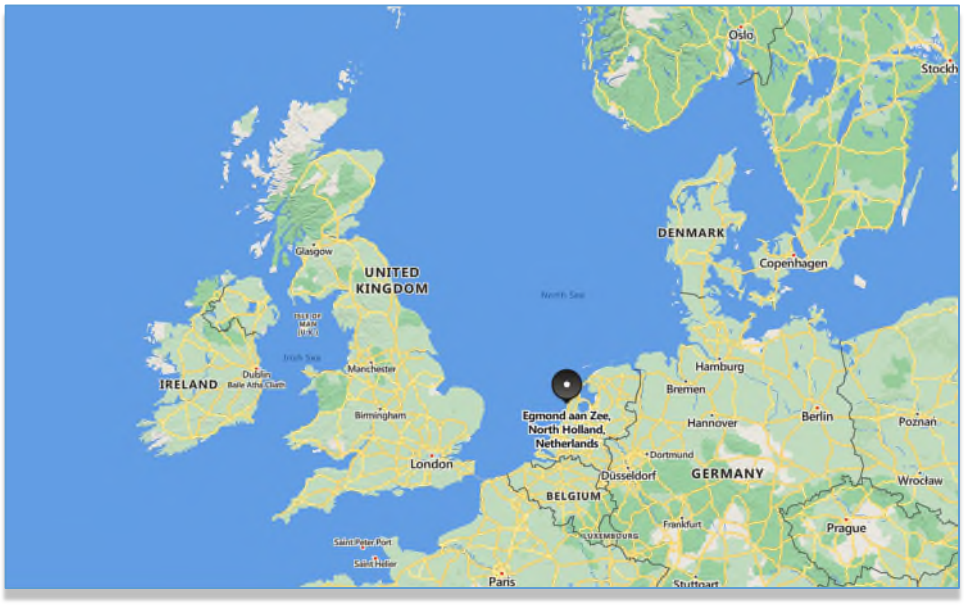


Figure 1 - HOLLANDSE KUST NOORD WIND PARK Location Map

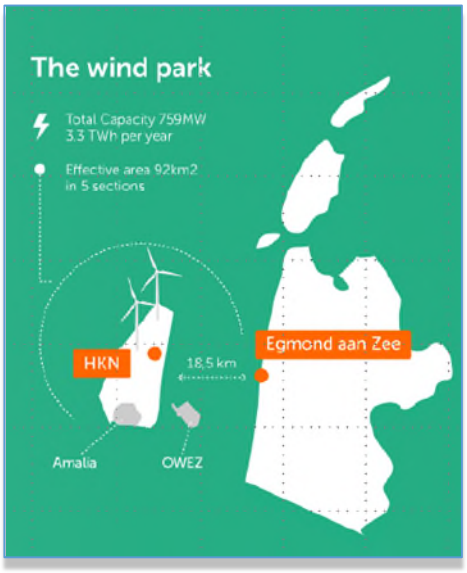


Figure 2 - Wind Park Details

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.

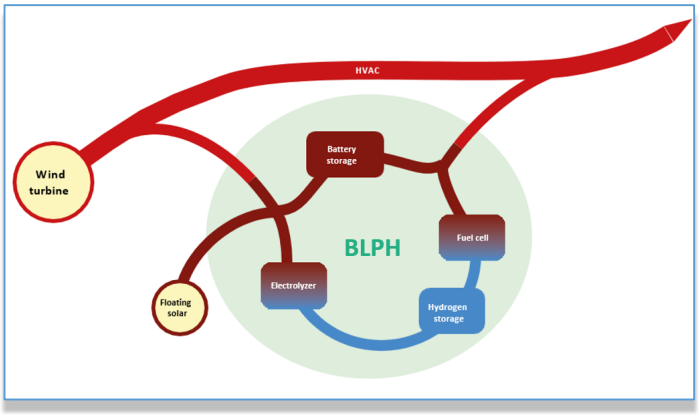


Figure 3 – BLPH Concept

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.

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2 DOCUMENT SCOPE

The scope of this specification is to cover the minimum requirements governing the supply of manual valves and strainers.

All valves shall be suitable for an offshore environment The valves will be within ASME B31.3 and ASME B31.12 design codes.

This specification should be read in conjunction with the following specifications.

i. 123A90-DDL-PP-SP-70000 Piping Material Classes

ii. 123A90-DDL–PP-DS-70003 Datasheets - Manual Valves

This specification is not applicable for the following systems -

- All instrument control piping downstream of the instrument side of the piping/instrument break point,
- All heating and ventilation systems

All valves and strainers shall be designated, verified, fabricated, inspected and tested in accordance with this document and Pressure Equipment Directive 2014/68/EU (PED)

The project is non-sour, thus NACE MR0175/ISO 15156 is not applicable.

2.1 REFERENCES

Doc. No.	Description
[1] K559-2254-PM-PLN-003	Basic Design Engineering Package
[2] 123A90-DDL-MAT-RE-60011	Material Selection Report
[3] 123A90-DDL-PP-SP-70029	Piping Materials Narrative
[4] 123A90-DDL–PP-DS-70003	Datasheets - Manual Valves
[5] 123A90-DDL-PP-SP-70000	Piping Material Classes
[6] 123A90-DDL-MAT-SP-60006	Coating and Painting Specification

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

ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
PED	Pressure Equipment Directive
NACE	National Association of Corrosion Engineers
MTC	Material Test Certificates
ISO	International Organisation of Standardization
NDE	Non-Destructive Examination
DN	Diametre Nominal
ITP	Inspection Test Plan
DPE	Double Piston Effect
ppm	Parts Per Million
Ra	Roughness Average
ANSI	American National Standards Institute
µm	micrometers
Norsok	Norsk Sokkels Konkuranseposisjon
BS	British Standard
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
FF	Flat Face
RF	Raised Face
CE	Carbon Equivalent
CVN	Charpy Vee Notch
EN	Euronorm
ASNT	American Society for Non-Destructive Testing
FAT	Factory Acceptance Tests
PREN	Pitting Resistance Equivalent Number
OD	Outside Diameter
AED	Anti Explosive Decompression
CRA	Corrosion Resistant Alloy
SBD	Single Block and Bleed
DBB	Double Block and Bleed

FE	Fugitive Emissions
PMI	Positive Material Identification
PMA	Particular Material Appraisal
NDT	Non-Destructive Tests

Table 2 - Definitions and Abbreviations

3 STANDARDS, CODES AND GUIDELINES

The codes, standards and specifications referenced in this specification shall be taken to mean the latest edition and addenda. It is not a definitive list and does not preclude the use of other Codes if approved in writing by CONTRACTOR.

In case of conflict between this specification, other referenced specifications and the codes and standards, this shall be brought to the COMPANY's attention for resolution in writing. In all cases the most stringent requirements shall apply.

Document Number	Document Title
ASME B31.3	Process Piping
ASME B31.12	Hydrogen Piping and Pipelines
API 594	Check Valves: Wafer-Lug, and Double Flange Type
API 598	Valve Inspection and Testing
API 599	Metal Plug Valves Flanged and Welding Ends
API 600 / ISO 10434	Steel Gate Valves – Flanged and Butt-Welding Ends
API 602 / ISO 15761	Compact Steel Gate Valves – Flanged, Threaded, Welding, and Extended Body Ends
API 607	Fire Test for Soft Seated Quarter Turn Valves
API 608	Metal Ball Valves – Flanged, Threaded & Welding Ends
API 609	Lug- and Wafer- Type Butterfly Valves
API 6D / ISO 14313	Specification for Pipeline Valves (Gate; Plug, Ball, and Check Valves)
API 6FA	Specification for Fire Tests for Valves
ASME B1.1	Unified Inch Screw Threads
ASME B1.20.1	Pipe Threads, General Purpose
ASME B16.10	Face-to-Face and End-to-End Dimension of Valves
ASME B16.11	Forged Fittings, Socket-Welding and Threaded
ASME B16.20	Metallic Gaskets for Pipe Flanges – Ring Joint, Spiral Wounds and Jacketed
ASME B16.21	Non-metallic Flat Gaskets for Pipe Flanges
ASME B16.25	Butt-welding Ends
ASME B16.34	Valves- Flanged, Threaded and Welding Ends
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B18.2.2	Square and Hex Nuts

ASME IX BPVC Section 9	Welding and Brazing Qualification
ASME VIII	ASME Boiler and Pressure Vessel Code.
ASTM A123	Specification Zinc (Hot-Dip Galvanised) Coatings on Iron and Steel Products
ASTM A153	Specification for Zinc Coating
ASTM A182	Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service
ASTM A193	Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A194/194M	Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A320/A320M	Specification for Alloy-Steel Bolting Materials for Low Temperature Service
ASTM A351	Specification for Steel Castings, Austenitic, for High Temperature Service
ASTM A564	Specification for Hot-Rolled and Cold-Finished Age Harding Stainless and Heat Resisting Steel Bares, Wire and Shapes
ASTM A705	Specification for Age-Harding Stainless and Heat Resisting Steel Forgings
ASTM A999/A999M	Standard Specification for General Requirements for Alloy and Stainless Steel Pipe
ASTM D2240	Test Methods for Rubber Property – Durometer Hardness
ASTM F36	Test Methods for Compressibility and Recovery of Gasket Materials
ASTM F467	Specification for Non-ferrous Nuts for General Use
ASTM F468	Specification for Non-ferrous Bolts, Hexlap Screws, and Studs for General Use
ASTM G48	Test Methods for Fittings and Crevice Corrosion Resistance of Stainless Steel and Related Alloys by use of Ferric Chloride Solutions
BSI BS 1868	Specification for Check Valves (flanged and buttwelding ends) for the Petroleum, Petrochemical and allied Industries
BSI BS 1873	Specification for Steel Globe and Globe Stops and Check Valves (Flanged and Butt-Welding Ends) for the Petroleum, Petrochemical and allied Industries

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BSI BS 3799	Specification for Steel Pipe Fittings, Screwed and Socket-Welding for the Petroleum Industry
BSI BS EN ISO 15761	Specification for Steel Wedge Gate, Globe and Check Valves 50mm and Smaller for the Petroleum, Petrochemical and allied Industries
BSI BS EN ISO 15848 pt1&2	Industrial Valves – Measurement, Test and Qualification Procedures for Fugitive Emissions
BSI BS EN ISO 17292	Specification for Steel Ball Valves for the Petroleum, Petrochemical and allied Industries
BS EN 12266 pt 1&2	Testing of Valves. Specification for Production Pressure Testing
BS EN ISO 10497	Testing of Valves. Specification for Fire Type Testing
EN 10204	Metallic Products – Types of Inspection Documents
ISO 5752	Metal Valves for Use in Flanged Pipe Systems
ISO 10684	Fasteners – Hot Dip Galvanized coatings
MSS-SP-25	Standard Marking Systems for Valves, Fittings, Flanges and Unions
MSS-SP-55	Quality Standard for Steel Castings for Valves, Flanges, Fittings and Other Piping Components – Visual Method for Evaluation of Surface Irregularities
PED 2014/68/EU	Pressure Equipment Directive
NORSOK M-710	Qualification of non-metallic materials and manufacturers - Polymers

Table 3 - List of codes and standards

3.1 DEVIATIONS

Any deviations from the requirements stated within the Requisition, and the documents and specifications referenced within the Requisition (including this specification and all attachments), shall be submitted in writing to the CONTRACTOR's for approval, with the SUPPLIER's bid. It shall be assumed that if deviations are not listed, then the SUPPLIER's bid shall be fully compliant.

4 TECHNICAL REQUIREMENTS

The SUPPLIER's extent of supply shall consist of the design, production of materials manufacture, drawings and data, assembly, painting, testing, inspection and all their sub-suppliers co-ordination, where applicable, in accordance with applicable codes and standards listed on the relevant data sheet and any additional requirements of this specification.

The SUPPLIER shall submit all pertinent drawings, documents for the valves in accordance with the Required Document Data Sheet (RDDS).

Where a SUPPLIER has not previously manufactured a specific valve size, rating or material type he shall notify CONTRACTOR at the bid stage. The SUPPLIER shall also state the manufacturer and country of origin of all the valves including their pressure containing material sub-suppliers during the bid stage.

Both minimum and maximum design temperature are as indicated in the respective valve data sheets along with the minimum and maximum operating temperatures.

The supply shall be provided complete with, but not limited to:

- Spare part list and quotation, as follows:
- Commissioning and start-up spare parts
- Two years spare parts (as option)

4.1 PRESSURE SEALING OF BLOCK VALVES

All block valves shall be designed to seal in both directions i.e. bi-directional and shall be provide specified sealing capability against all pressure up to maximum service pressure rating for the class unless specified otherwise in the valve data sheets.

4.2 FIRE TEST REQUIREMENTS

All valves where required to be fire tested on the valve data sheets shall be of a fire-tested design and certified accordingly. Valves shall be fire-tested in accordance with API 6FA, BS 6755 part II or API 607. The SUPPLIER shall detail any alternative fire type testing during bid evaluation.

The materials of construction of their design shall not deviate from certified fire-test certification unless specifically approved by a recognized Certified Authority.

A fire test certificate in accordance with API 6FA, BS 6755 part 2 or API 607, where the scaling properties shall be considered qualified. A copy of the qualified fire test certificate shall be included in SUPPLIER's bid.

4.3 VALVE OPERATION

Valve operation shall be in accordance with the valve data sheets. SUPPLIER shall guarantee that the maximum force to operate the valve shall not exceed 350N under full differential pressure. In achieving this figure the maximum lever length shall be 400mm and the maximum handwheel diameter shall be 700mm.

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SUPPLIER shall clarify whether based on their valve design, a gearbox at the size and pressure values stated in Table 4 is required.

Lever operated valves shall be fitted with removable levers, which shall fit parallel to the pipe when the valve is in the open position. Levers and handwheels shall be rigidly constructed from a carbon steel material suitably coated and a clockwise motion of the lever shall close the valve. Direction of closure shall always be indicated on the valves.

Gear operated valves shall have fully enclosed rigid construction gearboxes that are capable of withstanding heavy use commonly associated with an offshore facility and are fully protected from a saline marine atmosphere. Gearboxes shall have pertinent appurtenances for lubrication and maintenance. Clockwise rotation of the handwheel shall close the valve. Direction of the closure shall be indicated on all the valves. Gearbox material shall be ductile or nodule cast iron. Grey cast iron and or aluminium alloys are not acceptable.

Class	Butterfly	Ball	Gate	Globe
150	DN 4" and above	DN 6" and above	DN 8" and above	DN 8" and above
300	-	DN 6" and above	DN 6" and above	DN 6" and above
600	-	DN 4" and above	DN 6" and above	DN 6" and above

Table 4 – Valve size split for levers/handwheels and gearbox

Valves shall be capable of satisfactory operation with the valves' stems in any position i.e. vertical, horizontal or inclined. The CONTRACTOR will define any valves' stems below the horizontal position. Valves shall be capable of operating in both vertical and horizontal position unless stated otherwise in the valve data sheets.

Uni-directional valves and check valves where the design is limited to sealing against the flow or pressure from one direction and valves with a preferred direction for sealing shall have a flow direction arrow integrally cast with the valve's main body.0

4.4 FACE TO FACE DIMENSIONS

Generally, all valves shall adhere to the face to face dimensions in ASME B16.10 long pattern depending upon valves type. Valves' face to face dimensional standard as indicated in pertinent valve data sheets. If a SUPPLIER is not conforming, the SUPPLIER shall notify CONTRACTOR in the bid phase.

4.5 POSITION INDICATORS

All rising stem valves or valves with gearboxes shall have position indicators clearly stating both opening and closing positions. The position indicator shall be designed to ensure that correct orientation is assured whether on initial assembly or during any dismantling and reassembly. The position indicator shall be a robust construction and adequate coating shall be applied should carbon steel material be used.

4.6 BACK SEAT

All wedge gate and globe valves shall have a back seat feature.

4.7 STEM

The design of the valve's stem shall be blow-out proof.

The maximum force or torque output from the valve operator throughout the full range of the valve stroke, shall not exceed the allowable force or torque capability of the valve stem. SUPPLIER shall take suitable measures i.e. provide a more exotic stem material, thus increasing the mechanical properties if the valve's stem force or torque value results in a safety factor value below specification requirements.

Specifically for valves in hydrogen service, SUPPLIER shall provide stem material in Nitronic 50/60 for high mechanical strength should valves' stem in 316SS not be sufficient.

The SUPPLIER will need to submit pertinent valve stem calculations.

4.8 DRAINS AND VENTS

The requirements for drains and vents shall be as stated on the valve data sheets and shall comply with ASME B16.34. Such connections shall not be provided unless stated on their pertinent valve data sheet or in agreement with CONTRACTOR.

4.9 EXTENDED STEMS

A stem extension shall only be furnished where specifically requested in the valve data sheets or where recommended by the SUPPLIER for the conditions stated.

4.10 LOCKED AND INTERLOCKED VALVES

All quarter turn and rising stem valves shall be padlockable. Suitable robust brackets shall be supplied allowing the valves to be padlocked in either the open or closed positions. The padlock will be supplied by others.

The SUPPLIER shall provide all necessary information to the selected interlock manufacturer such as topwork dimensions to ensure correct alignment with the valve topwork flange. The locking devices will be fitted to the valves during site erection. The SUPPLIER shall confirm that the valves functionality will not be jeopardized or compromised by the mechanical key interlock device.

4.11 CORROSION ALLOVANCE

Valve data sheets will include corrosion allowance value. SUPPLIER to confirm the valve design includes the corrosion allowance value and minimum wall thickness in accordance with relevant valve design code requirements. Should SUPPLIER's valve design not suffice for stated corrosion allowance values, SUPPLIER shall either include CRA weld overlay in the valves' internal effected areas or provide a full CRA valve.

SUPPLIER shall notify CONTRACTOR during the bidding phase for the above.

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4.12 NON-METALLIC SEALS

All non-metallic static and dynamic seals shall be suitable for the service and minimum/maximum design pressure/temperature or operating pressure/temperature as stated on the individual valve data sheets.

All soft seat and seal materials up to and including ANSI 600 and in hydrocarbon service shall include AED properties. All elastomeric O-rings in hydrocarbon service in ANSI 600 and above to be limited to 6mm OD maximum.

Elastomeric material Viton is not acceptable on methanol services if the methanol content exceeds 5% in volume and if methanol is used during drying of pipes. SUPPLIER shall detail an acceptable alternative non-metallic material such as certain HNBR or FFKM grades during the bid evaluation phase.

Table 5 provides a guide to acceptable non-metallic seals. SUPPLIER shall identify acceptable nonmetallic seals during bid evaluation.

Type of seal material and trade mark	Nomenclature	Max. Operating Temperature range (°C)
Elastomeric		
Hydrogenated Nitrile Butadiene Rubber	HNBR	(minus) - 40 / + 150
Viton GLT	FKM	(minus) - 40 / + 180
Chemraz	FFKM	(minus) - 20 / + 220
Thermoplastic		
Teflon (virgin or filled)	PTFE	(minus) - 80 / + 220
Teflon (glass filled)	RPTFE	(minus) - 80 / + 200
KELF	PCTFE	(minus) - 150 / + 100
Nylon 12	Polyamide	(minus) - 20 / + 100
Devlon		(minus) - 20 / + 100
PEEK	Polyether Ketone	(minus) - 80 / + 160

Table 5 – Acceptable non-metallic seals

Specifically for valves in hydrogen service, the non-metallic seals shall already be qualified to NOSOK M-710. SUPPLIERs shall present their NOROSK M-710 qualification certificates for CTR's review and approval during technical discussions.

4.13 GLAND PACKING

Gland packing shall be suitable for the service and conditions shown on the valve data sheets. All gland packing shall be non-asbestos type. Graphite packing shall be low to medium density, high purity, incorporating a passivation corrosion inhibitor and anti-extrusion elements. SUPPLIER to ensure that any lubricated packing for low temperature service shall not solidify or have any detrimental effect on the valve operation at the design temperature specified.

Alternative packing arrangements may be submitted to CONTRACTOR during bid evaluation.

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These alternative seal materials may include lip seal or chevron type preloaded and/or pressure energized.

4.14 BONNET GASKET

All gaskets shall be compatible with all materials of construction and suitable for the services and design conditions as stated in the valve data sheets.

The body/bonnet connection shall be flanged and the flange connection shall be male and female, tongue and groove or ring type joint.

4.15 BONNET AND GLAND BOLTING

All bolting shall comply with the valve data sheets and shall meet the requirements of ASME B16.34 paragraph 6.4. The SUPPLIER shall advise CONTRACTOR during bid evaluation where bolting does not adhere to the minimum bolting requirements in ASME B16.34 paragraph 6.4.

All carbon steel or low alloy steel valves' bolting shall adhere to ISO 10684.

4.16 VALVE BODY CAVITY RELIEF

SUPPLIER shall clarify means of valves' cavity relief.

4.17 LIFTING LUGS

Lifting lugs shall be provided for valves of nominal size DN 6" and above. The design of these lugs shall include the gearbox weight and actuator where applicable. Lifting lugs shall be a threaded shackle type. The design and calculations of the lifting lugs shall be submitted to CONTRACTOR during the bidding phase. Specific additional lugs may also be required for valves to be installed in the vertical position.

Lifting points on either the gear box or actuator shall not be used to lift a valve complete with gearbox or actuator assembly.

4.18 VALVE SUPPORTS

Valves' supports shall be supplied on valves generally DN 8" and above when the valves are to be installed in the horizontal, stem vertical position. SUPPLIER shall provide to CONTRACTOR details of the valve supports. These supports will not be line supporting, unless specified otherwise.

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5 VALVE DESIGN

5.1 GENERAL

Valves shall comply with the relevant standards and codes specified in their valve data sheets. All valves shall be suitable for services and conditions stated in the valve data sheets. Valves shall normally meet the material rating requirements of ASME B16.34 unless otherwise stated. The SUPPLIER shall confirm at the bid stage the valve pressure/temperature ratings and pressure/temperature chart for all non-metallic dynamic and static seals.

All valve bodies shall suffice to accommodate the following end connections at design pressure and temperature.

i. Flanged End Valves – Resultant Bending Stress 75MPa.

Valves shall be forged or cast to shape. SUPPLIER shall advise CONTRACTOR whether valves will be machined from bar stock.

All suppliers shall provide overall dimensions of the valve and operator either gearbox with their bid for CONTRACTOR's review.

5.2 BALL VALVE

Ball valves up to and including DN 6" ANSI 150/300 and ANSI 600 DN 1 ½" and smaller can be floating ball valves, double seat supported design or trunnion mounted double seated bidirectional design. Valves DN 8" ANSI 150/300 and ANSI 600 DN 2" and greater shall be trunnion mounted double seated bi-directional design. All double seated valves, except DPE shall have automatic body cavity pressure relief via the seats. The relieving pressure in the body cavity shall not exceed 1.1 x full flange rated pressure.

Valves with holes drilled in the ball for pressure relief are not permitted.

All ball valves shall be with anti-blow stem and an anti-static device to ensure electrical continuity between body, stem and ball. Valves shall be type tested on each type of valve after FAT in a dry application. The test for electrical continuity shall be carried out after the test valve has been operated at least five times. It shall then be demonstrated that the discharge path between components has electrical continuity with a resistance not exceeding 1 ohm from a power source not exceeding 12V.

The SUPPLIER shall submit in its bid means to ensure alignment of the ball's bore to the bore of the valve.

Ball valves with hollow ball construction are not permitted.

SUPPLIER to state size reduction for reduced ball valves, which shall be in accordance with API 6D.

The SUPPLIER shall also select materials to minimize the effect of galvanic corrosion and galling.

SUPPLIER to clarify to ensure this is achieved throughout the valves' life-cycle.

Materials both metallic and non-metallic for balls valves in hydrogen service shall follow individual VDS in Ref. (4) 123A90-DDL–PP-DS-70003 where specific stem material and non-metallic seals qualified in accordance with NORSOK M-710 shall be provided.

All ball valves shall be supplied with integral flanges for through bolting for assembly to vessels or flanges. Weld flanges are not permitted. Studded connections may be permitted but is solely dependent upon any platform valve space constraints. CONTRACTOR shall advise SUPPLIER for this subject.

5.3 CHECK VALVES

5.3.1 Piston Check

Piston check valves from DN ½" to DN 1 ½" shall be lift type guided over the full length in accordance with ISO 15761. Hard-facing stellite 6 shall be completed on the seat and disc as stated in relevant valve data sheets for low temperature carbon steel valves.

5.3.2 Dual Plate Check

Dual plate check valves shall be lug type retainerless type.

All DN 2" and above dual plate check shall be suitable for both horizontal and vertical (typically flow upwards only) shall meet the requirements of API 594.

Both plates and integral seats shall be hard faced stellite 6 as stated in relevant valve data sheets for low temperature carbon steel valves.

5.4 GLOBE VALVE

The design of a globe valve shall be OS&Y, bolted bonnet complete with rising stem. The disc and seats shall be hard-faced stellite 6 for low temperature carbon steel valves as stated in the relevant valve data sheets.

Valve sizes DN ½" to DN 1 ½" shall be in accordance with EN 15761. Valves sizes DN 2" and above shall be in accordance with BS 1873.

5.5 DOUBLE BLOCK AND BLEED VALVE

All integral modular double block and bleed valves shall consist of a single forging and shall consist of a bolted construction. The valve body will be complete with two balls and a bleed connection located between the two balls. All forgings shall be forged as close as possible to the final shape and size.

Valves consisting of two seats for each ball and shall be provided with a means to vent the cavity overpressure typically to the upstream seat.

Any screwed joints shall not be dependent on thread tape and/or sealant to ensure a seal. Such joints shall be protected from accidental loosening by mechanical methods and shall be visibly locked.

Handle or lever retaining nuts shall be positively locked or consist of self-locking type to prevent loosening by vibration.

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All vent valves within the valve's body shall be needle type.

5.6 MONOFLANGE SBB AND DBB VALVE

All monoflange valves either single block and bleed or double block and bleed valves shall consist of a single forged body. All forgings shall be forged as close as possible to the final shape and size.

Any screwed joints shall not be dependent on thread tape and/or sealant to ensure a seal. Such joints shall be protected from accidental loosening by mechanical methods and shall be visibly locked.

Handle or lever retaining nuts shall be positively locked or consist of self-locking type to prevent loosening by vibration.

All vent valves within the valve's body shall be needle type.

6 END CONNECTIONS

6.1 FLANGES CONNECTIONS

Flanges shall comply with ASME B16.5. The bore of weld neck flanges shall be the same as the ID of the pipe to which it is to be welded.

Flange jointing faces shall have the following surface roughness in accordance with ASME B46.1.

- ANSI 150/300/600 – ASME B16.5 Ra 3.2 µm to 6.3 µm,

Surface finishes specified above are for the matching the following gasket types:

- ANSI 150 FF – Flat Ring B16.21

All ASME B16.5 flanges in hydrogen services shall be raised face type with a surface roughness Ra 3.2 µm to 6.3 µm.

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7 MATERIALS

7.1 GENERAL

Valve materials shall be as stated on the valve data sheets and shall incorporate any additional requirements specified in this specification.

During the bid evaluation, the SUPPLIER shall provide full details of all component materials and the material condition including procedures and qualification for overlays (if applicable) or any other surface treatment.

The SUPPLIER shall confirm that materials offered are suitable for the service conditions. All materials shall be new, clean and free from rust, mill scale, pits and defects.

EN 10204 3.1 shall apply for the following pressure containing components of the valve and strainer.

- Body/bonnet
- Stem,
- Seats
- Obturator

All other metallic components shall have a material test report.

All non-metallic components shall be with EN 10204 2.2.

Specifically for valves in hydrogen service, the non-metallic seals qualified in accordance with NORSOK M-710 shall be fully traceable to guarantee such non-metallic seals are assembled in hydrogen valves. SUPPLIER shall demonstrate the means of traceability such as Letter of Conformity of by other means.

7.2 BOLTING

All valve bolting shall be as specified on the valve data sheets and shall be for non-sour service. Alternative bolting proposed by the SUPPLIER shall be subjected to approval by CONTRACTOR.

All bolting shall be suitable for the full pressure and temperature ranges as stated in individual data sheets. All low temperature carbon steel bolting shall be hot dip galvanized in accordance with ISO 10684.

7.3 CARBON STEEL

Low temperature carbon steel used for the manufacture of cast or forged valve bodies and components shall be produced in an electrical furnace or by the basic oxygen process.

All carbon steel chemical percentages shall adhere to their respective ASTM standards.

The carbon equivalent shall be calculated based on the following formula.

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

7.4 AUSTENITIC STAINLESS STEEL

Austenitic stainless castings shall be produced from steel refined by the Argon Oxygen Decarburisation (AOD) or the Vacuum Oxygen Decarburisation (VOD) process. SUPPLIER shall detail if an equivalent producing process is proposed.

Austenitic stainless steel valves shall be free of subsequent cold working. The SUPPLIER shall provide MTC for the material where the heat treatment of the finished component is solution annealed.

Hardness testing for 316SS/316L SS in hydrogen service shall be in accordance with ASME B31.12 IP-9 and IP-10.

7.5 SUPER DUPLEX STAINLESS STEEL

The steel making process shall include alloy refining by Argon Oxygen Decarburisation (AOD) or the Vacuum Oxygen Decarburisation (VOD) process. SUPPLIER shall detail if an equivalent producing process is proposed. All components shall be delivered in the solution annealed water quenched condition. Any heat treatment shall be formed after all forming, welding but before final machining of the component.

Refer to Ref.[3] Piping Materials Narrative for the scope of metallographic tests to be completed on the valves' body/bonnet components only.

SUPPLIERS qualified to NORSOK M-650/ISO 17782 are preferred for the supply of 25% Cr super duplex pipes. Relevant NORSOK M-650/ISO 17782 qualification certificates shall be provided by vendors or their sub-suppliers.

7.6 CE MARKING

The relevant European Union CE marking compliance shall be supplied as stated in the Contract/PO requirements together with a Declaration of Conformity as required.

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8 IMPACT TESTING

8.1 GENERAL

Impact testing on parent material, welds and HAZ shall mean CVN and shall be completed by the procedures and apparatus stated in ASTM A370. Frequency of testing shall be one test (three specimens) for every heat.

If the thickness of the material does not permit to remove standard size CVN specimens, sub-size specimens shall be used. The minimum energy values required for sub size specimens shall be the ratio of the actual specimen width to that of a full size specimen multiplied by the full size specimen energy value.

CVNs values shall be minimum 27J to the piping material class minimum design temperature in accordance with PED 2014/68/EU for the following materials.

i. Low Temperature Carbon Steel at (minus) – 46°C

ii. 25% Cr super duplex at (minus) – 51°C

Material austenitic stainless steel 316SS/316L SS is not required to be subjected to CVN tests.

8.2 STAINLESS STEEL AND HIGH ALLOY STEEL STEMS

Where stainless steel 17/4PH and high alloy steels 4130/4140 stems are specified in valves with a minimum design temperature below (minus) - 10°C, they shall be CVN in accordance to ASME B31.3. Acceptance criteria shall be 0.38 mm minimum lateral expansion as per table 323.3.5 of ASME B31.3. The test temperature shall be at the minimum design temperature specified on the valve data sheets.

If 316SS/316L SS for hydrogen valves' stem material is not sufficient for mechanical strength, Nitronic 50/60 is the only alternative acceptable stem material.

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9 WELDING

9.1 GENERAL

Where welding including weld repairs, is proposed to be carried out in the manufacture of the valve, all welding shall be subject to welding procedures in accordance with ASME IX as a minimum. All procedures shall be subject to CONTRACTOR approval prior to commencement of any welding. All welding procedure specifications shall be qualified in accordance with the requirements of ASME IX for ASME B31.3/ASME B31.12.

Weld repair of forgings is not permitted.

Welding on the casting process is only acceptable for valve bodies and bonnets/cover plates in accordance with the provisions of their respective specifications and subject to prior agreement by the CONTRACTOR. Repairs to all body castings by peening or impregnation are not acceptable.

All machining prior to welding shall be subjected to MPI or DPI. No repairs shall be permitted to castings, which suffer porosity during hydrostatic and pneumatic testing. SUPPLIER shall submit a weld repair procedure qualification for CONTRACTOR's approval. This procedure shall detail heat treatment and NDT in accordance with this specification.

All welds, including repair welds shall be subject to 100% MPI or DPI and 100% radiography or ultrasonic examination. Any minor defects, which shall be approved by CONTRACTOR, can be ground or blended provided that minimum wall thickness, including corrosion allowance, is not affected.

9.2 WELD OVERLAY

Weld overlay and stellite 6 hard facing overlay shall be applied where specified on the VDS and shall adhere to Appendix A. The grade of stellite 6 or other types of overlays shall be approved by CONTRACTOR during the bidding phase. Weld procedures and weld procedure qualification for overlays including any PWHT shall be submitted to CONTRACTOR during the bidding phase.

10 INSPECTION AND TESTS

10.1 NON-DESTRUCTIVE EXAMINATION

NDE of all valves are in accordance with the related specifications and with reference ASTM standard.

All NDT activities shall be carried out by qualified and competent Level 1 and/or Level 2 NDT personnel.

All personnel performing NDT shall be qualified in accordance with EN 10256 or equivalent. All level 1 and 2 personnel and NDT operators shall be supervised by a Level 3 individual certified in accordance with EN 473.

Valve castings and forgings shall be subject to inspection in accordance with the following requirements in Table 6 below.

Class	Size (DN)	Non Destructive Testing Requirements
800	1/2" - 1 1/2"	To MSS-SP-55 100%
150	1/2" and above	To MSS-SP-55 100%
		DPI 100% on hydrogen valves' sealing grooves for non-metallic seals in accordance with ANSI B16.34 appendix III
300	1/2" and above	To MSS-SP-55 100%
		DPI 100% on hydrogen valves' sealing grooves for non-metallic seals in accordance with ANSI B16.34 appendix III

Table 6 – Scope of valves NDT

10.2 PRESSURE TESTING

Pressure testing shall consist of the hydrostatic body and seat test and low pressure pneumatically seat test in accordance with the requirements of BS6755 Pt 1 and API 598 as stated in the valve data sheets for ASME rating valves.

For all valves in hydrogen service, the scope of valves' pressure testing shall be in accordance with ASME B31.12 CHPT PL-2.2.2 (3). All hydrogen valves shall be pressure tested using helium as the test medium.

All valves shall be pressure tested by the SUPPLIER. Should a request from a TP inspector either from CONTRACTOR or COMPANY to witness pressure testing the following valve quantities shall be tested.

- 10% per valve type overall quantities for valves in ASME B31.3 and ASME B31.12 design codes.

There shall be no body leakage during FAT.

FAT acceptance criteria for seat leakage is rate 'A' for soft seated valves.

The removal and refitting, during or after test of any pressure retaining components shall be covered in the test procedure and shall be verified by and to the satisfaction of the CONTRACTOR's inspector.

While the hydrostatic body test is being completed, the valve shall also be inspected for leakage through the stem packing. Any observable leak, which cannot be stopped by tightening of the gland packing, which shall not impact the performance to operate the valve and at the discretion of the CONTRACTOR's inspector, shall be cause for rejection.

Hydrostatic tests shall be carried out using a potable water containing 1% by volume of biodegradable wetting agent. Maximum chloride and fluoride content shall be 15ppm and the pH valve shall be between 6.0 and 8.0.

All testing shall be carried out prior to the application of any primer or paint to the valves.

All valves' internal valves and cavities shall be fully drained and completely dried after completion of all hydrotests.

Optional tests as defined in API 598 table 1 will be specified on a case by case basis and will be stated in SUPPLIER's Purchase Order.

10.3 FUGITIVE EMISSION TESTING

When specified in the VDS for valves in hydrogen service , Fugitive Emissions in accordance with ISO 15848-1 Class B. Previous FE ISO 15848-1 qualification can be acceptable if pertinent certification replicates the actual stem size, valve type and class of the project's valve requirements. Such certification shall also include a Third Party stamp.

Fugitive Emission production testing in accordance with ISO 15818-2 shall be completed to the frequencies stated in this ISO specification.

10.4 POSITIVE MATERIAL IDENTIFICATION

All CRA materials, welds and components, including bolts, shall be subject to PMI in accordance with Ref.[3] Piping Materials Narrative.

11 STRAINERS

11.1 GENERAL

The purpose of the Y-strainer is that it shall have a minimum low pressure drop across the screen and shall protect all components downstream. Minimum thickness of the Y-strainer bodies shall be in accordance with pertinent codes and standards requirements. The vendor is completely responsible for the correct selection and for the dimensions taking into account body wall thickness calculated for at least 30 years of Y-strainer life cycle considering relevant corrosion allowance in the piping material classes. The nominal ANSI rating class shall be used for the specification of the required pressure class. Pressure classes are specified by the CONTRACTOR in accordance with the applicable rating tables in ASME B16.34.

11.2 END CONNECTIONS

Y-strainers shall be flanged matching ASME B16.5 either RF/RTJ.

End flanges shall be integrally forged or cast with the body.

Surface finishes of the RF in accordance with Sect. 6.

11.3 END TO END DIMENSIONS

Y-strainers face to face dimensions shall be in accordance to ASME B16.10.

Temporary strainers when specified overall dimension to SUPPLIER's standard.

When face to face dimensions of a Y-strainer are not conforming to ASME B16.10, the manufacturer is responsible to detail this information.

11.4 CONSTRUCTION

11.4.1 Materials of Construction

Body and screen materials are specified in Y-strainer data sheets.

11.4.2 Non-Destructive Testing

Y-strainers NDT scope and acceptance shall follow ASME B16.34 and Sect. 10.1

11.4.3 Screen Element

The screen element and mesh size are as stated in their pertinent individual datasheets. The screen element shall also be constructed to minimize any pressure drop.

11.4.4 Auxiliary Connections

The cover flange of every strainer shall have a threaded connection as per ASME B1.20.1 with a hexagonal head plug in material identical to the Y-strainers main body.

11.4.5 Cover Design

The type of facing for the bolted cover joint shall be equal or superior to the end facing. Gasket type shall follow Sect. 4.14..

11.4.6 Body Cover Bolting

Unless otherwise indicated in the Y-strainer data sheet, the bolting material shall follow the piping material class.

11.4.7 Certification

EN 10204 certification type shall be accordance with Sect.7.1.

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12 MARKING AND IDENTIFICATION

All valves shall be marked for material identification in accordance with the corresponding material specification. The identification marking shall be traceable to original mill certificates.

- All valves shall be marked in accordance with European Standards, MSS SP 25 and PED 2014/68/EU requirements.
- An additional tag shall be provided by SUPPLIER in material 316SS complete with 316SS wire where an individual valve tag number shall be provided.

13 PAINTING AND COATING

Painting and coating of valves shall adhere to Ref.[6] Painting and Coating specification.

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14 PACKING AND PROTECTION

After hydrostatic testing the internal surface of all valves and strainers shall be coated with a water displacing type of corrosion prevention oil/fluid, which does not require solvent cleaning. To ensure total coverage, the valve shall be suitably protected against damage or ingress of contamination using plastic end caps or plywood/plastic discs (approximately 5mm minimum thickness) as follows:

Flanged Ends – plywood or plastic discs to be bolted (minimum) four bolts to the flange face or securely fixed to the flange face using water proof tape.

All valves and strainers shall be protected during shipping using a marine package. The packing shall guarantee protection for 6 months storing in a marine environment site.

Care shall be taken not to apply temporary coating to areas which may be adversely affected (i.e. seat pockets).

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15 QUALITY ASSURANCE

The Manufacturer/Supplier shall have an approved quality assurance system for the design, manufacturing, testing and installation of proposed piping materials. The systems shall conform to ISO 9001 series or similar standards.

Valves shall be manufactured to a quality plan listing the activities to be checked and the appropriate hold, witness and review points. All the information required for the technical conditions of supply will be done during the detail engineering.

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16 PED COMPLIANCE

Valves shall comply with the requirements of the Pressure Equipment Directive 2014/68/EU (PED). The SUPPLIER shall ensure that the manufacturer of the required valve is aware of the requirement for PED compliance to be fulfilled.

All valves shall comply with the requirements of Category 2 of PED, unless specified otherwise by the requisition. Where supplied valves do not comply with the requirements of Category 2 the SUPPLIER shall identify this within their offer giving basis for non-compliance.

In accordance with PED defined requirements, certification shall also include Certificate(s) of Specific Product Control. It shall be the responsibility of the SUPPLIER to appoint a PED accredited NoBo for the design, materials of construction, manufacture and testing such that the supply is fully compliant with the PED and certified accordingly under a PED declaration of conformity.

This responsibility by the SUPPLIER is regardless of any elements of design, material, manufacture or testing defined by the CONTRACTOR.

Any effect on cost and/or schedule resulting from this requirement shall be included within the SUPPLIER offer/scope for the equipment. Any supplementary testing or substitution of alternative materials that arise from the material approval process shall be fully to the SUPPLIER account and at no additional cost to CONTRACTOR or COMPANY".

The PMA shall describe the material properties in a manner that is concise, complete and correct for the foreseen application (see also PED Guideline G-18). It shall comprise qualitative and quantitative data providing evidence that the relevant Essential Safety Requirements (ESR) of PED Annex I are met. The responsibility for drawing up the PMA lays with the pressure equipment manufacturer. The PMA shall be part of the technical documentation. The PED requires a specific assessment of a PMA by a notified body for pressure equipment in category III and IV.

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17 APPENDIX A HARDFACING OR COATING OF VALVES' OBTURATORS AND PRESSURE CONTAINING PARTS

17.1 GENERAL

Hardfacing or coating of valve seats shall be applied to provide an acceptable seating surface that is resistant to wear, galling and abrasion. In addition, CRA on a valve's main pressure containing parts i.e. body and/or body shall be provided in accordance to pertinent VDS.

17.2 ELECTROLESS NICKEL PLATING

ENP shall only be used for wear resistance in non-abrasive service. ENP on hydrogen valves is not acceptable.

On ball valves, ENP shall only be used on soft seated valves. If SUPPLIER's valve design requires a diverse approach, SUPPLIER shall notify CONTRACTOR accordingly during the bid phase.

SUPPLIER shall confirm whether ENP shall be applied by SUPPLIER or their SUB-SUPPLIER. All ENP coatings shall be with a qualified and approved procedure in accordance with ASTM B733.

The qualified procedure shall contain shall contain reference to chemical composition, wear performance, bond strength, contact resistance, hydrogen release treatment (if applicable) corrosion and pitting resistance data.

Any form of final heat treatment shall require the prior approval of CONTRACTOR.

17.3 SURFACE PREPARATION

Prior to application of the ENP coating the surface shall be grit blasted using aluminium oxide to Sa 3, followed by alkaline degreasing and 100% visual inspection. Sealing surfaces shall be masked and ground smooth prior to degreasing. Acid descaling shall not be used.

17.4 PLATING

SUPPLIER to confirm that for wear resistance properties, the phosphorous content shall be between 10-12% and coating density between 7.6 – 7.8 g/cm^2.

Continuous filtration to 1 micron shall be completed with air agitation to ensure a fresh supply of solution to the part and remove the hydrogen produced during deposition. The bath chemistry shall be analysed each hour of production to monitor the plating rate. During production, the bath shall be cleaned at least once per day and chemical life shall not exceed three replenishments.

ENP coating shall be minimum thickness 75µm.

17.5 INSPECTION

The final product shall be 100% visually inspected and be free from pores, pitting and any surface breaking defects. In addition, an examination shall be completed in accordance with ASTM B733 sect. 9.6 to verify the coating is free from porosity. Hardness shall be 48-52HRC in the as-deposited condition.

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17.6 WELD OVERLAY

This section is applicable for valves' obturators and CRA weld overlay. The SUPPLIER shall advise the method of application, consumable type and manufacturer during the bid phase.

17.6.1 Welding Procedure Qualification

Welding shall be qualified to ASME IX.

The procedure qualification documented records shall include test results on chemical analysis of the weld overlay no greater than 3mm from the original base material.

17.6.2 Welding

Gas Tungsten Arc Welding (GTAW) or Plasma Transferred Arc (PTAW) shall be used. A minimum of two layers shall be deposited and the finished machining thickness shall be minimum 3mm. Maximum allowable hardness on any location on the welded surface in the final machined condition shall not be less than 22HRC for 316L as stated in NACE MR0175/ISO 15156.

17.6.3 Welding Consumables

Welding consumable types per material shall be identified in the approved WPS.

17.6.4 Non-Destructive Testing

After final machining of the hardfacing, the surface shall be 100% visually inspected followed by 100% DPI in accordance with ASME VII Div.1. The surface shall be free from surface breaking defects.

17.6.5 Post Weld Heat Treatment

If required, any PWHT shall be submitted by SUPPLIER to CONTRACTOR for approval. The WPS/PQR shall include PWHT data and subsequent mechanical test results.

17.6.6 Weld Repairs

Weld repairs for any weld overlay shall be submitted by SUPPLIER to CONTRACTOR for approval.

17.6.7 Valve internal weld procedure

- Weld overlay inconel UNS N06625 shall be completed with minimum two layers,
- Weld overlay shall be a minimum 3mm thick after machining,
- Dilution on the welded surface shall not exceed 5% of the base metal,
- Vendor shall confirm welding process for internal weld overlay. Such welding procedures shall be already qualified in accordance with ASME IX,
- Maximum hardness of the weld surface UNS N06625 shall be 35HRC after machining,

- Any non-conforming local or total conditions can be repaired upon approval. Any defects shall be repaired by re-welding. Defect zones shall be liquid penetrant inspected before the start of repair welding to confirm the complete removal of defects. VENDOR shall provide their repair procedures for CTR's review and approval,
- The weld overlay shall be 100% dimensional, visual, liquid penetrant and ultrasonic inspected of the surface areas.
  - Dimensional verification to meet the final weld thickness after machining,
  - Visual inspection in accordance with MSS-SP-55 to guarantee no inclusions, visual defects, porosity and cracks,
  - Liquid penetrant shall be completed on the last layer after any PWHT and final machining. Liquid penetrant shall adhere to ASME VIII Div.1 appendix 8 including the acceptance criteria of all surfaces shall be free of i) relevant linear indications, ii) relevant rounded indications greater than 5mm, iii) four or more relevant rounded indications in a line separated by 1.5mm or less (edge to edge),
  - Ultrasonic inspection shall be completed on the entire weld overlay surface areas on the valve's body, bonnet and lateral flanges/hubs after any PWHT treatment and final machining. Ultrasonic testing shall adhere to ASME V article 4 where the ultrasonic calibration block shall be in accordance with ASME V article 4 Fig. T-434.4.1. The acceptance criteria shall be as follows:
    - No single indications exceeding reference distance amplitude curve,
    - No multiple indications exceeding 50% of reference distance amplitude curve. Multiple indications are defined as two or more indications (each exceeding 50% of the reference distance amplitude curve) within 13mm (1/2") of each other in any direction.

17.7 TUNGSTEN CARBIDE COATING

17.7.1 General

Tungsten carbide coating hardfacing overlay is predominately used for corrosion resistance. All seating areas of the valves shall be hardfaced such as ball and seat surface contact sealing areas. The entire surface of the ball shall be hardfaced.

17.7.2 Tungsten carbide coating thickness

The finished minimum coating thickness shall be 200µm after grinding/lapping and polishing.

17.7.3 Consumables

Consumables shall consist of nominal 86% Tungsten Carbide minimum complete with Nickel, Chromium and Cobalt.

17.7.4 Procedures

The technique for applying tungsten carbide shall be by a high oxy-fuel (HVOF) method. SUPPLIER shall detail any other type of method to apply tungsten carbide to CONTRACTOR during the bidding phase. SUPPLIER's procedure to apply tungsten carbide shall as a minimum be as follows:

- Machined surface condition prior to overlay typically 800µm,
- Machined surfaces shall be free of any contaminates,
- Pre-heat range and surface finish after grit blasting,
- Minimum bond strength in accordance with ISO 4624. Acceptance criteria 70MPa minimum,
- Porosity tests by metallographic and 100% DPI. Acceptance criteria no surface breaking defects,
- Hardness range 1000HV.

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