



ENGINEERING AND PROJECTS

COMPANY SPECIFICATION

No: KPO-80-PIP-SPC-00005-E

TITLE:

SPECIFICATION FOR VALVE PROCUREMENT FOR 2 1/4CR-1MO

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1. SCOPE

- 1.1 These products will be manufactured for Karachaganak Petroleum Operating bv (KPO) and used in piping systems designed for high pressure (605 bars (8770 psi)), sour service with ambient temperatures as low as -45°C (-49°F) and operating temperatures as high as 180°C (356°F).
- 1.2 This specification supplements the purchasing and manufacturing requirements for isolating, control, and check valves in KPO's injection compressor piping circuit.
- 1.3 In the event that requirements of this specification conflict with those of standards referenced herein, the requirements of this specification shall take precedence.
- 1.4 All materials shall be made in accordance with and certified as complying with the latest edition of NACE MR0175/ISO 15156.

2. CODES, STANDARDS, AND SPECIFICATIONS

Reference to Latest Editions

| | |
|---------------|---|
| API 6A | Specification for Wellhead and Christmas Tree Equipment |
| API 6D | Pipeline Valves |
| API 6FA | Specification for Fire Test for Valves |
| API 594 | Check Valves: Flanged, Lug, Wafer and Butt Welding |
| API 600 | Bolted Bonnet Steel Gate Valves for Petroleum and Natural Gas Industries |
| API RP 6HT | Heat Treatment and Testing of Large Cross Section and Critical Section Components |
| ASTM A182 | Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service |
| ASTM A320 | Alloy Steel and Stainless Steel Materials for Low Temperature Services |
| ASTM A350 | Forgings, Carbon and Low Alloy Steel, Requiring Notch Toughness Testing for Piping Components |
| ASTM A370 | Standard Test Methods for Mechanical Testing of Steel Products |
| ASTM A388 | Standard Practice for Ultrasonic Examination of Heavy Steel Forgings |
| ASTM A578 | Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications |
| ASTM A694 | Standard Specification for Forgings, Carbon and Alloy Steel for Pipe Flanges, Fittings, valves and Parts for High Pressure Transmission Service |
| ASME B 1.20.1 | Pipe Threads, General Purpose |
| ASME B16.9 | Factory-Made Wrought Steel Butt-welded Fittings |

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|-----------------------|---|
| ASME B31.3 Chapter IX | High Pressure Piping |
| ASME BPV Code | Boiler and Pressure Vessel Code |
| ASNT SNT-TC-1A | Personnel Qualification and Certification in Nondestructive Testing |
| BS EN 10204 | Metallic Products: Types of Inspection Documents |
| ISO 9000 | Quality Management Systems, Fundamentals and Vocabulary |
| ISO 9001 | Model for Quality Assurance in Design, Development, Production, Installation and Servicing |
| ISO 9002 | Quality Systems, Quality Assurance in Production, Installation and Servicing, Second Edition |
| NACE MR0175/ISO 15156 | Petroleum And Natural Gas Industries: Materials for Use in H ₂ S-Containing Environments In Oil And Gas Production |
| NACE TM0187 | Evaluating Elastomeric Materials in Sour Gas Environments |
| NACE TM0296 | Effects of High-Temperature, High-Pressure Carbon Dioxide Decompression on Elastomeric Materials |
| TA LUFT | Technical Instructions on Air Quality Control |

KPO Unit 2 Injection Compressor Piping Replacement Project Specifications:

| | |
|------------------------|---|
| KPO-80-PIP-SPC-00003-E | Specification for Welding of 2¼Cr-1Mo Process Piping |
| KPO-80-PIP-SPC-00004-E | High Pressure Piping Materials Specification |
| KPO-80-PIP-SPC-80008-E | Specification for the Qualification and Quality Control of Non-metallic Sealing Materials |
| KPO-80-PIP-SPC-00006-E | Specification for Positive Materials Identification |

3. ABBREVIATIONS

The following abbreviations are used in this document:

| | |
|----------|--|
| API | American Petroleum Institute |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| AYS | Actual Yield Strength |
| DN | Nominal diameter |
| GGT | Gosgortechnadzor – Department of the Agency on Energy Studies, whose responsibility includes the approval of pressurized equipment for use in Republic of Kazakhstan |
| HBW | Hardness Brinell with a Carbide ball indenter |
| HRB | Rockwell Hardness B scale |
| HV5/HV10 | Vickers Hardness (5kg/10kg load) |
| ISO | International Organization for Standardization |
| KPO | Karachaganak Petroleum Operating bv |

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| | |
|---------|---|
| MAOP | Maximum Allowable Operating Pressure |
| MSS | SUPPLIER's Standardization Society |
| NACE | National Association of Corrosion Engineers |
| NB | Nominal Bore |
| NDE/NDT | Non Destructive Examination/Testing |
| NPS | Nominal pipe size |
| OD | Outside Diameter |
| PMI | Positive Materials Identification |
| PR | Performance Requirement |
| PSL | Product Specification Level |
| PTFE | Poly TetraFluoroEthylene |
| PWHT | Post Weld Heat Treatment |
| QA / QC | Quality Assurance / Quality Control |
| SMYS | Specified minimum yield strength |
| SSC | Sulfide Stress Cracking |
| SMTS | Specified Minimum Tensile Strength |
| TA LUFT | German Clean Air Regulations |
| UTS | (Actual) Ultimate Tensile Strength |
| VPI | Vapor Phase Inhibitor |

- 3.1 The SUPPLIER shall notify the COMPANY of any conflict between this specification, the related data sheets, the Codes and Standards and any other specifications noted herein. Resolution and / or interpretation of precedence shall be obtained from the COMPANY in writing before proceeding with the design or manufacture.
- 3.2 In case of conflict, the order of precedence shall be:
- 3.2.1 Data Sheets
 - 3.2.2 Purchase Order / Material Requisition
 - 3.2.3 Project specifications and Standards
 - 3.2.4 Industry Codes and Standards
- 3.3 Any technical deviation(s) against this specification and its attachments and / or any code requirement shall be obtained in writing from the COMPANY by formal submission of CONCESSION REQUEST FORM, a blank copy of which is issued with the Purchase Order. Full details of the proposed concession shall be expressed on this form and forwarded to the COMPANY in advance of the deviation being implemented, together with any proposed remedial work. The COMPANY will return the master form to the SUPPLIER signed either accepted or rejected as considered appropriate. The COMPANY'S decision will be final in all cases.

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3.4 All concession forms shall be inserted into the appropriate section of the equipment passport.

4. DEFINITIONS

4.1 COMPANY means KPO and its designated representatives.

4.2 SUPPLIER means any seller, provider or supplier of goods to the COMPANY

4.3 A LOT shall consist of valve or components of the same nominal size, made from the same batch/heat of material, and heat treated (metallic) or moulded/sintered (nonmetallic) together. A lot is limited as follows:

4.3.1 25 pieces for DN > 400mm (16")

4.3.2 50 pieces for 200mm (8) < DN < 400 (16")

4.3.3 100 pieces for DN < 200mm (8")

4.4 BASE MATERIAL refers to the unfinished product form which undergoes subsequent manufacturing steps to result in a final product form.

4.5 CONTRACTOR means any provider of services to COMPANY including Consultants

4.6 COMPANY'S INSPECTOR means personnel or their representative hired by the COMPANY to perform a quality assurance function.

4.7 PASSPORT means assembly of final design, manufacturing, installation and maintenance documentation. Mainly in dual language format. Refer to referenced Passport Specification. This replaces data dossiers, manufacturing reports, etc.

5. MATERIALS

5.1 General requirements

5.1.1 For sour service, all stems, wedge segments, seats and seals shall meet the requirements of NACE MR-0175/ISO 15156.

5.1.2 Pressure retaining parts specified as forged shall not be substituted with castings or items of welded construction except weld on flanges.

5.1.3 The following materials are prohibited in all applications: Monel, Copper-Based alloys, Duplex Stainless Steels, Nickel-Based alloy X-750, 17-4PH precipitation hardened alloys, and any Martensitic stainless steels.

5.2 Valve Body

5.2.1 These requirements supplement those of the applicable valve body ASTM specification.

5.2.2 Body materials shall be made in accordance with relevant data sheet unless otherwise stated in Table I. Materials selected shall be subject to review and acceptance by COMPANY.

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5.2.3 Valve bodies shall only be made from forgings; cast valve bodies are prohibited.

5.3 Valve trim

5.3.1 COMPANY approved valve trims and other valve details have been summarized in Table I and shall be made in accordance with the latest edition of NACE MR0175/ISO 15156.

5.3.2 Trim materials for carbon and low alloy steel swing and lift check valves shall include the body seating surface, disc hinge pin (if applicable) and disc pin, as a minimum. Other internal parts that contact the service fluid shall be of the specified trim material where so indicated in the Item Code Description.

5.3.3 Trim materials for carbon steel and low alloy wafer type check valves shall conform to Table 3 of API 594 (2004 ed). Trim materials not covered there shall conform to Table 13 of API 600 (2001 ed.), as applicable.

5.4 Seals and Sealing Surfaces

5.4.1 The following requirements supplement those of the applicable ASTM or API specifications.

5.4.2 Elastomers shall not be used for primary seals.

5.4.3 Nonmetallic sealing materials shall be tested in accordance with KPO-80-PIP-SPC-80008-E, "Specification for Quality Control of Non-metallic Sealing Materials".

5.4.4 Stem / gland packing shall be made from one of the following materials (Other materials may be acceptable pending case-by-case basis approval by the COMPANY):

5.4.4.1 Braided Carbon or Graphite

Fibers shall contain 95% Carbon minimum, zinc powder or molybdenum corrosion inhibitor, graphite lube and 100 ppm leachable chlorides maximum. Ring construction shall be interbraid weave with no more than 25% weight loss upon ignition.

5.4.4.2 Flexible Graphite

This shall contain 95% carbon minimum, zinc powder or molybdenum corrosion inhibitor, 100 ppm leachable chlorides maximum, 1500 ppm total sulphur maximum, and free of lubes and binders. Material construction shall be die-formed rings or flexible graphite spiral pack, precompressed to 1121 to 1442 kg / m³ (70 to 90 lbs / cu. ft).

5.4.4.3 PTFE

Energized lip seals are permissible provided they have Elgiloy springs. If the design requires it, 316 stainless steel, or higher grade material, packing ring (in compression) to hold the lip open may be used.

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5.5 Seating Surface Overlays

5.5.1 Metal seating surfaces on API 2900# and higher rated valves shall have wear resistant, tungsten carbide overlays on the balls and seat rings.

5.5.2 Electroless Nickel and similar platings are not allowed as hardfacings.

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Table I. Valve Trim Code Descriptions

| Valve code | Replaces | Dimensions | Pressure Rating | Design Temperatures (Deg C) (Note D) | Connection | Design code | Construction (Note C) | Body Material (Note A) | Trim Material (Note A) | Seal Material (Note A) |
|------------|----------------------------|------------|-----------------|--------------------------------------|----------------|-----------------|-----------------------|------------------------|------------------------|------------------------|
| | BALL VALVES, Isolating | | | | | | | | | |
| VB1 | VBFE | 1/2"-1.5" | ANSI 1500 | 80/-45 | FL ANSI B16.5 | API 6D | Split Body Floating | ASTM A350 LF2 | (Note B) | PTFE |
| VB1 | VBFE | 2-16" | ANSI 1500 | 80/-45 | FL ANSI B16.5 | API 6D | Split Body Trunnion | ASTM A350 LF2 | (Note B) | PTFE |
| VB2 | VBFF | 1-1.5" | ANSI 2500 | 180/-45 | FL ANSI B16.5 | API 6D | Split Body, Floating | ASTM A350 LF2 | (Note B) | Metal-to-metal |
| VB2 | VBFF | 2-12" | ANSI 2500 | 180/-45 | FL ANSI B16.5 | API 6D | Split Body, Trunnion | ASTM A350 LF2 | (Note B) | Metal-to-metal |
| VB3 | VBFI | 0.5-1.5" | API 2900 | 115 (max) /-45 | FL ANSI B16.5 | ANSI B16.34 | Split Body, Trunnion | API 6A-60K 2 1/4Cr1Mo | (Note B) | Metal-to-metal |
| VB3 | VBFI | 2-12" | API 10,000 | 115 (max) /-45 | FL ANSI B16.5 | API 6A | Split Body, Trunnion | API 6A-60K 2 1/4Cr1Mo | (Note B) | Metal-to-metal |
| | | | | | | | | | | |
| | GLOBE VALVES, Hand Control | | | | | | | | | |
| VGL1 | VGLFE | 0.5-6 | ANSI 1500 | 80/-45 | FL ANSI B16.5 | BS 5352/BS 1873 | Bolted Bonnet, OS&Y | ASTM A350 LF2 | (Note B) | |
| VGL2 | VGLFF | 0.5-4" | ANSI 2500 | 180/-45 | FL ANSI B16.5 | BS 5352/BS 1873 | Bolted Bonnet, OS&Y | ASTM A350 LF2 | (Note B) | |
| VGL3 | VGLBE | 0.5-1.5" | ANSI 1500 | 80/-45 | BW ANSI 16.25 | BS 5352 | Bolted Bonnet, OS & Y | ASTM A350 LF2 | (Note B) | |
| VGL4 | VGLBF | 0.5-1.5 | ANSI 2500 | 180/-45 | BW ANSI B16.25 | BS 5352 | Bolted Bonnet, OS & Y | ASTM A350 LF2 | (Note B) | |
| VGL1 | VGLBG | 0.5-1.5 | API 2900 | 115/-45 | BW ANSI B16.25 | ANSI B16.34 | Pressure seal | API 6A-60K 2 1/4Cr1Mo | (Notes B, E) | |

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| Valve code | Replaces | Dimensions | Pressure Rating | Design Temperatures (Deg C) (Note D) | Connection | Design code | Construction (Note C) | Body Material (Note A) | Trim Material (Note A) | Seal Material (Note A) |
|------------|----------------------------|------------|-----------------|--------------------------------------|-----------------------------|-------------|-----------------------|------------------------|------------------------|------------------------|
| | CHECK | | | | | | | | | |
| VC1 | VCFE | 1-1.5 | ANSI 1500 | 80/-45 | FL ANSI B16.5 | BS 1868 | B.C. Ball Type | ASTM A350 LF2 | (Note B) | |
| VC2 | VCFF | 1-1.5 | ANSI 2500 | 180/-45 | FL ANSI B16.5 | BS 1868 | B.C. Ball Type | ASTM A350 LF2 | (Note B) | |
| VC3 | VCWF | 2-12" | ANSI 2500 | 180/-45 | Wafer ANSI B16.5 | API 594 | Wafer, Tilting Disc | ASTM A350 LF2 | (Note B) | |
| VC4 | VCFG | 1-1.5 | API 2900 | 115/-45 | FL API 2900 | ANSI B16.34 | B.C., Ball Type | API 6A-60K 2 1/4Cr1Mo | (Note B) | |
| VC5 | VCWI | 2-12" | API 10000 | 115/-45 | Wafer API 10K | API 6A | Wafer, Tilting Disc | API 6A-60K 2 1/4Cr1Mo | (Note B) | |
| | NEEDLE, Isolating Assembly | | | | | | | | | |
| VN1 | VNBI | 0.5-0.75 | API 10,000 | 180 (max) /-45 | BW ANSI B16.11 X 0.5" NPT-F | ANSI B16.34 | Double Needle Valve | BS 970 (Note B) | (Note B) | |

Note A: All materials shall conform to the latest edition of NACE MR0175/ISO 15156 unless otherwise noted. 17-4PH (UNS S17400) shall not be used.

Note B: The following materials are allowed when made as wrought products in accordance with the latest edition of NACE MR0175/ISO 15156 and API 6A: Nitronic 50 (UNS S20910) Alloy 718 (UNS N07718) including requirements of API6A718, or Alloy 925 (UNS N09925) as supplemented by a microstructural examination. Valve Stems shall be made of Alloy 718 (UNS N07718).

Note C: Where possible, these should be extension or radiation finned to protect against extreme process temperatures.

Note D: Where the trim is used with two design temperatures, the higher of the two is stated.

Note E: Low alloy steels, such as AISI 4130 are not permitted. 2 1/4Cr-1Mo shall be used.

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5.6 Ancillary Components

5.6.1 *Metal Gaskets*

Gaskets shall be made of Soft Iron in accordance with relevant specification.

5.6.2 *Bolts*

Corrosion Resistant Alloy bolts shall comply with the requirements of A453 GR660 Class D, unless otherwise agreed. They shall meet NACE MR0175/ISO 15156 requirements for sour service and meet API 6A for strength.

5.6.3 *Nuts*

Nuts shall conform with requirements of ASTM A194 GR 2HM.

6. FABRICATION

6.1 SUPPLIER Information before Production

- 6.1.1 SUPPLIER shall provide for review and approval, design calculations and drawings together with proposals for protection against damage during shipment.
- 6.1.2 Production shall not begin until COMPANY has agreed with the SUPPLIER'S Quality Plan, the manufacturing procedure, and the actual chemical analysis of the steel being used.
- 6.1.3 The manufacturing procedure and qualifications shall include all factors that influence the quality and reliability of the valve. These shall include but not be limited to:
- 6.1.3.1 Welding procedures (if applicable)
 - 6.1.3.2 Methods of dimensional control
 - 6.1.3.3 All NDE procedures
 - 6.1.3.4 Heat treatment procedures
 - 6.1.3.5 Hydrostatic testing procedures
 - 6.1.3.6 Leakage testing procedures
 - 6.1.3.7 PSL 4 Tightness testing procedures
 - 6.1.3.8 PSL 4 Certification and Traceability of all materials including soft goods
 - 6.1.3.9 PR 2 Certification for valves of similar size and design
 - 6.1.3.10 Soft goods material test reports and traceability
- 6.1.4 The welding of flanges on to valves to meet the requirements for a 'flanged' end valve specification is not acceptable without prior approval of the COMPANY. In the case of valves supplied with butt welding ends, the SUPPLIER shall advise COMPANY of the required length of the pup to ensure that field welding and subsequent PWHT will not cause damage to the valve including the sealing surfaces and any non-metallic trim. The SUPPLIER shall confirm that required

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machining operations (if any) can be performed with the pup piece in place. Welding procedures and qualifications shall require review and acceptance by the COMPANY before proceeding with valve manufacture. Sub-contracted welding work shall be treated similarly. Flanges shall be welded on with procedures qualified in accordance with the latest edition of KPO-80-PIP-SPC-00003-E, "Specification for Welding of 2 1/4Cr-1Mo Process Piping". All such flanges shall meet the requirements of the latest edition of KPO-80-PIP-SPC-00004-E, "High Pressure Piping Materials Specification for 2 1/4Cr-1Mo".

- 6.1.5 Hard facing and overlay procedures shall be qualified in accordance with Appendix A.
- 6.1.6 All welds and bolts shall be detailed or fully described by notes. The notes on assembly drawings shall clearly state all pertinent information not shown on other applicable drawings, including applicable codes, specifications, tests, material identification (by ASTM designation when possible), and weights.
- 6.1.7 No weld repairs to forgings shall be allowed. Welding to overlay seal areas shall be permitted.

6.2 Heat Treatment

- 6.2.1 Heating practices shall be consistent with API RP 6HT.
- 6.2.2 For API 6A 60k 2 1/4Cr-1Mo materials, the only allowed heat treatment is quench and temper. A double temper after quenching is also allowed. The tempering temperature shall be 710°C (1310°F) minimum.
- 6.2.3 Details of proposed heat treatments shall be provided for review and the valves shall be suitably marked to indicate the heat treatment applied.
- 6.2.4 There shall be at least one thermocouple connected directly to the forging during heat treatment.
- 6.2.5 Certification shall include temperatures and times for the heat treatment applied.

6.3 Fabrication Drawings

- 6.3.1 The fabrication drawings prepared by the SUPPLIER for COMPANY'S approval shall show complete design details; once approved, these drawings will govern fabrication. The locations of the weld seams, where applicable, shall be clearly indicated. Drawings shall show special weld details, reinforcements, support details, and similar mechanical information.
- 6.3.2 SUPPLIER shall also provide detail on dimensional drawings showing stem or shaft sealing design, number of and size of packing rings or stem seals required for each type and size of valve in the Purchase Order.

7. MECHANICAL PROPERTIES

- 7.1 One valve body from each production lot shall be sacrificed for tensile, Charpy, and hardness tests in accordance with Production Testing, "Mechanical Properties" in KPO-80-PIP-SPC-00004-E, "High Pressure Piping Materials Specification for 2 1/4Cr-1Mo".

7.2 Hardness Testing

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- 7.2.1 All valve bodies shall be hardness tested after the final heat treatment. Maximum hardness of plain carbon steel components (e.g. A350 LF2) exposed to the process shall be 200 HB. Enhanced strength alloy steels such as A182 F22 shall have a maximum hardness of 235HB (250 HV10). The method of hardness testing and the location of the measurements shall be subject to COMPANY approval.
- 7.2.2 If SUPPLIER are to supply stud bolts and nuts with the valve, then 5% from each container or box (but 5 minimum) shall be hardness checked in accordance with ASTM A370 (2003 ed.) Annex A3.

8. INSPECTION AND QUALITY CONTROL

8.1 Quality assurance / quality control

- 8.1.1 A copy of the SUPPLIER'S QA / QC program shall be submitted to the COMPANY with its quotation for review and concurrence prior to award.
- 8.1.2 The SUPPLIER shall identify in documents to its sub-suppliers, and subcontractors all applicable QA / QC requirements imposed by the COMPANY, and shall ensure compliance. On request, SUPPLIER shall provide objective evidence of its QA / QC surveillance for all levels of its activity.
- 8.1.3 Material certification and traceability is required. The level of inspection shall be as defined on the Equipment List and be in accordance with Criticality Rating System and the corresponding requirements for Minimum Shop Inspection and Certification.
- 8.1.4 The SUPPLIER shall establish and maintain a quality assurance system in accordance with ISO 9001, or an equivalent approved by the COMPANY.
- 8.1.5 Supplier Quality Standard

All pressure containing forgings shall be procured from manufacturers who can demonstrate their ability to supply sound forgings to the requirements of ISO 9002 and this specification.

8.2 Positive Material Identification (PMI)

- 8.2.1 All valve trim materials shall be inspected for composition using acceptable XRF in accordance with Section 8, "PMI Methods" of KPO-80-PIP-SPC-00006-E, "Specification for Positive Material Identification".
- 8.2.2 When the size of the item precludes testing, a complete chemical analysis shall be performed on one item from each lot.

8.3 Nondestructive Examination

- 8.3.1 Inspection and testing requirements shall be as per the Project Data Sheets listed in the Material Requisition. Where conflict exists between this technical specification and the Project Data Sheet, the Project Data Sheet shall take precedence over the inspection and testing requirements of this technical specification.
- 8.3.2 All inspections for acceptance by COMPANY shall be performed after any heat treatment processes that may be required, including final stress relieving.

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- 8.3.3 The forged valve body shall be inspected in accordance with Section 11, “Inspection” of KPO-80-PIP-SPC-00004-E, “High Pressure Piping Materials Specification for 2 1/4Cr-1Mo”.
- 8.3.4 Visual inspection of 100% of the completed part is required to ensure compliance with dimensional tolerances, including bevelled ends and gasket seat surface finish when present.
- 8.3.5 Welding end bevel areas on valves 4” NPS and larger shall be ultrasonically inspected, after final machining and ASTM A578 Acceptance Standard – Level C shall apply.
- 8.3.6 Welding end bevel areas on valves shall be inspected by MPI and no linear indication is permitted.

9. PERFORMANCE TESTING

9.1 All API 6A valves shall have a PR2 rating. Any valve size or type that does not have a PR2 rating shall be identified by the SUPPLIER and can not be supplied without written waiver of PR2 from the Company.

9.2 Leakage Testing

- 9.2.1 All valves made in accordance with API 6A shall be subject to leakage testing in accordance with API 6A, 2004 ed., PSL 4 PR2 (Annex I, Class I only). However the acceptable gas leakage rate for PR2 testing shall be 20cc/hour.
- 9.2.2 All other valves shall be tested in accordance with TA-LUFT requirements as follows:
 - 9.2.2.1 One valve, per stem size, of each category to be subject to a full ‘Production Type Approval Test’ based on the TA-LUFT Test procedure comprising a certified 99% Nitrogen/ 1% Helium mix gas test, at 1.1 times valve maximum design pressure, for a minimum of 500 actuation cycles at two constant test temperatures: –45°C and +200°C.
 - 9.2.2.2 Valve stem gland leakage to be measured with a Mass Spectrometer at 50 cycle increments. Test valves to be selected by COMPANY’S INSPECTOR from normal production run.
 - 9.2.2.3 Maximum allowable leakage rate, from the stem seal or any other single source, to be 1 X 10⁻⁶ atmospheric liters per second.

9.3 Pressure Testing of API 6A valves

- 9.3.1 Valves shall be operated through a full cycle from closed to open and then open to closed a minimum of five times at zero pressure prior to performing all other tests.
- 9.3.2 Valve closure torque requirements conducted during pressure testing shall not exceed the following parameters:

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- 9.3.2.1 For manual and gear operated valves: that attainable by hand tightening
- 9.3.2.2 For motor operated valves: the design closure Delta P per the On / Off valve schedule
- 9.3.3 All valves and operators shall be successfully pressure tested as a complete unit prior to painting. Valve operators to be installed by SUPPLIER shall be mounted in place and be operational prior to pressure testing.
- 9.3.4 Valve body or shell and valve seats shall be PSL4 gas tested as per API 6A-99, Table 7.10 – Quality Control Requirements for Full Bore Valves, unless otherwise noted in the Purchase Order / Data Sheets.
- 9.3.5 The tested valve shall include all auxiliary components or attachments which will be part of the final assembly and which may be subjected to the fluid service or the installed pressure test. It shall also include the type or style of packing, seals or gaskets that are specified to be furnished with the valve.
- 9.3.6 If a small bore relief valve is to be fitted to the valve in order to relieve potential pressure build up in the body / bonnet cavity, the SUPPLIER shall agree with the COMPANY a procedure to pressure test this connection and the subsequent ‘set pressure’ requirement for the relief valve.
- 9.3.7 SUPPLIER shall furnish a copy of the pressure testing procedure for review / authorization by COMPANY after Purchase Order placement.

9.4 Final Inspection

- 9.4.1 Final visual quality and dimensional inspection shall be made by COMPANY.
- 9.4.2 The independent inspector shall review the SUPPLIER’S inspection records and materials certification and shall endorse such records to confirm the review. Random independent checking shall be performed.
- 9.4.3 The Piping Material Passport shall be finally reviewed by the COMPANY’S INSPECTOR with particular emphasis on ensuring all forms have been completed and endorsed by the Authorised inspector. The nameplate rubbing, general inspection and traceability records shall all have been inserted.
- 9.4.4 All loose items, commissioning spares and packing lists shall be reviewed by the COMPANY’S INSPECTOR to ensure completeness of the Purchase Order.

10. DOCUMENTATION

- 10.1 SUPPLIERS shall submit for COMPANY approval, a list of sub-suppliers, including raw materials and all components and their manufacturing / assembly locations. This listing shall be included with all BID submissions and shall not be subject to revision after award of a purchase order. Any change or additional sub-suppliers or sub-contractors may only be used with the written permission from the COMPANY.
- 10.2 SUPPLIER Documentation Package

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- 10.2.1 The SUPPLIER shall state the following information for all valves:
 - 10.2.1.1 Stem Material
 - 10.2.1.2 Stem Diameter
 - 10.2.1.3 Maximum Stem Torque (under a full torsional load as induced by valve sticking)

- 10.2.2 Design torque at maximum differential shut in pressure x 1.5
 - 10.2.2.1 Break-out to open
 - 10.2.2.2 Break-out to close
 - 10.2.2.3 Running
 - 10.2.2.4 End to open
 - 10.2.2.5 End to close

10.3 Certification Documents

Certification is required to BS EN 10204 3.1. Unless otherwise specified in the order, the SUPPLIER shall forward to the COMPANY as part of the order three copies of the Passport documents in the language specified in the order as applicable.

11. PASSPORTS

11.1 Valves

The SUPPLIERS of all valves, irrespective of the country of manufacture, shall provide a passport in the format given by the COMPANY for each individual item of equipment within their scope of supply.

11.2 Test Certificates

- 11.2.1 It is a project requirement that materials supplied by the SUPPLIER can be traced back to a valid material certificate or similar document.
- 11.2.2 SUPPLIER shall submit test certificates for valves to the requirements of EN 10204 3.1 which shall include but not be limited to:

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- 11.2.2.1 Chemical and Mechanical Properties per heat and per valve size
- 11.2.2.2 Mechanical Properties (Including hardness test values for all relevant components)
- 11.2.2.3 Heat Treatment type, number, temperatures, times, and quenching details
- 11.2.2.4 Hydrostatic and air / inert gas test certificates
- 11.2.2.5 Radiographic, ultrasonic, magnetic particle, and dye penetrant inspection reports
- 11.2.2.6 Operational test reports
- 11.2.2.7 Compliance with NACE MR-01-75/ISO 15156
- 11.2.2.8 Welding and overlay procedures and qualifications
- 11.2.3 The Heat Number shall be traceable to the relevant original supply Material Test Certificate.
- 11.2.4 All certification shall state the SUPPLIER'S name and location, all forging certificates shall be from the original forgemaster. Certificates shall include COMPANY Purchase Order Number and Purchase Order Item Number.
- 11.2.5 Inspection level shall be in accordance with the requirements of the design code and the Material Requisition.

12. MARKING

12.1 Color Coding

There is no project requirement to color code valves.

12.2 Nameplates

- 12.2.1 Valve bodies and stainless steel nameplates shall be marked in accordance with Section 8, Table 8.1 of API 6A. The serial number of the valve shall be permanently steel die stamped on the valve body and on a stainless steel nameplate.
- 12.2.2 The nameplate of austenitic stainless steel shall be securely bonded to the valve, at a non-pressure holding location approved by COMPANY by the use of adhesives such as epoxies, acrylics, polyesters, etc., in addition to the use of drive screws or rivets. Prior to affixing the nameplate to the valve, the valve body surface shall be free of paint, grease, oil, rust, etc., to ensure proper bonding of nameplate to the valve body. The nameplate shall be marked by raised letters or by die stamping.
- 12.2.3 In addition to the above requirements, each valve shall be equipped with a second stainless steel nameplate giving the following information:
 - Purchase Order Number
 - Valve Tag Number
 - Test Pressure – Shell
 - Test Pressure – Seats
 - Wall Thickness and Grade of Transition Piece or Weld End

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- All main and auxiliary nameplate data shall be in dual language – English and Russian

13. PREPARATION FOR SHIPMENT

13.1 Packing, Crating and Shipping

- 13.1.1 SUPPLIER shall prepare the valves for shipment after all inspections and testing have been completed and they have been approved for shipment by the COMPANY'S INSPECTOR. Gates shall be in the closed position for shipment.
- 13.1.2 Packing, crating and shipping shall conform to the requirements in the COMPANY'S instructions
- 13.1.3 COMPANY reserves the right to inspect and approve the crating. SUPPLIER shall give COMPANY written notice at least 10 days before beginning export crating
- 13.1.4 All valves shall be crated for shipment complete with operator and extensions, if any. Component parts shall not be removed unless necessary for shipment purposes. If some measure of disassembly is required, the disassembled parts shall be properly packed and clearly marked with the valve tag number and piece number. Disassembled parts shall be shipped with the valve to which the parts belong.
- 13.1.5 For disassembled valves, re-assembly drawings shall be prepared for each valve / actuator configuration. Drawings shall clearly show the disassembled parts and piece numbers in the re-assembled state. Drawings shall be shipped with each valve.
- 13.1.6 All openings shall be provided with plugs, caps or closures to prevent the entrance of moisture or foreign materials.
- 13.1.7 Bevels shall have bevel protectors securely fastened.
- 13.1.8 If shipped loose, handwheels or wrenches shall be removed from valve stems and securely wired to the body with non-corrosive metal wire. Stem surfaces / threads exposed to the elements shall be protected with plastic covers or heavy duty tape, having first been greased. The handwheel / wrench securing nut shall be re-assembled to the stem.
- 13.1.9 Stainless steel internals shall be protected from chloride attack which can occur from exposure to salt water spray or the atmosphere during shipment. Protection through the use of waterproof barrier materials shall also be considered and provided where shipping by truck in areas where road salt is used.
- 13.1.10 Preparation details and shipping specification shall be submitted to COMPANY for review and acceptance prior to final inspection.
- 13.2 Vapor phase inhibitor shall be inserted into each valve prior to final packaging requirements. Valve shall be tagged in addition to the requirements of Section 8-Marking "SEALED WITH VPI. DO NOT OPEN".

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14. **COMMISSIONING SPARES**

SUPPLIER shall recommend the level of commissioning spares together with those required for 2 years .

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APPENDIX A TUNGSTEN CARBIDE COATING

A.1 GENERAL

The following requirements shall be considered as minimum requirements to be satisfied by Manufacturer for Tungsten Carbide Coating. Manufacturer shall submit for Company approval his own coating procedure.

A.2 COATING PROCESS

Coating process shall be HVOF (High Velocity Oxygen Fuel Process). Manufacturer can propose alternative methods subject to Company approval.

A.3 TECHNICAL REQUIREMENTS

A.3.1 Technical data

The following data are required to Manufacturer:

- Nominal composition: 86% WC, 10% Co, 4% Cr;
- Minimal hardness: 1050 HV;
- Tensile Bond Strength: > 10,000 psi (Vendor to advise test method/standard)
- Density: 10,4 g/cm³;
- Porosity: ≤ 1%

A.3.2 *Thickness*

The thickness of the coating shall be minimum 100 µm after grinding and polishing;

A.3.3 *Cleaning*

Components shall be machined to achieve a surface roughness of 0.8 µm Ra. The components shall be cleaned to remove oil/grease before coating process.

A.3.4 *Coating period*

Coating period shall be advised by vendor. Small components shall be coated within 4 hours after grit blasting.

A.3.5 *Sealing*

All coated surfaces, excluding parts used on pure oxygen service shall be sealed after the spraying. The type of sealing shall be specified in the manufacture procedure.

A.3.6 *Treatment after coating*

All coated surfaces, excluding parts used on pure oxygen service shall be sealed after the spraying. The seats shall be lapped with the corresponding seal surface to assure full tightness.

A.4 TESTING

Vendor shall certify that its coating process is fully qualified for the operating service condition. The qualification procedure shall as minimum include a bend test and a bonding test to be performed on base material equal to the one to be coated. Vendor shall certify and provide corrosion test data to support the service: this shall also include suitability with the actuator hydraulic fluid.

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Each valve coating shall be checked to ensure that as minimum the following are achieved:

- Surface roughness shall be $\leq 0.10 \mu\text{m Ra}$.
- 100 % of sealing area shall be dye penetrant examined (surface porosity test). No visible defects are acceptable.
- Hardness shall be a minimum of 1050 HV

The test method used to determine the adhesion strength of the coating shall comply to, ASTM C633 – Test Method for Adhesion or Cohesion Strength of Thermal Spray Coatings.

A.5 DOCUMENTATION

Documentation to be produced shall be as follows:

- Certificate of conformity;
- Dimensional report;
- Coating test certificate (Hardness, porosity, composition and bond test result)