SSGC/LP/EPADS/3Q/2119040

SSGC

SUI SOUTHERN GAS COMPANY LIMITED (SSGC)

TECHNICAL SPECIFICATION FOR ASSORTED VALVES

TABLE OF CONTENTS

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

1 GENERAL

1.1 Scope

1.1.1 The purpose of this specification is to describe the minimum functional and technical requirements for Assorted Valves suitable for natural gas transportation.

1.1.2 The specification also covers the design, fabrication, and shipment of manual gear operators and actuators to be supplied with these valves in natural gas service.

1.1.3 This specification is to be applied in conjunction with the Schedule of Requirements (S.O.R) and the supporting procurement Data Sheet (where applicable).

1.2 Definitions

PURCHASER means OWNER and MANUFACTURER means CONTRACTOR/SUPPLIER/ BIDDER. This definition shall apply throughout this specification.

1.3 Errors or Omissions

1.3.1 Any errors or omissions noted by the Manufacturer in this Specification shall be immediately brought to the attention of the Purchaser.

1.4 Deviations

1.4.1 All deviations to this Specification shall be brought to the knowledge of the Purchaser in the bid. All deviations made during the procurement, design, manufacturing, testing and inspection shall be with written approval of the Purchaser prior to execution of the work. Such deviations shall be shown in the documentation prepared by the Manufacturer.

1.5 Conflicting Requirements

1.5.1 In the event of conflict, inconsistency or ambiguity between the contract's scope of work, this Specification, and National Codes & Standards referenced in this Specification, the Purchaser shall be consulted and a ruling, in writing, shall be obtained before any work is started.

1.5.2 Some requirements in this specification may be modified by specific requirements in the Schedule of Requirements. In case of conflict, the specific requirements supersede this specification.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

2 ABBREVIATIONS/SYMBOLS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

ABBREVIATION	NAME
ANSI	American National Standard Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
BC	Bolted Cover
BW	Butt Welding
CS	Carbon Steel
D	Diameter
Gr.	Grade
Max	Maximum
MTC	Material Test Certificate
SOR	Schedule of Requirements

3 CODES, REGULATIONS AND STANDARDS

Manufacturer shall meet or exceed the requirements of the latest edition of the following applicable codes, regulations and standards, except as superseded herein.

- ASME B31.8, Gas Transmission and Distribution Piping Systems
- ASME Section VIII, Div – 1, Pressure Vessels
- ASME Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers and Welding and Brazing Operators
- ASME Section V, Non-Destructive Examination
- ASME B1.20.1, Pipe Threads, General Purpose (Inch)

- ASME B16.5, Steel Pipe Flanges and Flanged Fittings
- ASME B16.47, Large Diameter Steel Flanges (NPS 26 through NPS 60)
- ASME B16.20, Metallic Gaskets for Pipe Flanges - Ring Joint, Spiral Wound
- ASME B16.21, Nonmetallic Flat Gaskets for Pipe Flanges
- ASME B16.25, Buttwelding Ends
- ASME B16.9, Wrought Steel Butt-Welding Fittings
- ASME B16.10, Face-to-Face and End-to-End Dimensions of Valves
- ASME B16.11, Steel Socket Weld Fittings
- ASME B16.34, Valves - Flanged, Threaded and Welding End
- ASME B40.100, Pressure Gauges and Gauge Attachments
- API 600, Steel Gate Valves - Flanged and Butt-welding ends
- API 602, Compact Steel Gate Valves – Flanged, Threaded Welding & extended-body ends
- API 594 Check Valves: Wafer and Wafer-lug, and double flanged type
- API 6D, Specification for Pipe line valves (Gate, Plug, Ball and Check valves)
- API 6FA, Specification for fire test for Valves
- API 607, Fire Test for soft seated quarter-turn valves
- API 6FD, Specification for Fire Test for Check Valves
- API 598, Valve Inspection and Testing
- BS 1868, Steel Check valves (Flanged and Butt-welding ends)
- BS 1873, Steel Globe and Globe stop & Check valves (Flanged & Butt- welding ends)
- BS 5351 Steel Ball valves
- BS 5352, Steel wedge Gate, Globe and Check valves (50 mm and smaller)
- BS 6755, Testing of valves Part 1: Production pressure testing requirements
- BS 6755, Testing of valves Part 2: Specification for Fire-type testing requirements
- ASTM Standards, as applicable
- Bolt Torqueing/Tensioning procedure for Flanged connection
- MSS SP 25, Standard Marking System for Valves, Fittings, and Unions
- MSS SP 44, Steel Pipeline Flanges
- MSS SP 55, Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components
- MSS SP 91, Guidelines for Manual Operation of Valves

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

4 GENERAL REQUIREMENTS

4.1 This specification covers various types of valves intended for use in the natural gas service with design rating as specified in the Schedule of Requirements and temperature between -10°C and +75°C.

4.2 This specification incorporates the supplementary specification of manual operators and actuators for valves. The valves and operators shall be compatible. The manual operators/actuators shall be included in the scope of supply by the manufacturer wherever specific operator types are specified.

4.3 The manufacturer shall be responsible for the design, manufacture, inspection, operability and fitness for service of the valves and operators supplied under this specification. Dimensions of all the valves shall confirm to the standard dimensions for such valves given in API Specification 6D (latest edition) for Pipeline Valves.

4.4 All ball valves shall be of fire safe design conforming to API 607 (latest edition).

4.5 All plug valves and check valves shall be of fire safe design conforming to API 6FA & API 6FD (latest edition).

4.6 Fire test certificates, Fire test Reports with drawing of the Valve under Fire Test and photographs of Fire test event requirement as specified in the standards, are required to be submitted with the bid. Fire Safe Certification shall include Fire Safe Tests on at least one valve of each model and shall be submitted with the bid documents. Valves qualified by fire safe tests shall be proven in the natural gas service for a period of at least three (03) years following the date of the test. All above documents must be signed and stamped by third party inspection firm/inspector who witness the fire safe test of valves as a proof of verification. Failure to provide above documents shall be liable for rejection of bid documents.

4.7 **API Certificate**

4.7.1 Bidders/Manufacturers are required to submit certified copy of valid API-6D accreditation certificates for the specific valve type with the bid with date of initial accreditation

4.7.2 Each valve which would be manufactured according to API Standard must have API monogram on valve body

4.8 **Original Technical Literature**

The Bidder shall submit with his bid, detailed printed technical literature (in original) giving a description of the valve design and mode of operation, the materials used for

each valve and each operator quoted to this specification. Bids not in conformity to this requirement are liable for rejection. Each valve and each operator shall be fit for all year service on site.

4.9 **Sales Track Records**

4.9.1 The Bidder shall submit the supporting documents of sales track record for the offered assorted valves, including copies of purchase order & satisfactory certificate of operations of five (5) different end users related to Oil & Gas Sector with similar requirement along with their email (email address of end user's company domain and not the commercial domain like Yahoo, Gmail, or Hotmail, etc.), fax, telephone, address and name of persons to contact to whom they have supplied the offered assorted valves within the last five (05) years and have been successfully installed and operated.

4.9.2 Simply submitting a list of customers to whom the manufacturer has been supplying the offered assorted valves will not meet the intent and purpose of this requirement. Failure to comply with this requirement may result in rejection of the bid.

4.10 The Bidder and the Supplier covered by this Specification shall provide the following particulars of the equipment quoted or ordered:

- Make, type or series
- Pressure class
- Nominal diameter, bore/port area
- Types of ends (flanged or welding or threaded)
- Full details of materials
- Type of coating (above ground service)
- Manufacturer's Mark

4.11 Before manufacturing any valve under this Specification, the Supplier shall supply to the Purchaser the drawings and a detailed description of the materials fabrication methods and testing procedures applicable to the valve to be manufactured.

4.12 The documents related to the fabrication of the valve shall be reviewed by the Purchaser. The said review however shall in no way relieve the Supplier from any responsibilities and liabilities in connection with the Goods ordered, their safe & reliable operation and the specified delivery date.

4.13 The manual operator wherever specified in this specification is an integral part of the valve and, as such, shall be installed and tested before delivery of the valve. Where no specific manufacturer or type is specified, the manufacturer shall select a suitable type.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

The manufacturer shall test all functions of the valve and the operating equipment.

4.14 Inspection and Testing shall be carried out by the manufacturer at the manufacturing plant. All valves shall be visually examined for conformity to Purchaser's specifications and tested under the applicable codes and standards to make sure they conform to their intended use.

4.15 The Purchaser shall have the right to witness or require 3rd party inspection service at any time during the fabrication, testing and shipment of valves supplied in accordance with these specifications and to verify compliance with the Terms and conditions of the contract and Terms of references (TOR) attached with the bid document.

4.16 The Supplier shall give due and proper notice of commencements of valve fabrication and test under these specifications to the Purchaser/Third party inspector appointed by SSGC.

4.17 The Purchaser reserves the right to increase, decrease and delete the quantity of all the items given herein the Schedule of Requirements.

5 MANDATORY REQUIREMENTS

5.1 Bids are invited directly from the manufacturer or their authorized local agents in Pakistan. Beside local agent, principle involvement would be acceptable as regional Sales Representative, if applicable. However, in any case, bids from stockiest and Brokers will be rejected.

5.2 The local agents/suppliers are required to submit valid authorization letter from the manufacturer failing which will make bid non-compliant.

5.3 The bidder shall provide a clear and concise, clause by clause, compliance or exception (with detail) commentary to these technical specifications duly signed and stamped on each page by Manufacturer which is mandatory for technical evaluation, failing to submit this document may be considered non responsive.

5.4 Each valve, manual operator and actuator shall comply with the requirement of this specification. Valve, manual operator and actuator which do not strictly comply with the requirements of this specification are liable for rejection. However, if there is any deviation with the specification for the offered item. The bidder may submit the deviation sheet covering details of respective clause and bidder's offer against the clause. Acceptance of such deviation does not guarantee of approval and this would depend on discretion of Purchaser.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

6 SPECIFICATIONS FOR VALVES

6.1 Valve Design

6.1.1 Each valve shall be supplied with beveled butt welding ends or flanged ends or threaded ends or socket weld ends or a combination thereof as specified in the description of valve under Schedule of Requirements. The chemical composition of the weld ends shall meet the following requirements:

Maximum Carbon contents	0.23%
Maximum Silicon contents	0.40%
Maximum Manganese contents	1.50%

Carbon equivalent 0.43% Max by ladle analysis.

6.1.2 The internal diameter shall not vary more than 1/16 inch between the valve and the line pipe. The welding ends shall be beveled at an angle of 30° + 5° - 0° from the perpendicular to the axis of the valve with a root face of 1/16 inch ± 1/32 inch.

6.1.3 Where flanged valves are specified, facing will be as specified in the description of valves under Schedule of Requirements.

6.1.4 If welding end of valves are specified, the welding ends shall have dimensions and strength properties equivalent to those of the line pipe in accordance with Figure I-4 or I-5 of ASME B 31.8, Appendix-I.

6.1.5 Welding ends shall be free from defects such as laminations which could impair the quality of the welds for a distance of not less than 1" from the bevel. Compliance with this provision shall be assured by appropriate tests.

6.1.6 Each valve shall be supplied with lubricant, fit for service on site. The lubricant shall resist dissolving, gumming or chemical change in service. Sealing shall be resistant to aromatic hydrocarbons.

6.1.7 Each valve shall be designed in such a way that any failure of the operator will not affect any other part of the valve and the malfunction of the operating equipment shall be limited to these parts and any such defective component may be replaced without removing the valve from service.

6.1.8 Each valve including manual operator shall be fit for upright and horizontal installation.

6.1.9 Lugs shall be welded to the body of each valve with a nominal diameter exceeding 10" for handling and lifting equipment, transportation and installation.

6.1.10 All valves shall have position indicators, indicating, open, partially open and closed positions.

6.1.11 Valves shall be fitted with manufacturer standard support ribs/legs, unless otherwise specified in the Schedule of Requirements.

6.1.12 The design of all valves shall ensure correct functioning and a tight shut off, even though the gas may contain dust, impurities, water or condensate. Valves shall be able to withstand a sporadic passage of water and/or Methanol (e.g. in the case of hydrostatic testing).

6.1.13 Valves shall be of the anti-static and anti-blow out stem type.

6.1.14 Valves shall not have bolted connections perpendicular to the centre line of the valve, i.e., such valves shall be fully welded. The final weld seam of fully welded valves shall be made in such a way that defects in the root are prevented.

6.2 **Specific Valve Design**

6.2.1 The following section gives valve design requirements specific to the valve type. Bidders/Manufacturers shall comply with these specific requirements.

6.2.1.1 **Plug Valves**

6.2.1.1.1 Plug valves under this specification shall be of lubricated type with venturi or regular pattern as indicated in the description of valve under Schedule of Requirements. The valve shall be filled with lubricant and complete with combination lubricator.

6.2.1.1.2 Plug valves under this specification shall have inverted taper plug with provision for adjustment of plug with respect to seat equalizer ring between plug and operating steam.

6.2.1.1.3 Plug valves shall have fire safe graphite stem packing and an arrangement for stem packing feed unit.

6.2.1.1.4 Plug valves shall have side feed seat sealant injection provision.

6.2.1.1.5 Plug valves under this specification shall be of pressure balance type.

6.2.1.1.6 The port area of regular plug valves shall be at least 60 percent and venturi pattern plug valve shall be at least 40 percent of the cross sectional area of the corresponding adjacent pipe internal diameter.

6.2.1.1.7 Plugs of all valves shall be case hardened and lapped with the valve body seat after ground finish. The plug surface shall be PTFE treated or ENP (Electro less nickel plated). ENP to be minimum of 35 microns.

6.2.1.1.8 All plug valves shall be provided with weather seals for both stem and cover to

prevent corrosion.

6.2.1.2 **Ball Valves**

6.2.1.2.1 Each ball valve shall be designed and constructed for pigging.

6.2.1.2.2 Each valve shall be of the double-block-and-bleed type with double piston effect or as specified in the SOR (Schedule of Requirement).

6.2.1.2.3 Each valve shall be designed and constructed so as to minimize the entrapment of fluid in the valve body. A bleed assembly for the removal of entrapped liquids shall be provided on each side of each valve.

6.2.1.2.4 Each ball valve shall be provided with secondary seals between the ball and the seats. Secondary sealing may for example be by lubrication (in which case re-lubrication shall be feasible) or by another sealing system. Seals shall be resistant to aromatic hydrocarbons, methanol, etc.

6.2.1.2.5 Ball valves seat arrangement should be Primary Metal Seat and Secondary Soft Seat (PMSS) preferably for sales gas services or as specified in the SOR. The bidder is required to provide details of seat arrangement. Seat material should be compatible with the composition of gas.

6.2.1.2.6 The seal between ball and seat ring shall have a secondary sealing system e.g. using a lubricant, with facilities for reinjection during operation. The lubricant shall not solidify, dissolve or undergo chemical change at operating temperatures from -10°C to +75°C.

6.2.1.2.7 Connections to valve bodies shall be welded. Seal welded or threaded connections shall not be used for connections to valve bodies. The pressure sensing lines connections shall be provided directly on the valve bodies. Pressure sensing lines shall have isolating valves installed. These isolating valves shall be welding end for the ends towards the valve body (if applicable).

6.2.1.2.8 Drain connections shall be installed at the lowest point of each valve; however, these shall be positioned such that access is not prevented when the valve is mounted on a foundation plate or support while installed horizontally.

6.2.1.2.9 Pressure relief connections shall be located in the upper quarter of each valve. The diameter (D) of pressure relief lines shall be ½" for less than 4" dia valves and at least 1" for 4" dia valves and above.

6.2.1.2.10 Ball shall be ENP (Electro less nickel plated) and shall be stress relieved ENP to be a minimum of 75 microns.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

6.2.1.2.11 An external pressure relief valve with an isolating valve may be installed to prevent cavity over-pressurization.

6.2.1.3 **Check Valves**

6.2.1.3.1 Check valves under this specification shall conform to API 6D (Latest Edition).

6.2.1.3.2 The valves shall have leakage free bolted cover (BC).

6.2.1.3.3 The check valve shall be of swing check type.

6.2.1.4 **Needle Valves**

6.2.1.4.1 The valve shall have its application in pressure gauge installation, bubble-tight shutoff of natural gas required.

6.2.1.4.2 The size shall be as per the Schedule of Requirements.

6.2.1.4.3 The pressure/temperature rating shall be as per the Schedule of Requirements.

6.2.1.4.4 Bonnet locking stainless steel pin to prevent accidental removal.

6.2.1.4.5 The valve shall be globe pattern in compact design with ends screwed female NPTF, wheel operated or "T" bar handle operated as specified in the Schedule of Requirements, and 3000 psig cold working pressure.

6.2.1.4.6 Precision-machined stem shall have roll-formed stem threads. The end of the stem shall be needle pointed. Below stem thread packing gland required.

6.2.1.4.7 Metal-to-Metal Seat. Hardened and ground self-centering, non-rotating tip.

6.2.1.5 **Gate Valves**

6.2.1.5.1 The required metal seated gate valves should be handwheel operated with rising stem ideal for general service on gas applications.

6.2.1.5.2 The size of the valve shall be as per Schedule of Requirements.

6.2.1.5.3 The gate type shall be Slab Gate.

6.2.1.5.4 The stem type shall be Rising Stem.

6.2.1.5.5 The operating temperature shall be -10°C to +75°C.

6.2.1.5.6 The end connection shall be Flanged RTJ, ASME B16.5 with class as per Schedule of Requirements.

6.2.1.5.7 The valve design & testing standard shall be API Spec. 6D (Latest Edition).

6.2.1.5.8 The sealing surfaces of the gate and seat are hardfaced for wear and corrosion resistance.

6.2.1.5.9 Screwed ends should be NPTF ASME B16.10.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

6.3 Valve Material

6.3.1 Where not explicitly specified, the valve material shall be as under:

6.3.1.1 The body of each valve shall be forged or cast from easily weldable low alloy killed carbon steel or as specified. The steel used for valves shall conform to the standards stated in API 6D or material standards equivalent to these.

6.3.1.2 Non-metallic parts and elements such as packing, seal, sealing, injectable material, sealants and lubricants as required and shall be suitable for the service intended for, and should conform to the requirements of API 6D.

6.3.2 **Plug Valves**

6.3.2.1 Plug material shall be low alloy cast steel material suitable for pressure vessel application, conforming to material standards stated in API 6D or materials equivalent to API 6D material standards.

6.3.3 **Check Valves**

6.3.3.1 The body material of check valves shall be in carbon steel (CS) conforming to ASTM A 216 WCB. The internal material is to be suitable for installation in off take horizontal lines in natural gas service.

6.3.3.2 The seat material in body and disc should be suitable for pressure and temperature class rating specified.

6.3.4 Needle Valves

6.3.4.1 The body material of needle valves shall be Forged Carbon Steel conforming to ASTM A105 Gr. II or Equivalent / ASTM A182F 316 Stainless Steel/ASTM A105 Forged Single Piece Steel Plated or Equivalent.

6.3.4.2 The bonnet material shall be ASTM A182F 316 Stainless Steel/ASTM A105 Forged Single Piece Steel Plated or Equivalent.

6.3.4.3 The stem material shall be 316 Stainless Steel.

6.3.5 **Gate Valves**

6.3.5.1 The handwheel material shall be Ductile Iron.

6.3.5.2 The body material shall be ASTM A216-WCB/A351-CF8/CF8M/CF3/CF3M/A105.

6.3.5.3 The bonnet shall be ASTM A216-WCB/A351-CF8/CF8M/CF3/CF3M/A105.

6.3.5.4 The bonnet gasket material shall be 304 Wound Grafoil.

6.3.5.5 The stem will be ASTM A182-F6a/A105+ENP/LF2+ENP/F304/F316/F304L/F316L.

6.3.5.6 The stem packing material shall be Braided Graphite or Die-formed Graphite Ring or

PTFE.

6.3.5.7 The yoke sleeve material shall be Ductile Ni-resist.

6.3.5.8 The grease nipple material shall be Stainless Steel.

6.3.5.9 The gland material shall be ASTM A 182 Gr, F6a.

6.3.5.10 The gate material shall be ASTM A105+ENP/LF2+ENP/F304/F316/F304L/F316L.

6.3.5.11 The stud/nuts' material shall be A194 2H+A193 B7/ A1938+B8/A193 8M+A193 B8M.

6.3.5.12 The seat material shall be Metal to Metal (STL/SS304/SS316/SS304L/SS316L).

7 MANUAL OPERATORS FOR THE VALVES

7.1 General

Where required manual gear operators shall be supplied for use with valves in natural gas transmission lines with respective design rating to ANSI and design temperature of -10°C and +75°C. No stem extension is required except where specified in the Schedule of Requirement.

7.2 Technical Requirement

The following listed requirements shall be fulfilled by the manufacturer/supplier of the manual operators:

7.2.1.1 Compatibility between Valve and Manual Operator

The valve manufacturer shall be responsible for the correct dimensioning/sizing of the operator (Gear) and compliance with the requirements of this specification.

7.2.1.2 Torque for Manual Operation

7.2.1.2.1 The torque required to open a valve at a pressure drop across the valve equal to 100% of the maximum pressure rating of ANSI Class 600 (or as per schedule of requirement) shall be reasonable. The maximum driving torque shall be 250 Nm (Newton Meter). Each manual operator shall be designed to withstand a torque of 600 Nm. The breakaway torque and any upset condition shall be taken care of to establish the design torque. Each manual operator shall be of the self-retaining type.

7.2.1.2.2 The force required at the lever/wrench or the hand wheel to operate the valve shall not exceed 250 N (Newton).

7.2.1.2.3 In the bid, the Bidder shall indicate the minimum time and the number of rotations of the hand wheel required to open or close the valve.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

7.2.1.2.4 The hand wheel shall be vertical and placed sidewise adjacent to the Valve.

7.2.1.2.5 The operator shall, after assembly be equipped with a position indicator and corresponding metallic plate bearing the inscription (in English) open/closed. Stops are to be provided at the fully opened and closed position.

7.2.1.2.6 Flange dimensions for operating equipment shall be in accordance with the hand wheel and suitable for later installation of pneumatic actuator where indicated.

7.2.1.3 **Lubrication and Materials**

The manual operator gearing and the bearings shall be lubricated with a suitable lubricant. Each gear box shall be so designed that no lubricant can escape even under inadequate storage conditions. Cast iron shall not be used for any component of any manual operator with the sole exception of gear boxes.

7.2.1.4 **Assembly of Valve and Manual Operator**

7.2.1.4.1 Each manually operated valve shall be assembled prior to shipment and shall be ready for installation upon delivery. Each valve shall be suitably protected from damage during transportation.

7.2.1.4.2 Each manually operated valve shall be shipped in the open position. Hand wheel shall be removed and packed separately placed in the valve crate or attached to the valve skid. Valves in size less than 4 inches shall be wrench operated except otherwise specified in the Schedule of Requirement.

7.2.1.5 **External Surface Treatment**

Valve gear shall be delivered from the factory sand blasted and coated or painted in accordance with the manufacturer's standard specifications.

7.2.1.6 **Instructions**

The Supplier shall provide the Purchaser with six copies of original installation and operating instructions manual (in the English language) for the operators upon delivery.

8 VALVES ACTUATORS

8.1 **General**

Where required Actuators shall be supplied pre-installed with valves for installation on main pipeline/valve assemblies, transporting high pressure natural gas. The Supplier shall be responsible for design, manufacture, inspection, operability and fitness for service of the actuators supplied under these specifications.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

8.2 **Technical Requirement**

8.2.1 The following listed requirements shall be fulfilled by the manufacturer/supplier of the valve actuators:

8.2.1.1 Actuators shall be suitable for Local Valve operation, pneudraulic i.e., gas over oil pressure.

8.2.1.2 Actuators shall be of a piston type utilizing gas supply for hydraulic operation (with automatic level equalizing of the gas/oil circulation system) converting pneumatic pressure into hydraulic pressure to operate the valves. Piston sleeves shall be designed for the full differential pressure to which they could be exposed. Provision for speed control shall be included.

8.2.1.3 Actuator where required shall be supplied as a single assembly with actuator and other accessories supplied pre-installed with the Valve.

8.2.1.4 Valve, actuators shall preferably be supplied from a same vendor/manufacturer; however If a valve is provided with an actuator from other source, but supplied as part of valve requisition, the responsibility of the overall valve assembly (valve complete with actuator and/or accessories) shall be with the Contractor.

8.2.1.5 The actuators shall be compatible to the valves and respective design rating to ANSI and temperature of -10°C to +75°C.

8.2.1.6 Actuators and all appurtenances shall be suitable for outdoor installation and ambient temperatures ranging from 5°C to 55°C and exposure to a hot, dry and dusty environment with occasional sand storms.

8.2.1.7 The Bidder shall select proper actuators for the valves and shall assume full responsibility for valve operation under various differential pressure conditions across the valve.

8.2.1.8 Pipeline natural gas shall be used for operation of the Actuators. Maximum and minimum operating pressures of the pipeline are 1300 psig and 150 psig respectively. Regulators, if required for a selected pressure conditions for operation of the actuators shall be included in the scope of supply.

8.2.1.9 Unless other stroking times are indicated in the Data Sheet (where applicable), Max. Opening Stroke Time of actuator shall be at least 30 Seconds and, Closing Stroke Time of actuator shall be 05 Seconds. However; Vendor/manufacturer may propose better stroking time as per their manufacturing standard.

8.2.1.10 The valve/actuator package shall be supplied complete in all respects, including limit

Reviewed By	Atique Ur Rehman AE (R&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

switches; solenoid valves, pilot valves, breathers, drains, explosion proof control cabinet, terminal boxes installed with terminal strips.

8.2.1.11 Limit switches, solenoid valves shall be pre-wired in terminal box for single point cable termination.

8.2.1.12 The control cabinet of the actuators shall be lockable and weather proof for all weather conditions. The limit switches and circuit blocks housings should be air tight and should not allow any moisture entrance.

8.2.1.13 All electrical equipment shall be certified for use in the intended area in accordance with the Applicable standards from one of the following bodies:

- IEC : International Electro-technical Commission
- ATEX : European Union Directive for Explosive Atmospheres
- UL/FM : Underwriters Laboratories / Factory Mutual

8.2.1.14 All electrical components of actuator/valve assembly shall be certified for use in Class-1, Div.-II, Group D or Zone-2 Gas Group II A.

8.2.1.15 All instrumentation/controls tubing shall be 316 stainless steel, and tubing fittings shall be 'Flareless Type' (i.e. Ferrule type).

8.2.1.16 Electronic component including Solenoid valves and switches shall be 24 Volt DC power supply operable or other voltage level as specified in the Data Sheet (where applicable).

8.2.1.17 IP (Ingress Protection) of Electric Enclosures, IP requirement of actuator's various Enclosures i.e. JBs, Control panel and etc. shall be mentioned (shall meet ingress protection (IP) IP65 to IEC 60529 or NEMA 4X to NEMA 250 or equivalent.).

8.2.1.18 Provision shall be considered for open and closed position displays in Purchaser's central control room.

8.2.1.19 Electric Power Source Requirement shall be mentioned either the said source shall be built-in (integral part of actuator) or external (purchaser in purchaser scope).

8.2.1.20 Considering the reliable and smooth operation of gas distribution/transmission system actuator mechanism shall preferably be SIL rated.

8.2.1.21 The valve actuator shall be designed so that the valve fails last position on loss of hydraulic/gas supply pressure, Control voltage deriving Solenoids, etc.

8.2.1.22 Bypass Operation Provision of Actuator shall be considered, Actuator shall be equipped with handwheel with interlocking mechanism for direct manual handling of valve.

Reviewed By	Atique Ur Rehman AE (R&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

8.2.1.23 Local Valve operation using hand pump shall be considered.

8.2.1.24 Where specified in the Data Sheet (where applicable), provision for Line Break Control System shall be considered to over-ride remote, local power operation, for installation on river crossing.

8.2.1.25 The Line Break Control System should operate with local sensing pressure as specified in the Data Sheet (where applicable) and sensitive to 7.5-10 psi per minute. Line Break Valve should be closed when a limit of rate of decrease of mainline pressure at the river crossing location reaches a minimum of 10 psi/minute or as specified in data sheet. Line break valve should be adjustable type with minimum range of 10 psi/min to 100 psi/min and vendor/bidder to specify its suitability. (Bidder shall clearly specify the suitability of the offered Line Break Control System for river crossing installation).

8.2.1.26 Pressure Controlled Emergency Shut-Down (ESD) control shall be considered at low gas pressure at the preset pressure range in case of line rupture. This ESD control feature will automatically activated in case of pressure drop during break or explosion of line and closes the valve.

8.2.1.27 Valve Local Position Indication Provision shall be considered, position box of actuator shall be equipped with local position indicator to observe the valve position locally either valve is open or close.

8.2.1.28 Tightness Tests of the completed actuator shall be made using air or inert gas at a test pressure of 1.1 times maximum allowable operating pressure. All joints in the piping should be soap tested at 50 and 100 psig.

8.2.1.29 All test functions of the complete valve including actuator shall be made at the manufacturer's premises and a test certificate submitted with the valves.

8.2.1.30 The valve/actuator unit shall have proper arrangements (i.e. Eye bolts for sling connection) to avoid any damage during installation/removal.

8.2.1.31 Actuator & accessories shall be fire resistant/fire proof and shall meet requirements of API 607. Certification shall be provided by the Vendor in this regard.

8.2.1.32 The actuator specified is in integral part of the package and, as such, shall be installed and tested before delivery of the valve. The supplier shall select an appropriate actuator for the required service.

8.2.1.33 The package shall be supplied completely assembled and factory tested at the specified set of conditions and shall be ready for installation.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

8.2.1.34 The Bidder shall submit together with his bid:

- a description of the design and mode of operation of actuators
- Electric wiring diagram of actuators
- P&ID diagram of the actuators
- GAD drawing with actuator assembled/mounted on the Valve

8.2.1.35 The bidder shall submit valid authorization certificate for use of U-Stamp for design and manufacture of the pressure containing cylinders and parts in accordance with pressure Vessel Code, ASME Section-VIII. The bidder shall confirm that hydraulic cylinders are ASME U Stamped.

8.2.1.36 Each actuator shall be fit for all year service on site.

9 INSPECTION AND TESTING REQUIREMENTS

9.1 General

9.1.1 The valves shall be inspected and tested for the following items as minimum requirement and in accordance with API 6D, API 598 and other applicable codes.

- Appearance Inspection (Workmanship)
- Visual Inspection
- Dimensional Inspection
- Welding and Non Destructive Testing
- Pressure Tests
- Functional / Operational Test with Operator installed
- Fugitive Emissions Test
- Antistatic Device Test
- Fire Safe Test Procedure and Criterion shall be in accordance with API 6FA, 6FD and 607 (whichever applicable)

9.1.2 The Purchaser's representative inspector shall have access to any part of the plant along with the area outside Manufacturer's plant which is responsible for fabrication of pressure containing parts of valves whenever work on the order is under way.

9.1.3 The valve manufacturer shall notify the Purchaser prior to the required valve testing and any specified supplementary inspections or examinations, addressing the notice as stated in the purchase order or as mutually agreed with the Purchaser.

9.1.4 The valve stem shall be blow out proof and shall be statically grounded to the body.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

9.2 **Appearance Inspection (Workmanship)**

9.2.1 Appearance Inspection shall be done on all accessible surfaces of the valves.

9.2.2 Both inside and outside surfaces of casting material shall be free from harmful blowholes, fins, seizures of sand scales, sand inclusions and cracks and shall be in accordance with MSS-SP-55.

9.2.3 Machined surfaces shall be free from injurious defects in use and rust and finished condition shall be as per acceptable standards.

9.3 **Visual Inspection**

At a minimum, visual inspection of all pressure-containing and pressure-controlling steel forgings shall conform to ASME BPVC Section VIII, Division 1, UF-45, and UF-46. Acceptance criteria shall be that no visible defects, including seams, laps, and folds, shall be accepted.

9.4 **Dimensional Inspection**

9.4.1 Dimensional Inspection shall be done by using appropriate measuring instruments.

9.4.2 Dimensional Inspection shall confirm the parallelness, rectangularity and face to face dimensions, bore diameter etc. All outline dimensions including actuators shall comply with the approved drawings.

9.5 **Welding and Non Destructive Testing**

9.5.1 Welding qualifications shall be as per ASME BPVC IX or ISO 15614.

9.5.2 All factory welds shall be made in accordance with the requirements of the American Welding Society and ASME Section VIII, Division 1.

9.5.3 Procedure tests covering strength, hardness and toughness shall be made to show the fitness of the welding procedure used for factory welds shall be made by welders qualified in the procedure used, who have passed an appropriate welder qualification test. All welding operations shall be supervised by a qualified welding supervisor.

9.5.4 All welds shall be inspected visually by the welding supervisor. Welds, welding ends and any repair welds shall be tested by appropriate non-destructive methods to demonstrate to the welding supervisor that all welds, welding ends and repair welds meet the requirements of these specifications.

9.5.5 Without limitation of the generality of the foregoing, all welds parallel to the longitudinal axis of the valves, and 10% of all circumferential welds shall be inspected by radiographic methods. Each welding end shall be tested by dye penetration methods and each repair weld shall be tested by radiographic or ultrasonic methods. The welding

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

ends of valves shall be solidly sound and shall not be cause of failure in radiographic examination of the joints with piping.

9.5.6 Defects shall be removed, cleaned and prepared for inspection by magnetic particle or dye penetrant method to verify complete removal of the defect. Weld repair methods shall be in accordance with the approved welding procedures. All weld repairs to pressure containing parts shall be heat treated.

9.5.7 No weld in the body of any valve shall contain any lack of fusion. If feasible, body welds shall consist of both, external and internal runs. Each weld shall be smooth and free from cracks. No weld shall contain any major inclusions. The height of the weld above the surface of the parent metal shall not exceed 1/8 inch. Undercuts shall not exceed 10% of the wall thickness or 3/64 inch, whichever is lower. Each welded joint shall be completely filled. No weld shall be thinner than the wall thickness of the parent metal.

9.5.8 Magnetic particle or dye penetrant techniques shall be employed to test:

- Pressure containing components smaller than 2 inch welded to other pressure components.
- Welds joining non pressure components such as lifting lugs to pressure components.
- Weld builds ups such as overlays.

9.5.9 Radiographic, ultrasonic or both techniques shall be used for full volume inspection of:

- Pressure containing fabrication welds for 2 inch or larger components.
- Weld repair to these components.
- Major weld repairs to pressure containing components.

9.5.10 Valve bodies of welded construction shall be annealed if they include wall thickness of 1.20 inches or higher. All cast valve bodies, irrespective of wall thickness, shall be annealed. The annealing process shall be carried out after all repair welds, if any, have been completed.

9.6 **Pressure Tests**

9.6.1 Pressure tests shall be performed by the valve manufacturer at the valve manufacturer's plant or at a facility mutually agreeable to both the Manufacturer and Purchaser.

9.6.2 The equipment used to perform the required pressure tests shall not apply external forces that affect seat or body seal leakage.

9.6.3 Required protective coatings, such as paint, which can mask surface defects, shall not

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

be applied to any surface before inspection or pressure testing.

9.6.4 The pressure tests shall be performed on each valve in accordance with written procedures and applicability as mentioned in API 6D or API 598.

9.6.5 **Hydrostatic Shell Test**

9.6.5.1 Hydrostatic shell test of all valves shall be performed in accordance with Section 10.3 of API 6D.

9.6.5.2 The Hydrostatic Shell Test (including drain, vent and bypass lines) shall be made at the test pressure given in API 6D.

9.6.5.3 For double block and bleed valve, additional testing shall be done as per Annex L.9 of API 6D.

9.6.5.4 The duration of test pressure shall be as per Table 9 of API 6D.

9.6.5.5 Test pressures and hold times shall be continuously recorded on a test chart. Recorded test certificate and charts shall be submitted to the Purchaser.

9.6.5.6 The hydrostatic test fluid shall be water and shall contain a corrosion inhibitor.

9.6.5.7 There shall be no visible leakage permitted during the hydrostatic shell test.

9.6.6 **Hydrostatic Seat Test**

9.6.6.1 Hydrostatic seat test of all valves shall be performed in accordance with Section 10.4 of API 6D

9.6.6.2 The Hydrostatic Seat Test shall be made at the test pressure given in API 6D.

9.6.6.3 For double block and bleed valve, additional testing shall be done as per Annex L.9 of API 6D.

9.6.6.4 The duration of test pressure shall be as per Table 10 of API 6D.

9.6.6.5 Test pressures and hold times shall be continuously recorded on a test chart. Recorded test certificate and charts shall be submitted to the Purchaser.

9.6.6.6 The hydrostatic test fluid shall be water and shall contain a corrosion inhibitor.

9.6.6.7 Seat leakage shall be monitored from the downstream side of the seat when under hydrostatic seat test.

9.6.6.8 Leakage criteria shall be as per Section 10.4.1 of API 6D.

9.6.6.9 For low pressure test, the testing medium shall be air or inert gas.

9.6.6.10 For ball valves, the low pressure seat test shall be conducted with the ball and seats dry and free of oil, grease or any lubricant.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

9.6.7 **Stem Backseat Test**

9.6.7.1 Testing of backseat shall be performed as per Section 10.2 of API 6D.

9.6.7.2 The Backseat Test shall be made at the test pressure given in API 6D

9.6.7.3 The duration of test pressure shall be as per Table 8 of API 6D.

9.6.7.4 Test pressures and hold times shall be continuously recorded on a test chart. Recorded test certificate and charts shall be submitted to the Purchaser.

9.6.7.5 There shall be no leakage permitted for stem backseat test.

9.6.8 **High-Pressure and Low-Pressure Closure Test:**

9.6.8.1 When closure testing valves, the valve manufacturer's test procedure shall ensure that excessive force is not used to close the valve. The applied force may be determined from the appropriate figures mentioned in MSS SP-91 (Guidelines for Manual Operation of Valves).

9.6.8.2 The high and low pressure closure test shall be as per requirement mentioned in Table 1 of API 598.

9.6.8.3 Valves for which high pressure closure test is optional as mentioned in Table 1 of API 598 are still required to be able to pass the tests. The results shall be supplied if required by the Purchaser.

9.6.8.4 For high-pressure closure tests, the test fluid shall be air or inert gas. Unless otherwise specified in the purchase order, the test fluid temperature shall be within the range 5°C (41°F) to 38°C (100°F). For low pressure closure test, test fluid shall be air or inert gas.

9.6.8.5 Water used can contain water-soluble oil and/or corrosion inhibitor. When specified by the Purchaser, a wetting agent shall be included in the water.

9.6.8.6 When air or gas is used for closure tests, the valve manufacturer shall be capable of demonstrating the adequacy of the method of leakage detection.

9.6.8.7 Closure test pressures shall be as per Table 3 of API 598.

9.6.8.8 For closure tests, the required test pressure shall be maintained for at least the minimum time specified in Table 4 of API 598.

9.6.8.9 For both the low-pressure closure test and the high-pressure closure test, visual evidence of leakage through the disc, behind the seat rings, or past the shaft seals is not permitted and structural damage is not permitted. The allowable rate for leakage of test fluid at the seat-sealing surface interface, for the duration of the tests shall

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

be as per Table 5 of API 598.

9.6.8.10 The allowable leakage rate for closure tests of valves with nonmetallic seat materials shall be equal to that specified in Table 5 of API 598 for a metal-seated valve of equivalent size and type.

9.6.8.11 Closure test procedure shall be as per Section 6.4 and 6.5 of API 598.

9.6.8.12 For double block and bleed valve, the high-pressure closure test procedure shall be as per Section 6.6 of API 598.

9.7 **Antistatic Device Test**

When specified in the purchase order, antistatic testing shall be performed. The electrical resistance shall be tested with a power source not exceeding 12 V to have continuity between the parts listed in Section 5.8 of API 6D when tested on a dry valve before pressure testing.

9.8 **Fugitive Emissions Test**

9.8.1 When specified in the purchase order, for natural gas transmission service, valves shall undergo fugitive emission qualification testing. This shall be performed in conformance to a national or international standard such as:

- API 624 for rising stem valves
- API 641 for quarter-turn valves
- ISO 15848-1 for Industrial valves

9.8.2 When specified in the purchase order, valves shall be fugitive emission production tested. The production fugitive emission testing of valves shall conform to ISO 15848-2.

10 EXTERNAL SURFACE TREATMENT

10.1 Valves shall be delivered, externally sandblasted and primed in accordance with the Manufacturer's standard painting specifications.

10.2 Manufacturer will submit the painting specification for Purchaser's approval.

11 MARKING

11.1 Each valve accepted shall be marked visibly and permanently in a suitable position. The marking shall include the following information:

- Project Mark
- Purchase Order/Contract Number
- Manufacturer's Mark

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

- Diameter
- Pressure Rating
- Inspector's Stamp
- Traceability number

11.2 Butt Welding (BW) ends shall be marked with material designation.

12 DOCUMENTS

12.1 Prior to starting manufacture, the Manufacturer shall submit the following documents and receive written acceptance from the Purchaser:

- Controlled Copy of Quality Control Manual
- Welding Procedures
- Pressure Test Procedures
- Non-Destructive Test Procedures
- Drawings
- Inspection Test Plan
- Material Test Certificates
- Boiler and Pressure Vessel Safety Registration Certificate

12.2 Quality Control Program

12.2.1 The manufacturer shall provide documentation with the bidding documents for the in house quality control program which is strictly adhered to for the production of all manufactured equipment. This program must adhere to an internationally accepted quality control standard such as ISO 9000 series and API Spec Q1.

12.2.2 Failure to provide certification of proof of compliance may result in rejection of the bid.

12.2.3 The Supplier shall submit six copies of Inspection and Material Test Certificates to the Purchaser prior to delivery or with delivery of material. The Purchaser has right to reject the consignment if bidder has failed to provide MTC.

12.3 Six copies of the following documents shall be submitted four weeks before the delivery of the valves:

- Scale drawings with part's lists and material data
- Installation, operation and maintenance instructions for the complete valve
- Inspection test and material certificates
- Data sheets and diagrams showing adjustments and closing times.

Reviewed By	Atique Ur Rahman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

- Calculation sheets
- Description of manufacturing and test procedures

12.4 All documents must be reproducible and suitable for microfilming. Any deviations from the approved specifications must be approved by the Purchaser. The Supplier must submit a detailed test program of the tests to be carried out on the valves which must be subject to review of the Purchaser.

12.5 Six copies of the test documents of each valve in accordance with the requirements of API 6D shall be supplied to the Purchaser. Each such document shall clearly identify the valve to which the document relates.

12.6 Bidders shall include in their bids spare parts recommended for two years operation separately. However, the spare parts for commissioning purpose should be included with valve quotation (if required).

12.7 **Final Documentation**

12.7.1 A dossier shall be compiled concurrently with full record of the fabrication, materials, inspection and testing.

12.7.2 All items in the dossier shall be numbered and bound in an A4 four post binder; contents shall include but not be limited to the following (as applicable):

- Front cover sheet detailing:
  - P.O. No.
  - Project Title
  - Equipment Title
  - Equipment Item No.
- Index
- Purchaser Release Note
- Purchase Order
- A list of all applicable codes, standards and specifications
- All drawings "As-built" - wherever legibility can be preserved, reduced to A3 and folded, where legibility cannot be preserved, drawings to be folded to A4 size and inserted into pre-punched plastic wallets.
- NDT procedures
- All NDT / PWHT / Hydrostatic / Performance test reports
- Photocopy of Nameplate
- Material chemical analysis and mechanical test certification

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

- Final signed quality plan
- Material test certificates
- Mechanical design calculations
- Procedure Qualification Records
- Welding qualification Tests
- Painting inspection certificates
- Manufacturing Data Records (MDR)
- Installation Drawings and Procedures
- Operation and Maintenance Manual
- Schedules of commissioning spare parts

12.7.3 For all above documents, six (06) sets shall be submitted in clearly labeled 4 ring white hard cover binders. All documents smaller and larger than A4 shall be inserted into A4 pre-punched, top-opening plastic wallets with the project document number/title block clearly visible to the front.

13 LUBRICANT

Type of lubricant/sealant recommended and lubricant/sealant injection hand guns should be specified and prices quoted. The manufacturers shall have in-house know-how and manufacturing facilities of lubricant/sealant used in the offered valves.

14 INSPECTION CERTIFICATES

14.1 The Supplier shall cause inspection certificates to be issued and certified by an inspector of his own quality assurance department appointed for this purpose.

14.2 Each such certificate shall show the results of tests made under these specifications such as tests of the functions of the valves to be supplied and correct dimensions and shall show the Purchaser's Contract Number.

15 PACKING

15.1 All valves shall be assembled prior to shipment and shall be ready for installation upon delivery. The valve shall be so packed, transported and stored as to prevent damage prior to delivery. The Supplier shall warrant that the valves will remain clean and dry during transportation and storage until installation.

Reviewed By	Atique Ur Rehman AE (P&D Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)

15.2 All handling, loading and unloading shall be done in such a manner as to minimize mechanical damage.

15.3 Packing shall be sufficiently robust to withstand rough handling during ocean shipment and up-country journey. All items shall have their respective identification letters or numbers painted on body and these shall be suitably packed to provide case of handling and storage and maximum protection during transport and storage periods. Crates or boxes shall have a list of items contained therein secured to the exterior by means of an enveloping piece of tin sheet nailed to the wood. A duplicate list shall also be included inside with the contents.

15.4 Protection against corrosion/deterioration shall be given special attention. Machined steel and iron parts shall be heavily greased/varnished as a preventive measure against rust and where grease is used it shall be such that it retains its consistency, and does not melt at tropical temperatures and is acid free.

15.5 Valves shall be shipped with the faces of the flanges or the welding ends protected over the entire contact surfaces with suitable protectors securely attached to the valves. Hand wheels/wrenches shall be packed separately.

Reviewed By	Atique Ur Rehman AE (P&C Transmission)	Mehboob Ali Manager (Transmission)
Approved By	A/SGM (TS)	A/SGM (Transmission)