



Offshore Design Section  
Engineering Services  
ISO – 9001:2000

**Functional Specifications**  
**CONTROL VALVE**

**Spec. No.** 3700

**Rev. No.** 4



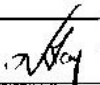
**Discipline** Instt

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# FUNCTIONAL SPECIFICATION

## FOR

## CONTROL VALVE

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## 1.0 SCOPE OF THIS DOCUMENT:

- 1.1 This functional specification describes the essential design considerations for the selection of Control Valve for the intended service.

## 2.0 Reference Documents and Specifications:

- a) Instrumentation Design Criteria
- b) Basic Bid Work
- c) Project P & IDs
- d) Process Design Criteria / Instrument Process Data Sheets

## 3.0 SCOPE OF SUPPLY:

- 3.1 The quantity to be supplied and installed shall be as per the requirements indicated in the Basic Bid Work, Design Criteria and the P & IDs.
- 3.2 The vendor shall be responsible for the selection of the Control Valve suitable for its intended application, its procurement, tagging, packing, stroke testing & calibration, preparation for shipment, along with accessories, spares, and assistance where required for its installation & commissioning at site.

## 4.0 CONTROL VALVE:

### 4.1 Valve Selection & Construction:

- 4.1.1 The Contractor shall select control valve based upon process flow capacity. The Contractor shall select reduced trim as required to satisfy the expected range of flow rate.
- 4.1.2 Valve selection shall consider all possible effect of erosion, cavitations and noise.
- 4.1.3 Maximum permissible noise level shall be 85 dBA at 1 m from valve in all direction. Noise mitigation by external noise reduction attachments shall be considered where noise levels increase beyond the limits.
- 4.1.4 Equal percentage and linear trim characteristic shall be used as applicable to process requirement. Quick opening type valve may be used for ON/OFF service only.
- 4.1.5 Globe valves are preferred for general service and shall be cage guided for low db application. In dirty or abrasive services (Produced liquids) post guiding is preferred. Pressure balanced plug type valve shall be used wherever diff. pressure across valve is high.
- 4.1.6 Butterfly control valves shall be used for water services, low differential pressure high flow and non-critical applications only.
- 4.1.7 In general, except flare gas service, process fluid entry to Cage type single seated globe valves shall be such as tending to open the valve (flow to open).
- 4.1.8 Shut-off leakage of valves shall be in accordance with ANSI B16.104. Tight shut-off (TSO) valves shall be class VI or better with soft seating (reinforced PTFE or similar).



- 4.1.9 Body rating, flange rating & facing and material of construction shall be in accordance with PMS / FS 401 the piping class specification for the associated piping.
- 4.1.10 Valve Packing boxes shall be flange bolted to the bonnet. Valve packing shall be spring loaded and adjustable. Teflon V rings shall be used up to 212<sup>0</sup>C. Above this temperature graphite shall be used with an external lubricator and isolation valve.
- 4.1.11 Valve bonnets shall be flange bolted to the body. Screwed bonnets shall not be provided. For operating temperature of 200<sup>0</sup>C or greater, a radiating finned bonnet may be required. For temperature below 0<sup>0</sup>C an extension bonnet is required. If bellows seals are required they shall be constructed from 316SS.
- 4.1.12 Minimum body size shall be DN25.
- 4.1.13 Where a valve is for flare gas service, TSO valve with soft seats are required. For high-pressure drop application in gas service, multiple orifice trim design shall be used. Labyrinth design shall not be used.
- 4.1.14 Pneumatic connections shall be 1/4" NPTF as minimum. Larger Port sizes shall be used wherever required for larger sizes of actuators.
- 4.1.15 Flow direction shall be stamped or cast on the body of all valves.
- 4.1.16 The Contractor shall provide detailed pressure temperature envelope curves for each combination of valve body, trim and elastomer material.

#### 4.2 Control Valve Sizing:

- 4.2.1 The Control valve shall be selected to pass high extreme of flow at 80% maximum opening of the valve travel and low extreme of flow at 20% minimum opening of the valve travel. The control valve shall be sized for required maximum diff. pressure and shut-off pressure. Butterfly valves shall be sized to pass high extreme of flow at 60% maximum opening of the valve travel.
- 4.2.2 The Contractor shall submit Control Valve sizing calculation performed in accordance with ISA S 75.01 and based on approved Process data, Process flow diagram and material balance.

#### 4.3 Actuator:

- 4.3.1 Control valve actuators shall be pneumatic, spring return type, diaphragm or piston type. Spring shall be corrosion resistant, cadmium plated or equal. Piston type actuator shall be used where diaphragm actuator cannot be used due to capacity limitation. Electric actuator shall be used wherever specified.
- 4.3.2 Actuators shall be sized for operation under maximum shutoff pressure drop across the valve minimum instrument air pressure or voltage to the actuator as specified in this specification.
- 4.3.3 Actuators shall be selected to achieve specified valve failure positions. All accessories, including pilot valves, relays, volume bottles etc. for double



acting actuator or air block relays for fail in position valves, shall be supplied with the valve.

4.3.4 A valve stem position indicator shall be provided. All control valve scales shall be calibrated from 0-100 % of valve travel. Smart positioner transmitters shall be considered for valve status indications in Process control room.

4.3.5 Side mounted heavy-duty hand wheels shall be provided for control valves wherever specified. Hand wheels material shall be corrosion resistant and with C-allowances over and above the thickness required as per design requirements. Hand wheels shall be normally in disengaged position and locked during normal Platform operation. These are to be used only during maintenance / manual operation.

4.3.6 Actuator action shall be designed and sized for Failure position indicated.

4.3.7 Diaphragm actuators shall be multiple bolted, pressed steel with Nylon reinforced Neoprene or Buna N Rubber Diaphragm and shall be corrosion resistant / with sufficient corrosion allowances to last the life of the platform.

#### 4.4 Positioner : (Unless otherwise specified it shall be SMART Positioner)

4.4.1 Control valve shall be supplied fitted with positioner for all services except on/off control.

4.4.2 Wherever specified for non-smart positioner the control valve shall be provided with integral positioner with intrinsically safe “smart” type integral i/p converter, and shall be direct acting, with field reversible provision.

4.4.3 Gauges shall be fitted to indicate pressure of the pneumatic supply, signal and output to the actuator.

#### 4.5 Material:

4.5.1 The material requirements for Control Valves shall in general be according to the Material Selection Chart provided in Annexure – I of Pressure Control Valve.

4.5.2 Control valve bodies shall generally be cast or forged carbon steel to ASTM A216 Gr WCB/WCC or A105 respectively with 316 SS trim as a minimum. However, more demanding services may require other materials as specified in the applicable valve specification/Material selection chart. Consideration shall be given in selection of all other valve part materials for erosion/corrosion due to process fluid and ambient conditions and valve trim/plug shall be stellited.

4.5.3 For painting, in general, Manufacturer standard procedures shall be followed. However, specification enclosed in the bid shall govern and shall form the minimum requirements.

4.5.4 All mounting accessories such as mounting bolts shall be of SS 316.

4.5.5 Tubing shall be seamless 316 SS tube 3/8” OD minimum with 316 SS double ferrule compression fittings.



#### 4.6 MISCELLANEOUS REQUIREMENT:

- 4.6.1 Control valves shall be installed in horizontal lines with Actuator vertically above the valve.
- 4.6.2 Clearance shall be provided to allow in- line maintenance of valves. Adequate clearance shall be provided above and below the valve to allow removal of the valve actuator and internal cage (trim) and valve bottom plate as applicable while not impeding access ways.
- 4.6.3 Control valve assembly shall be installed with two line isolation valves. One shall be provided at the upstream side of the control valve and the other at the downstream side. A bypass line shall be provided across the control valve with a line isolation (bypass) valve (globe type). Capacity of the bypass valve shall be in line with the control valve.
- 4.6.4 Control valves shall be installed in the direction recommended by the manufacturer and the valve shall not be subjected to stress due to pipeline movement or misalignment.
- 4.6.5 All valves shall be tested in accordance with API 598, hydro-tested to ASME B 16.34 clause 7.1, leak tested to ASME / FCI 70.
- 4.6.6 **Testing and Calibration :**  
In accordance with nameplate data and instrument specification following Testing and Calibration shall be carried out:
- All diaphragm and piston operated control valve shall be stroke tested pneumatically using a pressure regulator and pressure gauge against spring range.
  - Mechanical sealing and travel shall be checked.
  - Valve position shall be calibrated on control valve.
  - Split range or reverse acting positioner shall not have bypass and shall be checked carefully.
  - Zero position shall be live zero (just off the seat at minimum setting with air).
  - Signal line shall be bled to zero and failure action shall be confirmed.
  - Control valve accessories such as hand wheel, booster, relay, Volume bottle etc. shall be checked operationally. Declutchable hand wheel shall be operable both with and without air signal to diaphragm.
  - Check shall be made in shop prior to installation.
  - Butterfly valves shall be checked carefully to see that vane moves freely into upstream and downstream piping. Proper vane movement to stroke shall be confirmed when specified.



4.6.7 Each Control valve shall have a 316 SS Name plate attached firmly to the body furnishing the following information:

- Tag Number
- Body and Port size
- Stem Travel
- Action on air failure
- Spring Range
- Air supply Pressure
- Manufacturer Model Number for valve body, actuator and positioner.
- P.O. Number
- Serial Number
- Leakage Class
- Body rating and material grade
- Signal range
- Trim Characteristics
- Body Test Pressure
- Bench set Pressure



ANNEXURE – I

Material Selection Chart for Control Valves

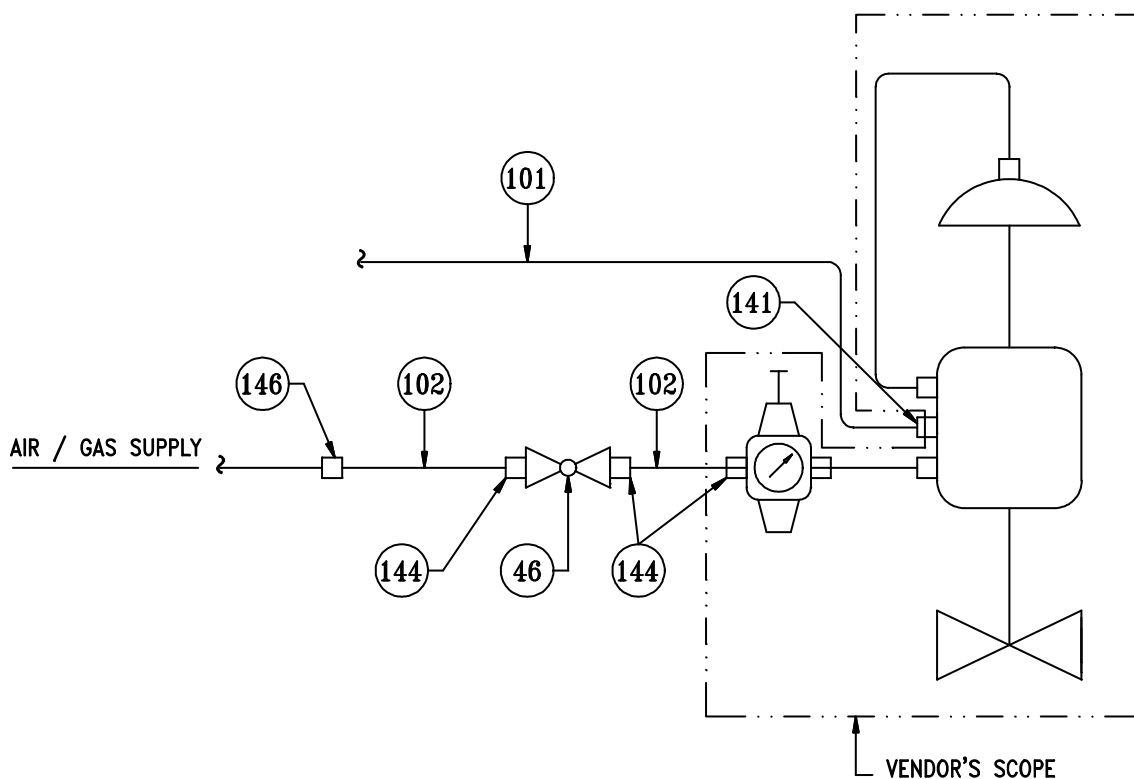
S. No.	Piping Class	Control Valves	
		Body	Trim
1	A1, B1, D1, E1, F1, XF1, F1, PA1, PB1, PD1, PE1, PXF1, PF1, A2, B2, D2, E2, XG1, A1H, A3, B3, A8 (EXCEPT WAT. INJ. SERVICE)	CS	SS 316
2	INJECTION WATER SERVICE	CS	SS 316
3	A4, A6, A9, B9, D9, E9	SS 316	SS 316
4	A5	ALUMINIUM BRONZE	MONEL
5	A7	HASTALLOY C.	HASTALLOY C.
6	A1N, B1N, D1N, E1N, F1N, XF1N, PA1N, PB1N, PD1N, PF1N, XG1N	CS NACE	SS 316 confirming to NACE
		PACKING - GRAPHOIL	
7	A10, B10, D10, E10, F10	SS 316	SS 316
		PACKING - GRAPHOIL	
8	A11, B11, D11, E11, F11, PA11, PB11, PD11, PE11, PF11	DUPLEX SS	SOLID ALLOY
		PACKING – GRAPHOIL/Teflon	





**ANNEXURE – II**

*(Hook Up Drawing)*



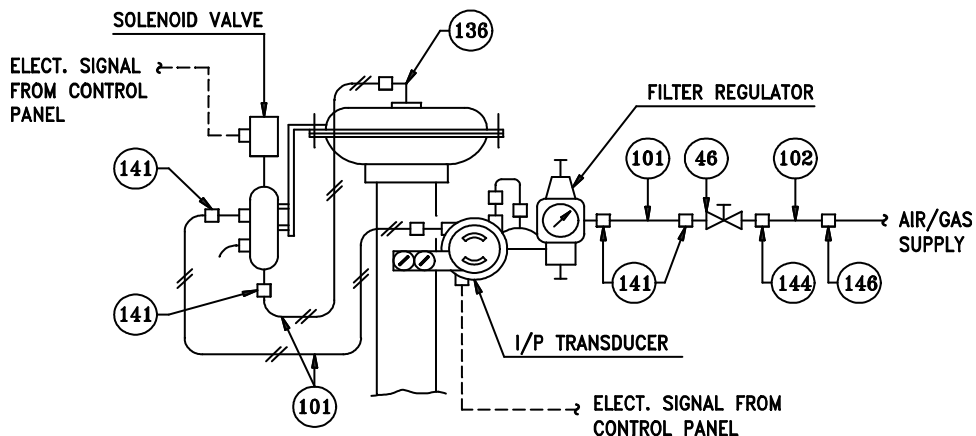
**CONTROL VALVE**

**BILL OF MATERIAL**

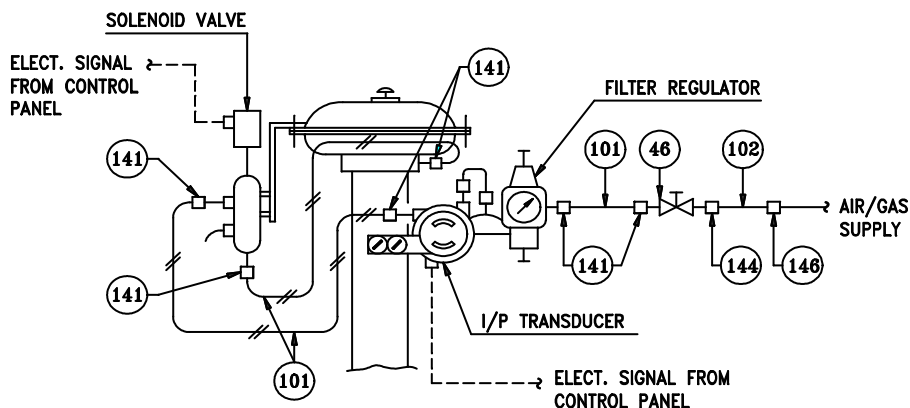
ITEM	QTY.	SIZE	DESCRIPTION	MATERIAL
46	1	1/4"	BALL VALVE,SCRWD,NPTF	
101	A/R	1/4"ODx0.035THK.	TUBING	
102	A/R	3/8"ODx0.035THK.	TUBING	
141	1	1/4"THx1/4"OD	MALE TUBING CONNECTOR,NPTM	
144	3	1/4"THx3/8"OD	MALE TUBING CONNECTOR,NPTM	
146	1	1/2"THx3/8"OD	MALE TUBING CONNECTOR,NPTM	



**ANNEXURE II (Contd.)**



**AIR FAIL TO OPEN CONTROL VALVE WITH I/P AND POSITIONER**



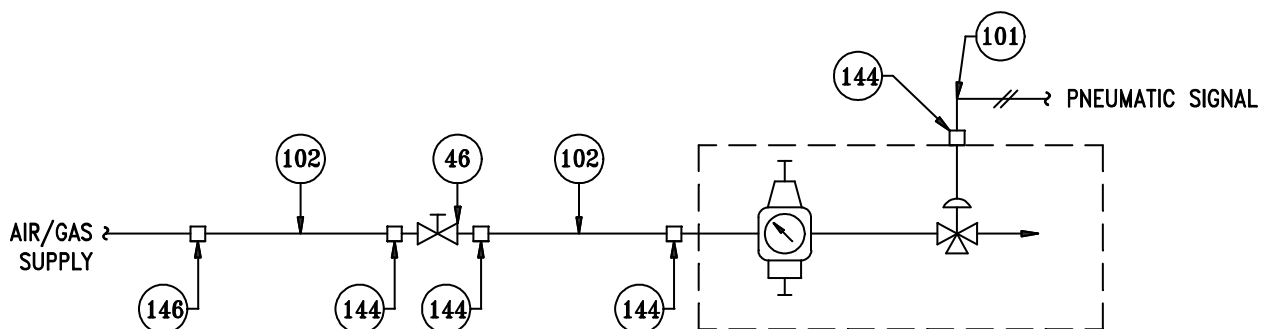
**AIR FAIL TO CLOSE CONTROL VALVE WITH I/P AND POSITIONER**

NOTE:- TRANSDUCER, AIR SET AND SOLENOID VALVE MAY BE INSTALLED AND CONNECTED TO VALVE TOPWORKS BY MANUFACTURER.

BILL OF MATERIAL					
ITEM	QTY.FOR		SIZE	DESCRIPTION	MATERIAL
	DET.1	DET.2			
46	1	1	1/4"	BALL VALVE SCRD NPTF	SS 316
101	A/R	A/R	1/4"OD.x0.035"THK.	TUBING	SS 316
102	A/R	A/R	3/8"OD.x0.035"THK.	TUBING	SS 316
136	1	—	1/4"THKx1/4"OD	MALE ELBOW TUBING CONNECTOR, NPTM	SS 316
141	7	8	1/4"THKx1/4"OD	MALE TUBING CONNECTOR, NPTM	SS 316
144	1	1	1/4"THKx3/8"OD	MALE TUBING CONNECTOR, NPTM	SS 316
146	1	1	1/2"THKx3/8"OD	MALE TUBING CONNECTOR, NPTM	SS 316



**ANNEXURE II (Contd.)**



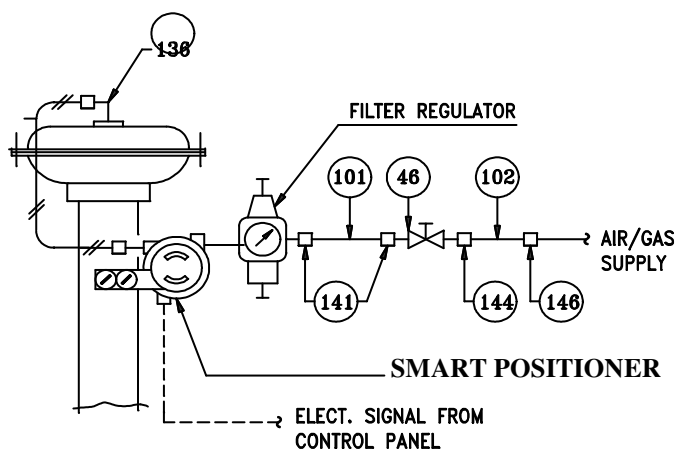
**CONTROL VALVE WITH PILOT VALVE**

**BILL OF MATERIAL**

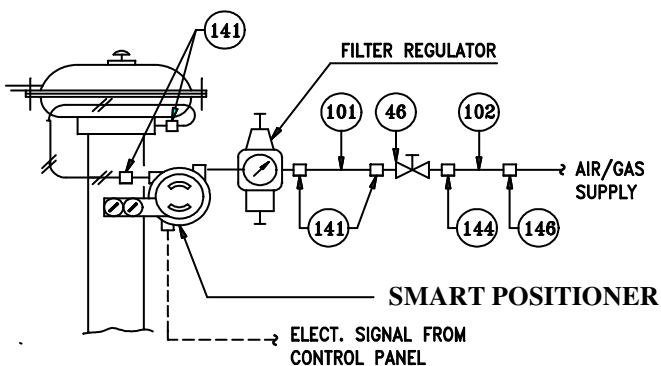
ITEM	QTY.	SIZE	DESCRIPTION	MATERIAL
46	3	1/4"	BALL VALVE SCRD NPTF	SS 316
101	A/R	1/4"OD.x0.035"THK.	TUBING	SS 316
102	A/R	3/8"OD.x0.035"THK.	TUBING	SS 316
136	3	1/4"THKx1/4"OD	MALE ELBOW TUBING CONNECTOR, NPTM	SS 316
139	3	1/4"THKx3/8"OD	MALE ELBOW TUBING CONNECTOR, NPTM	SS 316
141	6	1/4"THKx1/4"OD	MALE TUBING CONNECTOR, NPTM	SS 316
144	12	1/4"THKx3/8"OD	MALE TUBING CONNECTOR, NPTM	SS 316
146	3	1/2"THKx3/8"OD	MALE TUBING CONNECTOR, NPTM	SS 316



**ANNEXURE II (Contd.)**



**AIR FAIL TO OPEN CONTROL VALVE WITH SMART POSITIONER**



**AIR FAIL TO CLOSE CONTROL VALVE WITH SMART POSITIONER**

NOTE:– TRANSDUCER, AIR SET AND SOLENOID VALVE MAY BE INSTALLED  
AND CONNECTED TO VALVE TOPWORKS BY MANUFACTURER.

**BILL OF MATERIAL**

ITEM	QTY.FOR		SIZE	DESCRIPTION	MATERIAL
	DET.1	DET.2			
46	1	1	1/4"	BALL VALVE SCRD NPTF	SS 316
101	A/R	A/R	1/4"OD.x0.035"THK.	TUBING	SS 316
102	A/R	A/R	3/8"OD.x0.035"THK.	TUBING	SS 316
136	1	—	1/4"THKx1/4"OD	MALE ELBOW TUBING CONNECTOR, NPTM	SS 316
141	7	8	1/4"THKx1/4"OD	MALE TUBING CONNECTOR, NPTM	SS 316
144	1	1	1/4"THKx3/8"OD	MALE TUBING CONNECTOR, NPTM	SS 316
146	1	1	1/2"THKx3/8"OD	MALE TUBING CONNECTOR, NPTM	SS 316



**ANNEXURE – III: - TYPICAL DATA SHEET FOR CONTROL VALVE**

UNITS: Flow → Liquid : M <sup>3</sup> /Hr, Gas : SM <sup>3</sup> /Hr or Kg/Hr, Steam : Kg/Hr, Pressure : Kg/Cm <sup>2</sup> G, Temp: °C Level / Length : MM				
General	1.	Tag No.		
	2.	Inlet No.		
	3.	Outlet No.		
	4.	Service		
	5.	Line Size	Schedule	
	6.	Inlet Line I.D.	Outlet Line I.D	
Body	7.	Type of Body		
	8.	Body Size	Part Size	
	9.	Guiding	No. of Parts	
	10.	End Conn. Type. Size & Rating		
	11.	Facing & Finish		
	12.	Body Material		
	13.	Bonnet Type		
	14.	Packing Material		
	15.	Lubricator	Isolation . Valve	
	16.	Trim Form		
	17.	Trim / Plug (Stellite Mat.) /Disc/Ball & Seat Mat.		
	18.	Other Wetted Parts		
	19.	Soft Seating	Material	
	20.	ANSI Leakage Class		
Actuator	21.	Type		
	22.	Close At	Open At	
	23.	Failure Position		
	24.	Hand wheel & Location		
Positioner	25.	Air Supply Pressure		
	26.	Input	Output	
	27.	Bypass	Gauges	
Options	28.	Solenoid Valve		
	29.	I/P Converter		
	30.	Filter with Gauge		
	31.	Limit Switch		
	32.	Smart Positioner		
	33.			
Service Conditions	34.	Fluid	State	
	35.	Flow Liquid- Min	Normal	Max
	36.	Flow Vapour- Min	Normal	Max
	37.	Flow Water Min	Normal	Max
	38.	Inlet Pr. – Nor	Min.	
	39.	Process Flow Rate Min	Normal	Max
	40.	Pressure Shut Off		
	41.	Temp. Oper.	Max	
	42.	Oper. S. G.	Mol. Wt.	
	43.	Cp/Cv	Compress Factor	
	44.	Flash %	Visc. mPass (Oper)	
	45.	Deg. Of Superheat		
	46.	Vapour Pr.	Critical Pr.	
	Valve Data	47.	Cv Min.	Cv. Max.
48.		Cv. Nor.	Selected Cv	
49.		Predicted Sound Level dBA		
50.		Inlet Velocity m/s		
Model Nos.	51.	Valve	Actuator	
	52.	Positioner	Solenoid Valve	
	53.	IBR Certification		
NOTE :-				
VENDOR SEAL AND SIGNATURE				