



PROJECT No. E1150
ENGINEERING, PROCUREMENT & CONSTRUCTION FOR
1.0 MMBD SUSTAIN PHASE 1 – SURFACE FACILITIES PROJECT



SPECIFICATION FOR ACTUATED ON-OFF VALVES

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217601C-000-JSS-1543-0001

PROJECT No. E1150

**ENGINEERING PROCUREMENT & CONSTRUCTION FOR
1.0 MMBD SUSTAIN PHASE 1 SURFACE FACILITIES PROJECT**

Contract No. 4700022962

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SPECIFICATION FOR ACTUATED ON-OFF VALVES

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Rev. No.	Date Revised	Section Revised	Revision Description
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B2	19/09/2024	As Marked	Re-Issued for Approval
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HOLD LIST

HOLD	Section	Description



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1. INTRODUCTION

1.1 PROJECT OBJECTIVE

The objective is to deliver the incremental surface FACILITIES for “UPPER ZAKUM 1.0 MMBD Phase 1 PROJECT” required to sustain production through year-end 2029.

The SCOPE OF WORK shall include surface facilities adequate to meet production and injection forecast up to year-end 2029.

- Implementation of the system designed with additional capacity to sustain production beyond year-end 2029.
- Provision for Phase-2 and future facilities in terms of tie-ins and space reservation.

1.2 PROJECT SCOPE

SOW includes Engineering, Procurement, Fabrication, Testing, Transportation, Construction, Pre-Commissioning, Commissioning, Ready for Start-up, Assistance for Start-up, and completion of Performance Tests Works for the below mentioned Work Packages.

- WP A1 – Al Ghallan Island (Central Island or CI)
 - WP A1.1 – Water Injection Plant
 - WP A1.2 – Produced Water Treatment and Disposal
 - WP A1.3 – Pre-Assembled Well Manifold (PAM) and Local Equipment Room (LER)
 - WP A1.4 - Integration of UZ Power System with Onshore Grid Power “Project Lightning”
- WP A2 – Umm Al Anbar Island (West Island or WI)
 - WP A2.1 – Oil Production Enhancement
- WP A3 – Assefiya Island (South Island or SI)
 - WP A3.1 – De-Bottlenecking of Existing PWT Plant
- WP A4 – Ettouk Island (North Island or NI)
 - WP A4.1 – Produced Water Treatment and Disposal
 - WP A 4.2 – De-Bottlenecking of Existing PWT Plant
- WP A5 –Helipad on Al Ghallan Island, Assefiya Island, Ettouk Island & Umm Al Anbar Island
 - WP A5.1 – Helipad (Construction & Demolition) on AGI, ETI & Upgrade of Existing Helipad on ASI,
 - WP A5.2 -HEMS (Construction) on AGI, ETI & UAI.

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2. PURPOSE OF THE DOCUMENT

This document is aimed to describe Specification for Actuated On-off Valves on the Artificial Islands in Upper Zakum for the “1.0 MMBD Sustain Phase-1-Surface Facilities Project”.

This Project is an extension of the UZ750 Project. Existing philosophy shall be followed. Any deviation shall be highlighted clearly for COMPANY review.

3. ABBREVIATIONS & DEFINITIONS

3.1 ABBREVIATIONS

Acronym / Reference	Description
ADNOC	ABU DHABI NATIONAL OIL COMPANY
ADNOC OFFSHORE	Abu Dhabi COMPANY for Offshore Petroleum Operations (COMPANY)
AGI	Al Ghallan Island
AMS	Asset Management System
API	American Petroleum Institute
ASI	Assefiya Island
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
ATEX	Explosive Atmospheres – European Union Directive 94/9/EC.
BASEEFA	British Approval Service for Electrical Equipment in Flammable Atmospheres
BDV	Blowdown Valve



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BPCS	Basic Process Control System
BS	British Standard
Cv	(Control Valve) Flow Coefficient
CENELEC	European Committee for Electro-Technical Standardization
COC	Certificate of Conformity
CSA	Canadian Standards Association
dBA	Sound Pressure Level in Decibels (A-weighted)
DB&B (DBB)	Double Block and Bleed
DC	Direct Current
DIN	Deutsches Institut für Normung
EBD	Emergency Blow Down
ECAS	Emirates Conformity Assessment System
EDPV	Emergency Depressurization Valve
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
EN	Européisme Norme (European Standard)
EPA	Environmental Protection Agency
EPC	Engineering, Procurement and Construction
E/P	Electric to Pneumatic (Positioner)
ESD	Emergency Shutdown
ESDV	Emergency Shutdown Valve
ETI	Ettouk Island
FAT	Factory Acceptance Test
FC	Fail Close
FE	Fugitive Emission
FESA	Fire & Explosion Safety Assessment
FF	Foundation Fieldbus



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FISCO	Fieldbus Intrinsically Safe Concept
FM	Factory Mutual
FMR	Field Manual Reset
FO	Fail Open
GRP	Glass Reinforced Plastic
H ₂ S	Hydrogen Sulphide
HART	Highway Addressable Remote Transducer
HEMS	Helicopter Emergency Medical Services
HSE	Health, Safety and Environment
IEC	International Electro-technical Commission
IP	Ingress Protection
IS	Intrinsic Safety
ISA	International Society of Automation
ISO	International Organization for Standardization
LER	Local Equipment Room
MAC	Main Automation Contractor
MAST	Maximum Allowable Stem Torque
MAWP	Maximum Allowable Working Pressure
MMBD	Million Barrels per Day
N ₂	Nitrogen
NACE	National Association of Corrosion Engineers
NDT	Non-Destructive Testing
NEMA	National Electrical Manufacturers Association
NPT	National (American) Standard Pipe Taper (Thread)
NPT	National (American) Standard Pipe Taper (Thread)
OEM	Original Equipment Manufacturer
P&ID	Piping and Instrumentation Diagram



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PAM	Pre-Assembled Module
PFD	Probability of Failure on Demand
PMS	Piping Material Specification
PST	Partial Stroke Test
PSV	Pressure Safety Valve
PWT	Produced Water Treatment
QA/QC	Quality Assurance/ Quality Control
QAR	Quality Assessment Report
RFI	Radio Frequency Interference
RP	Recommended Practice
RTJ	Ring Type Joint
SDV	Shutdown Valve
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SOV	Solenoid Valve
SPDT	Single Pole, Double Throw
SS	Stainless Steel
TSO	Tight Shut-Off (valve)
UAE	United Arab Emirates
UAI	Umm Al Anbar island
UZ	Upper Zakum
WP	Work Pack
WPQR	Welder Performance Qualification Record
WPS	Welding Procedure Specification
WQT	Welder Qualification Test



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3.2 **DEFINITIONS**

COMPANY	Abu Dhabi COMPANY for Offshore Petroleum Operations (COMPANY)
EPC CONTRACTOR	Target Engineering Construction Company – Sole Proprietorship L.L.C
ENGINEERING SUBCONTRACTOR	Technip Energies France – Abu Dhabi
PROJECT	Engineering, Procurement & Construction For 1.0 MMBD Sustain Phase 1 Surface Facilities Project
SUBCONTRACTOR	Is a CONTRACTOR's affiliated firm responsible for performing services related to project scope under a separate agreement.
VENDOR	Means any person supplying or arranging the supply of materials for the WORKS including related documentation and services, where necessary.
WORKS	Means any works and services performed under the AGREEMENT.

4. **REFERENCES, CODES, AND STANDARDS**

4.1 **ORDER OF PRECEDENCE**

1. Annexure 3E-1: Rely Upon Information
2. UAE Federal Laws and National Local Regulations
3. ADNOC HSE Standards and ADNOC Offshore Procedures
4. Project Philosophies
5. Design Basis
6. P & ID'S
7. Plot Plan
8. Project Specifications
9. Datasheets
10. COMPANY Specifications
11. All remaining Project Deliverables
12. COMPANY Standard Specification and Procedures
13. Applicable International Design Codes, Standards and Regulations

If there is any conflict among the documents included in the AGREEMENT, the most stringent requirement among them will prevail. CONTRACTOR shall promptly bring to the notice of COMPANY any such conflicts, and COMPANY shall determine the prevailing requirement and advise CONTRACTOR accordingly.

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4.2 REFERENCE CODE AND STANDARDS

4.2.1 International Standards Organization (ISO)

CODE	TITLE
ISO 9001	Quality Management System – Requirements
ISO 1219	Fluid Power Systems and Components – Graphic Symbols and Circuit Diagram
ISO 17292	Metal Ball valves for petroleum, petrochemical and allied industries
ISO 10497	Testing of Valves: Fire type testing requirements
ISO 15848 - 1	Industrial Valves – Measurement, Test and Qualification Procedures for Fugitive Emissions (Classification Systems and Qualifications Procedures for Type Testing of Valves & Parts)
ISO 15848 – 2	Industrial Valves – Measurement, Test and Qualification Procedures for Fugitive Emissions (Production Acceptance Test of Valves)
ISO 5208	Industrial Valves: Pressure Testing of Metallic Valves
ISO 5211	Industrial valves - Part-turn actuator attachments
ISO 19011	Guidelines for Auditing Management Systems
ISO 10474	Steel and steel products - Inspection documents
ISO 12490	Mechanical Integrity and Sizing of actuators and mounting kits for Pipeline valves
ISO 9004	Quality management -Quality of an organization - Guidance to achieve sustained success

4.2.2 Instrument Systems and Automation Society (ISA)

CODE	TITLE
ISA TR96.05.01	Partial stroke testing of automated valves

4.2.3 American Petroleum Institute (API)

CODE	TITLE
API 6D	Specification for Pipeline Valves (Gate, Ball and Check)
API 6FA	Specification for Fire Test of Valves



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CODE	TITLE
API 552	Transmission System
API 578	Positive Material Identification (PMI)
API 598	Valve Inspection and Testing
API 607	Fire Test for Soft-Seated Quarter-Turn Valves
API STD 608	Metal Ball Valves - Flanged, Threaded, and Butt-Welding Ends
API 2218	Fire Proofing Practices in Petroleum and Petrochemical Plants
API STD 609	Butterfly Valves: Double-flanged, Lug- and Wafer-type

4.2.4 American Society of Mechanical Engineers (ASME)

CODE	TITLE
ASME B 1.20.1	Pipe Threads, General Purpose (Inch)
ASME B 16.10	Face to Face and End-to-End Dimensions of Valves
ASME B 16.47	Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard
ASME B 16.5	Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard
ASME B16.20	Metallic Gaskets for Pipe Flanges
ASME B16.34	Valves - Flanged, threaded and welding ends
ASME B31.3	ASME Code for Process Piping
ASME B 46.1	Surface Texture (Surface Roughness, Waviness and Lay)
ASTM A182	Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A269/269M	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A479	Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
ASTM B677	Standard specification for UNS 08925, UNS 08354 and UNS 08926 Seamless Pipe and tube



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4.2.5 National Association of Corrosion Engineers (NACE)

CODE	TITLE
NACE MR0175/ISO 15156	Petroleum and Natural Gas Industries – Materials for Use in H ₂ S Containing Environments in Oil and Gas Production
ANSI/NACE MR0103/ISO 17945	Metallic Materials resistant to Sulfide Stress Cracking in corrosive petroleum refining environments
NACE TM0177	Laboratory Testing of metals for resistance to sulfide stress cracking and stress corrosion cracking in H ₂ S environments

4.2.6 International Electrotechnical Commission (IEC)

CODE	TITLE
IEC 60079 (All Parts)	Electrical apparatus for Explosive gas atmospheres
IEC 60085	Electrical insulation - Thermal evaluation and designation
IEC 60529	Degrees of Protection provided by Enclosures (IP Code)
IEC 60534-4	Industrial-process control valves. Inspection and routine testing
IEC 60534-5	Industrial-process control valves marking
IEC 60947-5-2	Low-voltage switchgear and control gear - Part 5-2: Control circuit devices and switching elements - Proximity switches
IEC 61000 (All Parts)	Electromagnetic Compatibility (EMC)
IEC 61158	Digital Data Communications for measurement and Control – Field Bus for use in Industrial Control System
IEC 61508	Functional safety of Electrical /Electronic/ Programmable electronic safety related systems
IEC 61511	Functional safety – Safety Instrumented Systems for the Process Industry
IEC 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements, Part-1: General Requirements



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4.2.7 European Standards

CODE	TITLE
BS 6121	Mechanical Cable glands. Code of practice for selection, installation and inspection of cable glands and armoured glands.
BS EN 10204	Metallic Materials – Types of Inspection Documents
BS 4800	British Standard Schedule for Paint Colours for Building purposes
DIN 19234	Inductive Proximity Detectors
BS EN 12266-1	Industrial valves. Testing of Valves - Pressure Tests, test procedures and acceptance criteria. Mandatory requirements
BS EN 12266-2	Industrial valves. Testing of metallic valves - Tests, test procedures and acceptance criteria. Supplementary requirements
BS EN 60947-5-6	Low-Voltage Switchgear and Control gear Part 5-6: Control Circuit Devices and Switching Elements DC Interface for Proximity Sensors and Switching Amplifiers (NAMUR)

4.2.8 Process Industry Practices

CODE	TITLE
PIP PCCGN002	General Instrument Installation Criteria

4.2.9 COMPANY Standards, Guidelines & Code of Practices

DOCUMENT NUMBER	DOCUMENT TITLE
A0-Q-PQ-GDL-001	Guideline for Project Quality Plan
AGES-SP-13-001	Criticality Rating Specification
AGES-SP-13-002	Procurement Inspection & Certification Requirement in Projects

As applicable, the latest edition of above-mentioned Codes/Standards shall be used.

4.3 PROJECT REFERENCE DOCUMENTS

DOCUMENT NUMBER	DOCUMENT TITLE
E1150-BD-2000-J-0001	Instrument & Control Design Basis
E1150-TS-2000-J-0010	Specification for Instrument Material Selection



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DOCUMENT NUMBER	DOCUMENT TITLE
E1150-GD-2000-G-0022	Specification for General Environmental Data and Units of Measurement
E1150-TS-2000-W-0004	Specification for External and Internal Coating
E1150-TS-2000-P-0001	Piping Material Specification
E1150-TS-2000-P-0005	Specification for Valves
E1150-DS-2000-P-0001	Data Sheet for Ball valves
E1150-DS-2000-P-0006	Data Sheet for Butterfly valves
E1150-DS-2000-P-0003	Data Sheet for Globe valves
E1150-DS-2000-P-0002	Data Sheet for Gate valves
E1150-TS-2000-J-0003	Specification for Safety Relief Valves
E1150-TS-2000-J-0016	Specification for Instrument Cable, Cable Glands and Junction Boxes
E1150-TS-2000-J-0028	Specification for Pressure and Differential Pressure Transmitters
E1150-TS-2000-J-0026	Specification For Pressure Gauges
E1150-TS-2000-J-0020	Specification for Instruments and Controls Testing and Commissioning
E1150-TS-2000-W-0004	Specification for External and Internal Coating
E1150-SR-2000-N-0022	Fire & Explosion Safety Assessment (FESA) Study Report- Al Ghallan
E1150-SR-2100-N-0005	Fire & Explosion Safety Assessment (FESA) Study Report - Ettouk
E1150-SR-2200-N-0005	Fire & Explosion Safety Assessment (FESA) Study Report - Assefiya
E1150-SR-2300-N-0005	Fire & Explosion Safety Assessment (FESA) Study Report - Umm Al Anbar

5. **SCOPE**

This specification together with the associated Instrument Data Sheets defines the minimum mandatory requirements for the design, materials, manufacture and assembly, calibration, inspection and testing, nameplate marking and shipping of Actuated On-off Valves.

General technical requirements for all types of Actuated On-off Valves and associated accessories are covered in this specification.

Specific Technical Requirements for Actuated On-Off Valves for the following applications are considered in this specification.

- Emergency Shutdown Applications (SDV or ESDV).
- Emergency Blowdown Applications (EDPV or BDV).



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- Process stream Isolation valves.
- Isolation valves applications requiring sequentially timed opening/ closing operations.

This Project is an extension of the UZ750 Project. Existing philosophy shall be followed. Any deviation shall be highlighted clearly for COMPANY review.

The Valve selection responsibility is assigned to the Valve VENDOR and necessary guidelines for selection are also included.

The VENDOR shall be fully responsible for meeting both the General and Specific technical requirements of this specification inclusive of the referenced documents in respect of design, materials and services.

6. GENERAL REQUIREMENTS

Actuated On-Off valves shall be designed to be Fail-Safe (unless otherwise stated on the associated P&IDs and Instrument Valve Data Sheets) and the Actuator shall be the Fail-Safe spring return type (unless otherwise specified on the associated Instrument Valve Data Sheets).

Actuated On-Off valves used for safety applications shall be suitable for the Safety Integrity Level (SIL) specified on the associated Instrument Valve Data Sheet.

The SIL report and PFD values shall be for the whole assembly as one unit, this including valve body, actuator, control components, SOV, Quick Exhaust Valve, etc and any other accessories

Valve VENDOR is responsible to provide the SIL report for the complete assembly as above. The SIL report for the complete assembly shall be reviewed and certified by a recognized and COMPANY approved agency like TUV or Exida.

This certification shall be submitted with the bid.

All electronic, local station and Panels shall be protected by GRP sunshade.

ESD valves shall be fire-rated to an approved standard, but additionally passively fire protected if thermal radiation is above the fire-rating of the valve or above 32 kW/m².

6.1 HAZARDOUS AREA REQUIREMENTS

The detailed requirements for Hazardous Area are stated in the Project Document "Instrument & Control Design Basis" (E1150-BD-2000-J-0001).

The minimum hazardous area protection certification, irrespective of area specified (safe or hazardous area), shall be Flame proof/ Explosion proof or FISCO certified suitable to Zone 1, Gas group IIB, Ignition temperature class T3 at ambient Temperature of 55 °C as per IEC-60079, unless otherwise specifically stated in Instrument Valve Data Sheet.

Instruments installed in hazardous areas shall be certified by an Approved national authority (e.g. CSA, UL, BASEEFA, FM, CESI, LCIE, TUV) to the appropriate sections of IEC-60079.

All such equipment shall carry apparatus marking as per IEC.

Additional ATEX marking shall be applicable for equipment conforming to CENELEC / IEC as per EU Directive ATEX 2014/34/EU; whereas equipment conforming to North American Practices / NEMA shall carry AEx apparatus marking.



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Hazardous area certification shall apply to all components such as termination enclosures, Cable glands, local indicator, HART hand-held communicator and any other electrical / electronic accessory required for operation or maintenance of the Actuated On-Off valve.

On-Off Valve VENDORS shall submit as part of their bid documentation details of any barriers or I.S. power supply modules required for the offered On-Off Valves and Actuators.

All outdoor Instrument enclosures, switches, pushbuttons, Junction Boxes, etc. shall be certified as having a minimum Ingress Protection (IP) code of IP-66 as per IEC 60529: Degrees of protection provided by Enclosures.

Ex-certified equipment requires an Emirates Conformity Assessment System (ECAS). Ex Certificate of Conformity (CoC) shall be issued by a notified body. Requirement for the ECAS Ex programme utilizes IEC Standards, and qualification of conformity shall be met by meeting the requirements of the IECEx scheme in full including mandatory factory site Quality Assessment Reports (QARs).

6.2 **UTILITY SUPPLY**

Electronic Field Instrumentation such as Proximity Switches, Position Transmitters, solenoid valves, switches, lamps etc. shall use 24 V DC.

Hydraulic actuators shall be designed for a maximum supply pressure of 2300 psig unless otherwise specified on the associated Instrument Data Sheet.

EMC EMI/ RFI emission and immunity shall be as per IEC 61000, IEC 61326. The EMI / RFI effect shall be less than 0.1% of span when the instrument is subjected to electro-magnetic field strength of 30 V/m for frequency range 20 to 1000 MHz.

Transient and surge protection shall be provided on all field wiring and input/output modules and shall be designed as per API RP 552 to protect against and suppress electrical surges and transients of up to 1500V that may be imposed on the field wiring.

Air supply pressure conditions are as follows:

Design Pressure	175 psig
Maximum Pressure	130 psig
Normal pressure	109 psig
Minimum pressure	58 psig
Dew Point	Minus 40 °C

The valve actuators and the pneumatically powered valve accessories shall be sized using the above minimum pressure but also shall be suitable for the above design pressure.

6.3 **CONNECTIONS**

Tubing, vent and drain connections shall be NPT (Taper) as per ASME B 1.20.1.

Flanged end connections shall be as per ASME B 16.5 and ASME B 16.47. Rating and facing shall be as specified on the associated Valve Data Sheet.

Electrical field cable connections shall have parallel ISO M20 x 1.5". Metric threads suitable for double compression type armoured cable glands and as specified on the associated Valve Data Sheet. Separate entries shall be provided for input, output and power supply, as applicable. Spare entries shall be plugged with suitable certified plugs.



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Safety earth lug shall be provided for all electrical/electronic units, preferably as an external ground screw assembly.

The Minimum size of Pneumatic connections shall be 1/4" NPTF. The size of the pneumatic connection shall be based on the stroke time.

6.4 ENVIRONMENTAL DATA

All the Valves and accessories shall be designed suitable for the Environmental Conditions as indicated in Project Specification for General Environmental Data and Units of Measurement (Doc. No. E1150-GD-2000-G-0022) and Instrument & Control Design Basis (Doc. No. E1150-BD-2000-J-0001).

7. DESIGN REQUIREMENTS

7.1 VALVE SELECTION & GENERAL DESIGN

Actuated On-Off valves for Emergency Isolation Blow-down applications shall be Fire Safe Design and Type tested. Fire proofing for Actuators should be provided wherever specified in the associated Instrument Data Sheet based on the FESA study reports followings:

- Fire & Explosion Safety Assessment (FESA) Study Report- Al Ghallan (Doc. No. E1150-SR-2000-N-0022).
- Fire & Explosion Safety Assessment (FESA) Study Report – Ettouk (Doc. No. E1150-SR-2100-N-0005).
- Fire & Explosion Safety Assessment (FESA) Study Report – Asseifiya (Doc. No. E1150-SR-2200-N-0005).
- Fire & Explosion Safety Assessment (FESA) Study Report - Umm Al Anbar (Doc. No. E1150-SR-2300-N-0005).

Valve body style shall be as specified in the associated Instrument Data Sheet. For safety applications ball valves are the preferred choice. For specific details refer associated Instrument Valve Data Sheet.

Blow-down valves shall be pneumatically operated, solenoid valve de-energised /spring to open. To prevent blow-down valves operating on loss of main air supply, they shall be supplied with a back-up air supply sized for three strokes/cycles of the valve.

Butterfly and Plug style On-Off valves shall be supplied when specified in the associated Instrument Valve datasheet. All the butterfly valves shall be double Flanged type.

Valve design shall be generally in accordance with Project Piping documents identified in clause no. 4.3 of this specification and associated Instrument Valve Data Sheet.

Actuators shall be designed to be Fail-safe on supply failure with Fail Close (FC) for applications like blocking/ process isolation/ emergency shutdown and Fail Open (FO) for applications like blow-down/ venting unless otherwise specified in Data Sheet. Refer associated Instrument Valve Data Sheet for specific details.

Valve rating shall be as specified in the associated Instrument Valve Data Sheet.

The minimum hardness of RTJ grooves shall be as per the Project Piping Material Specification (Doc.No E1150-TS-2000-P-0001) and relevant Valve Data Sheets.



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Predicted sound pressure level shall not exceed 85 dBA at 1 m downstream and 1 m distance from valve surface.

The fluid velocities at the outlet of the valve body shall not exceed the maximum permitted value for the valve body. Valve body and Trim materials shall be suitable for all the operating conditions as specified in the associated Instrument Valve Data Sheet.

All Valves in hydrocarbon service (Sour service) shall be certified for Fugitive Emission Certification as per ISO 15848 Part 1 & Part 2. Wherever fugitive emission tests are specified in the Instrument Valve Data Sheets, valves shall be subjected to prototype and production tests in accordance to ISO 15848 Part 1 and Part 2 respectively and compliance certificate shall be provided for all the applicable valves.

Fugitive emission tightness class shall be according to Instrument Valve Data Sheet. Selection of valves, extension of qualification to untested valve, etc. shall be as per ISO 15848 Part 1.

The inspection & testing of the valve shall be as per the requirements of respective manual valve Piping Specifications (Ball or Butterfly) listed in section 4.3.

All ESDV and BDV shall be provided with the following buttons on local panel in field: Open, Close, Reset and Spare.

Necessary software license shall be provided for valvelink software. EPC Contractor shall arrange at site for the valve tuning / signature in valvelink software by vendors during commissioning.

Partial Stroke Testing

Actuated On-Off valves for the following services shall be equipped with partial stroke testing facilities.

- Shutdown valves and Isolation valves on the main Plant/Facility Inlet and Outlet lines.
- Process unit and critical Utility unit Inlet and Outlet shutdown valves, the tripping of which may lead to a complete facility shutdown or to shutdown of a key process unit.
- Blow down applications and any Actuated On-Off valve on a SIF duty.
- PST and SOV test option shall be applied for all valves including BDVs with size 3" and above, regardless the assigned SIL rating for that valve.
- Valves including BDVs with sizes less than 3" shall not be provided with PST and SOV test.

Partial Stroke Testing shall be implemented using the Position Control Methodology as per ANSI ISA TR96.05.01. The Partial Stroke Testing facility shall allow both Manual and Automatic Partial Stroke Testing.

The offered Valve Positioner shall be certified as meeting the requirements of IEC 61508 for incorporation into Safety Instrumented Function (SIF) loops that are rated to Safety Integrity Level 3 (SIL3). Positioner housing shall be SS316L and painted.

Positioners for PST shall be smart devices that are capable of initiating a valve stroke from normal position to a predetermined value, returning the valve to its normal position and recording and time-stamping the resulting actuator pressure/valve position/time profiles for transmission to ICSS via HART communication. Valve position feedback to the positioner shall not rely on mechanical connection between the positioner and the valve stem (non-contact sensing).



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Positioner interface to ICSS shall be 4 – 20mA +HART

Enclosure cable entries shall be threaded M20 x 1.5 to accept cable glands. Positioner housing shall be 316L stainless steel and have minimum enclosure ratings of IP 67.

The positioner shall be fitted with two pressure gauges, for supply inlet pressure and control outlet pressure.

The positioner shall be certified as,

- Suitable for use in safety applications up to SIL 3
- Designed to intrinsic safety Ex ib minimum in accordance with IEC 60079-11

Positioner shall be Fisher DVC6200S or latest DVC model.

The Partial Stroke Testing scheme shall be configured in the BPCS/SIS and AMS. All test data shall be recorded in the BPCS Historian (valve position data) and in AMS (PST test results). The Partial Stroke Testing Scheme shall also include testing of the solenoid valve. Solenoid valve will be tested generating a pulse in the solenoid activating signal by means of the ESD system. This pulse should be as short as possible to avoid or limit to a minimum movement of the isolation valve actuated by the solenoid. It's important to notice that minimum possible pulse length is limited by the scan cycle of the ESD controller (at present 300 ms). The solenoid selection to be consulted with MAC and the same shall be simulated during the MAC FAT utilizing actual solenoids and PST set up.

The recommended Partial Stroke Testing design scheme for Spring Return & Double Acting Pneumatically Operated Valves is shown in APPENDIX1.

The On-Off Valve, Actuator, Positioner and all necessary accessories shall be supplied completely assembled, properly wired and tubed and fully tested with a copy of the Test Valve Signature on disk. Partial Stroke testing plug-in software shall be supplied by Valve VENDOR for installation in the AMS by MAC.

Casting shall be free from injurious blowholes, porosity, shrinkage, faults, cracks or other defects. Reworked castings with defects plugged, welded, burned or impregnated are unacceptable.

Valve Test

Actuated On-Off valves for Emergency isolation, Blowdown applications shall meet the requirements of API 598, BS EN 12266, API 6FA. All the Actuated On-Off valves shall meet the requirements of API 598.

Material

Body and Trim Material selection shall be as per the requirements of the Piping Specifications and Valve Data Sheets identified in clause no. 4.3, Specification for Instrument Material Selection (Doc. No. E1150-TS-2000-J-0010) and the associated Instrument Data Sheets.

Valve Materials of Construction shall be electro-chemically and galvanically compatible with the associated Piping and Flange Bolt/Gasket materials.

Valves, Actuators, Positioners and all accessories shall be designed to have a minimum life expectancy of thirty years.

Actuated On-Off valves shall be equipped with Local Control Panel facility for the valves designated as Emergency Shutdown Applications (SDV or ESDV), Emergency Blowdown



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Applications (BDV or EDPV), Process stream Isolation (including DB & B) valves and Isolation valves applications requiring sequentially timed opening/ closing operations.

All the accessories and control components (e.g. Logic components, Miniature Valve, SOV, Partial Stroke devices, Open/Close Push Buttons, Filter Regulator etc.) shall be housed in a painted SS 316L Local Control Box, which shall be suitable for highly corrosive, humid, salt laden marine environment, weatherproof to IP66 as a minimum.

All Accessories, plates, box etc shall be in SS 316/L exposed to outside ambient condition shall be in SS 316L.

7.2 **ACTUATED ON-OFF BALL VALVES**

Fire safe Quarter-turn Trunnion-mounted Ball valves with Dual Seat Seals shall be provided for ESD Isolation and Blow-Down valves.

Double Block and Bleed (DB&B) Fire safe Quarter-Turn Trunnion-mounted Full Bore or Reduced Bore Ball valves shall be provided for Process Isolation valves where specified in the associated Instrument Valve Data Sheets. The Bleed outlet shall be provided with a pressure gauge and/or valve when specified on the Instrument Valve Data Sheet, otherwise, the bleed outlet shall be plugged.

Fire safe valves shall meet the requirements of API 607/API 6FA/ISO 10497 and shall be API 607/API 6FA/ISO 10497 certified.

Split body arrangement (for easy replacement of ball and seals) is the preferred design.

The inner seal shall be a surface contact based metallic face seal with outer soft seal.

Ball valves used as Isolation valves for process or metering applications shall be Double Block and Bleed type (DB&B).

Quarter-Turn rotary action shall preferably be through rack and pinion linkage arrangement. Scotch yoke mechanism may be employed for spring-opposed actuators.

Adjustable mechanical stops (independent of any actuator travel stops) shall be provided in the valve.

ESD valves shall provide tight shut-off (TSO) where specified. Valves shall be subject to "Seat Tightness Tests" as prescribed in API 598 and comply with "Acceptable Seat Test" criteria defined in ISO 5208.

In liquid service for tight shut-Off ESD valves ISO 5208 Rate B shall be used and for non-TSO Rate CC (equivalent to API 598) shall be used.

In gas service for TSO ESD valves ISO 5208 Rate A shall be used and non-TSO API 598 shall be used.

EBD valves shall meet the requirements of ISO 5208 Rate A.

Valve design, dimensions, marking and rating shall comply with API 6D.

7.3 **TRIPLE OFFSET BUTTERFLY VALVES**

- Butterfly valves shall be designed as per API 609 and shall be used up to 600# pressure class only.



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- High Performance Butterfly Valves (triple eccentric) shall be double flanged configuration. Valve with mono-flange, wafer or lug pattern shall not be used for shutdown valves.
- Valve shall be Fire safe, Quarter turn, Metal seated type.
- Butterfly valves shall be provided with Integral flanges.
- Lining of disc, trim, etc. shall not be used for shutdown valves.
- Soft seat shall be used only where there is a limitation in supplying the metal seated valve. Usage of soft seated valve requires prior approval from COMPANY.
- Fire safe requirements for metal seated valves shall meet API 608, API 6FA, BS EN ISO10497 certification and requirements.
- Butterfly Valves shall be supplied in a single piece configuration.
- Seat for the valve shall be renewable type.
- For soft seated valves, the inner seal shall be a surface contact based metallic face seal with outer soft seal. Fire safe requirement for soft seated valves shall meet API 607 requirements.

7.4 VALVE ACTUATORS

7.4.1 Actuator Design

The actuator shall be selected based on stroking time specified in the associated Instrument Valve Data Sheet. Valve VENDOR shall be responsible for the mechanical compatibility between the valve and actuator.

Actuator shall be supplied with all the necessary accessories such as solenoid valves, quick exhaust vent valve etc, as per the requirements of this specification and associated Instrument Valve Data Sheets.

Actuators may be fitted with speed control valves to regulate the stroking time in both directions. It shall not be possible to fully close the speed controlling devices, thereby preventing valve operation. The speed controls shall be suitable to enable the valve/actuator assembly to operate to its Fail safe (open or close) position within duration of generally 1 sec/inch of nominal bore size.

Pneumatic actuators of the Spring-Diaphragm or Spring-opposed Piston actuators shall be the first choice, unless otherwise specified. Maximum length for the single acting spring return pneumatic actuator shall be limited to 2.5 metres.

For valves requiring actuators in excess of 2.5 meters, two options can be considered:

- Double acting actuators shall be provided with back-up pneumatic/hydraulic power pack mounted on or adjacent to the valve and sized for three strokes/cycles of the valve.
- Electro-hydraulic actuators.

Tubing size, Boosters, Quick- exhaust valves and Restrictors shall be used as necessary to achieve the necessary stroking time.

The actuator design shall be such that it shall be possible to operate the valve under the maximum condition of ΔP (differential pressure) shut off in specified maximum stroking time at minimum air supply pressure.



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Actuators using instrument air shall be sized based on a minimum air pressure of 58 psig. Actuators requiring an instrument air supply pressure above 58 psig shall not be used unless approved by COMPANY.

For Safety/SIS applications, the actuator design torque/thrust shall be at least twice that required for the maximum shut-off differential pressure at minimum air supply pressure and this safety factor shall be available throughout the valve travel (from the closed position to the fully open position).

For non-Safety/non-SIS applications, the actuator design torque/thrust shall be at least 1.5 times that required for the maximum shut-off differential pressure at minimum air supply pressure and this safety factor shall be available throughout the valve travel (from the closed position to the fully open position).

All items in the load path between valve seat and actuator shall be capable of withstanding the maximum torque / thrust produced by the actuator at maximum supply pressure without suffering permanent deformation. VENDOR shall ensure that the Valve's Maximum Allowable Stem Torque (MAST) is never exceeded throughout the valve travel. If the maximum stem torque is exceeded, re-selection of actuator/valve or design of over-pressure protection is required to be provided by VENDOR.

Materials of construction of actuator assembly shall be galvanically compatible with the valve body.

Necessary boot shall be provided to prevent outside Dust / sand ingress to soft seals /guide /gaskets.

7.4.2 Spring & Diaphragm Actuators

Pneumatic actuators and other valve accessories shall be rated for maximum design air supply pressure as specified in Instrument Valve Data Sheet. The actuator shall use a 3-15 psig signal range unless otherwise specified on the associated Instrument Data Sheet. The use of higher pressure ranges requires prior written approval from the COMPANY.

Diaphragms shall withstand 175 psig pressure.

Yokes shall be of open-type design to allow access to packing gland follower adjustment.

Actuator springs shall not only be fully enclosed in a metal housing but also permanently treated/ coated to resist atmospheric corrosion. Plating of springs is not acceptable.

Spring and Diaphragm actuator case materials of construction shall be carbon steel with painting as per Specification for External and Internal Coating (Doc. No. E1150-TS-2000-W-0004). Aluminium actuators shall not be used.

If the actuator is supplied with multiple springs, then the springs are mounted in such that a single spring failure shall not result in a complete actuator failure.

7.4.3 Piston/Cylinder Actuators

Piston/ Cylinder actuators shall preferably be the pneumatic spring opposed diaphragm or spring opposed short stroke type.

Long stroke actuators may be the spring-less piston/cylinder type.

Spring-less Piston/Cylinder actuators used on SIF duty shall be Functional Safety assessed (refer to section 6 of this Specification) and shall be provided with a volume



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tank, air lock-up relay and all other necessary fail safe hardware required to achieve the fail-safe position of the valve. The volume tank shall be designed to ensure a minimum of three full strokes (on-off) cycles and shall be equipped with the necessary safety devices. The volume tank design shall be as per ASME section-VIII, Div 1.

Double-acting Actuator Over-ride controls shall be as follows:

- Manually, by means of Open/ Close shuttle valves.
- Remotely, by means of electrically operated solenoid valves (SOV).

Piston and Cylinder actuators shall be provided with mechanical adjustable travel stops to ensure protection against seat/plug damage.

Construction shall be leak tight with the necessary O-ring seals and gaskets used to provide leak tight operation.

Actuators shall be provided with lockable travel speed adjustment.

Shear keys shall not be supplied for mechanical coupling of actuator to valve. Mechanical coupling shall be designed to transfer the stall actuator torque/ thrust.

Carbon Steel shall be employed in the material of construction of Piston actuator with epoxy or powder coating. VENDOR shall furnish a parts list with material of construction in the bid.

Bearing surfaces, yoke assembly and any sliding or rolling contact shall be coated with corrosion-inhibited lubricant.

Wear rings shall be Teflon, unless otherwise specified.

Actuator cylinders shall be designed to ASME VIII and welding shall be in accordance with the provisions of ASME IX.

Valve VENDOR shall bear sole responsibility for the compatibility and performance of actuator with the valve.

All the auxiliaries and ancillaries of piston actuated valves shall be mounted inside an enclosure of material SS 316L and shall be painted as per the Specification for External and Internal Coating (Doc. No. E1150-TS-2000-W-0004).

7.4.4 Hydraulic Actuators

Hydraulic actuators shall be used for large size valves with high torques required for operation where conventional pneumatic piston actuators become too bulky and heavy to operate such valves. Also hydraulic actuator shall be considered where valves requiring actuator in excess of 2.5 meter length.

Valve VENDOR shall bear sole responsibility for the compatibility and performance of actuator with the valve.

Actuators shall be sized based on the minimum fluid supply pressure specified in the data sheets.

The specific requirement from VENDOR for Hydraulic actuators shall be part of the associated Instrument Valve Data Sheets. VENDOR shall submit his standard design based on the design basis below, unless otherwise specified.

The general requirement for hydraulic actuators shall be as follows:



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- Hydraulic Actuators shall be provided complete with the Hydraulic Power Units. The Hydraulic Power Unit (HPU) shall comprise pumps (pneumatically driven), oil storage tank/ reservoir, accumulators, strainer, local instrumentation & controls, relief controls, drains & vents, flame arresters and any other component to complete the system delivered as an independently mounted package to provide hydraulic supply pressure at a regulated pressure and temperature. All these components shall be supplied as a complete package by the VENDOR.
- VENDOR shall design and supply the following:
 - Pump of adequate Horsepower.
 - Oil tank of required capacity.
 - Heat exchanger (water-air/oil) as required by Valve actuator.
 - Suction, Discharge, Aeration, filling and return Filters with adequate mesh size.
 - Initial fill of oil.
 - Accumulator to ASME codes.
 - Initial fill and N2 charging unit.
 - PSV on N2 Reservoir vessel.
 - Control panels.
 - Emergency shut-off panel.
 - Interconnecting piping, wiring and tubing.
 - Instrumentation.
 - Skid or rack (e.g. accumulator).
 - Weather / Fire shielding.
- N2 Bladder type accumulators shall be provided unless otherwise specified. N2 Inert gas rack bottle with rack, fittings and bottle changeover facility and initial charge supply of Nitrogen complete with all instrumentation, valves and tubing shall be provided.
- Accumulator shall provide for at least 150% duty, with the valve operating on at least one accumulator on maintenance.
- Valve VENDOR shall provide flexible high-pressure hoses (1 m) for oil connection to actuators, when specified. Hoses shall be fire and oil resistant with braided corrosion resistant metal sheath. Piping between actuator and HPU and from Accumulator to HPU shall be by CONTRACTOR, unless otherwise specified.
- All the auxiliaries and ancillaries of Hydraulic actuated valves shall be mounted inside an enclosure of material SS 316L and shall be painted as per the Specification for External and Internal Coating (Doc. No. E1150-TS-2000-W-0004).
- Hydraulic components and circuits shall be represented based on ISO 1219 in all VENDOR drawings and documents.
- In general, Carbon steel shall be employed in the material of construction of Piston actuator with epoxy or powder coating. VENDOR shall furnish a parts list with material of construction in the bid.



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Note:

1. Bearing surfaces, yoke assembly and any sliding or rolling contact shall be coated with corrosion-inhibited lubricant.
2. Wear rings shall be Teflon, unless otherwise specified.
3. Actuator cylinders shall be designed to ASME VIII and welding shall be in accordance with the provisions of ASME IX.

7.5 SOLENOID VALVES

7.5.1 General

All Solenoid valves shall be 24VDC powered and designed for use in continuous energised duty.

Trip solenoid valves initiated by a shutdown system shall isolate and depressurise the supply to the actuator and therefore installed directly in the actuator signal line.

For Double acting Hydraulic actuators, the solenoid valve manifold of poppet or spool valves shall exhaust the appropriate side of the piston/ cylinder while energising and maintaining the full supply pressure on the other side. Dual solenoids for positive actuation are preferred.

Solenoid valve Flow Coefficient (CV) shall be chosen to ensure the required valve opening and closing stroking times.

DC operated solenoids shall be with a freewheeling shunt diode across the terminals suitably encapsulated and shall have polarity well marked on the terminals.

Solenoid valves shall have integral terminal box. Direct Flying leads are not acceptable.

Solenoid Coils shall be High Temperature type. Coil Insulation class shall be Class H, with temperature rise to class F, unless otherwise specified (IEC 60085).

7.5.2 Solenoid Valves (Pneumatic Service)

Solenoid valves (pneumatic) shall be continuous duty type and direct operated (not pilot pressure operated / flow assisted/ poppet type).

The solenoid valves shall have packless construction, full ported, spring return type.

The solenoid valve shall be 3-port, 2-position (3/2) universal type, unless otherwise specified.

Solenoid Valves shall be designed and certified for a shut-off differential pressure of 150 psi and a fluid temperature of 122 °F, unless otherwise specified on the associated Instrument Valve Data Sheet. Backpressure or downstream pressure shall be considered as zero psig (atmospheric).

Disc / seat shall be of resilient material to achieve TSO. Buna-N shall be the seat seal material, unless otherwise specified.

Auto reset SOV shall be provided. Manual reset devices shall not be used.

All pneumatic connections shall be 1/4" NPTF, unless otherwise specified. Higher sizes of 1" NPTF, 3/8" NPTF and 1/2" NPTF for solenoid valves with larger port size (greater than



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6 mm) required for faster pilot solenoid valve action shall be provided when specified or required.

The vent port of the solenoid valve shall be fitted with bug screen. The vent port connections shall be 1/4" NPTF (minimum) to facilitate connection to silencer or closed vent system. The vent port shall be supplied fixed with the spare vent plug (metallic).

Manual override shall be provided for process/ operation check of the valve in the field as specified in the datasheet.

Solenoids shall be selected from lower power-consumption type. Maximum continuous power consumption shall not exceed 4 W for DC solenoids.

Magnetically latched solenoid valves – additional features.

- Magnetically latched solenoid valves shall be DC pulse operated. The pulse width shall be 20-100 ms for normal operation of solenoid valve.
- Magnetically latched solenoid valve shall be toggle type, i.e. if one pulse opens the solenoid, the next pulse shall close it and vice versa.

I.S. Solenoid Valves – Additional features:

- Intrinsically safe solenoid valves shall only be used when specified in the associated Instrument Valve Data Sheet. Minimum hazardous area protection certification irrespective of the area classification shall be Ex-ia, IIB, T3.
- The valve shall be designed to operate at very low current level (about 20 mA at 24 V dc) to ensure low energy storage and power dissipation.

7.5.3 Hydraulic Service Solenoid Valves (Pilot Operated/ Assisted)

Hydraulic solenoid valves for double acting actuators shall be pilot operated modular stack type poppet based four/ five port two position valve with travel limited to only either of the two end positions (and without taking an intermediate or indeterminate position). (Spool type or Lapped disc type hydraulic pilot valves shall not be used).

Solenoid Valves shall be designed and certified for a shut-off differential pressure of 125 psi and a fluid temperature of 122 °F, unless otherwise specified on the associated Instrument Valve Data Sheet. Body pressure rating shall be 350 psig, unless otherwise specified on the associated Project Instrument Data Sheet.

Dual solenoid with electrical reset is preferred for Hydraulic unit SOV. A local lockable manual override lever shall also be provided in addition to electrical reset.

When specified, the local Open/ Close Pushbuttons and indicating lights with the SOV shall be supplied and mounted on a corrosion resistant SS 316L plate with corrosion resistant SS 316L fasteners.

When specified, a separate ESD pushbutton for Field operation shall also be delivered mounted on a separate corrosion resistant SS 316L plate with corrosion resistant SS 316L fasteners and with Red tag & Name plate.

VENDOR shall supply any other component or valve(s) necessary for the proper functioning of actuator in association with solenoid valve. All components and circuits shall be identified in accordance with ISO 1219.



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7.6 LIMIT SWITCHES

Limit switches shall be Proximity type, as specified in Instrument Valve Data Sheet.

Two limit switches (open and close) shall be provided.

Accuracy / Repeatability: Within 3% of valve travel limits.

Output contact rating shall be 1.0 A at 24V minimum. Contact form shall be SPDT, unless otherwise specified.

Limit switches connected to the BPCS shall be of the FF type. All other limit switches shall have 2A, 24VDC SPDT contacts, as specified in the instrument valve datasheets.

EOL resistor (by others) shall be provided for local push buttons in the JB side inline with the existing philosophy.

Limit switches shall be as follows:

- Directly activated by the valve stem or shaft position
- Operate within 3% of valve travel from respective open and closed limits
- Protected to prevent mechanical disturbance/malfunction
- Failure mode leads to alarm condition
- Adjustable so they operate at the correct point in the valve travel
- Limit switches used on ESDV valves shall be minimum SIL 2 certified.

Hermetically sealed Inductive Proximity switches shall be provided.

Minimum sensitivity gap shall be 4 mm.

The proximity switches for open and close shall be independent of each other in its field function.

Switch with galvanically isolated Amplifier shall be fail-safe for lead or power supply failure.

The Proximity switches shall be delivered housed in a termination box of SS316L with the enclosure suitably certified for Ingress Protection & Electrical Hazardous area. (Flying leads from proximity switches are not acceptable).

Separate entries for open and close switch wiring on the termination box shall be provided, unless otherwise specified.

Proximity switches shall be in accordance with DIN 19234: Measurement and Control Electrical distance sensors-DC interface for distance sensor and Signal converter.

The combination of proximity switch and sensing circuit shall be fail-safe.

7.7 HAND WHEEL

Hand wheel shall not be provided on ESD valves. Hand wheel on other applications shall be provided only when specified in Instrument Valve Data Sheet.

Manual hand wheel for HV and manual operated isolation valves for XVs shall be provided for maintenance during failure.

Note: Hand wheel or Manual Override actuation may be provided for process isolation valves through a de-clutchable, jackscrew or hydraulic mechanism, when specified in the Data Sheet.



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7.8 LIMIT STOPS

Limit stops shall be provided for control of opening only and when specified.

Limit stops shall be mechanical devices on the actuator. Bolts screwed in the body shall not be used as a limit stop.

Limit stops shall be adjustable over the full stroke length from 10% opening, unless otherwise specified.

All limit stops shall be with lock nut and tamper-proof.

7.9 VOLUME BOOSTERS

Volume boosters may be needed to reduce the stroking time of the valve. Pressure boosters shall not be used to adjust pressure and get the same effect.

Material shall be in SS 316L, unless otherwise specified.

7.10 LOCK UP RELAY / VALVE

Lock-up pneumatic relay/ valve may be provided for locking up the valve in its closed position on air supply failure, as part of complete assembly for fail-safe valve action on air supply failure.

Air lock relay shall be provided so that the SOV lies between air lock relay and input to actuator.

The lock-up valve shall be set at 8 psi above the minimum required air supply pressure, unless otherwise specified.

Lock-up valve setting shall be tamper proof.

Lock-up valve shall be in SS 316L, unless otherwise specified.

7.11 QUICK EXHAUST VALVES

Quick Exhaust air valve in SS 316L shall be pilot operated type and fitted with bug screen on vent. Quick Exhaust valve shall be of fail-safe design and PFD values shall be provided to achieve required SIL rating.

Mounting shall be on a SS 316L plate along with other accessories required for stroking time adjustment.

7.12 RESTRICTORS

Restrictors in SS 316L shall be lockable, adjustable (variable) restriction.

The Restrictor shall only affect the stroking time to slow opening or slow closing and shall not influence other valve movement (repeatability, linearity or characteristic).

Mounting shall be on a SS 316L plate along with other accessories required for stroking time adjustment.

Direction of flow shall be marked on the body.



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7.13 SPEED CONTROL

Speed control when specified, to avoid surge on sudden closure of valve, shall be a calibrated needle valve in SS 316L with provision for speed adjustment for Pneumatic Actuators.

For all the Hydraulic actuators, speed control shall be provided which shall be a calibrated variable restrictor on supply and return lines in the hydraulic system. Material of construction shall be SS 316L.

In hydraulic actuators the return lines shall be adequately sized higher than supply line taking into account the stroke speed requirements.

7.14 AIR FILTER REGULATORS (AIR SET)

Separate Air filter regulators shall be used at the air supply inlet of valve auxiliaries, when required.

Air Filter Regulators shall be Reducing relief valve type with overpressure protection and with setting lock nut.

The filter shall be 40 μ m (micron) in SS 316/316L, unless otherwise specified.

The air filter regulator shall be capable of supplying the required air flow rate to the actuator without any droop over the range of pressure required by actuator.

The regulator shall be mounted vertically to facilitate easy drainage of any liquids collecting in drain bowl.

Air Filter Regulators shall be SS316L and painted.

Air Filter Regulators shall have a manual water drain valve.

Air Filter Regulator shall be provided with two pressure gauges: one at supply pressure and the other at output. Gauges shall have scratchproof lenses.

Separate filter with lubricators shall be provided piston/ cylinder actuators. The mesh size for such cases shall be 40 μ m (micron).

7.15 AIR LUBRICATORS

For large size on-off valve, oil mist type air lubricators shall be used to ensure trouble free operation of piston/ cylinder type actuators.

The lubricant shall also help in reducing the effect of harsh environment on the actuator internals.

Oil buffer capacity shall be sufficient for at least one-month continuous operation.

Oil flow shall be externally adjustable. Provision for oil refilling under pressure shall be possible. Oil Level indication shall be provided where air lubricators are used with valves operated through a solenoid valve, the lubricator shall be installed upstream of solenoid valve.

Metallic bowl lubricators shall only be provided.

7.16 VOLUME TANKS

Where back-up air supplies are required, either by selection of double acting actuator or process duty requirement of Blow-down valves, Air Volume tanks shall be supplied.



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Volume tanks shall be mechanically designed to withstand a maximum pressure of 300 psig. Volume tanks shall be designed to ASME Section VIII, Div 1 and ASME UV stamped.

Volume tanks shall be sized for three strokes/cycles of the valve at the minimum available instrument air pressure of 58 psig.

Volume tanks shall be supplied with all necessary accessories like Pressure Transmitter, Pressure gauge, Pressure Safety Valve, etc.

Volume Tank shall be carbon steel and painted, unless otherwise specified.

Isolation valves (locked) shall be provided for online calibration.

7.17 TUBING AND TUBE FITTINGS

Hydraulic or Pneumatic tubing shall be UNS N08904 (904 L SS) as per ASTM B 677-91.

Tubing fittings shall be double compression double-ferruled type of 6MO in accordance with ASTM A 182 and ASTM A 479.

Tube size:

- Pneumatic – 3/8" OD *0.035", 1/4" OD *0.035" or 1/2" OD *0.049" or 3/4" OD *0.049" wall thickness or 1" or size as recommended by Actuator Valve VENDOR. In general, 3/8" tubing / fittings to be avoided and 1/4", 1/2", 3/4" or 1" to be used as far as possible.
- Hydraulic - 1/2" O.D. * 0.065" wall thickness or as recommended by Actuator Valve VENDOR.
- If any component(s) separate mounting is proposed, VENDOR shall specify the maximum distance (tubing length) that can be used while still maintaining specified performance. This tubing length shall be used for FAT.

7.18 FIRE PROOFING

All Emergency Shutdown Valves (SDV or ESDV) and Emergency Blowdown valves (BDV or EDPV) for which fireproofing will be required are identified on the FESA reports following:

- Fire & Explosion Safety Assessment (FESA) Study Report- Al Ghallan (Doc. No. E1150-SR-2000-N-0022).
- Fire & Explosion Safety Assessment (FESA) Study Report – Ettouk (Doc. No. E1150-SR-2100-N-0005).
- Fire & Explosion Safety Assessment (FESA) Study Report – Assefiya (Doc. No. E1150-SR-2200-N-0005).
- Fire & Explosion Safety Assessment (FESA) Study Report - Umm Al Anbar (Doc. No. E1150-SR-2300-N-0005).

Fire proofing enclosures shall be provided for Emergency Isolation and Blow-Down On-Off valves when specified in associated Instrument Valve Data Sheets and these shall have a certified rating according to the requirement established on the FESA study reports mentioned above.

Fire proofing enclosure shall be provided when specified with rating at 1100°C (2012°F) for 20 minutes as per API 2218.

Easily removable jacket type fire protection shall be provided.



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8. MATERIALS REQUIREMENTS

Requirements given here are typical to serve as guideline. VENDOR to ensure that the proposed materials are suitable and corrosion/ abrasion resistant in respect of the service conditions specified in the data sheet.

The material selection shall be as per the project Specification for Instrument Material selection (Doc. No. E1150-TS-2000-J-0010), Piping Material Specification (Doc. No. E1150-TS-2000-P-0001) and valve data sheet listed in section 4.3.

All valve body and trim (wetted parts) materials shall be ASTM and UNS designated.

Use of Aluminium, Cast iron or Ductile-iron is not acceptable.

Carbon steel body with SS 316L trims or wetted parts for valves and equipment shall be provided as a minimum.

Wetted parts materials shall comply with requirements of NACE MR01-75/ ISO 15156, for sour service applications.

For the other material of construction of the valve shall be as per the requirements of respective manual valve Piping Specifications (Ball or Butterfly) listed in section 4.3.

Soft seal material shall be Viton, with other material selected based on service conditions specified in Data Sheet.

The inner valve gaskets, if applicable, shall be non-asbestos suitable for the process fluids at specified maximum service conditions. Teflon Gaskets shall be used (as a minimum) with other material selected based on service conditions specified in Data Sheet.

Actuator (air) diaphragm material shall be nylon reinforced neoprene or Buna-N rubber. However Buna N rubber shall not be used for valves on Instrument gas motive power.

All metal accessories and auxiliaries shall be in SS 316L, unless otherwise specified.

Air set shall be SS 316L and painted.

Mounting plates, fasteners and fixtures shall be in corrosion resistant painted SS 316L.

Use of SS 304 is prohibited.

All fibre glass components should have Ultraviolet stabilizer agent to safeguard against solar radiation.

Wherever galvanizing is done as a protecting method for structures, it should be done by hot dipping process only.

9. INSTALLATION / COMMISSIONING REQUIREMENTS

When all the components / accessories are mounted inside the SS316L enclosure, the same shall be properly accessible and removable easily for replacement / maintenance.

Shutdown Valves shall be installed in horizontal lines. However, VENDOR shall furnish permissible mounting arrangements in his manual.

Certified and tested Lifting eyes for actuator shall be provided.

VENDOR shall ensure that all items however small are installed, mounted and supported. No item shall be supplied loose for field mounting by others.



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If any component to be proposed for a separate mounting, then VENDOR shall specify the maximum distance (Tubing length) that can be used while maintaining specified performance. This tubing length shall be used for FAT.

Accessories shall be rigidly mounted and bracketed to the Shutdown valve.

VENDOR shall provide clear commissioning instructions for each part & model offered.

All external earths of all items on actuator such as solenoid coil enclosure, limit switches etc., shall be connected to a common earth stud which in turn will be connected to the plant safety earth (by others). Valves shall have common 10mm earth boss for connection.

The detailed requirements for Instrument and Control Installations are stated in the associated Specification for Instruments & Control Installations (Doc. No. E1150-TS-2000-J-0012).

10. SURFACE PROTECTIVE COATING / PAINTING

External Painting and coating for Shutdown valves shall comply with Specification for External and Internal Coating (Doc. No. E1150-TS-2000-W-0004).

Painting shall be as per the manufacturer's standard for items not addressed in the Project Specification for External and Internal Coating (Doc. No. E1150-TS-2000-W-0004) and undefined within this specification and the associated Instrument Valve Data Sheet. VENDOR shall furnish his standard painting procedure as part of the Bid documentation for CONTRACTOR review and approval.

Colour and finish shall be to manufacturer's standard for items not addressed unless otherwise specified in the Project specification and Data Sheets. This shall require prior approval from CONTRACTOR.

Colour code for finish:

- Body: Light Grey to 10-A-03 as per BS-4800 or equal.
- Actuator:
 - Fail Close: Green to 14-E-53 as per BS-4800 or equal.
 - Fail Open: Yellow to 08-E-51 as per BS-4800 or equal.
 - Fail Lock: Light Grey 10-A-03.

Items shall be painted for highly corrosive, humid, salt laden marine environment.

Painting / Coating shall not foul threaded connections or jeopardise the proper operation of moving parts.

All fiberglass components should have Ultraviolet stabilizer agent to safeguard against solar radiation.

VENDOR to maintain highest standards of painting procedure to maintain high quality painting at each stage of the process to ensure durability of paint in harsh marine environment.



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11. QUALITY ASSURANCE / QUALITY CONTROL REQUIREMENTS

The product VENDOR shall maintain an effective Quality Management System which shall be certified to latest edition of ISO 9001 Quality Management Standards and ISO 9004 Quality management - Quality of an organization-Guidance to achieve sustained success.

The VENDOR shall submit his QA/ QC procedure for review and approval by the CONTRACTOR/COMPANY, clearly indicating the tests to be conducted, test equipment to be used, detailed test procedures and expected outcomes and performance levels. Control of non-conformity and corrective action and its long-term effects, if any, shall also be detailed. All the events and results shall be recorded.

It shall be VENDOR's responsibility to ensure all the inspection, test and calibration equipment is capable of meeting desired accuracy, precision and repeatability criteria.

Certified calibration certificates from locally recognized and certified laboratory shall be furnished, when requested/ needed.

A Certified copy of Calibration procedure for each type of testing instrument shall be furnished for CONTRACTOR/COMPANY's information and use.

All items shall be warranted against defective materials as required by Project specifications but (in any case) not less than 12 months in operation or 18 months from the date of shipment. Defective parts found within the guarantee period shall be replaced / repaired free of cost to permit the units to perform to design conditions.

12. INSPECTION AND TESTING REQUIREMENTS

The Inspection and Testing requirements for Actuated On-Off Valves shall include Factory Acceptance Test (FAT) which shall be witnessed by COMPANY/CONTRACTOR and/ or Third-Party Inspector.

FAT procedures shall be submitted for approval, prior to FAT. Vendor shall submit SAT procedures for COMPANY approval prior to SAT.

The VENDOR shall submit the following Factory test certificates/ reports for Purchaser's review, prior to FAT, as applicable.

Dimensional verification (all valves)

Face-to-Face and other Dimensional verification for each type and size shall be carried out in accordance with the relevant standard. Flange face finish shall also be carried out.

Material test certificates (all valves)

The material certificate of the valve shall be as per the requirements of respective manual valve Piping Specifications (Ball or Butterfly) listed in section 4.3.

For valves 3" and above with 300 #:

- Material Certificate EN10204 3.2 shall be provided for valve bodies and internals
- Material Certificate EN10204 3.1 shall be provided for actuators. Non pressure retaining parts to EN10204 2.2.

Welding (as applicable)

Welding shall be carried out only by qualified welders using qualified welding procedures (WPQR/WQT).



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Welding procedures, performance of welders and welding operators shall meet the requirements of ASME B31.3. Certificates for castings shall include weld repair data including extent of repair, WPS, welder qualifications, post weld heat treatment and NDE following the repair(s). Repair welding shall be performed using a properly qualified and approved procedure. A repair procedure must include a method statement regarding the excavation, NDT, and welding requirements. The repair of major defects shall not be performed without the knowledge of the CONTRACTOR. Welding, NDE and heat treatment procedures require submittal and approval by the CONTRACTOR/ prior to affecting the repairs.

NDT (as applicable)

Magnetic particle test, Dye penetration test, Radiography or Ultrasonic examination shall be carried out for weld integrity/internal defects check and shall be as per the Piping Specifications identified in clause no. 4.3 of this specification.

NACE Test (for Valves in sour service applications)

Hardness test for wetted parts and any other test needed for compliance to NACE MR-0175/ ISO 15156 shall be provided as mentioned below.

- Valve body and trim material shall be subjected to hardness test to ensure that the hardness requirements of NACE MR0175 / ISO 15156 are met.
- For small items (e.g. springs, pins, etc.) which cannot be hardness tested individually the VENDOR shall conduct tests on a random basis by selecting components from production runs or stores batches to ensure that the product complies fully with NACE MR0175 / ISO 15156 requirements.
- Hardness test shall be performed without damaging any component.

Hydro-test (all valves)

Hydrostatic test pressure shall be 1.5 times the MAWP at ambient temperature and there shall not be any visible leak during the test.

The minimum test duration shall be 60 sec for body size 1" and below, 120 sec for body sizes from 2" to 8" and 180 sec for valve body size 10" and above.

Hydro test for shell and packing shall be performed with actuator fitted.

The Water quality shall be clean potable water, clear and free of sulphides, having below 30ppm chlorides and with temperature below 50°C.

Valve shall be air dried after test.

Pressure testing on cylinders shall be carried out for Hydraulic actuators and Pneumatic Piston/ Cylinder actuators to manufacturer's standard.

Requirements of Piping Specifications identified in clause no. 4.3 of this Specification shall also be met.

Valve Seat leakage (all valves)

Seat leakage class shall be Tight shutoff Rate A as per ISO 5208 and as indicated in the Instrument Valve Data Sheet.

Helium leak test (type test) for Hydrogen rich applications or N2 / Helium low temperature or cryogenic applications shall be performed only when specified in Data Sheet as a Type test or for EPA certification requirements.



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Requirements of Piping Specifications identified in clause no. 4.3 of this Specification shall also be met.

Fugitive Emission Test (as applicable)

Wherever fugitive emission tests are specified, valves shall be subjected to prototype and production tests in accordance with ISO 15848 part 1 and part 2 respectively as per the datasheet and compliance certificate shall be provided for all applicable valves and shall meet:

- i. Class BM for quarter turn valves
- ii. Class CM for rising stem valves

For hydrogen service these requirements shall be:

- i. Class BH for quarter turn valves
- ii. Class CH for rising stem valves

Actuator Tests (all valves)

Actuator tests shall include Differential Pressure Test, Rated Valve Travel and Stroking time tests. Stroking time test shall be done on minimum instrument air supply pressure.

Actuator tests shall be performed with Instrument air or Nitrogen only for Pneumatic actuators.

Hazardous area certificate and Ingress protection certificate check for all applicable components.

Functional Test/ Checks (all or random for CONTRACTOR/COMPANY witness but all valves shall be inspected by Third Party Inspector).

Functional Test/ Checks of the valve & actuator assembly shall include Performance and Mechanical operation test.

It shall also include tests for auxiliary connections, speed control, limit switch actuation & other accessory / auxiliaries' calibration, Wiring, Painting & coating, Marking etc.

Accumulator back-up tests for actuators shall be after an eight-hour period after hydraulic supply is stopped for simulation of motive fluid failure.

Performance and Mechanical Operation

The valve shall be completely assembled and fitted with all accessories. The packing box shall be correctly packed to the tightness as needed for the hydrostatic test (if necessary, packing shall be renewed after testing).

The performance and mechanical test shall include a stroking time test.

The actuating medium for the tests shall be clean, dry air or nitrogen at a supply pressure of 4.5 kg/cm², unless otherwise specified. Where filter regulator is included in the assembly, the test shall be repeated with a supply pressure of 8 kg/cm² to the regulator.

For each valve the stroking time at the specified air pressures shall comply with the requirement specified in the data sheets.

If the valve is equipped with a handwheel, the fully open and closed position of the valve shall be achieved with handwheel operation, taking over from actuator starting at mid-position.



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If the valve is equipped with limit switches, they shall be checked for functional operation. The Inspection and test plan shall be developed and agreed with COMPANY prior to inspection and testing activities and subsequent notification and approving authorities are decided.

- Functional Tests (tests where applicable per valve type):
Functional testing of the valve and actuator shall include, but not be limited to, the following:
 - Actuator operation: cycle (open/close) each valve with its actuator at least five times
 - Verify: opening and closing times; that valve position coincides with position indicator, and limit Switches
 - Buffer Vessel capacity: cycle (open/close) each valve with its actuator three times
 - Operate valve using resets / overrides on solenoid valve (if such has been specified)
 - Simulate Partial Stroke Test (PST) by operating the valve utilizing the Partial Stroke Testing functionality and verify a subsequent ESD signal will override the PST and drive the valve to the failsafe position
 - Hydraulic test of valve, at test pressure as per API 6D
 - Air Seat test per C.3 of API 6D

The Inspection and Testing requirements for a Shutdown Valves shall include a witness test & inspection with a Factory Acceptance Test (FAT) and Site Acceptance Test (SAT) by Purchaser and/or Third-Party Inspector. 100% of valves shall be inspected. VENDOR shall submit FAT and SAT reports.

13. **MARKING AND TRACEABILITY REQUIREMENTS**

Each instrument shall bear corrosion resistant SS316L tag plate riveted to the instrument body engraved with the given below details. The letter height shall be minimum 2 mm and location of the plate shall permit easy readout in all possible installed positions.

The following minimum information shall be clearly and deeply stamped or engraved on the plate(s) of Actuated On-off valves and auxiliaries:

a. On Valve

- Tag Number as per the associated Instrument Valve Data Sheet.
- Manufacturer's Name, model no along with Serial Number and year of manufacture.
- Melt Identification (Heat no.).
- Relevant codes and standards.
- Body Size and End connection detail.
- Flow direction.



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- Valve rating (MAWP).
- Leakage Class.
- Material (body and internals exposed to the process fluid).
- Relevant process data.
- Maximum Gross Weight.

b. On Actuators

- Actuator bench setting.
- Maximum / minimum supply pressure.
- Maximum travel.
- Failure position.

c. On Hydraulic Actuator systems

Stainless Steel tags & description on every item / component on the Hydraulic Panel / Assembly and easily relatable to project specific hydraulic flow diagram to be submitted with the bid and commissioning / maintenance instructions.

Other detail to Manufacturer's standard.

d. On Instrument Auxiliaries (as applicable)

- Manufacturer's model no along with Serial Number.
- Input Signal.
- Output signal.
- IP or NEMA class marking as well as hazardous area certification mark where applicable.
- Supply pressure.
- Any other relevant data as per Manufacturer's Standard.

14. HANDLING, STORAGE, PRESERVATION AND PACKING REQUIREMENTS

Prior to shipment/packing all threaded and flanged openings shall be suitably protected to prevent ingress of foreign matter.

Packing and Preservation shall be suitable for the road, air and sea freight (open stowage) and subsequent short or long-term storage.

Instruments requiring indoor or special storage shall have specific legends outside the packing to ensure proper visual identification and compliance to handling/storage/presentation requirements.

All instruments shall be duly marked with the tag number at the packing box. Sufficient quantity of desiccant material should be stuffed in permeable sachets to safeguard against ingress of moisture.

Unpacking instructions should also be pasted.

All tubing shall be properly supported and secured with the valve yoke in a manner to ensure protection during transport.



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15. SPARES, CONSUMABLES AND SPECIAL EQUIPMENT

VENDOR shall recommend and supply spare parts for commissioning and start up as part of his scope of supply. List of the same should be provided with the bid as well as included in the final VENDOR documentation.

The VENDOR shall recommend and submit his priced spare parts list for two years of operation strictly in accordance with COMPANY Spare Parts Procedure including Standard Form for "Spare Parts" referred in the Purchase Requisition. Spare parts shall include at least one per type of auxiliary or accessory unit specified.

The spare part lists shall detail:

- Identifying model and/or figure number of the main equipment being quoted
- Part number and identification name
- Drawing or sketch number
- Source of the part. When a part is not manufactured by the VENDOR the original supplier's identification must be given
- Price of spare parts
- The lead time for supplying additional spares shall be quoted, (e.g., ex. stock, 30 days, subject to quotation, etc.).
- SPIR (Spare parts Interchangeability record)

All spare parts shall be clearly marked and identified using a concise tag number.

Original spare parts shall be guaranteed available for a period of 15 years from the date of delivery.

16. TRAINING

VENDOR shall quote for training of various categories of instrument personnel necessary to maintain and troubleshoot the valves supplied. Such training shall preferably be imparted at site subsequent to installation of valves at site and prior to commissioning.

Training shall be in person with actual conditions (not virtual) in minimum two batches of the site personnel. Training agenda, materials, schedule shall be shared by VENDOR in advance and agreed with COMPANY Site Maintenance team. VENDOR shall provide training through standard courses conducted by full-time training staff.

Training shall be carried out in the English language with an option of providing an Arabic translator. Course notes and drawings shall be in English.

17. QUOTING INSTRUCTIONS (TECHNICAL)

All bids shall be submitted complete with the following technical details:

- Completed Instrument data sheet.
- Complete Bill of material
- Catalogue details.
- Model number with decoding details.
- Options listed separately with unit costs.
- Information on weights



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- Painting specifications
- Impact on delivery for any stated custom technical requirements.
- List of exceptions & Non-compliance list (mandatory).
- List of spares, consumables, special tools, tackles and equipment (if any) for startup and Commissioning.
- List of Spares, Consumables for 2-year operation spares (maintenance spares).
- List of similar supply made in last five years.
- Latest ISO-9001 certificate.
- Sizing Calculations Sheet (Torque calculations for Actuator).
- SIL Certificates/Report

18. VENDOR DESIGN DATA

The VENDOR shall be responsible for supplying the data as specified in the VDRS. The following documents shall be supplied as a minimum for COMPANY's information and use. The data shall be preferably on CD, properly indexed and readable like an e-Book. In such cases only one set of hardcopy of documentation would be needed.

- Filled in Instrument Data Sheets in as per Project Format.
- Torque calculations for Actuator & Valve.
- Logic Schematics for Valve Actuation.
- Wiring & Hook-up details schematic.
- OEM catalogues and O&M manuals.
- Outline/ General Arrangement Drawings with Bill of Material and Weight Data.
- Material, Mill and Calibration Test Certificates.
- IP & Hazardous Area Certificates.
- Installation, Operational & Maintenance Procedure/ Manual.
- Painting Procedure.
- Fabrication and Quality Control Plan.
- VENDOR Data Book
- List of Spares, Consumables, Special tools and Equipment for Start-up and Commissioning.
- List of Spares, Consumables for Two years operation.
- Manufacturing Record Book.
- Welding Procedure Specification.
- Functional Safety Assessment Reports/ Failure Rate data, SIL Certificate, Safety Manual.
- Response Time.
- Guarantee/Warranty.
- FAT Procedure.
- Calibration and Pressure Testing Procedure.
- Calibration Report.
- Start-up and Commissioning.
- Manufacturing Schedule



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- Fire Safety Certification
- Pneumatic - Hydraulic Schematic
- Inspection Test Plan
- Fugitive Emission Test Procedure (As applicable)
- Liquid Penetrant Test Procedure
- Magnetic Particle Inspection Procedure and report
- Positive Material Identification - PMI – Procedure
- Pressure and Leak Test Procedure and Record
- Radiography Test Procedure and report
- Seat Leak Test Procedure and report
- Lubrication requirements
- Certificate of Compliance – Conformity
- Name Plate Detail
- Volume tanks calculations
- PFD Average / SIL Report Calculation for the complete valve assembly (valve, actuator, components etc.)

19. APPENDICES

Appendix-1A: Partial Stroke Testing Scheme for Pneumatic Single Acting Valve

Appendix-1B: Partial Stroke Testing Scheme for Pneumatic Double Acting Valve



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APPENDIX-1A: PARTIAL STROKE TESTING SCHEME FOR PNEUMATIC SINGLE
ACTING VALVE

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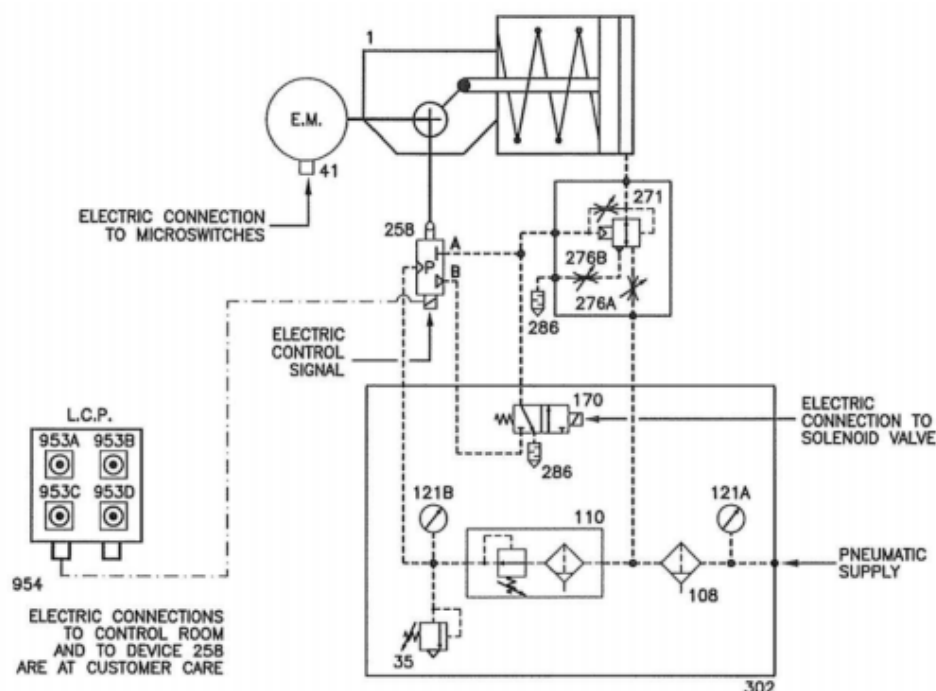
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PARTIAL STROKE TESTING SCHEME FOR PNEUMATIC SINGLE ACTING VALVE



- | | |
|--|--|
| 1 - Single Acting Spring Return Pneumatic Actuator | 258 - DVC6200 HART Valve positioner |
| 35 - Relief Valve | 271 - Pneumatic Booster + By-Pass (does not interfere with shutdown command) |
| 41 - Valve feedback limit switch | 276 - Bidirectional Flow Regulator (Adjustable Setting) |
| 108 - Pneumatic Filter With Manual Drain Valve | 286 - Dust Excluder |
| 110 - Filter Regulator | 302 - Panel |
| 121 - Pressure Gauge | 953 - Push Button – (Refer Detail below) |
| 170 - Direct Acting Solenoid Valve | 954 - Local Control Push Button |

Details of item 953 above

L.C.P Push button detail

A- Open PB

B- Close PB

C- Reset PB

D- Spare PB

NOTES:

1. The above sketch is only conceptual. Actuator / Valve VENDOR shall develop a detail drawing.
2. All ESDV / EPDV SOV shall have Auto Reset facility.
3. Actuator cylinders shall be designed to ASME VIII and welding shall be in accordance with the provisions of ASME IX.



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APPENDIX-1B: PARTIAL STROKE TESTING SCHEME FOR PNEUMATIC DOUBLE
ACTING VALVE

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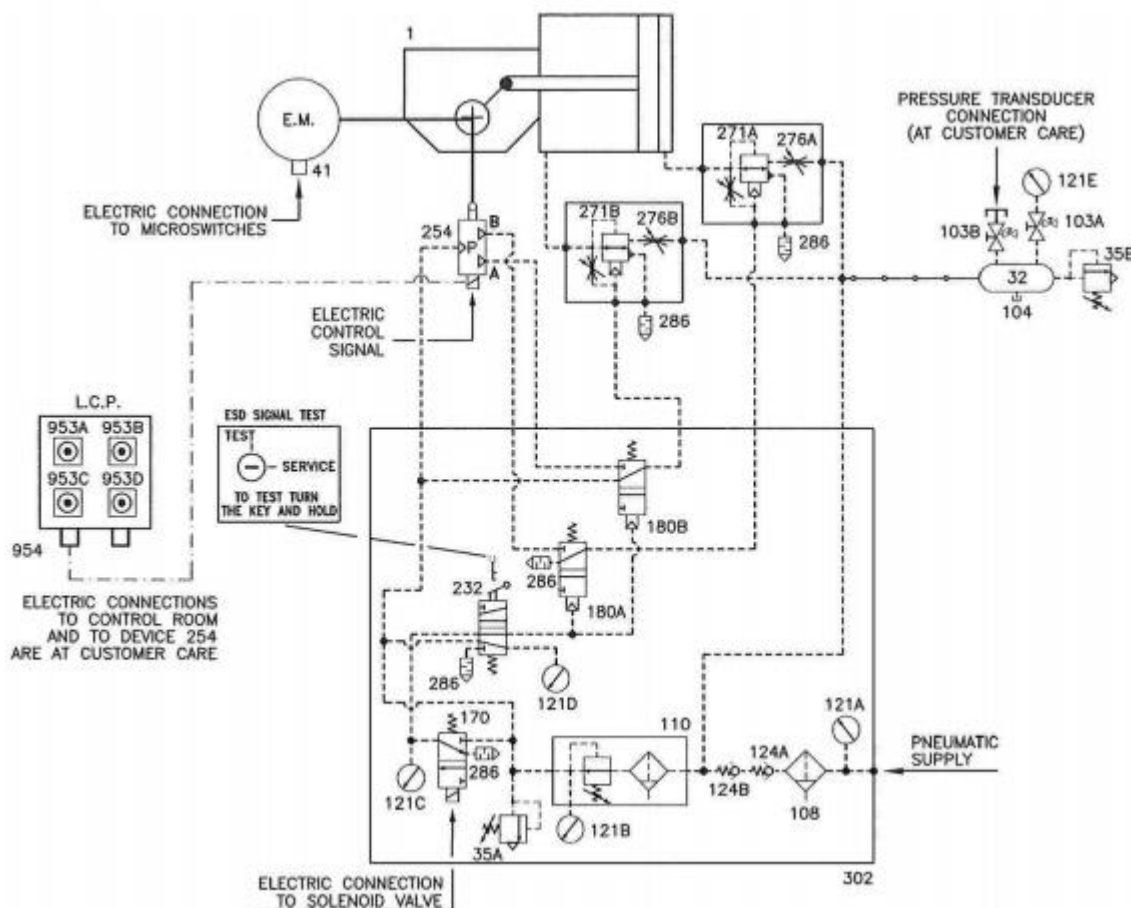
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PARTIAL STROKE TESTING SCHEME FOR PNEUMATIC DOUBLE ACTING VALVE



- 1 - Double Acting Pneumatic Actuator
- 32 - Air Storage Tank
- 35 - Relief Valve
- 41 - Valve feedback limit switch
- 103 - Needle Valve with Drain Valve
- 104 - Manual Drain Valve
- 108 - Pneumatic Filter With Manual Drain Valve
- 110 - Filter Regulator
- 121 - Pressure Gauge
- 124 - Check Valve
- 170 - Direct Acting Solenoid Valve

- 180 - 3/2 Univ. Operation Pneu.Pilot – Spring Return Valve
- 232 - 5/2 Univ. Oper. Hand Operated – Spring Return Valve
- 254 - DVC6200 HART Valve positioner
- 271 - Pneumatic Booster + By-Pass (does not interfere with shutdown command)
- 276 - Bidirectional Flow Regulator (Adjustable Setting)
- 286 - Dust Excluder
- 302 - Panel
- 953 - Push Button – (Refer Detail below)
- 954 - Local Control Push Button

Details of item 953 above

L.C.P Push button detail

A- Open PB

B- Close PB

C- Reset PB

D- Spare PB



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