



# **HPOIL GAS PRIVATE LIMITED CITY GAS DISTRIBUTION PROJECT IN NAGALAND STATE GASs**

## **SUPPLY OF CHECK METERING SKID AT DIMAPUR FOR THE STATE OF NAGALAND**

### **Bid Document For**

**Tender Number : HOGPL/VCS/2025-26  
/C&P-NL/PRC/CMS/014**

**Revision : C1**

**Issued : 04.08.2025**



ENERGISING QUALITY

**VCS Quality Services Private Limited**



# VCS Quality Services Private Limited

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Energising Quality

**PROJECT NUMBER: C261162**



HPOIL GAS

SCOPE OF WORK OF FOR CHECK METERING SKID

Total Sheets

8

**Document No**

C261162

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IN

SOW

5002

## **HPOIL GAS PRIVATE LIMITED CITY GAS DISTRIBUTION PROJECT IN NAGALAND STATE GAS**

### **SUPPLY OF CHECK METERING SKID FOR CITY GAS DISTRIBUTION PROJECT AT DIMAPUR FOR THE STATE OF NAGALAND**

C1	30.07.2025	Issued for Client Review	PS	AS	PK
<b>REV</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>PREP</b>	<b>CHKD</b>	<b>APPR</b>

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## 1.0 DEFINITION

Where used in this document, the following terms shall have the meanings indicated below, unless clearly indicated by the context to this order

PROJECT	Supply Of Check Metering Skid City Gas Distribution Project at Dimapur for the State of Nagaland
OWNER	HPOIL Gas Private Limited
CONSULTANT	VCS Quality Services Private Limited (VCS) the party to act for and on behalf of OWNER for the Detailed Engineering Services and Project Management.
VENDOR/ MANUFACTURER	Party, which manufactures and supplies equipment and services to the OWNER or to CONTRACTOR

## 2.0 INTRODUCTION

HPOIL GAS Private Limited. (Joint venture of HPCL & OIL India Ltd.) has received the authorization from PNGRB vide letter PNGRB/CGD(06)/2023/12.04 GA/Nagaland State dated 19/04/2024 to Lay, Build and Operate City Gas Distribution networks in Nagaland State GAs. HPOIL GAS Private Limited (hereinafter referred as HOGPL/Owner), is supplying Piped Natural Gas (PNG) to domestic, commercial and Industrial consumers and Compressed Natural Gas (CNG) to automobiles in Nagaland State GAs. HPOIL GAS Private Limited intends to provide the network to cover areas of Nagaland State GAs to supply Natural gas to Domestic, Commercial consumers through MDPE network and to new CNG stations through steel pipeline network.

## 3.0 PURPOSE OF THE DOCUMENT

The present project is for expansion of pipeline network in Nagaland State GAs for Supply of Piped Natural Gas (PNG) to Domestic, Commercial and Industrial consumers and Compressed Natural Gas (CNG) to automobiles consumer.

The purpose of this document is to define the minimum technical requirements and vendor's scope of work/supply of Check Metering Skid to be purchased for this project.

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## 4.0 ABBREVIATIONS

AGA	American Gas Association
SSV	Slam Shut Valve
OFC	Optical Fiber Cable
IS	Intrinsically Safe
FAT	Factory Acceptance Testing
FDS	Functional Design Specification
ITP	Inspection Test Plan
NIS	Non-Intrinsically Safe
PNGRB	Petroleum & Natural Gas Regulatory Board
QAP	Quality Assurance Procedure
RTU	Remote Terminal Unit
HMI	Human Machine Interface
SAT	Site Acceptance Testing
SCADA	Supervisory Control and Data Acquisition
SPIR	Spare Parts Interchangeability Record
TCP/IP	Transmission Control Protocol/Internet Protocol
TIT	Temperature Indicating Transmitter
PIT	Pressure Indicating Transmitter
ZT	Positional Transmitter
DPT	Differential Pressure Transmitter
PG	Pressure Gauge
PSV	Pressure Safety Valve
PCV	Pressure Control Valve
MOV	Motor Operated Valve
TFM	Turbine Flow Meter
RPD	Rotary Positive Displacement
GDS	Gas Detection System
MR	Material Requisition

## 5.0 DOCUMENT PRECEDENCE

It shall be the responsibility of the Manufacturer/Vendor to inform the Purchaser of any errors, ambiguities, inconsistencies, discrepancies, or conflict of information that may be found to exist in any document, specification or drawing submitted by the Purchaser.

In case of conflict, the order of precedence shall be as follows:

- Data sheets;
- Material Requisition;
- Scope of Work;
- Standard Specifications;

- Other Approved Documents/Drawings;
- International & National Codes & Standards;

As a rule, in the event of any discrepancy between technical matter and local laws / regulations and documents above listed the most stringent shall be applied.

Manufacturer/Vendor shall notify Purchaser of any apparent conflicts between MR, specifications, related datasheets, any code and standards and any other specifications noted herein. (Resolution and/or interpretation precedence shall be obtained from Purchaser in writing before proceeding with the design/manufacturer or completion of services.)

## 6.0 SCOPE OF WORK

### 6.1 Brief Scope of Work

- Vendor's Scope of Work shall include supply, Design, Engineering, Fabrication, Testing, Software Programming, Software Configuration, Transportation, and Documentation of Check Metering System using Turbine Flow Meter & RPD Meter Along with 1 Nos. Flow Computer with Flow Computation Software' shall be mounted in an Explosion Proof Enclosure in field including all the Valves, Fittings, tubes, Piping etc. as mentioned in the P&ID and Specifications, Supply of Commissioning & two years O&M Spares/ Special Tools and Tackles, Supervision of Installation, Integration with third party systems viz. RTU etc., Commissioning, Handing Over and Performance Guarantee of the same.
- Process Conditions and Gas Composition data required for design of the systems are provided in tender P&ID
- Meter tube configuration in Check metering skid shall be 5 D + Flow Straightener + 5D + TFM/RPD + 5D as per AGA report No. 7. There shall be no welds in meter tubes and the meter tube shall be honed to mirror finish.
- All field components such as piping, valves, fittings, meter, meter tube, associated instrumentation etc., of check Metering System shall be mounted on a fully grated Skid Frame with necessary Walkways and Crossing platforms.
- All Electrical and Instrumentation cables for the skids shall be terminated by the vendor up to skid edge junction boxes and from Skid Edge Junction Boxes to Flow Computer in skid vendor Scope. Junction boxes shall be provided individually for IS, non- IS, and Power Services.
- All associated Civil, Structural, Piping, Mechanical, Electrical & Instrumentation; works shall be performed in accordance with relevant specifications, drawings and requirements.
- Turbine Flow Meter & RPD Meter shall be dry calibrated at Vendor's works and wet calibrated at approved third party laboratory viz. CEESI, NMi, PTB, Pigsar, FCRI. Wet calibration of Turbine Flow Meter & RPD Meter shall be carried out with its own meter

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tubes (upstream and downstream) and profiler at a pressure around middle of the operating pressure range.

- viii) All calculations within flow computers including uncertainty calculations shall be submitted for owner review/ approval and upon approval submitted as part of final documentation.
- ix) Vendor shall prepare a complete dossier comprising of all information/ data required for joint calibration with customer which shall include calibration certificates/ reports of individual instrument/ wet and dry calibration reports of TFM & RPD meter as a minimum.
- x) The dossier shall be submitted as part of documentation and a copy of the same to be provided at respective sites.
- xi) Latest version of Diagnostic software's for Flow computer, Turbine Flow Meter & RPD Meter shall be supplied. Vendor shall install the diagnostic software in owner's laptop and demonstrate its working. All software licenses shall be in the name of the owner and shall be provided to owner's representative at site. A copy of the license shall also be provided as part of final documentation.
- xii) Vendor's proposal shall be in complete compliance with the requirements of the referenced specifications and datasheets including the following: -
  - Vendor shall take overall responsibility to ensure that the Check Metering System is fully functional and meets all the requirements of the relevant specifications, data sheets, drawings, and requirements of statutory authorities.
  - Project execution plan, Project schedule and stage wise implementation schedule including sub-ordering etc. shall be furnished to owner with weekly updation.
- xiii) Vendor shall provide a list of testing laboratories used for welding qualification tests and weld result tests with product accompanied documentation. All welding procedures and qualification tests shall be approved and signed by an AWS certified welding inspector. Manufacturers and sub-supplier's welding procedures shall be submitted to OWNER for review and formal approval prior to start of welding.
- xiv) Compliance by Vendor with the provisions of this package does not relieve Vendor of the responsibility of furnishing material of proper design, suited to meet safety and operating guarantees of integrated system.
- xv) The Vendor shall be solely responsible to review, assimilate, update and expand information contained within this document and/or inputs that may be provided by the OWNER during the course of the project.
- xvi) If this document does not contain all information that the Vendor may deem necessary for the supplies and services as defined hereunder, the Vendor shall contact OWNER in writing for such information. Lack of information shall not exempt Vendor of his responsibilities to obtain the necessary information under its contractual obligation.
- xvii) Vendor shall carry out all incidental and associated works and any other works not specifically listed herein but are required to be carried out to complete entire work and the associated facilities and making the entire system ready for operation.

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## 6.2 Scope of Supply

- i) The scope of skid supply is as below: -
  - a. Check Metering System along with 1 Nos. Field mounted Flow computer mounted in Explosion Proof Enclosure.

Note: Refer P&ID's referenced in this tender
- ii) Check Metering shall be designed to meet the desired functionality of Metering and regulation.
- iii) Vendor to calculate the power consumption and heat dissipation of the complete package and submit the same at the initial phase so as to facilitate engineering of power supply system by OWNER appointed Engineering Consultant.
- iv) Contractor shall procure and supply all materials other than Company supplied free issue items/ materials, required for permanent installation of I&C items in sequence and at appropriate time. All equipment, materials, components etc. shall be for the intended service, with high reliability and proven track record.

## 6.3 Scope of Services

- i) Vendor shall be responsible for Supervision of Installation, Testing and Commissioning of the Check Metering System along with 1 Nos. Field mounted Flow computer mounted in Explosion Proof Enclosure.
- ii) Erection, Installation of Skid's including laying of instrumentation cable from Instrument to JB and JB to Flow computer, Termination etc.
- iii) All works shall be undertaken in coordination with and upon approval from the concerned person of OWNER/OWNER Representative.
- iv) Coordination and supervising the work of sub-Contractors. (If any)
- v) All construction works shall be carried out as per "Approved for Construction" drawings, procedures, specifications and applicable codes and standards. Any changes at site shall need prior approval from the Company followed by subsequent revision of relevant drawings upon approval;
- vi) Vendor shall mobilize required manpower equipped with necessary software and computer hardware tools, test and calibration equipment and Tools & Tackles required for completing the works within the agreed schedule.
- vii) Vendor's installation supervisor shall visit the designated store / site at least 2 weeks before to assess the condition of received material. Any shortfall in supply also to be identified and necessary corrective action taken.
- viii) All installation works for the field equipment and the panel at site shall be carried out by third party Installation Contractor appointed by OWNER. The Vendor's representative shall be suitably skilled for supervising the installation works and shall guide the installation contractor for correct installation, as required.
- ix) Pre-commissioning of the system shall be done jointly with OWNER's representative. Assistance, if required, from station Instrumentation contractor for pre-commissioning shall be extended through OWNER's site representative for

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termination, loop checking, calibration etc.

- x) Third party interface with RTU/SCADA system shall be tested along with RTU/SCADA vendor(s) based on the interface document(s) prepared by Vendor and approved by OWNER. Minor modifications to the interfacing found during testing shall be carried out by the Vendor to complete the interface testing.
- xi) Site Acceptance Testing (SAT) shall be carried out as per document prepared by the vendor and approved by OWNER. SAT document shall be completed and duly signed by Vendor's and OWNER's representative(s).
- xii) Under certain circumstances, OWNER may require the Vendor's representative to assist in "Joint Calibration" with the party to whom gas is to be supplied. Vendor shall extend full assistance for completing the joint calibration successfully. Any faults/ defects observed at any stage are to be immediately attended.
- xiii) Vendor shall provide necessary guidance/ hands-on training to OWNER's representative(s) at site so as to facilitate future Operations and Maintenance of the system.
- xiv) Markup all documentation related to the system for any site changes and OWNER's site representative's approval obtained. Vendor shall complete As-built documentation and submit to OWNER after incorporating all the field changes.
- xv) All Safety compliances, Work Permits and Quality requirements prevalent in the station shall be strictly complied with.
- xvi) Contractor shall ensure that all works are carried out in accordance with the requirements of the applicable codes and standards and shall conform to the Oil Industry Safety Directorates (OISD) Standards 138 and 141 and other local rules and regulations including PNGRB.

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**MATERIAL REQUISITION FOR CHECK METERING SKID**

Total  
Sheets

11

**Document No**

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# **HPOIL GAS PRIVATE LIMITED**

## **SUPPLY OF CHECK METERING SKID AT DIMAPUR FOR THE STATE OF NAGALAND**

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## ABBREVIATION

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BS	British Standards
TFM	Turbine Flow Meter
DC	Direct Current
ESD	Emergency Shutdown
I/O	Input / Output
IP	Ingress Protection
RPD	Rotary Positive Displacement
PLC	Programmable Logic Controller
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SCS	Safety Control System
SIL	Safety Integrity Level
UPS	Uninterruptible Power Supply



# SUPPLY OF CHECK METERING SKID AT DIMAPUR FOR THE STATE OF NAGALAND



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## 1.0 DEFINITION

Where used in this document, the following terms shall have the meanings indicated below, unless clearly indicated by the context to this order

PROJECT	Supply of Check Metering Skid at Dimapur for the State of Nagaland
OWNER	M/S. HPOIL GAS PRIVATE LIMITED
EPMC	M/S. VCS Quality Services private limited the party to act for and on behalf of owner for the detailed engineering services
VENDOR/ MANUFACTURER	Party, which manufactures and supplies equipment and services to the OWNER or to CONTRACTOR

## 2.0 DOCUMENT PRECEDENCE

It shall be the responsibility of the Manufacturer/Vendor to inform the Purchaser of any errors, ambiguities, inconsistencies, discrepancies, or conflict of information that may be found to exist in any document, specification or drawing submitted by the Purchaser.

In case of conflict, the order of precedence shall be as follows:

- Material Requisition (MR);
- Scope of Work;
- Data sheets;
- Standard Specifications;
- Other Documents & Drawings;
- International & National Codes & Standards;

As a rule, in the event of any discrepancy between technical matter and local laws / regulations and documents above listed the most stringent shall be applied.

Manufacturer/Vendor shall notify Purchaser of any apparent conflicts between MR, specifications, related datasheets, any code and standards and any other specifications noted herein. (Resolution and/or interpretation precedence shall be obtained from Purchaser in writing before proceeding with the design/manufacturer or completion of services.)

## 3.0 SCOPE OF SUPPLY AND SERVICES

Vendor shall be completely responsible to supply below mentioned materials and services for satisfying the functional / operational requirements stated in this Requisition and its Attachments. (Herein after referred as Requisition).

### NAGALAND GA

Item No.	Description	Unit	Quantity
IN000.00.00	<b>Design, Engineering, Supply (including transportation to worksite(s)/workshop(s) loading, unloading and handling at site), Testing and Commissioning and supervision of erection of TFM &amp; RPD type Check Metering Skid along with field mounted Flow Computer mounted in Explosion Proof Enclosure and required accessories as per Datasheets, Documents, Specifications and P&amp;ID etc. attached with the Tender Document.</b>		
IN000.00.01	Design, Engineering, Supply (including transportation to worksite(s)/workshop(s) loading, unloading and handling at site), Testing, Commissioning and Supervision of Erection of Turbine Flow Meter (1500 SCMH to 40000 SCMH) & RPD (20 SCMH to 2000 SCMH) based Check Metering along with Field mounted Flow computer mounted in Explosion Proof Enclosure (1 Nos.).  The Skid comprises of Field Instruments like Temperature Transmitters, Flow Transmitters & Pressure Transmitters, Pressure/Temperature gauge , Restriction Orifice etc., as shown in the P&ID & Datasheets attached with the Tender Document along with associated accessories, instrument fittings, manifolds, impulse tubing with fittings, canopies for instruments, line pipes, valves, NRVs, flanges, gaskets, all structure / supports / operating platforms, internal skid cables (1 Pair/Triad) and cabling from field instruments to field JB's and multipair/Triad/Power cable from field JB to flow computer (Field mounted enclosure), required power cable to the skid, mounting stands and all applicable	Set.	1

	<p>accessories, Supply of erection &amp; commissioning spares, tools &amp; tackles at DIMAPUR NAGALAND GA ;</p> <p>Note: - 1. Supply of Multi Pair signal cable/Power cable/Triad cables /control cables from skid mounted JB to FC/ enclosure shall be in Skid Vendor scope and length shall be finalized as per the site requirement at the stage of detail engineering / document approval.</p> <p>2. The Installation of the Skid shall be in the Station Contractor Scope under the supervision of Metering Skid Vendor. However, Testing &amp; Commissioning shall be in Skid Vendor Scope.</p> <p>3.Data should be interface with odourising unit &amp; flow computer.</p> <p>4.All the specifications &amp; jobs should be inline as per tender document.</p> <p>5.Skid design inline as per P&amp;ID drawing no C261162-01-PC-PID-1001.</p>		
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Vendor shall have complete responsibility for all the items supplied by him including his sub-Vendors if any. The Vendor's scope of work includes, but not limited to the following:

- Design & Engineering as per P&ID.
- Meter tube configuration in Check metering skid shall be 5 D + Flow Straightener + 5D + TFM/RPD + 5D as per AGA report No. 7. There shall be no welds in meter tubes and the meter tube shall be honed to mirror finish.
- Procurement, Supply, Installation, Inspection, Factory Testing and Acceptance.
- Certification shall be 3.2 for all piping material including and 3.1 for instrumentation items coming in Metering skid.
- Vendor to supply, termination, testing of Instrument, Power cables for the instruments present in the skid as shown in the P&ID for integration with Flow Computer & RTU and Power requirement.
- Pre-commissioning & commissioning of the system.
- Transportation, Transit Insurance, loading and unloading of material at site/ stores;



- Rectification of any damage (if any) occurred during transportation/ unloading / observed on receipt of material at site;
- Compliance of Checklist points during FAT, SAT, Site, stores (if any);
- Vendor to provide anchor near to interface point. Further vendor to cross check the adequacy of anchor supports for the loads provided by EPMC.
- If required by Client, Vendor to provide Caesar file of Metering Skid based on which final load is provided.
- Other General scope of work.

It is the responsibility of vendor to verify the sizes of each and every skid component and provide details of the same along with basis of size selection/ sizing calculation.

The vendor shall also be responsible for carrying out any residual basic engineering necessary for proceeding with detailed engineering like equipment/ instrument sizing, utility consumption, specifying derived data in process data sheets, type and material selection of instruments/ equipment's wherever required.

### 3.1 Scope of Design and Engineering

Scope of design and engineering is entire responsibility of successful bidder. Documents and drawings attached in this tender document are minimum requirement. Successful Bidder shall carry out detail engineering of the skid covering all design aspects shall follow as per applicable codes and standards.

Equipment, instruments, and valves shall be sized as per process condition. Sizing calculations are to be provided to Company / PMC for verification / validation. Similarly, all design documents and drawings are to be submitted to company / PMC for approval.

### 3.2 Scope of Residual Engineering

The bidder shall also be responsible for carrying out residual engineering in order to proceed with detailed engineering such as equipment / instrument sizing, utility consumption, specifying derived data in process data sheets, type and material selection of instruments / equipment's wherever required.

### 3.3 Notes to Vendor

Check Metering Skid and its accessories shall be sized as per requirements as mentioned in datasheet, P&ID and suitable for installation.

Vendor shall submit datasheets and drawings for approval. Vendor to proceed further only upon approval of Vendor submitted documents.

Vendor to include the startup and commissioning spares in the quoted price. However, list of spares (start up and commissioning) to be made available without prices as per attached formats. In case no startup/commissioning spares are recommended by the Vendor but the

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same are required at the time of startup/commissioning, Vendor shall supply such spares free of cost.

Vendor shall furnish quotation only in case he can supply material strictly as per this MR and specification / data sheets forming part of MR.

The submission of prices by the Vendor shall be construed to mean that he has confirmed compliance with all technical specifications of the corresponding item(s).

If the offer contains any technical deviations or clarifications or stipulates any technical specifications (even if in line with MR requirements) and does not include complete scope and technical / performance data required to be submitted with the offer, the offer shall be liable for rejection.

Vendor must submit all design documents / drawings / calculations as specified in relevant specification along with offer and after award of order.

Purchaser's inspector reserves the right to perform stage wise inspection and witness tests, as indicated in Specification for Natural Gas Metering skid at Manufacturer's works prior to shipment. Manufacturer shall give reasonable notice of time and shall provide without charge reasonable access and facilities require for inspection to the Purchaser's inspector. Inspection and tests performed/witnessed by Purchaser's inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and test.

Vendor shall deliver the Natural Gas Metering skid as per the P&ID attached elsewhere in the Tender Document at M/s Hindustan Petroleum Corporation Limited Store/Site and the delivery schedule shall be 6 months FOT site basis

## 4.0 WARRANTY

The Vendor will warrant the equipment to be free of defects in material and workmanship and that it is adequately engineered to fulfill the design and operating conditions specified herein. The Vendor shall replace and install without cost any materials, supplies or equipment that fails under design conditions due to defects in design, material, or workmanship. If a defect is observed and/or such failure occurs within one (1) year from the date such equipment is put into operation, the Vendor shall replace and install without cost to EPC Contractor any materials, supplies or equipment involved.

Vendor shall provide another twelve (12) months warranty period for any repair or replacement in whole or in part made during the warranty period beginning on the day of satisfactory restoration of services. If the repair or replacement during the warranty period concerns an essential component, the new warranty shall extend to the whole equipment.

## 5.0 VENDOR DOCUMENTS

This section describes the Vendor Data Requirements applicable to a Vendor's scope. The Vendor data requirements shall be as mentioned in Check Metering Skid specification.

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Vendor shall submit, as a condition of Purchase Order or Contract, all data requirements specified on the Vendor Data Requirements. Electronic copies of all drawings will be provided on CD in DWG format for all drawing issues.

Each document submitted for review must be clear, legible, complete and properly identified. Failure to provide adequate documents may result in them being returned without review at Vendor's expense. In that event, Vendor will be considered not to have formerly submitted the documents so returned.

Vendor shall submit accurate, properly checked documents approved by the responsible Engineer(s). The documents shall be in English language. Dimensions, weights, and measures for drawings, etc. to be in SI units

Vendor shall submit Manufacturers Record Books with all certification, test and inspection information of a manufactured item.

Additionally, Vendor shall provide Vendor Data Books consisting of all pertinent Manufacturer's technical data and information relating to all the various elements of the units supplied by the Vendor. The data and information shall pertain to the facilities as a whole, to each major system, to each subsystem and every component. The Data Books shall commence with copy of the Purchase Order (pricing information may be blanked out) followed by the manufacturer's equipment brochures, data sheets, certificates, parts list and relevant "As Built" drawings.

## 5.1 Vendor Drawing Review

Drawings returned to Vendor for correction after markup by Company and / or Company designated representative shall be resubmitted by Vendor until "Proceed with Fabrication Issue Final Drawings". All revisions to documents must be clouded and identified with the revision number contained within a triangle placed beside the cloud.

Vendor shall not proceed with changes having a commercial impact unless authorized by Change Order.

If, for any reason, Vendor believes that he is not able to comply with Purchaser and / or Purchaser's designated representative marked-up comments on documents returned after review, Vendor shall notify, in writing, Purchaser within five (5) working days of receipt, giving his reasons and requesting a resolution. It is not acceptable to ignore marked-up comments.

Vendor must submit updated documents and drawings one (1) weeks after return of approved documents.

Drawings and data approval do not relieve Vendor of his responsibility to meet Purchase Order or contract conditions relating to specifications, material design or construction, and delivery requirements, nor relieve Vendor of responsibility for compliance with laws, codes and regulations.

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## 6.0 PACKAGE AND STORAGE

Preparation for shipment shall be in accordance with the Vendor's standards and as noted herein. Vendor shall be solely responsible for the adequacy of the preparation for shipment provisions with respect to materials and application, and to provide equipment at the destination in ex-works condition when handled by commercial carriers.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by Company's / Contractor's inspectors. All costs occasioned by such rejection shall be to the account of the Vendor.

Equipment shall be packed, securely anchored, and skid mounted when required. Bracing, supports, and rigging connections shall be provided to prevent damage during transit, lifting, or unloading.

Separate, loose, and spare parts shall be completely boxed. Pieces of equipment and spare parts shall be identified by item number and service and marked with Contractor's order number, tag number, and weight, both inside and outside of each individual package or container. A bill of material shall be enclosed in each package or container of parts.

One complete set of the installation, operation, and maintenance instructions shall be packed in the boxes or crates with equipment. This is in addition to the number called for in the Purchase Order.

Equipment and materials shall be protected to withstand ocean transit and extended period of storage at the jobsite for a minimum period of 18 months. Equipment shall be protected to safeguard against all adverse environments, such as: humidity, moisture, rain, dust, dirt, sand, mud, salt air, salt spray, and sea water.

## 7.0 LIST OF DRAWINGS/DOCUMENT REQUIRED TO BE SUBMITTED.

The following sample documents are required at the enquiry stage to be included in the bid by the bidder. This document shall be treated as information & understanding of the bidder's work quality:

- a) P&ID in compliance with the tender document- **With the Bid**
- b) Datasheets of individual Instruments, Valves, Filters etc. and the Complete Metering Skid as per the- **For Review and Approval**
- c) Purchase Order Copies & Supporting Documents, Unpriced SOR- **With the Bid.**
- d) Tentative GA drawing of the skid- **With the Bid**
- e) Brief operation and control philosophy write up of the system- **For Review and Approval**

	<b>MATERIAL REQUISITION FOR CHECK METERING SYSTEM</b>	<b>Document No.</b>	<b>Rev</b>
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- f) Power requirement calculation of the metering skid / systems- **For Review and Approval**
- g) Catalogues of brought out / important equipment's like, flow meter, flow computer, safety valves, PT, TT, filter elements, etc.- **With the Bid**
- h) QAP for the Complete Metering Skid in accordance with the Factory Acceptance Test procedures mentioned in the Doc No. VCS-SS-IN-5601\_Rev. 02.- **For Review and Approval**
- i) QAP for Individual Instruments, Valves, Filters etc. as per the ITP attached with the Tender Document- **For Review and Approval**
- j) Statutory certificates of equipment's, items, flow meter, valves etc.- **With the Bid**

## 8.0 LIST OF ATTACHMENTS

- a) Datasheets;
- b) Standard Specifications;
- c) P&IDs;
- d) Piping Material Specification;
- e) Checklist – Technical.
- f) ITP - Instrumentation Items, Filters & Valves;

	<b>MATERIAL REQUISITION FOR CHECK METERING SYSTEM</b>	<b>Document No.</b>	<b>Rev</b>
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CGD GAS SUPPLY	
SERVICE FLUID	NATURAL GAS
FLOWRATE	20 SCMH TO 30000 SCMH
DESIGN PRESSURE	49 kg/cm <sup>2</sup> g
DESIGN TEMPERATURE	-29 / 65°C
OPERATING PR. INLET	25 kg/cm <sup>2</sup> g

PIPELINE SYSTEM FOR CGS 8"			
PROCESS PARAMETERS		DESIGN PARAMETERS	
FLUID	NATURAL GAS	DESIGN CLASS	300#
FLOW RATE	20 SCMH (MIN.) / 30000 SCMH (MAX.)	DESIGN PRESSURE	49 kg/cm <sup>2</sup> g
OPERATING TEMPERATURE	0°C (MIN.) / 45°C (MAX.)	DESIGN TEMPERATURE	-29 / 65°C
OPERATING PRESSURE	25 kg/cm <sup>2</sup> g	LOCATION CLASS	
		PIPELINE	CLASS 4

CHECK METER	
RPD METER	TFM METER
TAG NO. RPD-1002	TFM-1001
FLOW 20 SCMH TO 2000 SCMH	1500 SCMH TO 40000 SCMH

REFERENCE DRAWINGS	
DRAWING TITLE	DRAWING NUMBER

#### GENERAL NOTES:-

- ALL LINE NUMBERING AND EQUIPMENT TAG NUMBERING SHALL BE PRE-FIXED WITH PROJECT & AREA CODE AS "C261162".
  - ALL INSTRUMENT TAG NUMBER SHALL BE PRE-FIXED WITH PROJECT AREA CODE AS "C261162" AND P & ID NUMBER.
- NOTES :-**
- THE ITEMS GIVEN IN THIS P&ID IS INDICATIVE ONLY. ALL DETAIL ENGG. / RESIDUAL ENGG. INCLUDING LINE SIZE FINALIZATION SHALL BE DONE BY VENDOR POST AWARD OF CONTRACT WITHOUT ANY COST IMPLICATIONS TOWARDS CLIENT.
  - EXISTING SKID OPERATING & DESIGN PARAMETERS SHALL BE DONE BY SKID VENDOR TO SUIT THE PRESENT DESIGN CONDITIONS.
  - ALL VENTS SHALL BE PROVIDED MIN. 3M HIGH FROM HIGHEST OPERATING PLATFORM ON NEARBY STRUCTURE WITH IN 15M WHICHEVER IS HIGHER NON SPARKING MATERIAL (BRASS) SHALL BE USED FAR FLAPPER TYPE VENT CONNECTION.
  - LOW POINT DRAIN SHALL BE PROVIDED AT MINIMUM DISTANCE FROM RISER PIPE OR VENT.
  - PSV SHALL BE FIRE CASE TYPE.
  - 2 NOS. FLOW COMPUTER SHALL BE PROVIDED FOR MTR-A & MTR-B.
  - MINIMUM INDICATIONS, AVAILABLE IN THE FLOW COMPUTER DISPLAY SHALL BE PI, TI, FI & ZI.
  - DISPLAY PARAMETERS ARE REQUIRED TO BE TELEMETERED FROM FLOW COMPUTERS TO SCADA THROUGH SOFT LINK / HARDWIRED.
  - MOV-1201 & MOV-1202 WILL BE OPERATED AND CONTROLLED FROM RTU AND INTERLOCK I-101 & I-102 SHALL BE IMPLEMENTED IN RTU FOR AUTO CHANGE OVER.

#### HOLDS :-

- PSV INLET AND OUTLET SIZE ARE UNDER HOLD. SHALL BE FINALIZED POST RECEIPT OF VENDOR DATA.

#### INTERLOCK :-

- I-101 IF THE FLOW IS LESS THAN 1800 SCMH MOV 1202 WILL OPEN AND WILL CLOSE ABOVE 1801 SCMH.
- I-102 IF THE FLOW IS LESS THAN 1800 SCMH MOV-1201 WILL BE CLOSED. IF THE FLOW IS ABOVE 1801 SCMH MOV-1201 WILL OPEN.

C1	17.07.25	ISSUED FOR CLIENT REVIEW	HS	BND	BND
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.

CLIENT:

 **HOGPL (HPOIL GAS PRIVATE LIMITED)**

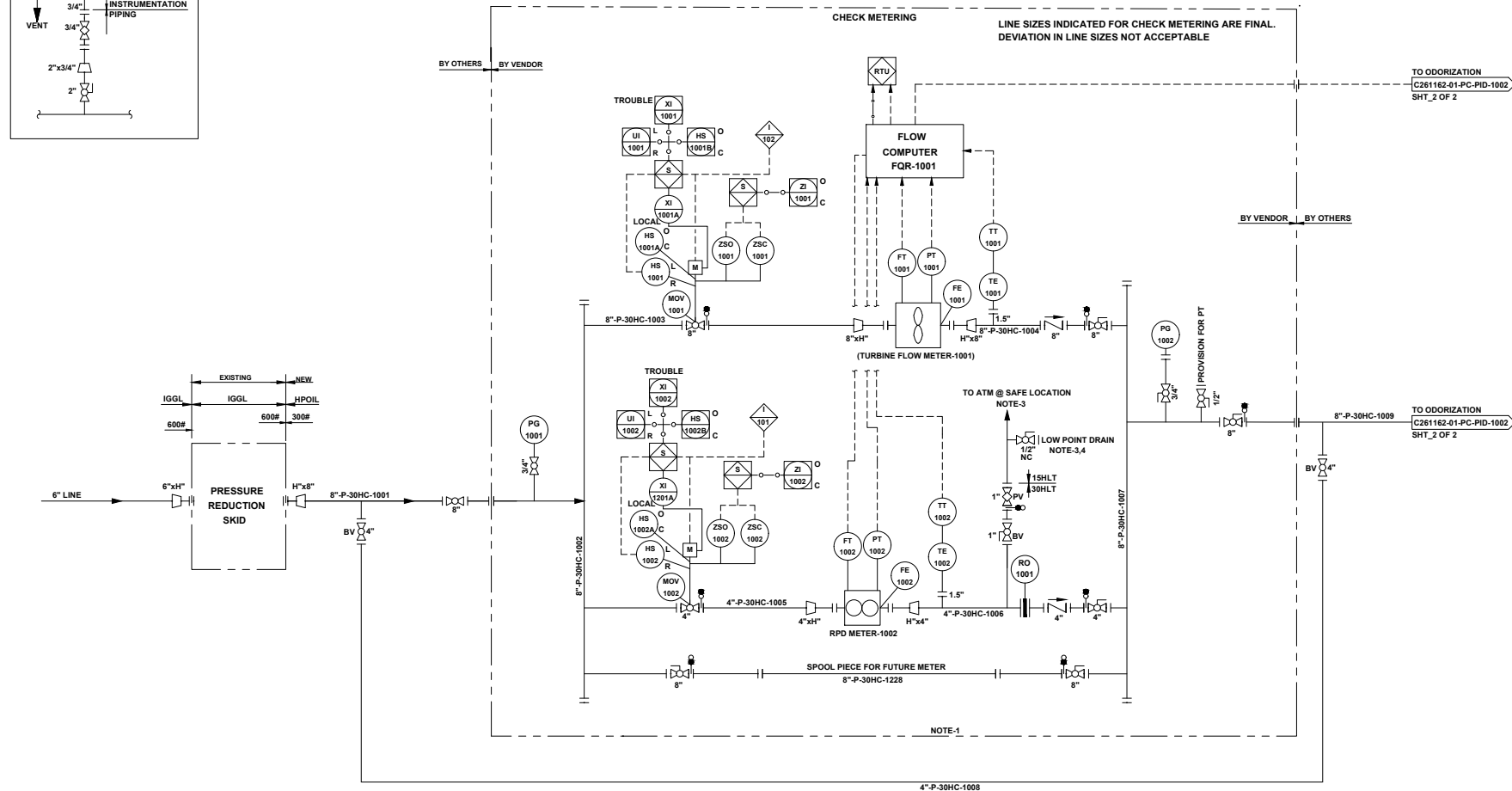
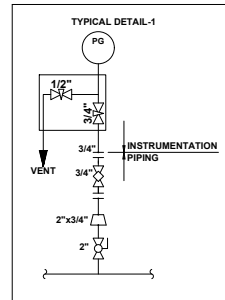
PMC:

 **VCS QUALITY SERVICES PVT. LTD.**

**PROJECT:**  
**CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF DIMAPUR NAGALAND**

**SCALE** **TITLE:**  
**N.T.S** **PIPING & INSTRUMENTATION DIAGRAM FOR CGS FACILITIES AT DIMAPUR NAGALAND**

SIZE	JOB NO.	DRAWING NUMBER	SHEET	REV.
A1	C261162	C261162-01-PC-PID-1001	1 OF 2	C1





Energising Quality

**PROJECT CODE: C261162**



**INSTRUMENT DATASHEETS FOR CHECK METERING SYSTEM**

**TOTAL SHEETS**

19

**DOCUMENT No.**

C261162

00

IN


DS

5003

## **HPOIL GAS PRIVATE LIMITED**

### **SUPPLY OF CHECK METERING SKID FOR CITY GAS DISTRIBUTION PROJECT AT DIMAPUR FOR THE STATE OF NAGALAND**

C1	30.07.2025	ISSUED FOR CLIENT REVIEW	PS	AS	PK
<b>REV</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>PREP</b>	<b>CHK</b>	<b>APPD</b>

PRESSURE GAUGE						Rev.
GENERAL	1	Tag No		Refer Attachment-1		
	2	Line No	Equipment No.	Refer P&ID	-	
	3	P&ID Number	Quantity	C261162-01-PC-PID-1001	Refer Attachment-1	
	4	Manufacturer	Model No.	*	*	
	5					
GAUGE	6	Type		BOURDON TUBE TYPE		
	7	Case	Type	Direct		
	8		Material	SS 316		
	9		Mounting	Local		
	10		Bezel	BAYONET		
	11		Glass Type	Shatter Proof Glass (3 mm)		
	12		Blowout Device	Required		
	13		Gasket Material	RUBBER		
	14	Dial Size	Dial Color	150 MM	White with Black Marking	
	15	Enclosure Class		IP 65		
	16	Range		0-60 kg/cm2		
	17	Liquid Filled		GLYCERINE		
	18					
ELEMENT	19	Type	Accuracy	C TYPE BOURDON TUBE	±1% FSD	
	20	Element Material	Socket Material	SS316	SS316	
	21	Movement Material		SS316		
	22	Conn. Size/Type	Connection Location	3/4" NPTF	BOTTOM	
	23	Zero Adjustment				
	24	Blow Out Protection	Over-Range Protection	Required	Required, 130% of Full Scale	
	25					
SEAL	26	Type	Model No.	N/A		
	27	Wetted Parts Material	Seal Material			
	28	Housing Lower Material	Housing Upper Material			
	29	Conn. Size/Type	Connection Rating			
	30	Seal Flush Conn.	Over Range Material			
	31	Seal Fill Fluid				
	32	Design Pressure				
	33					
MISC.	34	Snubber		NOT REQUIRED		
	35	Siphon		NOT REQUIRED		
	36	Manifold		2 way		
	37	Gauge Saver		NA		
Notes:						
1	Vendor to specify. *					
2	Calibration, material certificates shall be provided by the Vendor.					
3	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).					
4	Pressure gauge shall be selected in such a manner that normal operating pressure is approximately in the middle third of full scale (30% - 70% of range).					
5	Pressure gauge shall be fitted with blow-out protection at back and shall have a over-range protection of 130% of max. reading.					
 Energising Quality	CLIENT:	HPOIL GAS PRIVATE LIMITED				
	PROJECT:	'SUPPLY OF CHECK METERING SKID FOR CITY GAS DISTRIBUTION PROJECT AT DIMAPUR FOR THE STATE OF NAGALAND		C1	30.07.2025	PS
				AS	PK	
				REV.	DATE	PRPD




**ATTACHMENT -1**

<b>S.No.</b>	<b>Tag. No.</b>	<b>Service</b>	<b>Temperature (DegC) (Operating (Min/Max) ./Design)</b>	<b>Operating Pressure (Kg/cm<sup>2</sup>g)</b>	<b>Design Pressure (kg/cm<sup>2</sup>g)</b>	<b>Instrument Range (Kg/cm<sup>2</sup>g)*</b>	<b>Remarks</b>
1	C261162-01-PG-1001	NATURAL GAS	(0C-45C)/(-29C-65C)	25 Kg/Cm2	49 Kg/Cm2	0-60 Kg/Cm2	
2	C261162-01-PG-1002	NATURAL GAS	(0C-45C)/(-29C-65C)	25 Kg/Cm2	49 Kg/Cm2	0-60 Kg/Cm2	


PRESSURE TRANSMITTER					Rev.			
GENERAL	1	Tag Number		Refer Attachment-2				
	2	P&ID Number	Quantity	C261162-01-PC-PID-1001	Refer Attachment-2			
	3	Line No./Equipment No		REFER P&ID				
	4	Enclosure Type		IP 65				
	5	Hazardous Area Classification		ZONE 1 GROUP IIA/IIB T3				
	6							
PROCESS DATA	7	Service		NATURAL GAS				
	8	Fluid	Phase	NATURAL GAS	GAS			
	9	Corrosive	Erosive	-	-			
	10	Flammable	Toxic	YES	NO			
	11	Pressure (Min/Nor/Max) (kg/cm2)		REFER ATTACHMENT-2				
	12	Temperature (Min/Nor/Max) (°C)		REFER ATTACHMENT-2				
	13	Design Pressure (kg/cm2)	Design Temperature (°C)	REFER ATTACHMENT-2	REFER ATTACHMENT-2			
	14	Viscosity (cP)	Specific Gravity	REFER PROCESS DATASHEET				
	15	Steady / Pulsating	% Solids					
	16	Ambient Temperature(°C)						
17								
BODY AND SENSOR	18	Sensor Type		CAPACITANCE TYPE				
	19	Process Connection Size						
	20	Instrument Connection Size		1/2" NPTF				
	21	Body Material	Sensor Material	DIE CAST ALUMINIUM	SS316			
	22	Seal Ring Material		-				
	23	Fill Fluid		-				
	24	Design Pressure		-				
	25	Design Temperature		-				
	26	Burst Pressure		130%				
	27							
TRANSMITTER	28	Type		2 WIRE SMART TYPE WITH HART PROTOCOL				
	29	Output	Power Supply	4-20 mA	24 VDC			
	30	Instrument Range (kg/cm2)		REFER ATTACHMENT-2				
	31	Calibrated Range (kg/cm2)		REFER ATTACHMENT-2				
	32	Accuracy	Response Time	±0.065% of the Span				
	33	Damping	Failure Mode Output					
	34	Integral Indicator						
	35	Electrical Connection Size		1/2" NPT				
	36	Elevation / Suppression						
	37	Ambient Temperature Rating						
SEAL	39	Seal Conn Size	Conn Type & Rating	NA				
	40	Diaphragm Material	Seal Flange Material					
	41	Capillary Conn Size	Capillary Conn Type					
	42	Capillary Material	Capillary Length					
	43	Fill Fluid						
	44	Seal Design Pressure						
	45	Seal Design Temperature						
	46							
MISC.	47	Manifold Type	Manifold Mounting	2 WAY MANIFOLD	DIRECT			
	48	Manifold Manufacturer	Manifold Model No.	*	*			
	49	Lightning Protection		NOT REQUIRED				
	50	Mounting Bracket		REQUIRED				
	51	Mounting		2" PIPE MOUNT				
	52	Manufacturer	Model No.	*	*			
	53							
Notes:								
1 Vendor to specify. *								
2 Calibration, material and hazardous area certificates shall be provided by the Vendor.								
3 Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).								
4 Pressure transmitter shall be of the direct sensing type with the sensing element as per Manufacturer's standard.								
5 Pressure transmitter shall be fitted with blow-out protection and shall have a over-range protection of 130% of range.								
 ENERGISING QUALITY	CLIENT:	HPOIL GAS PRIVATE LIMITED						
	PROJECT:	SUPPLY OF CHECK METERING SKID FOR CITY GAS DISTRIBUTION PROJECT AT DIMAPUR FOR THE STATE OF NAGALAND		C1	30.07.2025	PS	AS	PK
				REV.	DATE	PRPD	CHKD	APPD

**ATTACHMENT -2**


<b>S.No.</b>	<b>Tag No's</b>	<b>Service</b>	<b>Temperature (DegC) (Operating Min./Max./Design)</b>	<b>Pressure (Kg/cm<sup>2</sup>g) (Operating Min./Max./Design)</b>	<b>Instrument Range (Kg/cm<sup>2</sup>g)*</b>	<b>Remarks</b>
1	C261162-01-PT-1001	NATURAL GAS	(0C-45C)/(-29C-65C)	25 Kg/Cm2	0-60 KG/CM2	
2	C261162-01-PT-1002	NATURAL GAS	(0C-45C)/(-29C-65C)	25 Kg/Cm2	0-60 KG/CM2	

TEMPERATURE TRANSMITTER						Rev.	
General	1	Tag Number	Quantity	REFER ATTACHMENT-3	REFER ATTACHMENT-3		
	2	P&ID Number		REFER ATTACHMENT-3			
	3	Line No	Equipment No.		-		
	4	Hazardous Area Classification		Zone 1, Gas Group IIA/IIB, T3			
Process Data	5	Service Fluid		Natural Gas			
	6	Fluid State	Phase	Gas			
	7	Errosive & Corrosive is due to					
	8	Flammable	Toxic	Yes	NO		
	9	Pressure (Min/Nor/Max)(Kg/cm2g)		83.51-92.00			
	10	Temperature (Min/Nor/Max)(deg C)		45-55			
	11	Design Pressure	Design Temperature	100 KG/CM2G	-29/65 Deg. C		
	12	Viscosity (cP)	Specific Gravity	0.0144	-		
	13	Steady / Pulsating	% Solids	-	-		
	14	Velocity (m/s)		-			
Element	15	Ambient Temperature( <sup>0</sup> C)		-			
	16						
	17	Element type	Material	RTD - PT100	SS316		
	18	Simplex / Duplex	Grounded	Duplex	*		
	19	Cold Junction Comp.	Ice Point Resistance	*	*		
	20	Temperature Range		*			
	21	Mounting Connection		*			
	22	Sheath Material	Outerside Diameter	*	*		
Head	23	No.Of Lead Wires	Termination Type	*	*		
	24	Vibration Req.	Spring loaded	*	*		
	25	Type		-			
	26	Material		Die Cast Alumminium			
Transmitter	27	Mounting Connection	Conduit Connection	1/2" NPTF	1/2" NPT		
	28	Union	Nipple	*			
	29	Nipple/ Union Length					
	30						
	31	Transmitter Type		2 Wire , SMART, HART			
	32	Output		4 - 20 mA HART			
	33	Power Supply		24 VDC 2-wire loop powered			
	34	Encloser Type		IP-65, Ex 'ia'			
	35	Instrument Range (DegC)		0-90			
	36	Calibrated Range (DegC)		-94			
Thermowell	37	Accuracy	Response Time	±0.1% of FSD	*		
	38	Damping	Failure Mode Output	*	*		
	39	Integral Indicator		Required			
	40	Cable Entry		1/2" NPTF			
	41	Housing Material		Die cast aluminium with epoxy coating			
	42	Ambient Temperature Rating		N/A			
	43	Type		Tapered			
	44	Construction	Material	Drilled Bar Stack	SS316L		
	45	Process Connection	Instrument Connection	Flanged type	1/2" NPTF		
	46	Outside Dia	Bore	*	*		
Misc.	47	Tip Diameter	Tip Thickness	*	*		
	48	Leg Length	Insertion Length (U)	*	300mm * (Note 7)		
	49	Maximum Allowable Insertion (U)		*			
	50	Mounting Location	Lightning Protection		N/A		
	51	Mounting Bracket		Required			
	52	Manufacturer	Model No.	*			
Notes:							
1 Vendor to specify. *							
2 Calibration, material and hazardous area certificates shall be provided by the Vendor.							
3 Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).							
4 Temperature Transmitter shall be selected in such a manner that normal operating temperature is approximately in the middle third of full scale (30% - 70% of range).							
5 Calibration, material and hazardous area certificates shall be provided by the Vendor.							
6 Transmitters shall be provided with canopy of MOC GRP.							
7 Vendor to do sizing and provide thermowell sizing calculations for review and approval.							
8 The quantities of temperature transmitter shall be for one typical PRS. Vendor to supply temperature transmitter for all skids taking typical datasheet and P&ID as reference.							
 Energising Quality	CLIENT:	HPOIL GAS PRIVATE LIMITED					
	PROJECT:	SUPPLY OF CHECK METERING SKID FOR CITY GAS DISTRIBUTION PROJECT AT DIMAPUR FOR THE STATE OF NAGALAND	C1	30.07.2025	PS	AS	PK
				REV	DATE	PRPD	CHKD


Attachment-3										
SNo .	Tag.No	Service	P&ID Number	Line/Equipment No.	Temperature (Operating / Design) (degC)	(Pressure Design) (Kg/cm <sup>2</sup> g)	Operating Pressure (Kg/cm2g)	Calibration Range (Deg c)	Instrument Range * (Deg c)	Insertion Length* (mm)
1	C261162-01-TT-1001	NATURAL GAS	C261162-01-PC-PID-1001	8"-P-30HC-1004	(0C-45C)/(-29C-65C)	49 Kg/Cm2	25 Kg/Cm2	*	0-60	*
2	C261162-01-TT-1002	NATURAL GAS	C261162-01-PC-PID-1001	4"-P-30HC-1006	(0C-45C)/(-29C-65C)	49 Kg/Cm2	25 Kg/Cm2	*	0-60	*


TURBINE FLOW METER							Rev.
GENERAL	1	Tag Number		C261162-01-FT-1001			
	2	Quantity		1 No.			
	3	P&ID Number		C261162-01-PC-PID-1001			
	4	Hazardous Area Classification		Zone 1, Gas Group IIA/IIB, T3			
	5	Line Size/Sch	Line No.	Refer P&ID & PMS	Refer P&ID		
	6						
	7						
PROCESS DATA	8	Service		Check Metering System			
	9	Fluid	Phase	Natural Gas	Single		
	10	Corrosive	Erosive	N/A	N/A		
	11	Flow (Min/Nor/Max)	SCMH	1500 TO 40000			
	12	Operating Pressure (Min/Nor/Max)	kg/cm2g	25			
	13	Pressure Drop (Min/Max)	bar	*			
	14	Operating Temperature (Min/Nor/Max)	deg C	0 - 45			
	15	Max. Allowable Pressure Drop	bar	max. 1 bar			
	16	Design Pressure (kg/cm2g)	Design Temperature (deg C)	49	-29 / 65		
	17	Viscosity (cP)		*			
	18	Density (kg/m3)	Mol. Wt	*	*		
	19	Sp Heat Ratio(Cp/Cv)	Compressibility(Z)	*	*		
20							
FLOWMETER	21	End Connection	Size and Rating	*			
	22		Facing & Finish	RF			
	23	Pulses / M3		LF & HF*			
	24	Flow Range	SCMH	1500 TO 40000			
	25	Accuracy	Rangeability	$\pm 1\%$ from $Q_{min}$ to $0.2Q_{max}$ and $\pm 0.5\%$ from $0.2Q_{max}$ to $Q_{max}$	01:30		
	26	Material	Body	CS			
	27		End Connections	Flanged RF			
	28		Rotor	AL			
	29		Bearing	SS316			
	30		Other Wetted Parts	SS316			
	31	Enclosure Protection		Ex 'd' , IP-65			
	32	Cable Entry		1/2" NPTF			
	33						
	34						
TRANSMITTER	35	Type - 2 wire / 3 wire		2 - wire			
	36	Pre-amplifier Location		Meter Mounted			
	37	Power Supply		24 V DC loop powered from flow computer			
	38	Cable Entry		1/2" NPT(F)			
	39	Enclosure		Ex 'd' , IP-65			
	40	Hazardous Area Classification		Zone 1 Group IIA /IIB as per IEC, T3			
	41	Mounting	Accessories	Integral with turbine flow meter	Required		
	42	Input		Pulse from pulse generator of turbine flow meter			
	43	Output		4 - 20 mA, Smart HART			
	45						
	49						
	50						
OPTIONS	51	Compensation - Viscosity		N/A			
	52	Straightening Vanes Type		Integral			
	53	Local Counter		Required with digital display			
	54	Air Eliminator	End Connection	*	*		
	55	Strainer	Size and Mesh	*	*		
	56	Pressure Tap on Meter Body		Required			
	57	Lubricator with Accessories		Required			
	58	Radiography		100 % required for all welded joints			
	59						
MISC	60	Manufacturer &	Meter	*			
	61	Model No.	Transmitter	*			
Notes:							
1 Vendor to specify. *							
2 This datasheet is preliminary and shall be further detailed during detail engineering.							
3 Design of Turbine meter shall comply to AGA 7/EN 12261.							
4 Tagplate (SS316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).							
5 Vendor to furnish meter sizing calculations based on process conditions and to finalize the meter size.							
6 Turbine meters shall be certified by international agencies for custody transfer application.							
7 Vendor offer shall include mandatory spares and operating spares for 2 years.							
8 Vendor shall provide detailed GA drawing along with all parts name and MOC for the turbine flow meter along with data sheet.							
9 The maximum velocity shall be less than 20 m/sec through the turbine flow meter. Vendor shall submit code compliance/type approval certificate as per governing standard along with the datasheet.							
	CLIENT:	HPOIL GAS PRIVATE LIMITED					
PROJECT:	SUPPLY OF CHECK METERING SKID FOR CITY GAS DISTRIBUTION PROJECT AT DIMAPUR FOR THE STATE OF NAGALAND		C1	30.07.2025	PS	AS	PK
		REV.	DATE	PRPD	CHKD	APPD	


RPD FLOWMETER					Rev.			
General	1	Tag No.		C261162-01-FT-1002				
	2	Quantity		1 No.				
	3	Line No.		Refer P&ID				
	4	Line Size & Schedule		Refer P&ID & PMS				
	5	P&ID Number		C261162-01-PC-PID-1001				
	6	Service		Natural Gas				
Flow Meter	7	End connection	Size and Rating	Flanged*				
	8	Facing & Finish		*				
	9	Pulses / M3		LF & HF*				
	10	Flow Range(SCMH)(Min./Max.)		20/2000				
	11	Enclosure		Weather proof IP65 as per IEC 60529 / IS 2147				
	12	Cable Entry		*				
	13	Material	Body	ASTM A 216 Gr. WCB/ Aluminium alloy or equivalent				
	14	End Connections		ASTM A 105 Flanged or equivalent				
	15	Impeller & Shaft		High Grade alloy steel with Synthetic Elastomers				
	16	Bearing		SS316				
	17	Other Wetted Parts		SS316				
	18	Accuracy		As per EN 12480, ±2% (Qmin to 0.1Qmax) and ±1% (0.1Qmax to Qmax)				
	19	Rangeability		1: 160 or better				
	20	Type - 2 wire/ 3 wire		2 wire				
	21	Preamplifier location		Field				
	22	Power supply		No contact, reed relay, voltage approx. 3.6 V DC				
	23	Cable Entry		1/2" NPT(F)				
	24	Enclosure		Weather proof IP65 as per IEC 60529 / IS 2147				
	25	Intrinsic safe		Ex'd'				
	26	Mounting	Accessories	Integral with RPD flow meter	Required			
	27	Output		Pulses to flow computer				
	28	Enclosure		Weather proof IP65 as per IEC 60529 / IS 2147				
	29	Intrinsic safe		Ex'd'				
	30	Repeatability		+/-0.2% or better				
Options	31	-		-				
	32	-		-				
	33	Local Counter		Required 8 Digit, Mechanical, non- resettable counter				
	34	Temperature tapping on meter body		Not required				
	35	Strainer	Size and Mesh	*				
	36	Pressure Tap on Meter Body		Not required				
	37	Lubricator with accessories		Required				
	38	Radiography		100 % required for all welded joints				
Service Conditions	39	Fluid and State		Natural gas				
	40	Flow (min/max)SCMH		Refer P&ID				
	41	Design Temp(°c)		-29 to 65 °c				
	42	Design Pressure		49 kg/cm2g				
	43	Molecular Wt.		*				
	44	Viscosity (cP)		*				
	45	Cp/ Cv ratio		*				
	46	Max. allowable pressure drop		0.2 bar				
	47	Compressibility Factor						
	48	Area Classification		Zone 1 Group IIA /IIB as per IEC, T3				
	49	Model No.		*				
	50			*				
Notes :								
1	* By Bidder							
2	The design of RPD meter shall be as per EN 12480							
3	Vendor shall provide detailed GA drawing along with all parts name and MOC for the RPD meter along with data sheet.							
4	Vendor shall supply ' first fill + 10 fills' lubricant with each RPD meter.							
5	The maximum velocity shall be less than 20 m/sec through the RPD meter. Vendor shall submit code compliance/type approval certificate for EN 12480 along with the datasheet.							
	CLIENT:	HPOIL GAS PRIVATE LIMITED						
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FLOW COMPUTER						Rev.			
GENERAL	1	Tag Number	REFER P&ID						
	2	Quantity	1						
	3	P&ID Number	C261162-01-PC-PID-1001						
	4	Location	REFER P&ID						
	5	Type	Microprocessor based, Dual Channel as per the P&ID						
FLOW COMPUTER	6	Processor Type	32 Bit CMOS Microprocessor, 16 MHz Operation						
	7	Primary Flow Device	Turbine Flow Meter & RPD Meter						
	8	Primary Flow Device Tag No.	REFER P&ID						
	9	Power Supply	24V DC						
	10	Power Consumption	*						
	11	Display	LCD (4 line, 20 alpha-numeric character)						
	12	Mounting	Refer note - 2						
	13	Alarms	Active alarm LED(REFER NOTE 19)						
	14	Software Lock	Shall be provided						
	15	Battery Backup	NIMH battery as RAM power backup is provided which can retain data for more than 30 days in case no external power is connected.						
	16	Memory Details	a). 4 Mbytes of FLASH memory b). 2 Mbytes of battery Backed RAM c) EEPROM for storing I/O calibration Data						
	17	Calculation Accuracy	+/- 0.01% of Full scale						
	18	Analog Input Accuracy	T26+/- 0.025%						
	19	Diagnostics	Elaborated & sufficient on-line diagnostics to a certain accurate & proper functioning of flow computer.						
INPUT/OUTPUT	20	Analog Input	Refere note - 4						
	21	Analog Output	Refere note - 4						
	22	Pulse Input	N/A						
	23	Digital Input / Output	Refere note - 4						
	24	Ethernet Port	2 Nos.						
	25	Serial Interface	4 Nos. RS232/485 (Selectable)						
	26	Protocol	MODBUS (RTU or ASCII), MODBUS TCP/IP						
	27	Baud Rate	Software selectable (38400, 19200, 9600, 4800, 2400, 1200, 600, 300)						
MISC.	28	PID Controller Inbuilt	-						
	29	Model No.	*						
	30	Manufacturer	*						
	31	Interface cables	Will be provided by the bidder/contractor						
	32	Software	*						
	33	Approval Certification	Declaration of Conformity for NMI Approval, W&M Certificate will be provided						
	34	Custody Transfer Certification	-						
Notes :									
1	Vendor to specify - *								
2	Flow computer shall be skid mounted								
3	20% Spare I/O shall be considered extra for the flow computer.								
4	Digital & Analog input/output as shown in P&ID for Flow Computer.								
5	Redundant serial communication port/card shall be provided in Flow Computer to communicate with SCADA for Remote/SCADA monitoring of process data as minimum as shown in P&ID.								
6	Memory Type of Flow Computer shall be non-volatile.								
7	A/D & D/A Connector of Flow Computer shall be atleast 12 bit resolution.								
8	Scan processing time of Flow Computer Shall be :- a) Maximum 1 Second for interval between computer reading of process variable. B) Maximum 1 Second for interval between each cycle of Computation of instantaneous flow rate & totalised flow.								
9	Password and key lock shall be provided for prevention of unauthorised data entry in flow computer.								
10	Flow Computer shall have the capacity to detect loop fault.								
11	Flow Computer shall have the facility to enter manually point calibration curve, storing the name & computing actual flow in relation to error curve.								
12	When analog input to the Flow Computer go beyond HI/LO limit, the default value shall be taken automatically for calculation.								
13	Flow Computer shall have the facility to enter manually the Natural gas Composition and direct connectivity with online Gas Chromatograph (Existing GC).								
14	Approved make of Flow Computer shall be as follows:- i) Danielii) Omni iii) Instrometiv) RMGv) FMC								
15	Buffer memory of event log of Flow Computer shall be minimum 450 events.								
16	At the time of apporval of data sheet of Flow Computer, bidder/supplier shall furnish DS along with catalogues.								
17	Functional Block shall be defined to enable operator to compare the desired set point value of Natural Gas flow with the measured value and generate its respective corrected set point value.								
18	Volume and energy flow rate volume & energy running total for the current day & last day, cumulative volume & energy specific gravity, calorific value, C3 & C4 component etc.shall be available at SCADA from Flow Computer through serial link, other than the signals, as shown in P&ID.								
19	Events And Alarm Stamping Required With Time And Event Description.								
		CLIENT:	HPOIL GAS PRIVATE LIMITED						
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MOTOR OPERATED VALVE						Rev.
GENERAL	SL. NO.					
	1	Tag Number		C261162-01-MOV-1001, C261162-01-MOV-1002		
	2	Location	Quantity	Refer P&ID	2 Nos.	
	3	P&ID Number		C261162-01-PC-PID-1001		
	5	Hazardous Area Classification		Zone 1, Gas Group IIA/B, T3		
PIPELINE	6	Line No/Equipment No.		Refer P&ID		
	7	Inlet & Outlet Line Size/Sch		Refer P&ID		
	8	Inlet line Material		Refer PMS		
	9					
PROCESS DATA	10	Service Fluid		NATURAL GAS		
	11	Fluid State	Phase	Refer Process Datasheet		
	12	Corrosive	Erosive			
	13	Flow (Min/Max)	kg/hr			
	14	Pressure (Min/Max)	Kg/cm <sup>2</sup> g			
	15	Temperature (Min/Max)	°C			
	16	Design Pressure	Design Temperature			
	17	Max Shut off DP	Viscosity (cP)			
	18	Molecular Weight	Vapour Pressure			
	19	Density (kg/m3)				
VALVE	20	Sp Heat Ratio(Cp/Cv)	Compressibility(Z)			Refer Valve Datasheet
	21	Valve Body Orientation				
	22	Valve Cv				
	23	Body Type	Body Material			
	24	Body Size	Conn Type & Rating			
	25	Trim Material	Stem Material			
	26	Packing	Lubrication & Isolation			
	27	Bolts/ Nuts Material				
	28	Seat Leakage Class				
	29	Torque Break / Run / End / Stem Shear				
	30	Fire Safe Design and Test				
ACTUATOR	31	Service (ON/OFF or INCHING or Control)		ON / OFF		
	32	Actuator Type	Insulation Class	Electrical Motor Actuator	Class F	
	33	Actuator Orientation		Top		
	34	Power Supply		415 VAC, 3-phase, 50 Hz		
	35	Cable Entry	Power Cable	M20 (1 No.) & M25 (1 No.)		
	36		Control Cable	M15 (1 no.) & M25 (1 No.) & M40 (1 No.)		
	37	Body Material		Carbon Steel		
	38	Enclosure Protection		Ex 'd', IP-66		
	39	Torque Start / Run / End (Nm)		*		
	40	Fail Position	Stroke Time (Sec)	Fail Last	60 sec max. for closing	
	41	Hand Wheel	Clutch Lever	Yes	Yes ( Pad Lockable)	
	42	Remote Control Inputs	Communication Interface	24 VDC	Required - Modbus / Ethernet	
	43	Travel Stop / Torque Limit Switch		Yes ( Closed / % Travel / Open ) / Yes		
	44	Local / Off / Remote Selection		Yes		
	45	Position Indicator		Required; Local & Remote		
	46	Local Push Button - Open / Close		Yes		
	47	Mid Travel Reverse	Motor Protection	Required	Yes	
	48	Gearbox Ratio		*		
49	No. of Operations		*			
MISC	50	Manufacturer &	Valve	*		
	51	Model No.	Actuator	*		
Notes :						
1 Vendor to specify. *						
2 This datasheet is typical. Detailed actuator datasheet shall be provided by Vendor.						
3 Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).						
4 Vendor to furnish actuator sizing calculation & Torque calculation to finalize the actuator size.						
5 Vendor shall submit detailed catalogue with model decodification sheet with datasheet.						
6 Vendor shall submit detailed GA drawing along with part names and MOC of the parts along with datasheets.						
7 Actuator stall torque shall not exceed maximum allowable valve stem torque at all conditions. Safety margin of 25% in the valve torque shall be considered while stroking the actuator.						
8 3-Phase Motor shall have protections such as thermal over load, single phasing, phase discrimination, over current and earth fault protections.						
9 Refer Process datasheet, P&ID and Piping Material Specification for more information.						
10 Material and hazardous area certification (ATEX or CCOE/PESO) shall be provided by the Vendor						
11	Vendor to provide the following signals in MOV a) Open Limit Switch b) Close Limit Switch c) Valve Open Command d) Valve Close Command e) Valve trouble Signal f) Valve Remote Selection g) Valve Local Selection					
12	Following minimum datas, related to motor to be provided by vendor in data sheet: i) Starting Current, ii) Rated load current, iii) Current at average load, iv) Motor power at average load ,v) Starting Power Factor, vi) Power factor at avarage load & vii) No. of poles of motor etc.					
	CLIENT:	HPOIL GAS PRIVATE LIMITED				
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RESTRICTION ORIFICE					Rev.		
GENERAL	1	Tag Number	C261162-01-RO-1001				
	2	P&ID Number	C261162-01-PC-PID-1001				
	3	Quantity	01 No.				
	4	Line No	Refer P&ID				
	5	LineID (mm)	Refer P&ID				
	6	Line OD (mm)	Refer P&ID				
	7	Flange Rating	*				
	8	Line Size / Line Schedule	Refer P&ID	*			
	9	Line Class & Rating	Refer P&ID	-			
	10	Line Material	*				
	11	Connecting Flange Material	*				
PROCESS CONDITIONS		Fluid	State	Natural Gas	Gas		
	13	Flammable /Toxic	Yes	No			
	14	Liquid Density at WT (kg/m3)	-				
	15	Viscosity at WP & WT(Cp)	-				
	16	Allowable ΔP at above flow rate (barg)	*				
	17	Flow Rate (Min. / Nor. / Design)	Refer P&ID				
	18	Pressure (Min. / Nor. / Max.)	Refer P&ID				
	19	Temperature (Min. / Max.)	Refer P&ID				
	20	Gas compressibility at WP & WT	-				
	21	Design Pressure (barg)	Refer P&ID				
	22	Design temperature (Min. / Max.)	Refer P&ID				
	23	Gas Specific Gravity (MW/29)	-				
	24	Ratio of Specific Heat (Cp/Cv)	-				
	25	Vapour Pressure at WT	-				
	26	Critical pressure	-				
	27	Critical temperature	-				
	28	Reynolds Number	-				
ORIFICE PLATE	29	Plate Type	Concentric				
	30	Orifice bore type	Square Edge Orifice				
	31	Plate material	SS316				
	32	Plate thickness	*				
	33	Plate outside diameter	*				
	34	Plate Holder	Not Required				
	35	Diameter ratio (Beta d/D)	*				
	36	Orifice bore diameter (d) in mm	*				
ORIFICE FLANGE	37	Vent / Drain Hole	Size	Required	*		
	38	Flange type	*				
	39	Flange size	Rating				
	40	Flange material					
	41	Flange Facing	Finish				
	42	Studs					
	43	Bolts & Nuts Material	N/A				
	44	Gasket material					
	45	Gasket Thickness					
	46	Pressure tap type	Number of Sets				
	47	Pressure tap size					
PHYSICAL DATA	48	Pressure tap orientation					
	49	Estimated weight	*				
	50	Removal clearance	*				
	51	Face-to-face Dimension	*				
	52						
	53						
Notes:							
1	Vendor to specify. *						
2	Vendor shall submit detailed GA drawing along with part names and MOC of the parts along with sizing calculation and datasheet.						
3	Restriction Orifice shall be designed in accordance with ISO 5167 part-2. Vendor to submit sizing calculation for approval.						
4	Tagplate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm)						
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INSTRUMENT - MULTI - TRIAD CABLE				Rev.			
GENERAL	1	Cable Identification	Analog - PVC/OSCR-AL/FRLS/PVC/SWA/PVC				
	2	Number of Pairs	6T (NIS)				
	3	Cable Length	Refer SOR, Cable Schedule and Cable Summary				
	4	Number of Twists per Meter	10 minimum				
	5	Application	F&G Cables				
	6	Voltage Grade	500 V				
	7	Code Conformity	BS 5308: part 2: 1986 type 2 & IS 1554 part1 armoured cables, IS-8130/84				
	8	Code Identification	Black and White (as per BS-5308, part-2, 1986 )				
COND UCTOR	9	Type	7 Stranded, each strand of 0.53 mm dia				
	10	Conductor Size	1.5 Sq.mm				
INSULA TION	11	Material	Plain Annealed Electrolytic Copper Conductor,BS: 6360, Class 2,				
	12	Material	PVC Type TI1 (as per BS: 6746), as referred in BS: 5308				
	13	Niminal Thickness of Insulation	As per table 1 OF BS: 5308				
	14	Color of Conductor Insulation	As per BS: 5308 (Table 11)				
INNER JACKET	15						
	16	Material	Extruded Fire Resistant (FR), TM1 PVC to IS-5831, as per BS: 6746,				
	17	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986				
	18	Lead Jacket Thickness	N/A				
	19	Color	Orange				
	20						
INDIVIDUAL SHIELD	21	Material	Aluminium backed by Mylar / Polyester tape				
	22	Nominal Thickness (in mm)	0.05 mm minimum				
	23	Binder Tape Material	Non-Hygroscopic Tape				
	24	Overlap	Min. 25% on either side				
	25	Coverage	100%				
	26	Drain Wire	Multi-strand bare tinned annealed Copper conductor				
	27	Drain Wire Cross section	0.5 mm² minimum				
	28						
OVERALL SHIELD	29	Material	Aluminium backed by Mylar / Polyester tape				
	30	Nominal Thickness (in mm)	0.05 mm minimum				
	31	Binder Tape Material	Non-Hygroscopic Tape				
	32	Overlap	Min. 25% on either side				
	33	Coverage	100%				
	34	Drain Wire	Multi-strand bare tinned annealed copper conductor				
	35	Drain Wire Cross section	0.5 mm² minimum				
	36						
OUTER JACKET	37	Material	Extruded Fire Resistant (FR), TM1 PVC to IS-5831, as per BS: 6746				
	38	Color	Orange				
	39	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986				
	40						
ARMOUR	41	Armour Material	Galvanised steel wire as per cl. 13.2.2 of BS 5308:Part2: 1986				
	42	Armour Wire Size	BS: 5308, (Table 10)				
	43						
OTHERS	44	Overall Outer Diameter (with Tolerance)	*				
	45	Under Armour Diamater	*				
	46	Over Armour Diamater	*				
	47	Weight (in Kg / Km)	*				
	48	Min. Bending Radius	*				
	49	Rip Cord	Non-metallic under inner jacket				
	50	Max. Recommended Pulley Tension	*				
	51	Oxygen Index	30 % minimum as per ASTM D 2863				
	52	Temperature Index	250 °C minimum as per ASTM D 2863				
	53	Sequential Marking on Outer Sheath	Length marking every meter				
	54	Drum Length	*				
	55	Tolerance	± 5%				
	56						
Notes:							
1	Vendor to specify.*						
2	Refer standard specification for Instrument Cable doc. No. VCS-SPC-5310 for more information .						
3	Cable Tag number shall be same as instrument tag number.						
4	Safety Cables shall be Fire Resistant type.						
 ENERGISING QUALITY	CLIENT:	HPOIL GAS PRIVATE LIMITED					
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F&G JUNCTION BOX						Rev.
GENERAL	1	Tag Number	Quantity	Refer Note-5	Refer Note-5	
	2	Application		For Termination Instrument IS Cables		
	3	Suitable for		Multipair cable**		
	4	Area Classification		Zone 1 Group IIA /IIB as per IEC, T3		
	5	Enclosure Rating		EEx'd' (Explosion Proof)		
	6	Ingress Protection		WP to IP-65 as per IEC-60529 / IS-2147		
	7	Material of Construction		Corrosion resistant , Cast Aluminum LM6 /25 or FRP		
	8	Overall Dimension		*		
	9	Cover		Bolted		
	10	Painting / Finish		Blue		
	11	Rating		Upto 500 VAC		
	12					
	13					
SINGLE CABLE	14	No. of Entry	Left Side	** , 3/4" NPTF & ** , 1/2" NPTF		
	15		Right Side	** , 3/4" NPTF & ** , 1/2" NPTF		
	16		Top Side	-		
	17		Bottom Side	-		
	18		Other	-		
	19	Cable Gland	Type	Ex'd', Double Compression Type,Brass with Zinc/ Nickel plated		
	20		Size	3/4 NPTM & 1/2" NPTM		
	21		Qty	**		
	22	Plugs	Type	Ex'd', Brass with Zinc/ Nickel plated		
	23		Size	3/4 NPTM & 1/2" NPTM		
24	Qty		**			
MULTI CABLE	25	No. of Entry	Left Side	-		
	26		Right Side	-		
	27		Top Side	-		
	28		Bottom Side	** , 1.5" NPTF and ** , 1" NPTF		
	29		Other	-		
	30	Cable Gland	Type	Ex'd', Double Compression Type,Brass with Zinc/ Nickel plated		
	31		Size	1.5" NPTM & 1" NPTM		
	32		Qty	**		
	33	Plugs	Type	Ex'd', Brass with Zinc/ Nickel plated		
	34		Size	1.5" NPTM & 1" NPTM		
35	Qty		**			
TERMINALS	36	Type	Spring Loaded, anti-loosening, vibration proof, screwless clamp type			
	37	Quantity	**			
	38	No. of Rows	1 no. *			
	39	Numbering System	Terminal strip and terminals shall be suitably numbered			
	40	Size	2.5 mm <sup>2</sup>			
	41	Make	*			
	42					
	43	Earthing Busbar (Internal)	Required			
ACCESSORIES	44	Earthing Screw (External)	Required			
	45	Rail(s) for Terminals	Required			
	46	PVC Shroud along with Cable Gland	Required			
	47	Nameplate Fixture	Required			
	48	Gasket	Required			
	49	Mounting	Suitable for mounting on wall, column and steel structure			
	50					
OTHERS	51	Manufacturer	*			
	52	Model	*			
	53	Certification	DGMS & PESO certified			
	54					
Notes: To be decided **						
1	Vendor to specify.*					
2	Refer standard specification for Junction Box doc. No. VCS-SPC-5311 for more information .					
3	Material certificates shall be provided by the Vendor.					
4	Vendor to provide General Arrangement Drawing of JB supplied, indicating dimension, layout etc. and hazardous area certificates.					
5	Please refer cable schedule and SOR for quantity,tag nos and JB Summary .					
	CLIENT:	HPOIL GAS PRIVATE LIMITED				
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INSTRUMENT JUNCTION BOX										Rev.
GENERAL	1	Tag Number	Quantity	Refer Note-5	Refer Note-5					
	2	Application			For Termination Instrument IS Cables					
	3	Suitable for			**					
	4	Area Classification			Zone 1 Group IIA /IIB as per IEC, T3					
	5	Enclosure Rating			EEx'd' (Explosion Proof)					
	6	Ingress Protection			WP to IP-65 as per IEC-60529 / IS-2147					
	7	Material of Construction			Corrosion resistant , Cast Aluminum LM6 /25 or FRP					
	8	Overall Dimension			*					
	9	Cover			Bolted					
	10	Painting / Finish			Blue					
	11	Rating			Upto 500 VAC					
	12									
	13									
SINGLE CABLE	14	No. of Entry	Left Side	**, 1/2" NPTF						
	15		Right Side	**, 1/2" NPTF						
	16		Top Side	-						
	17		Bottom Side	-						
	18		Other	-						
	19	Cable Gland	Type	Ex'd', Double Compression Type,Brass with Zinc/ Nickel plated						
	20		Size	1/2" NPTM						
	21		Qty	**						
	22	Plugs	Type	Ex'd', Brass with Zinc/ Nickel plated						
	23		Size	1/2" NPTM						
	24		Qty	**						
	MULTI CABLE	25	No. of Entry	Left Side	-					
26		Right Side		-						
27		Top Side		-						
28		Bottom Side		**, 1" NPTF						
29		Other		-						
30		Cable Gland	Type	Ex'd', Double Compression Type,Brass with Zinc/ Nickel plated						
31			Size	1" NPTM						
32			Qty	**						
33		Plugs	Type	Ex'd', Brass with Zinc/ Nickel plated						
34			Size	1" NPTM						
35			Qty	**						
TERMINALS		36	Type	Spring Loaded, anti-loosening, vibration proof, screwless clamp						
	37	Quantity	**							
	38	No. of Rows	1 no. *							
	39	Numbering System	Terminal strip and terminals shall be suitably numbered							
	40	Size	2.5 mm²							
	41	Make	*							
	42									
	43	Earthing Busbar (Internal)	Required							
ACCESSORIES	44	Earthing Screw (External)	Required							
	45	Rail(s) for Terminals	Required							
	46	PVC Shroud along with Cable Gland	Required							
	47	Nameplate Fixture	Required							
	48	Gasket	Required							
	49	Mounting	Suitable for mounting on wall, column and steel structure							
	50									
	51	Manufacturer	*							
OTHERS	52	Model	*							
	53	Certification	DGMS & PESO certified							
	54									
Notes: To be decided **										
1	Vendor to specify.*									
2	Refer standard specification for Junction Box doc. No. VCS-SPC-5311 for more information .									
3	Material certificates shall be provided by the Vendor.									
4	Vendor to provide General Arrangement Drawing of JB supplied, indicating dimension, layout etc. and hazardous									
5	Please refer cable schedule and SOR for quantity,tag nos and JB Summary .									
 ENERGISING QUALITY	CLIENT:		HPOIL GAS PRIVATE LIMITED							
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INSTRUMENT - PAIR CABLE (Fire Resistance)					Rev.
GENERAL	1	Cable Identification	Digital - PVC/OSCR-AL/INDSCR-AL/FR/PVC/SWA/PVC		
	2	Number of Pairs	1P (NIS)	6P (NIS)	
	3	Cable Length	Refer SOR, Cable Schedule and Cable Summary		
	4	Number of Twists per Meter	10 minimum		
	5	Application	Instrumentation & Control Cables		
	6	Voltage Grade	300 V		
	7	Code Conformity	BS 5308: part 2: 1986 type 2 & IS 1554 part1 armoured cables, IS-8130/84		
CONDUCTOR	8	Type	7 Stranded, each strand of 0.53 mm dia		
	9	Conductor Size	1.5 Sq.mm		
	10	Material	Plain Annealed Electrolytic Copper Conductor,BS: 6360, Class 2		
	11	Core Identification	Black and White (as per BS-5308, part-2, 1986 )		
	12				
INSULATION	13				
	14	Material	PVC Type TI1 (as per BS: 6746), as referred in BS: 5308		
	15	Niminal Thickness of Insulation	As per table 1 OF BS: 5308		
	16	Color of Conductor Insulation	As per BS: 5308 (Table 11)		
	17				
	18				
INNER JACKET	19	Material	Extruded Fire Resistance (FR) TM1 PVC to IS-5831, as per BS: 6746,		
	20	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986		
	21	Lead Jacket Thickness	N/A		
	22	Color	Orange		
	23				
INDIVIDUAL SHIELD	24	Material	Aluminium backed by Mylar / Polyster tape		
	25	Nominal Thickness (in mm)	0.05 mm minimum		
	26	Binder Tape Material	Non-Hygroscopic Tape		
	27	Overlap	Min. 25% on either side		
	28	Coverage	100%		
	29	Drain Wire	Multi-strand bare tinned annealed Copper conductor		
	30	Drain Wire Cross section	0.5 mm² minimum		
	31				
OVERALL SHIELD	32	Material	Aluminium backed by Mylar / Polyster tape		
	33	Nominal Thickness (in mm)	0.05 mm minimum		
	34	Binder Tape Material	Non-Hygroscopic Tape		
	35	Overlap	Min. 25% on either side		
	36	Coverage	100%		
	37	Drain Wire	Multi-strand bare tinned annealed Copper conductor		
	38	Drain Wire Cross section	0.5 mm² minimum		
	39				
OUTER JACKET	40	Material	Extruded Fire Resistance (FR) TM1 PVC to IS-5831, as per BS: 6746		
	41	Color	Orange		
	42	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986		
	43				
ARMOUR	44	Armour Material	Galvanised steel wire as per cl. 13.2.2 of BS 5308:Part2: 1986		
	45	Armour Wire Size	BS: 5308, (Table 10)		
	46				
	47				
OTHERS	48	Overall Outer Diameter (with Tolerance)	*		
	49	Under Armour Diamater	*		
	50	Over Armour Diamater	*		
	51	Weight (in Kg / Km)	*		
	52	Min. Bending Radius	*		
	53	Rip Cord	Non-metallic under inner jacket		
	54	Max. Recommended Pulley Tension	*		
	55	Oxygen Index	30 % minimum as per ASTM D 2863		
	56	Temperature Index	250 °C minimum as per ASTM D 2863		
	57	Sequential Marking on Outer Sheath	Length marking every meter		
	58	Drum Length	*		
	59	Tolerance	± 5%		
	60				
Notes: To be decided **					
1	Vendor to specify.*				
2	Refer standard specification for Instrument Cable doc. No. VCS-SPC-5310 for more information .				
3	Cable Tag number shall be same as instrument tag number.				
 ENERGISING QUALITY	CLIENT:	HPOIL GAS PRIVATE LIMITED			
	PROJECT:	SUPPLY OF CHECK METERING SKID FOR CITY GAS DISTRIBUTION PROJECT AT DIMAPUR FOR THE STATE OF NAGALAND	C1	30.07.2025	PS AS PK
			REV.	DATE	PRPD CHKD APPD

INSTRUMENT - SINGLE TRIAD CABLE ( Fire Resistance Low Smoke )					Rev.		
GENERAL	1	Cable Identification	Analog - PVC/OSCR-AL/INDSCR-AL/FRLS/PVC/SWA/PVC				
	2	Number of Pairs	1T (IS)6T (IS)				
	3	Cable Length	Refer SOR, Cable Schedule and Cable Summary				
	4	Number of Twists per Meter	10 minimum				
	5	Application	F&G Cables				
	6	Voltage Grade	500 V				
	7	Code Conformity	BS 5308: part 2: 1986 type 2 & IS 1554 part1 armoured cables, IS-8130/				
	8	Code Identification	Black and White (as per BS-5308, part-2, 1986 )				
COND UCTOR	9	Type	7 Stranded, each strand of 0.53 mm dia				
	10	Conductor Size	1.5 Sq.mm				
INSUL ATIO N	11	Material	Plain Annealed Electrolytic Copper Conductor,BS: 6360, Class 2,				
	12	Material	PVC Type TI1 (as per BS: 6746), as referred in BS: 5308				
	13	Niminal Thickness of Insulation	As per table 1 OF BS: 5308				
	14	Color of Conductor Insulation	As per BS: 5308 (Table 11)				
INNER JACKET	15	Material	Extruded Fire Resistant (FR), TM1 PVC to IS-5831, as per BS: 6746				
	16	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986				
	17	Lead Jacket Thickness	N/A				
	18	Color	Orange				
INDIVIDUAL SHIELD	19	Material	Aluminium backed by Mylar / Polyster tape				
	20	Nominal Thickness (in mm)	0.05 mm minimum				
	21	Binder Tape Material	Non-Hygroscopic Tape				
	22	Overlap	Min. 25% on either side				
	23	Coverage	100%				
	24	Drain Wire	Multi-strand bare tinned annealed Copper conductor				
	25	Drain Wire Cross section	0.5 mm² minimum				
	26	Material	Aluminium backed by Mylar / Polyster tape				
OVERALL SHIELD	27	Nominal Thickness (in mm)	0.05 mm minimum				
	28	Binder Tape Material	Non-Hygroscopic Tape				
	29	Overlap	Min. 25% on either side				
	30	Coverage	100%				
	31	Drain Wire	Multi-strand bare tinned annealed copper conductor				
	32	Drain Wire Cross section	0.5 mm² minimum				
	33	Material	Extruded Fire Resistant (FR), TM1 PVC to IS-5831, as per BS: 6746				
	34	Color	Orange				
OUTER JACKET	35	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986				
	36	Armour Material	Galvanised steel wire as per cl. 13.2.2 of BS 5308:Part2: 1986 BS: 5308, (Table 10)				
37	Armour Wire Size						
OTHERS	38	Overall Outer Diameter (with Tolerance)	*				
	39	Under Armour Diamater	*				
	40	Over Armour Diamater	*				
	41	Weight (in Kg / Km)	*				
	42	Min. Bending Radius	*				
	43	Rip Cord	Non-metallic under inner jacket				
	44	Max. Recommended Pulley Tension	*				
	45	Oxygen Index	30 % minimum as per ASTM D 2863				
	46	Temperature Index	250 °C minimum as per ASTM D 2863				
	47	Sequential Marking on Outer Sheath	Length marking every meter				
	48	Drum Length	*				
	49	Tolerance	± 5%				
Notes: To be decided **							
1	Vendor to specify.*						
2	Refer standard specification for Instrument Cable doc. No. VCS-SPC-5310 for more information .						
3	Cable Tag number shall be same as instrument tag number.						
4	Safety Cables shall be Fire Resistant type.						
<div> ENERGISING QUALITY</div>	CLIENT:	HPOIL GAS PRIVATE LIMITED					
	PROJECT:	SUPPLY OF CHECK METERING SKID FOR CITY GAS DISTRIBUTION PROJECT AT DIMAPUR FOR THE STATE OF NAGALAND	C1	30.07.2025	PS	AS	PK
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INSTRUMENT - MULTI - PAIR CABLE (Flame Retardant Low Smoke)					Rev.
GENERAL	1	Cable Identification	Digital - PVC/OSCR-AL/INDSCR-AL/FRLS/PVC/SWA/PVC		
	2	Number of Pairs	6P (NIS)	12P (NIS)	
	3	Cable Length	Refer SOR, Cable Schedule and Cable Summary		
	4	Number of Twists per Meter	10 minimum		
	5	Application	Instrumentation & Control Cables		
	6	Voltage Grade	300 V		
	7	Code Conformity	BS 5308: part 2: 1986 type 2 & IS 1554 part1 armoured cables, IS-8130/84		
CONDUCTOR	8	Type	7 Stranded, each strand of 0.53 mm dia		
	9	Conductor Size	1.5 Sq.mm		
	10	Material	Plain Annealed Electrolytic Copper Conductor,BS: 6360, Class 2		
	11	Core Identification	Black and White (as per BS-5308, part-2, 1986 )		
INSULATION	12	Material	PVC Type TI1 (as per BS: 6746), as referred in BS: 5308		
	13	Niminal Thickness of Insulation	As per table 1 OF BS: 5308		
	14	Color of Conductor Insulation	As per BS: 5308 (Table 11)		
INNER JACKET	15	Material	Extruded Flame Retardant Low Smoke (FRLS), TM1 PVC to IS-5831, as per BS: 6746,		
	16	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986		
	17	Lead Jacket Thickness	N/A		
	18	Color	Grey		
INDIVIDUAL SHIELD	19	Material	Aluminium backed by Mylar / Polyster tape		
	20	Nominal Thickness (in mm)	0.05 mm minimum		
	21	Binder Tape Material	Non-Hygroscopic Tape		
	22	Overlap	Min. 25% on either side		
	23	Coverage	100%		
	24	Drain Wire	Multi-strand bare tinned annealed Copper conductor		
	25	Drain Wire Cross section	0.5 mm <sup>2</sup> minimum		
OVERALL SHIELD	26	Material	Aluminium backed by Mylar / Polyster tape		
	27	Nominal Thickness (in mm)	0.05 mm minimum		
	28	Binder Tape Material	Non-Hygroscopic Tape		
	29	Overlap	Min. 25% on either side		
	30	Coverage	100%		
	31	Drain Wire	Multi-strand bare tinned annealed Copper conductor		
	32	Drain Wire Cross section	0.5 mm <sup>2</sup> minimum		
OUTER JACKET	33	Material	Extruded FRLS TM1 PVC to IS-5831, as per BS: 6746		
	34	Color	Grey		
	35	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986		
ARMOUR	36	Armour Material	Galvanised steel wire as per cl. 13.2.2 of BS 5308:Part2: 1986		
	37	Armour Wire Size	BS: 5308, (Table 10)		
OTHERS	38	Overall Outer Diameter (with Tolerance)	*		
	39	Under Armour Diamater	*		
	40	Over Armour Diamater	*		
	41	Weight (in Kg / Km)	*		
	42	Min. Bending Radius	*		
	43	Rip Cord	Non-metallic under inner jacket		
	44	Max. Recommended Pulley Tension	*		
	45	Oxygen Index	30 % minimum as per ASTM D 2863		
	46	Temperature Index	250 °C minimum as per ASTM D 2863		
	47	Sequential Marking on Outer Sheath	Length marking every meter		
	48	Drum Length	*		
	49	Tolerance	± 5%		
Notes: To be decided **					
1	Vendor to specify.*				
2	Refer standard specification for Instrument Cable doc. No. VCS-SPC-5310 for more information .				
3	MultiPair Cable Tag number shall be same as instrument tag number.				
 ENERGISING QUALITY	CLIENT:	HPOIL GAS PRIVATE LIMITED			
	PROJECT:	SUPPLY OF CHECK METERING SKID FOR CITY GAS DISTRIBUTION PROJECT AT DIMAPUR FOR THE STATE OF NAGALAND	C1	30.07.2025	PS AS PK
			REV.	DATE	PRPD CHKD APPD



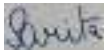



INSTRUMENT - PAIR CABLE (Flame Retardant Low Smoke)					Rev.
GENERAL	1	Cable Identification	Analog- PVC/OSCR-AL/INDSCR-AL/FRLS/PVC/SWA/PVC		
	2	Number of Pairs	1P (IS)	6P (IS)	
	3	Cable Length	Refer SOR , cable schedule and Cable Summary		
	4	Number of Twists per Meter	10 minimum		
	5	Application	Instrumentation & Control Cables		
	6	Voltage Grade	300 V		
	7	Code Conformity	BS 5308: part 2: 1986 type 2 & IS 1554 part1 armoured cables, IS-8130/84		
CONDUCTOR	8	Type	7 Stranded, each strand of 0.53 mm dia		
	9	Conductor Size	1.5 Sq.mm		
	10	Material	Plain Annealed Electrolytic Copper Conductor,BS: 6360, Class 2		
	11	Core Identification	Black and White (as per BS-5308, part-2, 1986 )		
INSULATION	12	Material	PVC Type TI1 (as per BS: 6746), as referred in BS: 5308		
	13	Niminal Thickness of Insulation	As per table 1 OF BS: 5308		
	14	Color of Conductor Insulation	As per BS: 5308 (Table 11)		
INNER JACKET	15	Material	Extruded Flame Retardant Low Smoke (FRLS) TM1 PVC to IS-5831, as per BS: 6746,		
	16	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986		
	17	Lead Jacket Thickness	N/A		
	18	Color	Blue		
INDIVIDUAL SHIELD	19	Material	Aluminium backed by Mylar / Polyester tape		
	20	Nominal Thickness (in mm)	0.05 mm minimum		
	21	Binder Tape Material	Non-Hygroscopic Tape		
	22	Overlap	Min. 25% on either side		
	23	Coverage	100%		
	24	Drain Wire	Multi-strand bare tinned annealed Copper conductor		
	25	Drain Wire Cross section	0.5 mm² minimum		
OVERALL SHIELD	26	Material	Aluminium backed by Mylar / Polyester tape		
	27	Nominal Thickness (in mm)	0.05 mm minimum		
	28	Binder Tape Material	Non-Hygroscopic Tape		
	29	Overlap	Min. 25% on either side		
	30	Coverage	100%		
	31	Drain Wire	Multi-strand bare tinned annealed Copper conductor		
	32	Drain Wire Cross section	0.5 mm² minimum		
	33				
OUTER JACKET	34	Material	Extruded FRLS TM1 PVC to IS-5831, as per BS: 6746		
	35	Color	Blue		
	36	Nominal Thickness (in mm)	As per table 10 & CL. 13.3 of BS 5308: Part 2: 1986		
	37				
ARMOUR	38	Armour Material	Galvanised steel wire as per cl. 13.2.2 of BS 5308:Part2: 1986		
	39	Armour Wire Size	BS: 5308, (Table 10)		
OTHERS	40	Overall Outer Diameter (with Tolerance)	*		
	41	Under Armour Diamater	*		
	42	Over Armour Diamater	*		
	43	Weight (in Kg / Km)	*		
	44	Min. Bending Radius	*		
	45	Rip Cord	Non-metallic under inner jacket		
	46	Max. Recommended Pulley Tension	*		
	47	Oxygen Index	30 % minimum as per ASTM D 2863		
	48	Temperature Index	250 °C minimum as per ASTM D 2863		
	49	Sequential Marking on Outer Sheath	Length marking every meter		
	50	Drum Length	*		
	51	Tolerance	± 5%		
Notes:					
1	Vendor to specify.*				
2	Refer standard specification for Instrument Cable doc. No. VCS-SPC-5310 for more information .				
3	Cable Tag number shall be same as instrument tag number.				
 ENERGISING QUALITY	CLIENT:	HPOIL GAS PRIVATE LIMITED			
	PROJECT:	SUPPLY OF CHECK METERING SKID FOR CITY GAS DISTRIBUTION PROJECT AT DIMAPUR FOR THE STATE OF NAGALAND	C1	30.07.2025	PS
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## VCS Quality Services Pvt. Ltd.

### STANDARD SPECIFICATION FOR PRESSURE GAUGE

VCS-SS-IN-5001\_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	KS	VB	KNC	AD
00	23.05.2019	ND	UM	KP	KNC
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
UNCONTROLLED COPY : If printed					
CONTROLLED COPY : If in soft and signed					

<b>REVISION RECORD</b>						
<b>Rev.</b>	<b>Revision Date</b>	<b>Prepared by</b>	<b>Checked by</b>	<b>Approved by</b>	<b>Authorized by</b>	<b>Revision Description</b>
00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
		Karan Singh	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	

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## **ABBREVIATION**

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BS	British Standards
DIN	Deutsches institute fur Normung
FAT	Factory Acceptance Test
IEC	International Electro-technical Commission
IP	Ingress Protection
IS	Indian Standards
ISA	Instrument Society of America
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
NPT	Nominal Pipe Thread
SAT	Site Acceptance Test
SS	Stainless Steel

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## **1 SCOPE**

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of Pressure Gauge along with its accessories.

## **2 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.

### 3 REFERENCE DOCUMENTS

#### 3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

##### **American Society of Mechanical Engineers**

ASME B1.20.1	Pipe Threads
ASME B 16.5	Steel Pipe Flanges and Flanged Fitting
ASME B 16.20	Ring Joint Gaskets and Grooves for Steel Pipe Flanges

##### **British Standards**

BS 1780	Specifications for Bourdon Tube Pressure and Vacuum Gauges
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##### **Deutsches Institute fur Normung**

DIN 50049	Document on Material Testing
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##### **Indian Standards**

IS 3624	Specification for Pressure and Vacuum Gauges
IS 2147	Degree of Protection provided for Enclosures

##### **International Electro technical Commission**

IEC 529	Degree of Protection by providing Enclosures
EN 837	Pressure Gauges Part-t: Bourdon Type Pressure Gauges, Dimensions, Metrology, Requirements and Testing

#### 3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.

## **4 MATERIALS**

Materials selected shall be in accordance with the Data Sheets and Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

## **5 DESIGN**

### **5.1 Pressure Element, Gauge Movement and Socket**

The Pressure Gauges shall be used for local indication.

Pressure Gauge sensing element shall be SS316 and movement of SS304, as a minimum. Pressure Gauge measuring element shall generally be Bourdon / Bellows / Diaphragm type. In case of Bourdon type of Gauges, the size of the Bourdon tube shall not be less than 75% of the nominal diameter of the dial size.

The wetted parts of the Pressure Gauge, the Bourdon tube and socket must be compatible with the process media. If not compatible with the wetted parts of the Gauge, corrosion will occur. Corrosion of Gauge wetted parts will eventually cause gauge failure and possibly safety issues.

The material of construction of all accessories wetted by process shall be as per socket material.

Gauge construction shall ensure no leakage of process fluid from the sensor elements to atmosphere and between the high pressure and low-pressure side (in case of differential Pressure Gauges) under normal condition.

Primary elements shall withstand the specified overpressure for at least 30 minutes without having their elastic characteristics affected.

When any Gauge is used for steam pressures, a siphon filled with water must be installed between the Gauge and the line.

All Pressure Gauges with maximum operating pressure exceeding 60 Kg/cm<sup>2</sup> shall be solid front type.

Over range protector and pulsation dampener, whenever used shall be of SS304, as a minimum. Pulsation Dampener shall be used for all pulsating services. It shall be floating pin type, externally mounted and externally adjustable.

### **5.2 Cases Dials**

Unless specified otherwise the gauges shall be weather proof to IP 65 as per IEC 529/IS 2147 as a minimum.

When safety type cases are specified, they shall consist of a solid partition isolating the pressure element from the dial.

Pressure Gauge dial shall be white, non-rusting plastic with black figures. The dial face shall be marked with pressure element material; dial size shall be 150mm. Pointers shall have micrometer adjustment.

Cases shall normally be cast aluminum alloy or black phenol.

In general, dial markings and dial color shall be as per IS 3624. Protect Gauges from frequent pressure pulsations by using liquid-filled.



### 5.3 Diaphragm Seals

Diaphragm seals, filled type or mechanical type shall be furnished where plugging of the element may occur or where suitable material is not available in highly corrosive services. When chemical seals are required, they shall be of the clean out type with flushing connection. Gauges specified with diaphragm seals shall have their diaphragms integral with the Gauges.

The sealing liquid for diaphragm seal Gauges shall be an inert liquid, compatible with the process fluid temperature.

For Gauges in oxygen and chlorine service, the sealing liquid shall be fluoro lube or equivalent compatible with the specified service.

For diaphragm seal Pressure Gauges with flanged ends, the diaphragm shall be rated for the maximum allowable pressure of the associated flange.

### 5.4 End Connection

Process Pressure Gauges with 150mm dial sizes or larger are most often supplied with a ½ NPTM connection to best support the gauge. Where NPT connections have been specified, the threading shall be to ANSI/ASM 81.20.1.

When flanges are specified, unless otherwise stated, they shall be to ANSI / ASME B 16.5. Process connection shall be bottom entry type.

### 5.5 Accuracy

For a mechanical Pressure Gauge, accuracy is defined as a percentage of the full scale range. The following are general guidelines:

- a. Test Gauges and standards: 0.25% through 0.10% full scale.
- b. Critical processes: 0.5% full scale.
- c. General industrial processes: 1.0% Less Critical Commercial Uses:2.0%

### 5.6 Range

Ranges shall be so specified that the Gauge normally operates in the middle third of the scale and shall conform to IS-3624 standard dials, wherever possible.

Pressure range is approximately twice the normal operating pressure. The maximum operating pressure should not exceed approximately 75% of the full scale range. Pressure Gauges shall have an accuracy of  $\pm 0.5\%$  as a minimum. Over range protection of 130% shall be used.

### 5.7 Name Plate

All Pressure Gauges shall be marked as per Manufacturer's standard and shall have a permanently attached stainless steel plate with the following, as a minimum detail:

- d. Tag number as per Data Sheet
- e. Manufacturer's name and trade mark
- f. Gauge type, model no. Serial no.
- g. Range of the Instrument.
- h. Maximum working pressure and maximum vacuum rating of the element.

- i. Area classification

## **6 FABRICATION AND PAINTING**

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Pressure Gauge. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein.

## **7 INSPECTION AND TESTING**

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Pressure Gauge shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing for Approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, calibration test and any other before Factory Acceptance Testing (FAT).

### **7.1 Factory Acceptance Testing (FAT)**

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Pressure Gauges complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Pressure Gauge.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Visual inspection
- b. Dimensional check
- c. Chemical and mechanical properties as per relevant material standards
- d. Calibration
- e. Functional test
- f. A certificate to detail the results and records obtained during the FAT shall be made available for ratification by the Vendor on the date of test. Following certificates shall be submitted by the Vendor:
- g. Mill test certificates relevant to the chemical analysis and mechanical properties of the materials as per the relevant Standards and Specifications.
- h. NOT reports for radiography, ultrasonic, magnetic particle and liquid penetrate inspection.
- i. Test report on operation of Gauges including operating time.

- j. Test report on hydrostatic test of Gauges.
- k. Test report on Gauge assembly tests.
- l. All other test reports and certificates as required by this Specification.
- m. The certificates shall be valid only when signed by Purchaser's Inspector. Only those Gauges which have been certified by Purchaser's Inspector shall be dispatched from Manufacturer's works.

## **7.2 Site Acceptance Testing (SAT)**

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the company / owner's representative. SAT shall be performed on the Pressure Gauge as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Gauge functions correctly and properly in accordance with the specified requirements.

## **8 MARKING, PACKING AND SHIPMENT**

Following FAT completion, Vendor responsible for the Pressure Gauge shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard "Marking, Packing and Shipping Procedures" for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

## **9 SPARES AND ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Pressure Gauge, for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

## **10 DOCUMENTATION**

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

### **10.1 Documentation Required with Technical Bid**

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;
- e. A list of accessory items together with Manufacturer's name and part number;
- f. Any other documents.

### **10.2 Documentation Required for Approval**

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- g. Specifications, Data Sheets;
- h. Bill of materials including Vendor list, details for third party items;
- i. Catalogues, Manuals and relevant drawings and documents;
- j. Dimensional drawings;
- k. Calibration certificates;
- l. Material test certificates;
- m. Procedures for FAT;
- n. Quality Assurance Plan;
- o. Any Other documents.

### **10.3 Guarantee & Warranty**

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.



**STANDARD SPECIFICATION  
FOR  
PRESSURE GAUGE**

**DOC NO : VCS-SS-IN-5001  
Rev No : 02**

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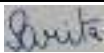



The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



## VCS Quality Services Pvt. Ltd.

### STANDARD SPECIFICATION FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER

VCS-SS-IN-5003\_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	KS	VB	KNC	AD
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Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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**STANDARD SPECIFICATION  
FOR  
PRESSURE / DIFFERENTIAL PRESSURE  
TRANSMITTER**

**DOCNO: VCS-SS-IN-5003  
Rev No : 02**

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00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
		Karan Singh	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



**STANDARD SPECIFICATION  
FOR  
PRESSURE / DIFFERENTIAL PRESSURE  
TRANSMITTER**

**DOCNO: VCS-SS-IN-5003  
Rev No : 02**

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**ABBREVIATION**

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
FAT	Factory acceptance Test
IEC	International Electro technical Commission
IP	Ingress Protection
IS	Indian Standard
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
NPT	Nominal Pipe Thread
SAT	Site acceptance Test
SS	Stainless Steel





**STANDARD SPECIFICATION  
FOR  
PRESSURE / DIFFERENTIAL PRESSURE  
TRANSMITTER**

**DOCNO: VCS-SS-IN-5003  
Rev No : 02**

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## **1.0 SCOPE**

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of Pressure Transmitter /Differential Pressure Transmitter along with its accessories.

## **2.0 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.



### 3.0 REFERENCE DOCUMENTS

#### 3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

##### **American Society of Mechanical Engineers**

ASME B 16.5	Steel Pipe Flanges and Flanged Fitting
ASME B 16.20	Ring Joint Gaskets and Grooves for Steel Pipe Flanges
ASME B1.20.1	Pipe Threads

##### **American Petroleum Institute (API)**

API RP 551	Process Measurements Instrumentation
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##### **International Electro technical Commission**

IEC-60529	Degree of Protection by providing Enclosures (IP Code)
IEC-60079-15	Electrical Apparatus with type of protection 'n'
IEC-60079-7	Electrical apparatus for explosive gas atmospheres increased safety 'e'
IEC-60605-1	Equipment Reliability Testing.
IEC-60068.2-13	Basic Environmental Testing Procedure for Electrical Components and Electronic Equipment.

##### **Indian Standards**

IS 2147	Degree of Protection provided for Enclosures
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#### 3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.



## **4.0 MATERIALS**

Materials requirements for Pressure/ Differential Pressure Transmitter shall be in accordance with the Data sheets and Company's Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175/ISO-15156 latest editions

Transmitter body studs shall be high tensile stainless steel or other corrosion - resistant material for higher stress levels.

## **5.0 DESIGN**

### **5.1 General**

The Pressure / Differential Pressure Transmitters shall be used in all cases where a continuous transmission of a pressure measurement is required in the control room for use in a control loop, or for indication or data acquisition.

Pressure / Differential Pressure Transmitters shall have an electronic state-of-art capacitance or any other type of sensor meeting all functional requirements. Element material for Transmitters shall be SS316 as a minimum.

Diaphragm seal element with capillary shall be used for congealing, corrosive and highly viscous services.

All Transmitters shall have an integral output meter. Remote mounted meters may be provided if required in addition. All Transmitters shall have accuracy of  $\pm 0.25\%$  of full scale deflection, unless otherwise specified.

Transmitter shall be capable of working with a minimum load of 600 ohms and at a 24V DC supply.

All electronic modules shall be designed for short circuit protection.

The change in output due to change in ambient temperature should be very minimum.

Electronic Transmitters shall have externally adjustable zero and span. Setting adjustment shall have locking adjustment.

### **5.2 Process Connection**

Process connection for Transmitters shall be ½ NPT or 2" flanged connection as per the Job Specification.

Process connection should be from bottom side.

3 Valve manifold in SS316 shall be used for Pressure Transmitter and 5 Valve manifold in SS316 shall be used for Differential Pressure Transmitter.

### **5.3 Equipment Protection**

Transmitter shall be furnished with all necessary weather and anti-corrosion protection to prevent damage from saline and corrosive process atmosphere.

Over range protection shall be 130 % of range or maximum pressure whichever is higher.



## **5.4 Enclosure Class**

In addition to weatherproof, the Pressure Transmitter enclosure shall be explosion-proof to NEMA-7 and certified by third party statutory bodies like UL/FM/BASIEFA or equal for use in hazardous area.

## **5.5 Range**

Where possible, Pressure Transmitters shall use the same range selection as Pressure Gauges. However, the range of a Transmitter shall always be within the range of the local gauge used to monitor its output.

The normal pressure shall not be read at greater than 75 % of the Transmitter calibrated range for instruments reading steady pressure. For fluctuating service, the normal pressure shall be not more than 60 % of the range:

## **5.6 Name Plate**

All transmitters shall be marked as per Manufacturer's standard and shall have a permanently attached stainless steel plate with the following, as a minimum detail:

- a. Tag number as per Data Sheet
- b. Manufacturer's name and trade mark
- c. Area classification
- d. Adjustment range.
- e. Element material.
- f. Body material.
- g. Service

## **6.0 FABRICATION**

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Pressure/ Differential Pressure Transmitter. Vendor shall submit the required specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein.

## **7.0 INSPECTION AND TESTING**

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Pressure Transmitter shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing for Approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, calibration test and any other before Factory Acceptance Testing (FAT).



## **7.1 Factory Acceptance Testing (FAT)**

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Pressure/Differential Pressure Transmitter complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Pressure Transmitter.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Visual inspection
- b. Dimensional check
- c. Chemical and mechanical properties as per relevant material standards
- d. Calibration
- e. Functional test

A certificate to detail the results and records obtained during the FAT shall be made available for ratification by the Vendor on the date of test.

## **7.2 Site Acceptance Testing (SAT)**

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the Company / Owner's representative. SAT shall be performed on the Pressure / Differential Pressure Transmitter as per the approved test procedure. A comprehensive test procedure in compliance with the Company Specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Pressure Transmitters functions correctly and properly in accordance with the specified requirements.

## **8.0 MARKING, PACKING AND SHIPMENT**

Following FAT completion, Vendor responsible for the Pressure Transmitter shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard "Marking, Packing and Shipping Procedures" for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.



Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

## **9.0 SPARES AND ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Pressure / Differential Pressure Transmitter, for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

## **10.0 DOCUMENTATION**

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

### **10.1 Documentation Required with Technical Bid**

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;
- e. Any other documents.



## 10.2 Documentation Required for Approval

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogues, Manuals and relevant drawings and documents;
- d. Dimensional drawings;
- e. Calibration certificates;
- f. Material test certificates;
- g. Procedures for FAT;
- h. Quality Assurance Plan;
- i. Any Other documents.

## 10.3 Guarantee / Warranty

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.

The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.

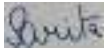







## VCS Quality Services Pvt. Ltd.

### STANDARD SPECIFICATION FOR TEMPERATURE TRANSMITTER

VCS-SS-IN-5103\_02

					
02	11.05.2022	SV	KNC	HK	GVW
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**STANDARD SPECIFICATION  
FOR  
TEMPERATURE TRANSMITTER**

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00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
		Karan Singh	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



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## **ABBREVIATION**

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
IEC	International Electro technical Commission
NACE	National Association of Corrosion Engineers
HART	Highway Addressable Remote Transmission
PROM	Programmable Read only Memory
RTD	Resistance Temperature Detector
HHC	Hand Held Communicator
LCD	Liquid Crystal Display
IP	Ingress Protection



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## **1.0 SCOPE**

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of Temperature Transmitter.

## **2.0 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.



### 3.0 REFERENCE DOCUMENTS

#### 3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

ANSI/ASME	ASME B 16.5 Steel Pipe Flanges and Flanged Fitting
	ASME B 16.20 Ring Joint Gaskets and Grooves for Steel Pipe Flanges
	ASME B1.20.1 Pipe Threads
IEC-529	Degree of Protection by Provided by Enclosures
IEC-60529	Degrees of protection provided by Enclosures (IP Code)
IEC-60770	Transmitters for use in Industrial Process control systems
IEC-60751	Industrial Platinum resistance thermometer sensors
BS-5345	Electrical and Instruments in Hazardous Areas.
IS-2147	Degree of protection Provided for Enclosures for Low Voltage Switch gear and control gear
IS-2148	Flameproof Enclosures for Electrical Apparatus
NACE MR-01-75	Material Requirement- Sulfide stress cracking Resistant Material for oil Field Equipment (Latest)

#### 3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- Data sheets
- Job Specifications
- Standard Specifications
- Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.



## **4.0 MATERIALS**

Materials selected shall be in accordance with the Data Sheets and Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

## **5.0 DESIGN**

### **5.1 General**

The temperature element type shall be as specified in the Data Sheets unless otherwise specified. The Temperature Transmitters should be 'SMART' type suitable for analog signal transmission using HART protocol and have a non-volatile memory, unless otherwise specified. A self-diagnostic facility shall be available. The Transmitters shall be certified for use in a hazardous area classified as mentioned in Data Sheet. The Vendor shall supply the extension cable between the temperature element and the Transmitter. All field Transmitters shall have an accuracy of 0.25% of span and shall be provided with output meter / output gauge at the signal output. Burn out protection must be provided with Temperature Transmitters and trip amplifiers. Upscale or down scale protection shall be decided based on its application to ensure fail safe operation.

### **5.2 Element**

If element is RTD, then RTD shall comply with IEC 60751. The RTD shall be three-wire type unless otherwise specified and shall have a resistance value of 100 ohms at 100°C.

### **5.3 Output**

Transmitter output shall be 4-20 mA analog signals complying with HART protocol. The Transmitter power supply shall be normally 24 VDC, arranged for two wire transmission, with minimum power supply voltage of 12.5 VDC.

### **5.4 Electronics**

The Transmitter electronics shall be solid state with appropriate smart circuitry. Printed circuit boards should be of a replaceable modular construction and shall be hermetically sealed or protected by a corrosion resistant coating. It should be supported against vibration in the case of plug-in type circuit boards. Signal wiring terminals and electronics shall be housed in separate compartments so that the electronics remain sealed during electrical connection to the signal cable. The electronics system shall be provided with environmental protection cover.

### **5.5 Calibration / Configuration**

It shall be possible to perform on-line and remote set point configuration / calibration of the transmitter via a hand held communicator (HHC) The HHC shall be of easy to use and shall be suitable for use in the area classification specified in this Specification. The analog output of the transmitter shall not be affected during communication with the HHC. At least one number of hand held configurator shall be supplied as a minimum



## **5.6 Adjustments**

The zero and span of the Transmitters shall be adjusted through a hand held communicator (HHC). A facility for engineering unit selection shall be available from the hand held communicator. The zero and span adjustments shall be non-interactive and continuously adjustable.

## **5.7 Indication**

The Transmitters shall be provided with integral digital output indicator with 4 digits, LCD readout. The output meter scale meter shall cover the range specified in the Data Sheets, with selectable indication either in the specified engineering units or in percentage value.

## **5.8 Performance**

The Transmitter accuracy, including the combined effect of linearity, hysteresis and repeatability shall be equal to or better than as stated in the Data Sheets. With reference to IEC 60770, errors shall be expressed as percentage of calibrated span, unless stated otherwise

## **5.9 Temperature Compensation**

The Transmitter electronics shall include for the temperature compensation. The sensor characterization curve shall be stored in PROM.

## **5.10 Transmitter Housing**

The instrument housing shall be low copper aluminum coated with epoxy paint. The epoxy coating shall be as per the industry standard, and shall be done on dry blast clean surface. The ingress protection for the enclosure shall be IP 65 as a minimum. No aluminum in its un-anodized form shall be used. No copper or its alloys shall be used except in its plated or tinned condition. No plastic shall be used except with a UV filter. The unit shall be supplied in housing suitable for outside (field) mounting in service conditions mentioned in the data sheets. Transmitters shall be installed in a sunshade for protection against direct sunlight.

## **5.11 CABLE ENTRY / CONNECTION**

The electrical signal cable entry shall be M20. Unused cable entries shall be plugged off in compliance with the specified electrical safety rating. Signal wiring terminals shall be of the screw type.

## **5.12 TAGGING**

Transmitters shall be provided with an identification plate, with all data clearly stamped on a corrosion resistant plate permanently attached to each instrument by means of rivets or pins and shall indicate, as a minimum, the following:

- a. Name of the Manufacturer or trademark.
- b. Instrument tag number.
- c. Serial number





- d. Year of manufacture
- e. Range & calibration (including units of measurement)
- f. Type of input
- g. Electrical safety (Type of Protection)
- h. Output signal.
- i. All information on the nameplate shall be die- stamped or deep engraved.

## **6.0 FABRICATION**

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Temperature Transmitter. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing mentioned herein. Painting of Thermocouple & RTD shall be in accordance with Company Painting Specifications.

## **7.0 INSPECTION AND TESTING**

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Temperature Transmitter shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing for Approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, calibration test and any other before Factory Acceptance Testing (FAT).

### **7.1 Factory Acceptance Testing (FAT)**

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Temperature Transmitter complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Temperature Transmitter.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Visual inspection
- b. Dimensional check
- c. Functional test
- d. Any other relevant test

A certificate to detail the results and records obtained during the FAT shall be made available for ratification by the Vendor on the date of test.



## **7.2 Site Acceptance Testing (SAT)**

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the company / owner's representative. SAT shall be performed on the Temperature Transmitter as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Temperature Transmitter correctly and properly in accordance with the specified requirements.

## **8.0 MARKING, PACKING AND SHIPMENT**

Following FAT completion, Vendor responsible for the Temperature Transmitter shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard "Marking, Packing and Shipping Procedures" for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

## **9.0 SPARES AND ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- I. Itemized recommended spare parts list for start-up and pre-commissioning.
- II. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Pressure Switch, for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.



All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

## **10.0 DOCUMENTATION**

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

### **10.1 Documentation Required with Technical Bid**

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;

### **10.2 Documentation Required for Approval**

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogues, Manuals and relevant drawings and documents;
- d. Dimensional drawings;
- e. Calibration certificates;
- f. Material test certificates;
- g. Procedures for FAT;
- h. Quality Assurance Plan;
- i. Any Other documents.

### **10.3 Guarantee / Warranty**

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.

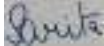



The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



## VCS Quality Services Pvt. Ltd.

### STANDARD SPECIFICATION FOR POSITIVE DISPLACEMENT METERS

VCS-SS-IN-5301\_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	KS	VB	KNC	AD
00	23.05.2018	ND	UM	KP	AD
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**STANDARD SPECIFICATION  
FOR  
POSITIVE DISPLACEMENT METERS**

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## **ABBREVIATION**

AGA	American Gas Association
AISC	American Institute for Steel Construction
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BP	British Petroleum
BS	British Standards
EIA	Electronic Industries Alliance
FAT	Factory Acceptance Test
IEC	International Electro-technical Commission
IP	Ingress Protection
IS	Indian Standards
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
NPT	Nominal Pipe Thread
SAT	Site Acceptance Test
SS	Stainless Steel
UV	Ultra Violet



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## **1.0 SCOPE**

This Standard Specification, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, inspection and testing, documentation, marking, packing and shipping of in line Positive Displacement Meters (PD meters), along with its accessories

## **2.0 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.





### 3.0 REFERENCE DOCUMENTS

#### 3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

Mechanical:

Equipment shall generally be mechanically designed in accordance with the relevant Institute of Gas Engineers (IGE) codes and the following principal codes of practice (Latest Editions).

Instrumentation shall generally be in accordance with the applicable sections of the following principal codes of practice (Latest Editions):

AGA Report no 7	Measurement of Gas by Turbine flow meter
AGA 8	Compressibility factors of Natural gas and other Related Hydrocarbon Gases
AGA 9	Measurement of Gas by Multipath Ultrasonic Meters
AGA 10	Speed of Sound in Natural gas & related Hydrocarbon gases
API 6D	Specification for pipeline valves, and closures and swivels
API RP 520	Part-1 & 2, Design and installation of pressure relieving systems in refineries
API RP 521	Guide for Pressure Relief and Depressing Systems.
API 527	Commercial Seat Tightness of Safety Relief Valves with Metal-to-Metal Seats
API RP 550	Manual on installation of refinery instrument and control systems
API RP 551	Process Measurement Instrumentation
API RP 554	Process Instrument and Control
API RP 555	Process Analyzers
API 2534	Measurement of Liquid Hydrocarbons by Turbine Meter



Systems

ANSI B 2.1	Pipe Threads, General Purpose (Inch) - Revision and Re designation of ASME/ANSI 82.1-1968
ANSI 816.5	Pipe Flanges and Flanged Fittings
ANSI B 16.104	The reference standard for control valves leakage classes is FCI-70-2 (previously named "ANSI B 16.104"; latest revision: 2003)
ASME Boiler and Pressure Vessel Code	Section-V: Non-destructive examination Section-VIII : Pressure Vessel, Division-1 Section-IX : Welding and brazing qualifications
ASME 816.5	Steel Pipe Flanges and Flanged Fittings
ASME 831.3	Steel Pipe Flanges and Flanged Fittings
ASME 831.8	Gas Transmission and Distribution Systems
AWSD1.1	Pipe Design and Fabrication Specification
AISC M013	Structural Steel Code (Skid Fabrication)
BS 449	Structural Steel Work
BS 1515	Materials of Filters & Scrubbers Instrumentation
BS 1041	Code for Temperature Measurement
BS 1042	Code for Measurement of Fluid Flow in Pipes
BS 5501	Part-1, Electrical apparatus for potentially explosive atmospheres
BS 2765	Thermowells
BS 5501	Detailing for Steel Construction
BS 5345	Electrical apparatus for potentially explosive atmosphere
BS 5308 Part-1	Selection, Installation and Maintenance of Electrical Apparatus in Explosive Atmospheres Instrumentation



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	Cables.
BS 6121	Cable Glands
IP Code Part 15	Area Classification Code for Petroleum Installation
BP RP-30-1	Design Practice for Instrumentation & Control
BP RP-30-2	Selection and Use of Measurement Instrumentation
BP RP 32-1/2	Inspection and Testing of New Equipment in Manufacture
EIA RS 485	Electrical characteristics of generators and receivers for use in balanced digital multi-point system
EN-12186	Gas supply systems - Gas pressure regulating stations for transmission and distribution - Functional requirements
EN -12405	Gas meters - Conversion devices - Part 1: volume conversion
EN – 1776	Gas supply - Natural gas measuring stations - Functional Requirements
EN 334	Gas pressure regulators for inlet pressures up to 100 bar
RS-232C	Interface between data terminal equipment and data communication equipment
IEC 60529	Degrees of Protection provided by Enclosures
IEC 60770	Transmitters for Use in Industrial Process Control Systems
IEC 60801	Electromagnetic capability for industrial process measurement and Control equipment
ISA AS.1	Instrument Symbols & Identification
ISO-9001	Quality Management System - Requirements 2000 Edition
ISO 6976	Natural gas - Calculation of calorific values, density,



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	relative density and Wobbe index from composition
18012213	Natural gas - Calculation of compression factor
OIML R6	General provisions for gas volume meters
OIML-TC8/SC8	Measurement of quantities of fluids / Gas meters
OIML R32	Rotary piston gas meters and turbine gas meters
NACE-MR0175/ISO15156	Petroleum and natural gas industries-Materials for use in H2S-containing environments in oil and gas production

### 3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.

## 4.0 MATERIALS

Materials selected shall be in accordance with the Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

## 5.0 DESIGN

### 5.1 General

The in line Positive Displacement Meters (PD meters) with its associated systems shall be designed for natural gas flow measurement required for both custody transfer and non-custody transfer applications. And it shall be field proven and no prototype shall be offered.

Positive Displacement flow meters measure the volume or flow rate of a moving fluid or gas by dividing the media into fixed, metered volumes. These devices consist of a chamber that obstructs the media flow and a rotating or reciprocating mechanism that allows the passage of fixed-volume amounts. The number of parcels that pass through



the chamber determines the media volume. The rate of revolution or reciprocation determines the flow rate. There are two basic types of Positive Displacement flow meters. Sensor-only systems or transducers are switch-like devices that provide outputs for processors, controllers, or data acquisition systems. Complete sensor systems provide additional capabilities such as an integral display and/or user interface. For both types of Positive Displacement Flow Meters, performance Specifications include operating pressure, temperature range, maximum material density, connection size, and percent accuracy. Suppliers indicate whether devices are designed to move fluid or gas.

There are several metering technologies for Positive Displacement Flow Meters. Gear meters have two rotating gears with synchronized, close-fitting teeth. Oval, spur and helical gears are often used because shaft rotation can be monitored to obtain specific flow rates. Vortex meters measure the frequency with which vortices are shed from a bluff body placed in the flow stream. Typically, the frequency is proportional to the material velocity. Nutating disc meters use media pressure to rock a disc in a circulating path without causing the disc to rotate about its own axis. A pin that extends from the disc is connected to a counter that monitors the disc's rocking motions. Meters that measure incremental volumes of flow with a piston are also available.

Positive Displacement flow meters differ in terms of electrical outputs. Analog current levels such as 4 - 20 mA are suitable for sending signals over long distances. Feedback is used to provide the appropriate current regardless of line noise and impedance. Analog voltages are simple, usually linear functions of the measurement. Modulated analog output signals are encoded, but still analog in nature. Examples include sine wave, pulse wave, amplitude modulation (AM), and frequency modulation (FM) signals. Several types of digital outputs are available. RS232, RS422, and RS485 are common serial, digital protocols. Popular parallel protocols include the general-purpose interface bus (GPIB), a standard which is also known as IEEE 488. Positive displacement flow meters with outputs that change the state of a switch or alarm are also available.

Selecting Positive Displacement Flow Meters requires an analysis of available features. Flow meters that can accommodate mixed phase materials such as steam or liquids with suspended solids (slurries) are also available. Some Positive Displacement Flow Meters contain built-in audible or visible alarms. Others are programmable and can be adjusted electronically for different materials, ranges, and outputs. Devices with recorder or totalizer functions are used to plot or chart flow history, or to provide information about total flow for a given unit of time. Multi-insertion or averaging flow meters determine the flow rate by taking flow rate measurements across several points in the flow path. Devices with controller function are commonly available.

The flow measurement shall be done by means of using the PD meter with selected technique of measurement Specifications and Data Sheets shall be referred for the exact measurement technique used in PD flow metering) depends upon the line size, process flow rate requirements and required accuracy, linearity, repeatability levels and rangeability.



**STANDARD SPECIFICATION  
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This Specification together with all annexures (enclosed elsewhere) covers the requirement for the design, engineering, manufacturing, testing, inspection and supply of PD meter along with all accessories.

Purchaser's Data Sheets for PD meters and its accessories (filters, etc) shall be referred and complied fully.

However, this does not absolve the Vendor of the responsibility for proper selection with respect to the fluid and its operating conditions. Proper sizing and selection of PD meter with its accessories are Vendor's responsibility.

Process parameters for PD meter design shall be provided by the Purchaser. Vendor shall take single point responsibility for the design & performance of the PD meter based on the Data Sheets and the Specifications furnished and taking into consideration successful operation, safety as per the established International Standards and Codes.

As a part of the PD meter, design & Engineering of following shall be included by Vendor:

- a. The Design of PD meter shall be done by Manufacturer of the metering device. The upstream and downstream Meter Runs, Flow Profiler shall also be supplied and wet calibrated by metering Manufacturer.
- b. Metering Manufacturer shall be responsible for review and approve entire PD meter design to maintain accuracy as per standards.
- c. Make, model & detailed Specification of each item.
- d. Fixing pressure drop across PD meter and filters.
- e. All design performance characteristics
- f. Overall dimensions of each PD meter and its support
- g. Weight of each PD meter

Vendor shall consider all the requirements of this Specification along with those as per relevant standards and shall assume total responsibility including all aspects of engineering, design, certification etc. for pressure reducing, metering skids & Instrumentation.

Vendor's quotations shall include the detailed Specifications for all the items of PD meter and its components. The Vendor shall also offer any instruments/ equipment required for safe and efficient operation of the system.

Vendor to furnish

- (a) The max. Flow rate (in Sm<sup>3</sup>/hr) at min. inlet pressure for the PD meter.
- (b) Min. flow rate (in Sm<sup>3</sup>/hr) through PD meter without damaging the internals of meter and valve intervals at min. inlet pressure.



(c) Flow rate vs. trim open curve to justify the valve rangeability and gear / disc regulation characteristics.

All units of measurements in Vendor's Specification sheets shall be same as those in Purchaser's Data Sheets.

All material Specification for the various parts in the Vendor's Specification sheets shall be to the same standard as those in Purchaser's Data Sheets.

As a minimum, the following data shall be used in determining the design requirements for a PD metering system:

- a. Fluid properties (e.g., specific gravity, viscosity, vapour pressure, etc.)
- b. Operating and design temperature and pressure
- c. System maximum and minimum flow rate
- d. Available maximum pressure drop in the complete system at maximum flow rate
- e. Available utilities (e.g. electrical power, instrument air)
- f. Pipe I. D. and line pressure at sample point

## **5.2 PD Meters**

Nutating Disc	The pressure of the medium causes a disc to rock in a circulating path without rotating about its own axis. A pin extending from the disc is connected to a counter that monitors the disc's rocking motions.
Oval Gear	Oval-gear meters have two rotating, oval-shaped gears with synchronized, close-fitting teeth. A fixed quantity of liquid passes through the meter for each revolution. Shaft rotation can be monitored to obtain specific flow rates.
Piston	Incremental volumes of flow are measured via a piston.
Other	Other unlisted, specialized, or proprietary configurations

### **Features**

Audible or Visual Alarms	Instruments have audible or visual alarms to alert users to dangerous conditions
Averaging / Multi-Insertion	Multi-insertion flow meters determine the flow rate by taking flow rate measurements across several points in the flow path.
Controller Functions	Devices have or receive sensor input, provide control, (limits,



PIO, logic, etc.) and output a control signal.

Programmable	Typically, programmable meters include a built-in microprocessor. They can be adjusted electronically for different materials, ranges, outputs, etc.
Recorder / Totalizer Functions	Totalizer functions totalize the amount of material, media, or process variable controlled. A recorder function may be a data logger that logs system or process variables and/or control commands for later viewing or analysis. A chart recorder that can plot (chart) flow history or give total flow for a given unit of time may also be available.

### **Output Options**

#### **Electrical Output**

Analog Current	Analog current levels (transmitters) such as 4 - 20 mA are suitable for sending signals over long distances. A current is imposed on the output circuit proportional to the measurement. Feedback is used to provide the appropriate current regardless of line noise and impedance.
Analog Voltage	Analog voltage outputs are simple, usually linear functions of the measurement.
Frequency	Frequency or modulated frequency outputs include amplitude modulation (AM), frequency modulation (FM), sine waves, and pulse trains.
Switch	The output is a change in state of a switch or a relay.

#### **Interface Options**

Serial / Digital	Flow meters can provide signal outputs in serial, parallel, Ethernet, or other digital formats. Devices with a serial/digital interface can provide a process variable for measurement, but do not include communication lines.
Network / Fieldbus	Devices output signals that are formatted according to an industrial fieldbus protocol such as CANBUS, PROFIBUS®, or SERCOS; a networking protocol such as Ethernet; or another industrial automation protocol. PROFIBUS is a registered trademark of PROFIBUS International.





Other Other unlisted, specialized, or proprietary interface options.

### **End Fittings**

Clamp Devices are inserted parallel to the flow path and clamped between two existing process pipes. External clamp-on flow meters are non-invasive. They do not require mounting directly in the process flow and can be used in closed piping systems. Ultrasonic, or Doppler, flow meters may use this type of mounting to read the flow through the pipe.

Compression Compression fittings tighten down a sleeve or ferrule over a joint to prevent leakage.

Flanged Devices are inserted parallel to the flow path, usually between two pieces of existing, flanged process pipes. Circular or square flanges are used to connect the fitting, typically via bolting or welding.

Plain End Devices have a plain, straight-pipe end that can be inserted into the bell end of the connecting pipe.

Socket Weld / Union The end fitting is designed for welding or soldering and can be a weld neck

Threaded Devices are inserted parallel to the flow path and threaded into two existing process pipes. National pipe thread (NPT) is the most common thread type.

### **Mounting Type**

In-line In-line flow meters are installed directly in the process line. They have a variety of end-fittings including flanges, threads, and compression fittings. Typically, in-line flow meters require a straight run of pipe for installation.

Insertion Type Devices are inserted perpendicular to flow path. They usually require a threaded hole in the process pipe or another means of access.

Non-Invasive Non-invasive flow meters do not require mounting directly in the process flow and can be used in closed piping systems. Ultrasonic flow meters such as Doppler devices may use this type of mounting to read the flow through the pipe.



### 5.3 Oval Gear Type

The oval gear PD meters are in line low flow positive displacement oval flowmeters designed for applications requiring the high accuracy measurement of clean liquids with viscosities less than 1000 Cp.

Units are available with a pulse output from a Reed switch or solid state Hall Effect switch for remote registration and/or totalization.

#### Principle of Operation

The oval meter is a Positive Displacement meter. As the fluid being measured passes through the meter, it rotates 2 oval gears in a measuring chamber to displace a precision volume of fluid. A sensor detects the gear rotation to determine displaced volume and flow rate.

#### Specifications

##### Viscosity / Flow range

< 5cP / (5 to 500 lph)

5 to 1,000cP / (2 to 500 lph)

##### Performance

Accuracy: +/- 1 % or better

Repeatability: 0.03% or better

Typical Meter performance and pressure drop: low; Vendor to specify

##### Ratings

The ratings shall be as per the job specifications

Maximum working pressure shall be upto 150 PSIG (1000 KPAG)

Maximum working temperature shall be 248° F (120° C).

Ambient Temperature: -4° F to 104° F (-20° C to +40° C).

##### Outputs

Reed Switch

Detection Method: Reed switch, two wire SPST N/O contact.

Max. Voltage: 150 VDC maximum.

Contact Capacity: 0.25 amps.

Rating 3 Watts or min

Termination: 39 inch (1 meter) flying lead.



Nominal K-Factor:

### **Meter Materials of Construction**

Meter Body: 316 stainless steel.

Rotors (Gears): 316 stainless steel.

Rotors (Gears) Bearings: Zirconia or equivalent

Rotors (Gears) Shafts: 316 stainless steel or optional

Hastalloy® C (PPS body only).

O-Rings: Standard Viton® fluoroelastomers or optional teflon® or equivalent.

### **Connections**

¼ inch NPT (female)

### **Dimensions**

Vendor shall specify and submit the GA and installation drawings.

## **5.4 Custody Transfer Applications**

### **5.4.1 Flow Metering System**

Overall accuracy of the PD meter shall be +/-1% or better of rate of flow. The Metering System shall provide measurement accuracy for accounting purposes for mass and volumetric quantities and the flow rates of product. It shall incorporate sufficient parallel meter runs to enable the maximum and minimum flow rates to be measured at the specified accuracy. The turn-down ratio (Rangeability) of PD meter shall be 100: 1.

Each PD meter operates as an independent unit with display unit / totalizer and having communication interface of HART 4-20 mA for communicating with the SCADA/PLC.

## **5.5 Name Plate**

All Instruments/valves shall be provided with an identification plate, with all data clearly stamped on a corrosion resistant plate permanently attached to each instrument/valve by means of rivets or pins and shall indicate, as a minimum, the following:

- a. Name of the Manufacturer or trade mark
- b. Manufacturer's model / type number
- c. Instrument tag number
- d. Serial number
- e. Year of manufacture
- f. Range & calibration (including units of measurement)
- g. Body rating (including units)



h. Electrical safety (type of protection)

All information on the nameplate shall be die-stamped or deep engraved.

## **6.0 FABRICATION AND PAINTING**

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of PD Meter. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein. Painting of PD Meter shall be in accordance with standard painting Specifications.

Painting shall be such that there is no rust formation on the PD Meter when exposed continuously to the corrosive atmosphere. All carbon steel bolting shall be hot dip galvanized or cadmium plated and bi-chromated.

Aluminium components shall be anodized then coated with epoxy paint.

The Supplier's painting standard will be considered as an alternative offer provided it meets or exceeds the preceding requirements.

## **7.0 INSPECTION AND TESTING**

Vendor shall perform all inspection and testing as per job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for metering skid shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing for Approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, calibration test and any other before Factory Acceptance Testing (FAT).

Instrumentation components shall meet the inspection and testing requirements of BP RP 32-1.

All materials and equipment shall be factory tested before shipment in the presence of Purchaser's representative. No material shall be transported to site until all required tests have been carried out and equipment is certified as ready for shipment. Acceptance of equipment or the exemption of inspection or tests thereof, shall in no way absolve Supplier of the responsibility for delivering equipment meeting the requirements of the specifications. Following tests shall be included.

- a. Material test certificate, hydrostatic test certificate, type test certificate
- b. Calibration certificate
- c. Test certificate.
- d. Certificates from statutory body being flame proof and weatherproof.

Supplier shall perform the usual standard tests to maintain quality control procedures. Purchaser shall submit these test certificates for review before starting inspection. Supplier shall be responsible for testing and complete integration of the system. Detailed procedures of test and inspection shall be submitted by the supplier for review before order and mutually agreed upon.



Inspection will be done by the Purchaser or authorized representative at Vendor's shop. For this inspection, labor, consumable, equipment and utilities as required shall be in Vendor's scope.

Testing and inspection works have to be carried out at Bidder's works or works designated by the Bidder.

### **7.1 Factory Acceptance Testing (FAT)**

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the PD Meters, complete with the project approved tags and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the PD Meter.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

### **7.2 Witnessing**

Flow Metering system and its associated instrumentation supplied in accordance with this Specification are subject to the minimum inspection requirements. Testing is to involve all components and subcomponents of the PD Meter. The Vendor is responsible to perform a complete functionality test of the PD meter.

### **7.3 Test and Inspection Schedule**

The Vendor shall submit an inspection and test plan and check list detailing the inspection and tests with their acceptance criteria for approval by the Purchaser.

In addition, the following tests and inspections shall be performed by the Manufacturer and may be witnessed or executed by Purchaser or his representative when so specified.

### **7.4 Visual Inspection**

A visual inspection and physical check shall be made for compliance of the material with requirements of the specifications of the original Purchase Order and all subsequent change orders including the relevant attachments and with Manufacturer's catalogue description and certified drawings furnished. Included are:

- a. Check for satisfactory workmanship, materials compliance and freedom from surface defects and broken glass;
- b. Check for compliance with certified drawings including dimensions;
- c. Check for all accessories on Purchase Order;
- d. Check for required cable length, if any
- e. Check paint for imperfections;



Verify that each component has a tag of corrosion resistant material permanently fastened to the unit and stamped with information

Verify that all terminals for interconnecting wiring between units are accessible for connecting and checking. Terminal blocks should be numbered and where 2 or more are present, should have block identification. Interconnecting cables shall be colour coded or numbered.

All electrical wiring shall be checked for continuity and insulation test.

## **7.5 Functional Testing**

Each PD Meter shall be accurately calibrated and tested by the Manufacturer at the normal working conditions specified in the attached Data Sheet. All test equipment used for testing shall have traceability to national standards.

## **7.6 Hydro-Testing**

All piping along with piping components shall be hydro-tested in accordance with ANSI 831.3 and the piping material Specifications prior to the application of internal coating, external paint and insulation. Instruments shall be hydro tested as per piping material Specifications.

## **7.7 Radiographic Testing**

10% of Meter needs shall be radiographic tested. The remaining shall be subjected to either magnetic particle test or dye penetration tests as applicable.

## **7.8 Flow Calibration**

Individual transmitters, shall be calibrated at Vendor's works. All equipments used for calibration shall have valid calibration certificate having traceability to National Institute of Standards & Technology or equivalent.

Each Flow meter & transmitter (Other than Master Meter) shall be calibrated for the complete flow rates with water at accredited facility. The meter factor shall be burnt in the flow transmitter.

The master meter & transmitter shall be calibrated at NMI accredited facility at similar flow, pressure and temperature conditions. Alternately the Master Meter can also be proved using mobile prover having valid calibration certificate from the internationally accredited laboratory at site.

Each skid shall be recalibrated at site in-situ with master meter. The flow test shall conform to API Standards and shall be carried at different flow rates. The meter factor shall be configured in the flow transmitter.

The flowmeter shall be calibrated for bi-directional measurement for the complete flow rates at accredited facility.

## **7.9 Site Acceptance Testing (SAT)**

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the Company / Owner's representative. SAT shall be



performed on the PD Meter as per the approved test procedure. A comprehensive test procedure in compliance with the Standard Specification shall be developed and issued to Company / Owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the PD Meter functions correctly and properly in accordance with the specified requirements.

## **7.10 Certificates of Acceptance**

At the satisfactory conclusion of the FAT, a factory Certificate of Acceptance shall be provided by the Vendor for signature by the Company.

At the satisfactory conclusion of the SAT (Site Acceptance Test) a final Certificate of Acceptance shall be prepared by the Vendor.

Attached shall be all test records, receipt for documentation and spare parts plus any other pertinent records regarding the Vendor's delivery. The document becomes a Certificate of final site acceptance, which Company shall review and approve.

Material certificates shall be furnished for PD meter, and its accessories in accordance to BS EN 10204, 3.1 b Type B.

Hazardous Area Certificates for electrical / instrument components suitable for Zone-1 shall be issued by a recognized approval authority.

The Vendor shall supply test documentation in accordance with the Specifications, covering all the tests, which are to be performed during the implementation stages and the installation & commissioning Phase. The Vendor shall supply all relevant test and calibration certificates applicable to the instrumentation equipment.

Vendor shall submit the Certification for Custody Transfer for the following instruments.

## **8.0 MARKING, PACKING AND SHIPMENT**

Following FAT completion, Vendor responsible for PD Meter shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed and secured for transit to site without damage.

Vendor shall provide and submit his standard 'Marking, Packing and Shipping Procedures' for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the job Site.



After inspection and testing, equipment shall be completely free of water and dry before start of preparation for shipment.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

All openings shall be sealed. Flanged openings shall be protected with wood, threaded connections' shall be protected with forged steel or moulded plastic screwed plugs.

All mechanical or machined surfaces subject to atmospheric corrosion prior to installation on site shall be treated with an easily removable rust preventative.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Each individual crate shall be marked on the top and at least one side with the following

- a. Contract number and name
- b. Consignee's name and address
- c. Purchase Order number and Item number
- d. Description of goods.

Initial spare parts shall be packed separately from the main equipment. The box or carton shall be clearly marked 'INITIAL SPARES'. Furthermore each, spare part shall have its part number clearly identified and attached.

## **8.1 Rejection**

Vendor shall make his offer in detail, with respect to every item of the Purchaser's Specification. Any offer not conforming to this shall be summarily rejected.

## **9.0 SPARES AND ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include with the bid recommended spare parts list for start-up, pre-commissioning and two year operation as per following:

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

The Vendor shall submit recommended accessories and special tools required for operation and maintenance of flow elements for review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be





properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

## **10.0 DOCUMENTATION**

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

### **10.1 Documentation Required with Technical Bid**

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Specification, Data Sheets.
- b. Bill of Materials including Vendor List, Details for third party items.
- c. Catalogues and manuals.
- d. Quality Assurance Plan.
- e. Any other documents.

The Vendor shall provide at the time of tendering a complete detailed engineering package in accordance with the Purchaser's data requirement and shall include but not necessarily be limited to the same.

### **10.2 Documentation Required for Approval**

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications;
- b. Bill of materials including Vendor list, details for third party items
- c. Catalogues, Manuals
- d. Sizing calculations
- e. JB wiring drawings
- f. Assembly drawings with overall dimensions
- g. Detailed sectional drawings showing all parts with reference numbers and material specifications.
- h. Welding, heat treatment, inspection and testing procedures
- i. Calibration certificates



- j. Material Test Certificates
- k. Procedures for FAT
- l. Quality Assurance Plan
- m. Any other documents.

### **10.3 Installation, Testing & Commissioning**

The supplier shall assist during erection, testing and commissioning of PD Meters at site. The bidders shall indicate separate pricing for this purpose in their offers, if applicable.

### **10.4 Guarantee / Warranty**

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Generally the Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor.

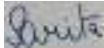



The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



## VCS Quality Services Pvt. Ltd.

# STANDARD SPECIFICATION FOR TURBINE FLOW-METERS

VCS-SS-IN-5303\_02

					
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**STANDARD SPECIFICATION  
FOR  
TURBINE FLOW-METERS**

**DOCNO: VCS-SS-IN-5303  
Rev No : 02**

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00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
		Karan Singh	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



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## **ABBREVIATION**

AGA	American Gas Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
DC	Direct Current
IEC	International Electrotechnical Commission
IP	Ingress Protection
ISA	Instrument Society of America
IS	Indian Standards
LCD	Liquid Crystal Display
NACE	National Association of Corrosion Engineers
NPT	Nominal Pipe Thread
NPTF	Nominal Pipe Thread - Female
SS	Stainless Steel



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## **1.0 SCOPE**

This Standard Specification, together with the data sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, inspection and testing, documentation, marking, packing and shipping of Turbine Flow Meters.

## **2.0 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.



### 3.0 REFERENCE DOCUMENTS

#### 3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

AGA Report No.7	Measurement of Natural Gas by Turbine Meters
ANSI B 1.20.1	Pipe Threads, General Purpose (Inch)
ANSI B 16.5	Pipe Flanges and Flanged Fittings NPS ½" Through NPS 24 Metric/ Inch Standard
API MPMS	Manual of Petroleum Measurement Standards Chapter 1 - Vocabulary Chapter 4 - Proving Systems Chapter 5 - Metering
ASME Section-VIII	Boiler & Pressure vessel code: Rules for construction of pressures vessels
IEC-801	Electromagnetic compatibility for industrial-process measurement and control equipment
IEC-529/ IS-2147	Degrees of protection provided by enclosures (IP code)
IEC-79/ IS-2148	Electrical apparatus for explosive gas atmospheres - Flameproof enclosures
ISA RP 31.1	Specification, Installation, and Calibration of Turbine Flow meters
NACE MR-01-75	Petroleum and natural gas industries - Materials for use in H <sub>2</sub> S-containing environments in oil and gas production - Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys - Part 3

#### 3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.





## **4.0 MATERIALS**

Materials selected shall be in accordance with the Data Sheets and standard specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

The material used for the flow element shall be SS-316 as minimum unless and otherwise specified in the Job Specifications / Data Sheets.

## **5.0 DESIGN**

The following design requirement covers the general requirements of Turbine Flow Meters and accessories etc., but for the exact requirements and applications, the relevant, project Specifications and design basis shall be referred and complied.

### **5.1 General**

- a. Unless otherwise specified, transmitter of the self-generating type is preferred.
- b. The flow direction shall be clearly stamped or cast on the body.
- c. Meter cable entry shall be 3/4" NPTF.
- d. Unless otherwise mentioned, end connection details shall be as below:
  - i. Threaded end connections shall be to NPT as per ANSI B 1.20.1
  - ii. Flanged end connections shall be as per ANSI B 16.5
  - iii. Grooves of ring type joint flanges shall be octagonal as per ANSI B 16.20
  - iv. Flange face finish shall be serrated concentric to paragraphs 6.3.4.1, 6.3.4.2, and 6.3.4.3 of ANSI B 16.5
- e. Vendor shall select the proper type and material of bearing for the service conditions indicated. The bearing shall be of the non-lubricating type.
- f. The pick-up coil shall be hermetically sealed.
- g. The design of electronic instruments shall be in compliance with the electromagnetic compatibility requirements as per IEC-801.
- h. The Flow Meter shall have an over-range protection of at least 30% of specified range. Suitable protection shall be provided against over speeding.
- i. Vendor shall indicate whether the Flow Meter is suitable for mounting in a vertical line.
- j. Where Purchaser's Data Sheets indicate a wide variation in the fluid viscosity, Vendor shall offer viscosity compensated rotors. Vendor shall also indicate the range of viscosities over which the measurement accuracy remains within limits.
- k. The transmitter's enclosure housing the electrical parts shall be suitable for the area classification indicated in the Purchaser's Data Sheets. Unless otherwise specified, the enclosure shall conform to the following standards:

Weatherproof housing - to IP-55 as per IEC-529 / IS-2147

Flame proof housing - Ex (d) as per IEC-79 / IS-2148

Flameproof housing shall also be made weatherproof.



## 5.2 Accessories

### 5.2.1 Air Eliminator

- a. The air eliminator, where specified shall be supplied complete with all accessories such as differential pressure gauge, pressure gauge, safety valve, sight flow glasses etc. as applicable.
- b. The air eliminator shall be supplied with necessary supporting brackets suitable for floor mounting.

### 5.2.2 Strainer

- a. Strainer shall be suitably selected by the Vendor for service conditions indicated in Purchaser's Data Sheets and also for the type of Turbine Meter offered. These shall also meet ASME Section VIII as applicable. Accessories mentioned in air eliminator are also applicable as required.
- b. The strainer shall have the following US standard sieve mesh sizes against the nominal size of the flow transmitter shown:

Nominal Size of Flow Transmitter (in inches)	Mesh Size
3/8	170
1/2	120
3/4 and 1	45
1 1/2 and above	18

### 5.2.3 Flow Strainer

- a. Vendor to recommend the flow straightener (tube or vane type etc.) best suitable for the application. Construction of the flow straightener shall correspond in general to AGA Report number 7.
- b. The straightening element shall be made out of a thin walled tube or light gauge metal vane. However, the design shall be rugged enough to resist the forward thrust due to high flows. The element shall have smooth leading and trailing edges.
- c. For tube type flow straightener, the length to diameter ratio of each tube shall be at least 10: 1.



## **5.3 Meter Electronics**

### **5.3.1 Totalizer**

- a. A local totalizer with one non-resettable counter and one manually resettable counter, 6-digit LCD digital readout, rechargeable / permanent batteries, battery charger (in case of rechargeable batteries) and mounting accessories for 2" stanchion shall be provided with the Turbine Flow Meter.
- b. The totalizer shall be capable of operating in the absence of power and shall display the readings when requested.
- c. Battery change shall not cause any loss of data.

### **5.3.2 Pre – Amplifier**

- a. Pre-amplifier provided with the Turbine Flow Meter shall be intrinsically safe, and shall be located on the meter.
- b. The pre-amplifier shall operate on 24 V DC signal.
- c. The cable entry to the pre-amplifier shall be 3/4" NPTF

### **5.3.3 Transmitter**

- a. The transmitter provided with the Turbine Flow Meter shall be intrinsically safe and shall operate on 24 V DC power.
- b. The cable entry to the transmitter shall be 3/4" NPTF.
- c. The transmitter shall be capable of generating pulse output signal. The pulse output shall be less than 2 KHz and voltage level shall be 250 mV to 24 V maximum at 1500 ohms.

### **5.3.4 Field mounted items shall have enclosures suitable for the area classification indicated in Purchaser's Data Sheets.**

### **5.3.5 Recorders, where specified, shall be supplied with chart rolls and ink for six months continuous operation.**

### **5.3.6 Where the Vendor is supplying the complete meter electronics, Vendor shall ensure that input / output signals and performance characteristics of individual instrument are compatible with each other.**

### **5.3.7 Supply voltage fluctuation of $\pm 10\%$ from the specified value and supply frequency fluctuation of $\pm 3$ Hz from the specified value shall not affect the meter performance.**



- 5.3.8 Vendor shall calibrate each Turbine Meter at his shop using preferably the mechanical displacement meter prover as detailed out in API MPMS. The proving conditions simulate the actual operating conditions as nearly as possible. All the precautions mentioned under paragraph 5.2 of ISA RP 31.1 shall be observed during proving.

## **5.4 Name Plate Details**

Each Turbine Flow Meter and its accessory shall have a SS name plate attached firmly to it at a visible place, furnishing the following information:

- a. Tag Number as provided in the Data Sheet.
- b. Manufacturer's name or trade Mark.
- c. Instrument's serial number and model number
- d. Nominal end connection size and rating in psi
- e. Body and trim material
- f. Calibrated range and units of measurement of flow
- g. Area classification in which the instrument can be used
- h. Standards for body / trim material (e.g. ASTM)

## **6.0 FABRICATION AND PAINTING**

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Turbine Flow Meters. Vendor shall submit the required specification, drawings & documents for approval. Also vendor shall refer the relevant codes and standards for manufacturing herein.

Painting of Turbine Flow Meters shall be in accordance with Company Painting Specifications

## **7.0 INSPECTION AND TESTING**

Vendor shall perform all inspection and testing as per job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Turbine Flow Meters shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing Plan for Proprietary items / Special items for Approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like material test, hazardous area certification test and any other before Factory Acceptance Testing (FAT).

### **7.1 Factory Acceptance Testing (FAT)**

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Turbine Flow Meters, complete with the project approved tags and highlighting the inspection and testing requirements of all such flow meters.



FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Turbine Flow Meters.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum.

#### **7.1.1 Witness Inspection**

All Turbine Meters and their accessories shall be offered for pre-dispatch inspection for the following as minimum:

- a. Physical / dimensional checks and workmanship.
- b. Calibration, including establishing accuracy and repeatability over the entire range, on representative samples.
- c. Review of all certificates and test reports as indicated at Para of 7.1.3 of this specification.

In the event of not witnessed by Purchaser, the tests shall anyway be completed by the Vendor & documents for same submitted for scrutiny.

#### **7.1.2 Hydrostatic Test**

Each Turbine Meter shall be subjected to hydrostatic test. The hydrostatic test pressure shall be 1.5 times the maximum allowable working pressure.

#### **7.1.3 Vendor shall submit following test certificates and test reports for Purchaser's review:**

- a. Material test certificates (MIL certificates) for Turbine Meter and its accessories
- b. Certificates of radiography / X-ray for welded joints. Dye penetration test certificate shall be provided where radiography / X-ray is not possible.
- c. Hydrostatic test report as per Para 7.1.2 of this Specification
- d. Type test report of enclosure for meter electronics
- e. Calibration report for Turbine Meter
- f. Dimensional test report

### **7.2 Site Acceptance Testing (SAT)**

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the Company / Owner's representative. SAT shall be performed on the Restriction Orifice Plates and its accessories, as per the approved test procedure. A comprehensive test procedure in compliance with the Company



specification shall be developed and issued to Company / Owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Turbine Flow Meters functions correctly and properly in accordance with the specified requirements.

## **8.0 MARKING, PACKING AND SHIPMENT**

Following FAT completion, Vendor responsible for Turbine Flow Meters and its accessories shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard 'Marking, Packing and Shipping Procedures' for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by Company's / Contractor's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

## **9.0 SPARES AND ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include with the bid recommended spare parts list for start-up, pre-commissioning and two year operation as per following:

- i. Itemized recommended spare parts list for start-up and pre-commissioning.
- ii. Itemized recommended spare parts list for two years operation.

The Vendor shall submit recommended accessories and special tools required for operation and maintenance of Turbine Flow Meters for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.



## 10.0 DOCUMENTATION

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

### 10.1 Documentation Required with Technical Bid

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Vendor's quotation shall include a detailed Specification sheet for each Turbine Meter with following information:
  - i. All the details regarding type, construction materials etc. for various parts of the Turbine Meter and its accessories.
  - ii. All the design characteristics and performance characteristics as per paragraphs 4.1 and 4.2 of ISA RP 31.1.
  - iii. Type of cabling required and the maximum permissible cable length between the meter and its associated receiver instrument.
  - iv. Maximum pressure loss through the meter and its accessories like strainer at maximum flow rate
  - v. Overall dimensions in millimetres of the Turbine Meter and its accessories
- b. Purchaser's Data Sheets
- c. Bill of Materials including Vendor list, details for third party items
- d. Catalogues and Manuals giving detailed technical Specification and other information for each type of Turbine Meter and its accessories covered in the bid.
- e. Detailed drawings and data
- f. Quality Assurance Plan.

### 10.2 Documentation Required for Approval

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Certified drawings and Specification sheets, which include the following:
  - i. Calibration performance characteristic curves for Turbine Meter similar to that in AGA Report No.7
  - ii. Graphs of temperature correction factor
  - iii. Graphs of pressure correction factor
- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogues, Manuals and relevant drawings and documents;
- d. Dimensional drawings;
- e. Material test certificates;



- f. Procedures for FAT and SAT;
- g. Quality Assurance Plan;
- h. List for spare parts for start-up and for 2 years of operation.

### **10.3 Guarantee / Warranty**

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Generally the Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor.

The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.

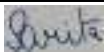







## VCS Quality Services Pvt. Ltd.

### STANDARD SPECIFICATION FOR ELECTRICAL MOTOR ACTUATOR FOR VALVES

VCS-SS-IN-5507\_02

					
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**STANDARD SPECIFICATION  
FOR  
ELECTRICAL MOTOR ACTUATOR VALVES**

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02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



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## **1 SCOPE**

This Standard Specification covers the requirements for the design, material, fabrication / manufacturing, painting, inspection and testing of factory assembled electric motor powered actuator for valves.

## **2 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.



### 3 REFERENCE DOCUMENTS

#### 3.1 Codes & Standards

The design, materials, manufacturing, inspection and testing of electric motor powered actuator shall comply with the latest edition of the following codes and standards.

##### **Bureau of Indian Standard (IS Codes)**

IS 8623	Low-voltage Switchgear and Control gear Assemblies
IS 13947	LT Switch gear and Control gear – Contactor and Motor Starter
IS 325	Three phase induction motors
IS 5571	Guide for Selection and installation of Electrical Equipment for Hazardous Areas(other than mines)

##### **International Electro Technical Commission (IEC CODES)**

IEC 60439	Low -Voltage Switchgear and Controlgear assemblies
IEC 60529	Degrees of Protection Provided by enclosures (IP Code)
IEC 60947-1	Low -Voltage Switchgear and Controlgear-General rules
IEC 60034	Rotating Electrical Machines
IEC 60072	Dimensions and Output Series for Rotating Electrical Machines
IEC 60079	Electrical apparatus for explosive gas atmospheres
IEC 61158-2	Digital Data communication for measurement and control field bus for use in industrial control system.
IEC 61241	Electrical apparatus for use in the presence of combustible dust

##### **Others**

ISO 15	Rolling Bearings, Radial Bearings, Boundary Dimensions, General Plan.
ISO 281	Rolling Bearings - Dynamic Load Ratings and Rating Life
ISO 1940/1	Mechanical vibration - Balance quality requirements for Rotors in a courant (rigid) state. Part 1: Specification and verification of balance tolerance.
NEMA	National Electrical Manufacturer's Association
ASME B31.8	Gas Transmission and Distribution Piping System



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ASME B16.5	Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24
ASME B16.47	Large Diameter steel Flanges: NPS 26 through NPS 60
ASME B1.20.1	Pipe Threads, General Purpose
NFPA 70	National Electrical Code
ISA-SP50	Recommendation for Field bus Devices

### **3.2 Order of Precedence**

In the event of conflict between specifications, data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets;
- b. Job Specifications;
- c. Standard Specifications;
- d. Codes and Standards.

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the Manufacture of the items in question.

## **4 DESIGN**

### **4.1 General**

Electric motor powered actuator shall be designed, assembled, inspected and tested in accordance with standards and requirements covered in this specification.

Actuator manufacturer shall be responsible for the design and safe operation of the supplied actuator.

Valve and actuator shall be supplied duly assembled complete with all equipment, fittings, piping and valves for remote and manual control of the valve and actuator. The assembly may be disassembled if necessary for shipping considerations. Preference shall be given to designs which minimize actuator equipment interconnecting cabling.

The actuator Manufacturer shall co-ordinate with valve Manufacturer for timely delivery and testing requirements specified in Purchase Order.

The construction of the actuator and its controls shall be such that the proper manual operation and maintenance can be carried out by skilled operating personal without the risk of being injured by moving parts.

Manufacturer shall be responsible for integrating the potential free NO and / or NC contacts of Remote Telemetry Unit (RTU) for open and close command in interlock circuit. These commands will be of momentary type with 1 sec duration.



The interconnecting cabling, adapters, cable glands, junction boxes are in Manufacturer's scope of supply.

The actuator shall be supplied totally self-contained, wired, and mounted on valve. In case of separate control box, wiring between control box and actuator is in the vendor's scope.

## **4.2 Service Conditions**

Unless specified otherwise in datasheet following service conditions shall be considered for design of equipment and its components.

Ambient Air Temperature

- a. Outdoor installation;
- b. Max. 45°C ,average @ in 24 Hrs +35°C;
- c. Min. -5°C;
- d. Design Life - 20 Years.

The atmosphere is to be considered sulpharious, and dusty. The possibility of condensation, as experienced during large temperature variations in humid atmosphere, shall be taken into account.

## **4.3 Mechanical Design**

The stroke of the actuator shall be easily adjustable in steps of maximum 0.50 for valves.

A local / remote switch shall be installed to prevent remote operation during maintenance work. This switch shall be provided with a hole of 12 mm in diameter for locking with pad lock in either position.

All control accessories shall be mounted in an enclosure and shall be fully wired. The enclosure shall be IP 65.

### **4.3.1 Powered Actuator**

Manual Over-Ride

- a. Provision for manual override valve operation shall be provided by a hand-wheel;
- b. The direction for closing the valves shall be clearly marked, with the directions of closure clearly worded. If the hand-wheel itself carries the direction of closing, then the hand-wheel shall be non-reversible on the spindle. Means shall also be provided to show the position of the valve through the arc of travel;
- c. The manual override shall be lockable with lugs sized to accept padlocks with a 10 mm diameter shank. The hole in the lugs shall be a minimum of 14 mm in diameter;
- d. The actuator should have a shear pin. In the event of jamming of the valve or the gearbox, the shear pin should break so as to prevent damage to the valve further;
- e. A force no greater than 200N shall be required to operate the hand wheel or hand pump. The position of the hand wheel shall be field interchangeable between either sides of the actuator.

Remote / Local Operation and Selection

- a. All actuators shall be able to work in a selectable remote / local mode.
- b. The valve actuator shall be provided with a minimum of:



1. Local valve position indication;
2. Limit switches for fully open and fully closed valve position;
3. Local manual operating and test facility where normal actuator operation may be locally manually initiated. The device used to initiate local manual operation shall be lockable;
4. Operating speed controls for opening and closing valves shall be provided.

#### Actuator Torque

- a. The guaranteed minimum output torque of the actuator shall be at least 1.5 times the breakaway torque required to operate the valve throughout its stroke under maximum differential pressure corresponding to class rating of the valve;
- b. At the time of bidding, the actuator manufacturer shall provide actuator torque output curves showing guaranteed torque against valve position. The plot shall also show similar torque curves, for torque required to open/close valve at maximum differential pressure, based on data obtained from valve manufacturer.

#### Actuator Mounting

- a. All mounting accessories needed for installing the actuator, tanks, etc. are in Seller's scope of supply;
- b. The actuator shall be suitable for direct mounting to the valve without changing the standard top works of the valve and shall have the capability to be mounted or removed from the valve when the valve is in service;
- c. The actuator shall be flanged and bolted directly on the valve body or extension. The connection between actuator and the valve or between the operator, the outer casing of the extension and the valve shall be such that there is no movement between these connections when the valve is actuated by the actuator under any load;
- d. Actuator to valve stem connection shall be keyed or splined, D Section or bolted split clamp type;
- e. The actuator Manufacturer shall be responsible for the mechanical compatibility and provision of the mechanical coupling between the actuator and valve. The actuator shall be sized such that the maximum torque / thrust capabilities can be safely transmitted to the valve without mechanical damage to the valve, actuator or coupling;
- f. Actuator mounting pads on the valve shall be as per the latest ISO standard.

#### Torque and Position Control

- a. Actuator torque and position control shall be adjustable;
- b. Torque control shall allow setting the Motors torque to suit the valve load requirement and protect the Motors from a jammed valve condition;
- c. Position control shall allow setting the number of actuator turns to suit the valve operation;
- d. Torque and position control settings shall be stored electronically and displayed on the actuator.

#### Electronic Display

The following functions shall have an electronic display on the actuator:





- a. Valve position from fully open to fully closed in %;
- b. Valve status: open, closed and intermediate;
- c. The actuator display window should be field reversible.

#### Memory Storage

- a. Actuator settings, remote control settings and the electronic display shall be stored electronically with a battery backup to maintain memory in the event of power failure or isolation. The battery life shall be seven years minimum;
- b. Battery drain feedback should be available from the actuator.

#### Dust Protection

Gaiters and/or transparent dust covers shall be provided to protect stem and guide bushings from dust ingress.

#### ESD and Fail Position

All Non-ESD (emergency shutdown) valve actuators shall be designed to remain in the selected position until an alternative position is selected. ESD valve actuators shall fail as indicated on the valve data sheets. For ESD valves, there shall be an external volt free contact input, hardwired from the SIS system.

#### Lubricators

Valves and actuators utilizing "no-maintenance" lubrication components shall be offered where available. An automatic lubricator shall be offered wherever available.

#### Pressure Relief

All actuators shall be provided with a pressure relief system that will automatically relieve any internal body pressure, which may result from leakage through the valve stem.

#### Mechanical Stops

All actuators shall be fitted with adjustable mechanical stops to prevent torque being applied to the valve after the valve has been fully opened or closed. These stops shall be independent of any valve stops.

## 4.4 Remote Control and Monitoring

Electric actuators shall have connections for remote contact inputs to open/close the valve as well as "dry" contacts for valve position and selector switch position monitoring. Serial communications shall be provided and defined by the following requirements.

- a. Serial communication shall comply with the IEC 61158-2 international standards and ISA-SP50 recommendations for field bus devices and follows the Open Systems Interconnect (OSI) 7 layer communication model using layers 1, 2 and 7;
- b. It shall also follow the ISA-SP50 recommendations for field bus networks and utilize standard instrumentation field cables;
- c. The field network shall be intrinsically safe with the field cabling and equipment protected by barriers;
- d. The set of data available shall include as a minimum:

STOP	Stop Command Issued
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OPEN	Open Command issued
CLOSE	Close Command Issued
INHIBITED	Motion Inhibit Timer Running
LOCAL OVERRIDE	Local Selected
POSITION ACHIEVED	Stationary in Mid Travel
TORQUE	Torque Trip
MOVING	Actuator Moving
POSITION & STOP	Stopped Mid Travel at Desired Position
POSITION & OPEN	Valve Open Limit Switch
POSITION & CLOSE	Valve Closed Limit Switch
TORQUE & OPEN	Valve Open Torque Switch
TORQUE & CLOSE	Valve Closed Torque Switch
MOVING & OPEN	Traveling in Open Direction
MOVING & CLOSE	Traveling in Close Direction
FAIL & MIDPOS	Torque Valve Obstructed
FAIL & ESD	Command Issued
FAIL & STALLED	Valve Jammed
FAIL & HANDWHEEL	Manual Movement Detected

**Technical details:**

Electrical Interface	IEC 61158-2 electrical standard for 2 wire connection
Data Coding	Manchester Biphase-L

Data rate	31.25 kbits/sec
Processor Isolation	Optical
Communication Interface	SMAR
Communication Protocol	Foundation Fieldbus IEC-61158-2
Function Blocks	2xAI; 1xAO; 2xDI; 8xDO; 1xPID; Transducer; Resource
Power Consumption	20 mA max from the data highway
Interface Operating Voltage	9V to 32V DC (from SCADA System)

#### **4.5 Electrical Assemblies**

Electrical assemblies shall generally comprise control components mounted on printed circuit boards with interconnecting wiring via plugs and sockets with flexible ribbon cable of 250V rating.

Power wiring shall be multi-strand flexible cable minimum 2.5 mm<sup>2</sup> copper with PVC 0.6/1kV insulation.

Actuator wiring shall be completely enclosed within the actuator such that there is no external wiring or conduits.

The control system compartment shall be separated from the compartment containing power cables for the Motors.

### **5 MATERIAL AND MANUFACTURING**

#### **5.1 General**

Material of construction shall be as per Manufacturer's standard and shall be subject to approval by Company.

All materials shall be suitable for the fluids handled (gas and/or hydraulic fluid) and shall be resistant to corrosion.

#### **5.2 Components Installed in Electric Motor Powered Actuator**

Components incorporated in the Actuator shall comply with the relevant IEC standards.

All components shall be standardized as far as possible.

##### **5.2.1 Electric Motors**

The Electric Motors shall be totally enclosed, non-ventilated squirrel cage induction motor of high torque low inertia design. The Motors shall be suitable for a supply voltage of 415V, 50Hz, 3-phase only. All the control voltages required shall be internally derived. The Motors shall be suitable for direct on line starting. The Motors shall be capable of operating the valve with 80% of the rated voltage at the terminals.



The Motors shall be suitable for continuous operations with a voltage tolerance of +/- 20% without exceeding permissible temperature rise in any part of the Motors.

Motors windings shall have class F insulation with temperature rise limited to class B.

The Motors shall be suitable for outdoor application unless specified otherwise in valve data sheet.

Unless otherwise specified on the actuator data sheets, Motors shall be of Ex'd' construction suitable for Gas Group IIB, Temp rise T3. The Motors shall comply with latest edition of IS5571 or equivalent IEC for requirements of electrical equipment to be used in hazardous areas.

### 5.2.2 Starter

The starter shall be integral to the actuator & incorporate the following:

- a. Forward and reversing contactors with electrical and mechanical interlocks;
- b. Control supply transformer as required;
- c. Thermal overload protection;
- d. Single phasing protection;
- e. Reverse phase protection.

Control selector switches as follows;

- a. Mode selector: "Remote – Off – Local";
- b. Local mode: "Open – Close".

Remote operation shall be provided with both hardwired control cables & on serial link unless otherwise specified in data sheets.

Following signals are required for remote control & monitoring

- a. Status of the selector switches;
- b. Close;
- c. Open;
- d. Operation status (closing, opening, tripped);
- e. Additional signal requirements as specified on the valve data sheet.

Terminal block (WAGO or ELMEX make) for external cable connection fully pre-wired for internal devices of valve actuator with minimum of IP20 protection with covers open. Separate terminal blocks for power & control cables shall be provided. Each terminal block shall be provided with permanent markings for terminal strip numbers.

All cables shall be ferruled at both ends.

In "Remote" mode the local control function shall be disabled and in "Local" mode the remote control functions shall be disabled however the remote monitoring functions shall remain.

A hand wheel with hand / auto lockable lever shall be provided for emergency operation of the MOV. The energisation of the MOV shall automatically re-engage power operation.

### 5.2.3 Enclosures

Enclosures shall meet the following requirements:

- a. Have minimum degree of protection IP 65;



- b. Have heavy duty neoprene seals (except where this would violate the hazardous area certification);
- c. Be electrically continuous and connected to an earth terminal next to the power terminals;
- d. Have power tunnel type terminals for connecting up to 16mm<sup>2</sup>, Aluminum, Armored cables with space for terminating the cable via a flameproof gland;
- e. Have control terminals for terminating a serial data cable with space for terminating the cable via a gland;
- f. Have three metric threaded conduit entries: 1 x M40 and 2 x M25 sealed with steel plugs;
- g. The Motors and limit switch compartment shall be located with respect to the gear case such as to facilitate maintenance;
- h. Cable entries shall be provided with suitable converters for the NPT glands;
- i. Top cable entries shall not be provided;
- j. The actuator shall be fully pre-wired up to the terminal block. 10% spare terminals shall be provided for future interlock at the terminal block. Internal wiring shall be suitably sized for actuator rating. Each wire shall be identified at both ends using PVC ferrules. The terminal section shall be separated from the inner electrical components of the actuator by means of a watertight seal so that the actuator electrical components are protected from the ingress of moisture & foreign materials when the terminal cover is removed;
- k. Each electrical component shall be identified with a nameplate.

## **6 INSPECTION AND TEST**

### **6.1 General Requirements**

The Manufacturer shall ensure all equipment used for inspection and testing purposes is calibrated and certified.

The Manufacturer shall record all inspection and testing activity on the appropriate inspection certificate.

The inspection and testing shall be carried out as per Company approved Inspection and Test Plan (ITP) prior to marking and shipment of materials.

Actuator motor shall be subjected to Routine test as per applicable standard IS/IEC.

### **6.2 Testing of Materials**

Manufacturer shall carry out all electrical and mechanical testing of assembly in accordance with applicable material specification and requirement specified under standards applicable.

Actuator motor shall be inspected & tested for technical execution and conformity with the latest issue of the approved drawings and with the order, spot check shall be made to verify at:

#### **6.2.1 Actuator Manufacturer's Shop**

- a. All actuators shall be visually inspected;
- b. Dimensional check on actuators shall be carried out as per the Purchaser approved drawings;



- c. Electrical and mechanical operating tests;
- d. Check of required functions;
- e. Check of operating time control;
- f. Check of limiting device operation;
- g. Check of actuator torque or thrust.

#### **6.2.2 Valve Manufacturer's Shop**

- a. Test and check covered in above points after assembly with ball valve;
- b. Check of the limiting device operation;
- c. Various tests on the valve according to provisions of specific documentation;
- d. Testing shall confirm to actual field operating conditions.

### **7 MATERIAL SOURCING, TRACEABILITY AND CERTIFICATION**

#### **7.1 Manufacturer's Data Report**

The Manufacturer shall submit a Manufacturer's Data Report (MDR) which shall allow identification and certification of all supplied materials / products and shall, as a minimum, include approval drawings, ITP, records of duly reviewed / approved / accepted chemical composition analysis reports, mechanical properties, mill certificates (inspection and test records / certificates) and certificates of conformance.

Test reports and inspection reports shall show heat number / batch number of materials used for manufacturing of product duly linked to raw material supplier's heat / batch number for a proper traceability of materials.

MDR shall include only certified final documents (e.g. drawings, procedures, material test certificates, inspections and test reports, etc.). All such documents shall be duly signed by Manufacturer's authorized personnel, Third Party Inspection (TPI) agency (where applicable) and/or Company Representative.

#### **7.2 Test Certificates**

The Manufacturer shall submit test certificates in compliance with EN 10204 "Type 3.2" inspection certificates.

The Manufacturer shall, as a minimum, provide following test certificates:

- a. Reports for all mandatory tests as per applicable material specifications;
- b. Reports on dimensional check and visual inspection;
- c. Certificates for any other tests specified in this specification.

All test certificates shall be available at manufacturer's works during final inspection by Company's Representative

### **8 PANTING**

The actuator, including gearboxes, shall be coated as described below:

- a. Removal of all rust by means of emery cloth or wire brush;
- b. Shot blast as per SIS 055900 to SA 2.5. First layer of Epoxy-Polyamide primer of DFT 75 microns, intermediate layer of Epoxy-Polyamide of DFT 25 microns and final



layer of Epoxy-Polyamide of DFT 75 microns. Total coating thickness of 175 microns and color RAL 7032.

## **9 MARKING**

Marking shall have a stainless steel nameplate permanently fixed to it at a visible place furnishing the following information:

- a. Tag number as per owner's data sheets;
- b. Manufacturer's serial number and model number;
- c. Manufacturer's name / trade mark;
- d. Stamp of certifying agency with certificate number;
- e. The following documentation shall be fulfilled by the Vendor;
- f. Electrical area classification and Ingress protection.

## **10 SPARE PARTS AND SPECIAL TOOLS**

### **10.1 Spare Parts Requirement**

Manufacturer shall quote for two years operational spares for actuator and its accessories.

Spare Parts Interchange ability Record (SPIR) shall be completed by the supplier and submitted.

### **10.2 Special Tools Requirement**

A complete set of any special tools required for operation, maintenance and testing of the actuator motor shall be provided. The Manufacturer shall provide a list of special tools, individually priced, with his quotation. A storage box shall be provided.

## **11 DOCUMENTATION**

The Manufacturer shall be responsible to provide all documentations as indicated in applicable SDDR (Seller Drawings and Data Requirements) attached with Purchase Requisition.

All documents (including drawings, procedures, test certificates, product catalogues etc.) shall be in English language only and units of measurements shall be in SI system, unless specified otherwise.

## **12 SHIPPING, HANDLING AND STORAGE**

Actuator shall be shipped to suit ease of handling for transportation and installation. It should be possible to store the actuator if site is not ready for installation.

Shipping section shall be provided with location of lifting points clearly marked on shipping containers. Shipping section shall have its weight clearly marked on the container.

Preparation for shipment shall protect the actuator, auxiliary devices, accessories, etc. against corrosion, dampness, and breakage or vibration injury during transportation and handling.

Shipping container shall be identified with the contents, purchase order number and item number.



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Instructions shall be provided for reassembly of sections in the field.

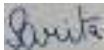







## VCS Quality Services Pvt. Ltd

### STANDARD SPECIFICATION FOR METERING SKID WITH PRESSURE REGULATION

VCS-SS-IN-5601\_02

					
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01	18.01.2020					Format change and document numbering is revised.
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02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



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## **ABBREVIATION**

ANSI	American National Standards Institute
AGA	American Institute for Steel Construction
AISC	American National Standards Institute
ASME	American Society of Mechanical Engineers
API	American Petroleum Institute
ASTM	American Society of Testing and Materials
AWS	American Welding Society
BP	British Petroleum
BS	British Standards
EIA	Electronic Industries Alliance
FAT	Factory Acceptance Test
IEC	International Electro-technical Commission
IP	Ingress Protection
IS	Indian Standards
ISA	Instrument Society of America
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
NPT	Nominal Pipe Thread
SAT	Site Acceptance Test
SS	Stainless Steel
UV	Ultra violet



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## **1 SCOPE**

This Standard Specification establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, inspection and testing, documentation, marking, packing and shipping of Metering System, along with its accessories

## **2 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.



## 3 REFERENCE DOCUMENTS

### 3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

Mechanical:

Equipment shall generally be mechanically designed in accordance with the relevant Institute of Gas Engineers (IGE) codes and the following principal codes of practice (Latest Editions).

Instrumentation shall generally be in accordance with the applicable sections of the following principal codes of practice (Latest Editions):

AGA Report No.7	Measurement of Natural Gas by Turbine Meters
AGA 8	Compressibility factors of Natural gas and other Related Hydrocarbon Gases
AGA 9	Measurement of Gas by Multipath Ultrasonic Meters
AGA 10	Speed of Sound in Natural gas & related Hydrocarbon gases
API 6D	Specification for pipeline valves, end closures and swivels
API RP 520	Part-1 & 2, Design and installation of pressure relieving systems in refineries
API RP 521	Guide for Pressure Relief and Depressing Systems
API 527	Commercial Seat Tightness of Safety Relief Valves with Metal-to-Metal Seats.
API RP 550	Manual on installation of refinery instrument and control systems
API RP 551	Process Measurement Instrumentation
API RP 554	Process Instrument and Control
API RP 555	Process Analysers
API 2534	Measurement of Liquid Hydrocarbons by Turbine Meter Systems
ANSI B 2.1	Pipe Threads, General Purpose (Inch) - Revision and Redesignation of ASME/ANSI B2.1-1968
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B 16.104	The reference standard for control valves leakage classes is FCI-70-2 (previously named "ANSI B 16.104"; latest revision: 2003)
ASME	Boiler and Pressure Vessel Code Section-V : Non-destructive examination Section-VIII: Pressure Vessel, Division-1 Section-IX: Welding and brazing qualifications
ASME B 16.5	Steel Pipe Flanges and Flanged Fitting
ASME B 31.3	Steel Pipe Flanges and Flanged Fittings



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ASME B31.8	Gas Transmission and Distribution Systems
AWS D 1.1	Pipe Design and Fabrication Specification
AISC M013	Structural Steel Code (Skid Fabrication)
BS 449	Structural Steel Work
BS 1515	Materials of Filters & Scrubbers Instrumentation
BS 1041	Code for Temperature Measurement
BS 1042	Code for Measurement of Fluid Flow in Pipes
BS 5501	Part-1, Electrical apparatus for potentially explosive atmospheres
BS 2765	Thermowells
BS 5345	Electrical apparatus for potentially explosive atmosphere
BS 5308 Part-1	Selection, Installation and Maintenance of Electrical Apparatus in Explosive Atmospheres Instrumentation Cables
BS 6121	Cable Glands
IP Code Part 15	Area Classification Code for Petroleum Installation
BP RP-30-1	Design Practice for Instrumentation & Control
BP RP-30-2	Selection and Use of Measurement Instrumentation
BP RP 32-1/2	Inspection and Testing of New Equipment in Manufacture
EIA RS 485	Electrical characteristics of generators and receivers for use in balanced digital multi-point system
EN-12186	Gas supply systems - Gas pressure regulating stations for transmission and distribution - Functional requirements
EN -12405	Gas meters - Conversion devices - Part 1: volume conversion
EN - 1776	Gas supply - Natural gas measuring stations - Functional Requirements
EN 334	Gas pressure regulators for inlet pressures up to 100 bar
RS-232C	Interface between data terminal equipment and data communication equipment



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IEC 60529	Degrees of Protection provided by Enclosures
IEC 60770	Transmitters for Use in Industrial Process Control Systems
IEC 60801	Electromagnetic capability for industrial process measurement and Control equipment
ISA A5.1	Instrument Symbols & Identification
ISO-9001	Quality Management System - Requirements 2000 Edition
ISO 6976	Natural gas - Calculation of calorific values, density, relative density and Wobbe index from composition
ISO 1221	Natural gas - Calculation of compression factor
OIML R6	General provisions for gas volume meters
OIML – TC8/ SC8	Measurement of quantities of fluids / Gas meters
OIML R32	Rotary piston gas meters and turbine gas meters
NACE-MR0175/ISO15156	Petroleum and natural gas industries-Materials for use in H2S-containing environments in oil and gas production

### **3.2 Order of Precedence**

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.

### **4 MATERIALS**

Materials selected shall be in accordance with the Data Sheets and Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.





## **5 DESIGN**

### **5.1 General**

The Metering System with its associated systems shall be designed for natural gas flow measurement required for both Custody transfer and non-custody transfer applications. And it shall be field proven and no prototype shall be offered.

The flow measurement shall be done by means of using the Ultrasonic Flow meter or Turbine Flow meter depends upon the line size, process flow rate requirements and required accuracy, linearity, repeatability levels and rangeability. The specific project / job specifications shall be referred for the exact requirement of flow element type used in the Metering system.

This Specification together with. All annexures (enclosed elsewhere) covers the requirement for the design, engineering, manufacturing, testing, inspection and supply of Metering Skid along with all accessories.

Purchaser's Data Sheets for Cartridge filters, Pressure regulators & Slam shut valves, Ultrasonic flow meter / Turbine meter ( as the case may be), Control Panel mounted Flow computer, Control valve, Pressure relief valves, Pressure/ Differential pressure Transmitter and accessories indicate materials for body, internals etc. shall be referred.

However, this does not absolve the Vendor of the responsibility for proper selection with respect to the fluid and its operating conditions. Proper sizing and selection of Cartridge filters, Ultrasonic flow meter / Turbine meter, Control room mounted Flow computer, Control valve, Pressure regulators, Slam shut valves, Pressure relief valves and accessories are Vendor's responsibility.

Process parameters for skids shall be provided by the Purchaser. Vendor shall take single point responsibility for the design & performance of the skids based on the data sheets and the specifications furnished and taking into consideration successful operation, safety as per the established International Standards for the complete skids.

As a part of the skid, design & Engineering of following shall be included by Vendor:

- a. The Design of Metering System shall be done by Manufacturer of the Metering Device. The Upstream and Downstream Meter Runs, Flow Profiler shall also be supplied and wet calibrated by metering manufacturer.
- b. Metering Manufacturer shall be responsible for review and approve entire Metering Skid layout drawing to maintain accuracy as per NPL/ NMI/ PTB.
- c. Make, model & detailed Specification of each item.
- d. Fixing pressure drop across various elements.
- e. Sizing of Cartridge Filters, PCVs, Slam Shuts, Ultrasonic flow meter or Turbine flow meter, Control room mounted Flow computer, Control valve & PSV.
- f. Noise calculations for PCVs, Slam Shut Valves.
- g. Selection range of PG, DPT, PT, TG & RTD.
- h. All design performance characteristics
- i. Overall dimensions of each skid
- j. Weight of each skid
- k. In addition to metering skid Control panel & Panel mounted instruments also to be executed.



Vendor shall consider all the requirements of this specification along with those as per relevant standards and shall assume total responsibility including all aspects of engineering, design, certification etc. for pressure reducing, metering skids & Instrumentation.

Vendor to note that all the items including Cartridge filters, Pressure regulators and Slam shut valves, Ultrasonic flow meter / Turbine meter, Control room mounted Flow computer, Control valve, Pressure safety valves etc. shall be procured from reputed Vendors and shall follow the Vendor list enclosed.

Vendor's quotations shall include the detailed specifications for all the items of metering skid. The Vendor shall also offer any instruments/ equipment required for safe and efficient operation of the system.

Vendor to furnish

- a. The max. Flow rate (in Sm<sup>3</sup>/hr) at min. inlet pressure for all the PCVs & Control Valve at valve full open condition.
- b. Min. flow rate (in Sm<sup>3</sup>/hr) through each PCV & Control valve without damaging the trim and valve intervals at min. inlet pressure.
- c. Flow rate vs. trim lift curve to justify the valve rangeability and valve regulation characteristics.

All units of measurements in Vendor's Specification sheets shall be same as those in Purchaser's Data Sheets.

All material specification for the various parts in the Vendor's Specification Sheets shall be to the same standard as those in Purchaser's Data Sheets.

Vendor shall enclose catalogues giving detailed technical specification and other information for cartridge filters, Pilot operated pressure control valve, and Slam shut valves, pressure relief valves, pressure gauges etc. covered in the bid.

Vendor's quotation, catalogues, drawings, operating and maintenance manuals etc. shall be only in English Language.

Vendor shall submit subsequent to award of contract the sizing details & specification of all the equipments, instruments and piping items make & model, skid details etc. The relevant catalogue, technical literature shall also be furnished.

## **Flow Measurement**

### **Ultrasonic Flowmeter**

Ultrasonic Flow measurement is determined by measuring the difference in transit time of high-frequency Ultrasonic pulses. Transit times are measured for sound pulses travelling diagonally across the pipe, downstream with the gas flow and upstream against the gas flow. The difference in these transit times is related to the average gas flow velocity along the acoustic paths. Numerical calculation techniques are then used to compute the average axial gas flow velocity and the gas volume flow rate at line conditions through the meter.

Multi-path Ultrasonic meters shall be used for both custody transfer and non-custody transfer applications. It shall be field proven and no prototype shall be offered.

As a minimum, the following data shall be used in determining the design requirements for a flow metering system:

- a. Fluid properties (e.g., specific gravity, viscosity, vapour pressure, etc.)
- b. Operating and design temperature and pressure
- c. System maximum and minimum flow rate



- d. Available maximum pressure drop in the complete system at maximum flow rate
- e. Available utilities (e.g. electrical power, instrument air)
- f. Pipe I.D and line pressure at sample point

Temperature and pressure measurement devices (temperature transmitter, RTD, glass thermometer, test thermowell and pressure transmitter, gauge) shall be provided for each meter run.

Density transmitter / On-line gas analyzer (if required by the project) shall be used for measuring the gas relative density (Specific gravity) to calculate the mass flow rate and the composition of the gas.

Motor operated valves (MOV) provided in the Ultrasonic Flow Meter skid will be automatically operated through PLC/SCADA system.

Metering system design shall be such that ultrasonic noise from other components shall not affect the performance of the meter. Supporting Ultrasonic noise calculations shall be provided by the Vendor.

### **Turbine Meter**

As a substance moves through a pipe, it acts on the vanes on a Turbine to get it to spin. The rate of spin is measured to find out the speed of the flow.

The Turbine Flow meter (better described as an axial turbine) translates the mechanical action of the Turbine rotating in the liquid or gas flow around an axis into a user-readable rate of flow (gpm, lpm, etc.). The Turbine tends to have all the flow traveling around it.

The Turbine wheel is set in the path of a fluid stream. The flowing fluid impinges on the turbine blades, imparting a force to the blade surface and setting the rotor in motion. When a steady rotation speed has been reached, the speed is proportional to fluid velocity.

The Turbine Meter shall be used for both Custody and Non-Custody transfer applications. And the offered Turbine meter shall be field proven and no prototype shall be offered.

As a minimum, the following data shall be used in determining the design requirements for a Flow Metering system:

- a. Fluid properties (e.g., specific gravity, viscosity, vapour pressure, etc.)
- b. Operating and design temperature and pressure
- c. System maximum and minimum flow rate
- d. Available maximum pressure drop in the complete system at maximum flow rate
- e. Available utilities (e.g. electrical power, instrument air)
- f. Pipe I.D. and line pressure at sample point

Temperature and pressure measurement devices (temperature transmitter, RTD, glass thermometer, test thermowell and pressure transmitter, gauge) shall be provided for each meter run.

Density transmitter / On-line gas analyzer (if required by the project) shall be used for measuring the gas relative density (Specific gravity) to calculate the mass flow rate and the composition of the gas.

Motor operated valves (MOV) provided in the Turbine Flow meter skid will be automatically operated through PLC/SCADA system.



## 5.2 Custody Transfer Applications

### 5.2.1 Flow Metering System

Multi-path Ultrasonic Flow meters or Turbine meter shall be designed for all gas metering custody transfer applications, comply with AGA report-9 and other referred international standards for accuracy, rangeability, bi-directional flow, calibration and testing procedures. Each metering skid shall be having one working and one standby meter run with "Z" type construction with On-Line proving facility if required by the project. The job specifications shall be referred for the exact requirement of flow metering system type and proving facility.

Overall accuracy of the Custody Transfer Ultrasonic Flow Metering system shall be  $\pm 0.15\%$  or better of rate of flow and the overall accuracy with Turbine metering shall be  $\pm 0.2\%$  or better of rate of flow. The Metering System shall provide measurement accuracy for accounting purposes for mass and volumetric quantities and the flow rates of product. It shall incorporate sufficient parallel meter runs to enable the maximum and minimum flow rates to be measured at the specified accuracy. The turn-down ratio (Rangeability) of Ultrasonic Flow meter shall be 100: 1. And the same for Turbine meter shall be 50: 1

Ultrasonic Flow meters shall measure the speed of sound for all the Ultrasonic paths at actual operating conditions. Also using AGA-8 & AGA-10 calculations, the speed of sound calculations shall be computed in the flow computer.

Turbine meter shall measure the speed of flow of gas at actual operation conditions using AGA Report NO.7. The speed of flow shall be computed in the Flowmeter using AGA calculations.

The custody transfer Flow Metering System shall consist of the following two major subsystems:

Complete Metering skid with each meter run consisting of Ultrasonic Flow Meters or Turbine meters, MOV's, skid piping, field mounted instruments and accessories.

Each Metering Skid operates as an independent unit with a microprocessor based flow computer communicating with the SCADA/ PLC. The skid flow computer will be located in the control building.

Each Custody Transfer Metering System shall be supplied as skid mounted package with dual meters and shall include all necessary equipment to measure the gas transferred through the station. Each Metering System shall include, but not limited to the following equipment / Instrument items:

- a. Two nos. Multi-path, Intrusive Ultrasonic Flow Meters or Turbine meters;
- b. Inlet/outlet meter runs;
- c. Pressure instruments;
- d. Temperature instruments;
- e. Density transmitter, if required;
- f. Motor Operated Valves;
- g. Check valves;
- h. Skid Piping, valves, flanges, support, etc as required;
- i. All necessary cables, junction boxes, cable glands, tray and other wiring accessories;
- j. Control Room mounted common Flow Metering Panel consisting of Flow Computers,



Recorder, etc.

In general metering system shall measure the flow rate continuously and flow computer shall log this information. Flow computer shall do needful pressure, temperature compensation for base volume flow rate, totalized flow rate, mass flow rate, and totalized mass flow rate.

The Ultrasonic Flow meter or Turbine meter shall have custody transfer certification by an internationally accredited body / authority.

### 5.2.2 Ultrasonic Flow Meters

Ultrasonic Flow sensor shall be intrusive type, multi-path for both custody transfer and non-custody transfer purpose.

Following additional requirement shall be considered in Vendor scope:

- a. Any special software and required tool required for configuration and calibration shall be supplied with the meter.
- b. Third party inspector (Approved by Company) witnessed Flow Calibration certificate shall be provided.
- c. The accuracy of the flow meter shall be equal or better than 0.15% of the reading.
- d. Meter Design shall consider a minimum of four paths.

### 5.2.3 Flow Computer

The Flow Computers shall be of latest design, field proven; micro-processor based and shall have required input/output and display modules. No prototype shall be offered.

For the application of Ultrasonic Flow metering, the Flow Computers shall be employed for totalized flow calculation of the metered streams for temperature, pressure and density corrections. In addition, the flow computer shall be capable of calculating gas flow velocity, Speed of sound and instantaneous average molecular weight and other flow parameters as specified in the section Computation capability, and shall confirm to the requirements of AGA Report No. 9 - "Measurement of Gas by Multipath Ultrasonic Meters" and AGA-10-Speed of Sound in Natural Gas & related Hydrocarbon gases '.

And for the application of Turbine Flow metering, the Flow Computers shall be employed for totalized flow calculation of the metered streams for temperature, pressure and density corrections. In addition, the Flow Computers shall be capable of calculating speed of flow of gas and other flow parameters as specified in the section Computation capability, and shall confirm to the requirements of AGA Report No.7 Measurement of Natural Gas by Turbine Meters.

The Flow Computers shall be multi-dropped and flush mounted with integral LCD display and keypad for local programming and configuration. The Flow Computers for custody transfer metering system shall be provided with password protection to control level of access for operator, engineer for security purpose.

- a. The Flow Computers shall meet the required international fiscal metering standards and shall provide as a minimum provide the following functions:
- b. Flow Computers shall be microprocessor based with 32 bit CPU.
- c. A/D conversion shall have 16 bit resolution. Calculation accuracy shall be better than +0.05 % of full scale.
- d. Input/output channels for the flow meter, MOV, temperature and pressure transmitters, density meter/gas analyzer etc.



- e. 20% spare input/output channels for each type of I/O.
- f. A function keypad or push buttons for Start, Pause, Resume, and Stop functions.
- g. An alphanumeric display with 4 lines of 40 characters (or more) to display instructions and status information to the operator.
- h. Interface with the respective PLC/SCADA systems and with any third party Vendor system.
- i. Flow Computers shall be provided with On-line prover algorithm functions if required by the project specifications.
- j. Display selected parameters and Display an index of all the commands and functions available to the operator.
- k. Permanently display metering skid mass flow with sufficient digits to accumulate three month's maximum design flow without roll-over.
- l. Display on demand the station daily totalized flow.
- m. Daily, Weekly and Monthly report generation facility and necessary interface for printing through PLC / SCADA shall be provided.

Each module shall have on board diagnostics, with on board LED indicators, defining status. Upon malfunction of Flow Computers, it shall generate alarm. The configuration loaded into the microprocessor shall be held in non-volatile memory to maintain critical parameters for at least 30 days on failure of the power supply. An integral battery backup with "low charge" alarm to provide this facility is acceptable. Vendor shall provide all original certificates and original licensed software of the custody flow metering system in the name of Company.

#### **Network Interface**

The Flow Computer for Custody Transfer Metering System shall provide hardware and software for interfacing and communicating with the following devices as a minimum:

- a. PLC/SCADA Systems
- b. Portable laptop based computer
- c. On-line gas Analyzer control unit, wherever applicable
- d. Any other third party system

#### **Data Communications**

The system shall be furnished with a reliable data communications system. The following features shall be provided as a minimum:

- a. Communications diagnostics are to be continuous such that a failure is alarmed in the minimum time.
- b. Each node shall have message checking capability; detection and alarm of node failure shall be within one second.
- c. "Software" points shall be capable of being passed node to node.
- d. Failure of one or more node(s) will not degrade the communication.
- e. Positive acknowledgment of all messages transmitted.
- f. Any measured or calculated variable in one part of the system shall be available to any other node in the system without hardwiring.

#### **Communication Efficiency**





An industry standard communications protocol (such as MODBUS) shall be used. A diagnostic routine shall be included to monitor the highway performance and log, on request the accumulated number of errors over a specified time period. Vendor shall fully document data protocols and diagnostics.

### **Keyboard Capability**

The data entry keyboard shall have the provision to enter the following:

- a. Pressure and temperature base factor
- b. Gas density and scaling factor
- c. Flow, pressure, temperature and density values and give compensated flow for any external conditions including at 15 deg C.
- d. Flow Computer shall have the facility to enter report headings, frequency timings and parameters to be printed. The printout shall be provided for Flow Computers rates, integrated flows, alarms and also for the various parameters to which the flow computer has access.
- e. Other standard features available

### **Input Capability**

Flow Computer shall have the following inputs as a minimum:

- a. High speed pulse signal from Ultrasonic Flow Transmitter or Turbine Flow Meter.
- b. Line pressure sensing signal (4 - 20 mA).
- c. Line temperature sensing signal (4 - 20 mA).
- d. Flow signal from Ultrasonic Flow transmitter (4 - 20 mA).
- e. Spare 4 - 20 mA inputs - 2 nos.
- f. Digital inputs potential free contact - 4 nos.
- g. Serial input using RS232C / RS485 MODBUS from Ultrasonic Flow Transmitter or Turbine Flow Meter
- h. RTD input (4 wire / 3 wire) of PT-1 00

### **Output Capability**

Flow Computer outputs shall be optically isolated. Suitable isolators shall be included for each output. Following minimum outputs shall be provided: -

Four 4 - 20 mA of isolated signal outputs for corrected volume flow rate at 15 deg C, Mass Flow rate, pressure and density.

Flow Computer shall have following minimum serial ports:

- a. RS 232-C/ RS 485 serial output link for PLC / SCADA for all output signal with MODBUS protocol
- b. One number serial link for interfacing with HMI and one number for Laptop
- c. Serial link with On-line Gas Analyzer

Pulse signal output for compensated total Mass Flow Rate.

Two nos, Contact; alarm outputs for low flow settable alarm. Set point shall be adjustable.

Two nos. configurable Potential free contact outputs

Pulse output totalizer (normal volume total, corrected volume total, mass total) Flow Computers shall have plug in slots for modular I/O expansion of total numbers of outputs.

### **Computation Capability**

As a minimum, it shall calculate and/or indicate on the front display of the microprocessor Flow Computer, the applicable parameters and totals listed below.

- a. Mass Flow Rate
- b. Mass Flow Total
- c. Standard Volume Flow rate
- d. Standard Volume
- e. Volume Flow Rate
- f. Volume Total
- g. Volume Flow Rate Low Alarm
- h. Volume Flow Rate High Alarm
- i. Temperature in
- j. Pressure
- k. Density
- l. Density High Alarm
- m. Density Low Alarm

### **Alarms**

All alarms generated by the Flow Computer shall be available on PLC/SCADA through serial link.

### **Report Generation**

The Metering Systems report shall be generated from the PLC/SCADA system.

All the current Metering information required for these reports shall be continuously available, on demand, for transmission via serial link, to the PLC/SCADA and enable hard copies to be produced.

## **5.2.4 Human Machine Interface**

Dedicated Human Machine interface with licensed software shall be provided for monitor/control of the Flow Metering facilities.

Each Video Display unit shall have a minimum 1280X1024 pixels, and have a high resolution colour monitor capable of displaying mixed alphanumeric, graphic information. It is of prime importance that the operational displays present the exact status of the plant under control.

HMI's shall be dual monitor type with minimum Specifications as below:

- a. Intel Pentium D 960 processor 3.6 GHz
- b. 2x2 MB L2 cache - EM64T - Dual core technology
- c. 1.44 MB Floppy drive





- d. 1 GB DDRII(2x512 MB - 533 MHz) SDRAM Memory expandable to 4 GB
- e. 160 GB DATA 7200 RPM Hard drive
- f. 16X DVD+RW/-R Drive
- g. Integrated ADI 1981 B AC 97 Codec audio controller
- h. Internal speakers
- i. Integrated Intel GMA 950 Graphics utilizing up to 224 MB of System memory
- j. Integrated Broadcom 5751 Gigabit Ethernet LAN solution 10/100/1000 Ethernet
- k. Remote wake up and PXE support
- l. Duplex 19" Ultra sharp LCD TFT flat panel monitor
- m. Quiet key keyboard
- n. Optical mouse USB
- o. Microsoft windows XP Prof SP2 English or the proven latest OS
- p. Optiplex resource CD
- q. 3 years warranty

#### 5.2.5 Software Requirements

Flow Computers will be equipped with a Serial/Ethernet port for connection to a laptop computer, which shall be used for engineering, operation, control, safeguarding and System configuration.

The programming shall be carried out with a software package 'running on a standard PC / Laptop communicating via the standard PC serial port. All software needed shall be supplied by System Vendor. Programming and editing shall be compliant with part 3 of IEC-61131. The used programming language (IEC 61133-3) shall be agreed with the Company before' System configuration. All software used in the Flow metering System shall have a valid license for use by Company and the license agreements shall be handed over to Company at the end of the project. The operating System shall be Windows based.

Vendor shall provide the latest software for the Operator station-HMI for Flow Metering system. Windows based development software, shall be provided to support communication interface shall be able to be ported on any standalone PC as part of the System. User friendly Graphics builder' software shall be provided to build and view the process facilities.

The minimum requirements for application/programming software are;

- a. System and I/O configuration identifying each module type location and tag name,
- b. System database including tag names, description, type, etc.
- c. Test and debug program execution which allows software testing before actual program downloading.
- d. Modification user program on line,
- e. Automatic documentation and report generation for documenting programs and audit trials of program changes and user changes.
- f. On-line/Off line testing of the control program including full emulation of program and monitoring of the emulated program,
- g. Downloading of configuration software and application program.



- h. Input override, this function shall only be performed under password protection and work permit conditions.
- i. View the System diagnostics.
- j. Password security to define user and their privileges with regard to editing, manual, forcing, downloading and any other user operations.

Type and characteristics of the program development shall be submitted by Vendor at bid stage and shall be subject to Company's approval.

## **5.2.6 Metering Skid**

### **Design and Fabrication**

Each Metering Skid shall be having one working and standby meter run as a minimum for Custody Transfer. However Vendor shall recommend the number of working run based on process requirements and flow meter capacity with one common standby run. The metering system shall be completely piped and assembled along with all components/instruments. The skid shall consist of fabricated base frame, with pipe supports for all pipe work if required/recommended by the metering system Vendor. Necessary instruments enclosures, sunshades and other accessories as required shall be provided. Layout arrangements shall be submitted with the Vendor's proposal.

Equipment arrangement shall ensure convenient access for operation, maintenance and/or replacement. Equipment (transmitters, gauges etc.) shall be located at convenient working heights from top of any platform/skid work surface, i.e., grating, and will not be accessed by crossing piping or other fixed structures. Where equipment is located above normal working heights, access steps or ladders shall be provided.

All fabrication and welding works shall be in accordance with American Institute of Steel Construction (AISC) / American Welding Society (AWS) guidelines or equivalent European standards, and these drawings require the Company's approval. Metering System design shall be carried out by taking in to account the handling and transportation conditions.

Vendor shall be responsible for providing lifting lugs to facilitate the Construction Contractor to install the Metering System assembly. The lifting lug locations shall be clearly identified. Any necessary certified lifting apparatus (e.g., slings, spreader beams, etc.) should also be supplied. Special instructions, if any, facilitating placement of the meter runs shall also be provided.

Meter Station piping arrangements shall be designed with a minimum number of bends and fittings.

Upon finalization of system design, the Vendor shall provide nozzle load limits facilitating Contractor's pipe stress evaluation. (Forces and moments at Vendor's flanged connection interface to Contractor piping).

Wetted parts of instruments and associated fittings must be made of a corrosion resistant material and shall meet NACE MR0175 requirements and QP standard QPSTO-R-001.

Piping items such as valves and fittings shall be supplied in accordance with relevant project specifications as indicated.

Metering stations shall be equipped with vent lines, for depressurization. Vent lines shall extend at least 3 meters above the highest operating platform and shall be properly supported. Full opening drain valves shall be installed on the upstream and downstream spool pieces of the Ultrasonic flow meters

### **METER RUNS**



Upstream spool piece shall be minimum 150 straight run and the spool piece shall comprise of vent and drain connections for allowing the depressurization before demounting the Ultrasonic Flow Meter. The vent/drain connection shall be provided with block valve for piping connection to the plant vent/drain system. The internal diameter of spool piece shall not have a deviation of more than  $\pm 1\%$  from the internal diameter of the Ultrasonic Flow meter.

For unidirectional flow measurement, the downstream spool piece shall be, minimum 50 straight run and/ or bi-directional applications, both ends of the meter shall be considered "upstream".

The downstream section shall contain:

- a. 1 no. thermowell for installation of RTO for temperature measurement
- b. 1 no. for installation of Pressure measurement
- c. 1 no. nozzle connection for density meter.

Manufacturer's recommendations shall be followed for location of thermowell, Pressure transmitter and sampling probe in the downstream spool piece.

Flow Conditioner, if recommended by Vendor, shall be inserted ahead of the upstream spool piece to minimize flow pattern disturbance. Flow conditioner shall be of perforated plate or flange type and material of construction shall be SS316 as a minimum.

Vendor shall confirm that noise generated, by flow conditioners do not interfere with the Ultrasonic Flow meter in the entire application range.

### **Structural Requirements**

The complete custody transfer Metering shall be skid mounted on a single structural base. Access shall be provided for operation and maintenance of all equipments, instruments and piping components with grated floors, walkways / platforms. It shall also provide access for easy removal of the equipment.

Custody Transfer Metering Skid connection shall be provided on side with required isolation valve. All connection to the skid shall be flanged and protected with blind flange for transportation.

The Skid shall be fitted with lifting lugs, which shall be clearly marked with sling attachments. Certified slings and spreader beams shall be included.

For earthing purposes, Skids shall be provided with two (2) M10 bolts. These shall be located diagonally at opposite corners. The skid shall consist of a fabricated base frame with pipe supports, grated walkways for all valves, fittings, instruments and meters etc. Drip trays shall be installed under all metering runs and under the working areas of the master meter loop which are likely to see spillage. The Vendor shall define the "skid datum point: to which all dimensions on the skid, its pipe work and all accessories shall be referred.

Structural steel work design shall be in accordance with AISC and applicable Project Specifications.

### **Mechanical Requirements**

Meters along with associated equipments / instruments shall be pre-installed and supplied as a single skid.

The custody transfer metering skid mounted instrumentation, pressure containing components and piping shall be designed and constructed in accordance with ASME B31.3. They shall adhere to the material and rating requirements of the piping line class in accordance with the Piping Material Specification applicable for this project.



The pressure drop value shall include all items of equipment in the system between the two terminal piping flanges. The Vendor shall provide written data in the form of a calculation sheet, detailing the components of the system to substantiate compliance.

Spool pieces shall be included in the pipe work to facilitate inspection and removal of equipment as required. Spool pieces shall be provided for replacement of in-line instruments during pipe flushing pressure testing.

Provision shall be made to eliminate Meter body distortion due to piping movement or misalignment.

Piping supports shall be provided to isolate meters from the external forces created by thermal expansion, or movement due to hydraulic line shock.

Temperature and pressure measurement devices shall be located within a 1-m long piping segment adjacent to, and preferably downstream of, the meter.

The temperature and pressure measurement devices shall be located in the specified piping segment in the following order:

- a. Primary temperature measurement device (temperature transmitter, RTD or thermometer);
- b. Pressure transmitter and/or pressure gauge.

Provision shall be made to isolate and drain each individual meter, without affecting the operation of adjacent meter.

High point vents shall be provided in all systems to facilitate the venting of trapped air or vapour.

Thermal relief valves shall be provided as per API RP 520 and shall discharge into a common drain header. The number of vents drains and thermal relief valves on the piping between a meter(s) and between a meter(s) and the point of custody transfer shall be kept to a minimum. Each vent, drain or thermal relief shall be provided with a means to permit examination for, or prevention of, leakage. Each vent shall be connected to a common header and the header shall be terminated to battery limit of the skid for venting to a safe location. Each drain connection shall be connected to common drain header and header shall be terminated to battery limit, of the skid for draining to a safe location.

Blind flange connections shall be provided on the inlet and outlet 'header to permit the future addition of at least one meter.

To balance the flow between the various Meters and reduce the fittings the inlet and outlet shall be positioned on opposite corners of the skid.

Metering header and General arrangement design shall be such that it shall avoid any flow disturbances, swirls in the flow and equally distribute the flow in each run.

The system design shall include provisions to ensure that pressure pulsation and surges are minimized.

### **Electrical Requirements**

- a. Certification :

All field mounted electrical/electronic instruments installed in hazardous areas shall be certified for use in such locations, It shall comply with the requirements of IEC Std, International Electro Technical Commission, and certified by internationally recognised authority like FM, BASSEFA or equivalent. All field equipment shall be suitable for Zone 1 Group IIA, IIB Temperature Class T3

- b. Power Supplies :



Company shall provide required 24VDC UPS power supply at oily one point. Further distribution including all necessary hardware, as required shall be in the scope of the Vendor.

Power supply distribution for all items related to Metering System (excluding power for MOV) shall be carried out from the metering cabinet itself. Power for each item shall be provided with separate switch and fuse for isolation and protection of the system.

The Vendor shall submit a calculation of the estimated power consumption and heat dissipation of the Metering System panel.

**c. Earthing :**

All metallic parts on the skid shall be connected to electrical safety earth bars by yellow green PVC insulated flexible earthing cables. Also earthing cables from junction boxes, panel etc. to be connected to the safety earth bar.

Earthing cable minimum conductor size shall be 2.5 mm<sup>2</sup>.

Removable parts (instrument panel doors, junction box cover etc.) shall be connected to the main body through flexible earthing strips. Screens (individual and overall) from signal cables to be terminated to the signal earth bar in junction boxes for further connection to earthing grid at control room side. No signal cable screens shall be terminated at metering skid side

**Cables / Cable Glands / Junction Box**

Instrument cabling shall conform to BS 5308, Part-I. Shielded, twisted-pair, armored cables shall be used for all meter pulse and analog signals. All cables shall be flame retardant as per IEC 332 Part III. Instrument cables supplied shall be in accordance with QP document QPED-5050.

All cable entries to the Instrument / JB's shall be glanded and provided with a seal. All cable glands shall be of SS material double compression type with IP 66 & EEx'd' certified. All cable glands shall be constructed in accordance with the requirements of BS 6121. All cables from skid instruments shall be terminated in Junction box (JB) on the skid edge.

The electrical cable entry for the instruments/valves actuators shall be M20. Unused cable entries shall be plugged off in compliance with specified electrical safety. Signal wiring terminals shall be of the screw type.

Interconnecting cables between the Skid and the remote mounted metering control panel will be provided by others (EPIC Contractor). Vendor shall recommend the details for interface cables.

Field Junction boxes and associated terminals shall be certified in accordance with the type of circuit and hazardous area.

All Skid-mounted instruments are to be wired to a Junction box through proper cable trays.

Cable entry to the junction box shall be from bottom. Spare cable entries shall be provided in the junction box. Spare entries shall be plugged with Eexd certified gland plugs.

Vendor to provide separate JB for Analog signals, digital signals, communication cables and power supply

The JB shall be made of Stainless Steel. Separate junction boxes shall be provided for different type of signals and voltage levels. Cable entries shall be through the bottom and side only. Junction boxes shall have terminals suitable for accepting conductor cross-section of 4 mm<sup>2</sup> and terminals shall be mounted on rails. 20% spare terminals shall be



supplied in each junction box. Each junction box will have min 20% spare cable entry with plug and ensure enough space for wire routing to terminals.

The metering control panel shall be supplied as loose item and shall be installed in the respective equipment room by others. Cabling between the metering control panel and the metering skid junction boxes shall be supplied and installed by others.

The cables shall be laid in cable trays within the Skid. Cable trays shall be hot dip galvanized design.

Equipment shall be immune to, or provided with protection against, the effects of electromagnetic interference and electrical transients.

### **Cabinets and Wiring**

Custody Metering Control System equipment shall be mounted in standard cabinets (e.g. Rittal) suitable for a safe environment, with a minimum ingress protection of IP-42. Cabinets shall be supplied with cooling fans for proper ventilation: Fluorescent lights shall be supplied inside the cabinets.

The cabinet shall be of 800 (Width) x 800 (Depth) x 2100 (Height) mm dimension, including the base frame and cabinet colour shall be as per QP standard.

All required internal power supplies and power distribution shall be supplied by the Vendor. These power supplies shall have redundant design, be self-cooled, and be provided with indication for proper operation of the system.

Design and installation of instruments and electrical equipment shall conform to the requirements of BP RP-30.

All wires shall be stranded copper except for thermocouple where it should match the thermocouple type:

All signal wire shields shall be drained to a heavy earth bus (isolated earth) at the power supply side:

All wire ends shall be identified with permanently attached (shrink on tubing) tags showing wire identification and loop number, and terminal details and shall be of cross ferruling type.

Field cables to rack-mounted equipment shall enter from the bottom in such a manner so as not to block service or maintenance.

Digital inputs shall have individual indicator fuses at the terminal strips or on the 110 Modules.

Terminal blocks shall be non-hygroscopic type. Terminals shall be tinned and shall be clearly identified. The size of the terminal blocks shall suit the wire size (it shall be possible to terminate two wires of 2.5mm<sup>2</sup> size). Each terminal shall hold only one wire. Jumper straps especially designed for the block must be used if more than one wire requires connection to a common point. Terminals shall be knife, disconnect and compression terminal connector type. Fused terminals shall be used as required. Raceways shall be designed to segregate according to type (input or output) and voltage levels and must accommodate all cables without overflow.

The equipment will normally be installed so that terminals and all electronic equipment are accessible from the front of the cabinet. A plan drawing showing accessibility to the cabinet shall be furnished to the Vendor by Company / EPIC Contractor.

Vendor's standard internal wiring conductor identification method shall be submitted for Company/EPIC Contractor approval.





### 5.2.7 Field Instrumentation

#### a. General Requirements :

Field instrumentation shall be provided for measuring the static pressure, temperature and, density.

Pressure transmitter's impulse lines shall be 1/2 inch type 316 stainless steel tubing, installed with a slope of not less than 1:12.

Field pressure, temperature and density transmitters shall be IS (EEEx'ia') certified Zone 1, Gas group IIA/ IIB, temperature class T3.

All electronic Transmitters shall be HART type with 4 to 20 mA DC output and with an overall accuracy of + 0.2% of span or better shall be used. Local digital Indicator shall be integral part of the transmitter.

Platinum Resistance Temperature Detectors (RTD) sensors shall be used. Pressure Gauge - shall have an accuracy of +/- 0.5 percent of span or better. Its range shall be selected so that the maximum operating pressure does not exceed 75 percent of the full-scale range. Piping installations shall incorporate vent/drain/test features.

All wetted parts material shall be suitable for sour hydrocarbon service in accordance with NACE-MR01075I1S0-15156 (latest edition).

Instruments shall be supplied with all required mounting accessories.

#### a. Temperature Instruments:

Electronic temperature transmitters shall use platinum resistance temperature detectors (RTD's) as the primary element. Temperature transmitters shall be two wire, SMART type with 4 to 20mA DC output, load driving capability of 600 ohms at 24V DC and will have the HART protocol facility. Accuracy shall be equal to better than 0.2% of span.

RTD's shall be of three or four wire design, with an R (100)/ R (0) ratio of 1.385 per DIN 43760.

Temperature Gauges shall be "Bimetallic" type and be of "any angle" type with a view to rotate the Gauge to facilitate viewing from the desired angle.

Temperature Gauges shall be weather proof with dial size of 150 /160 mm and shall have features like screwed bezels and shall be constructed with SS 316.

Temperature Instruments shall meet the general requirement outlined in the QP specification QPED-5052, Specification for Temperature elements & Transmitters.

#### b. Pressure Instruments

##### **Pressure Gauges**

Pressure Gauges sensing element shall be generally bourdon type and shall be weather proof with dial size of 150 / 160 mm and shall have features like screwed bezels. Accuracy will be better than 1% Full scale.

The process connection for the pressure gauge shall be 112" NPT (M) at bottom.

Pressure Gauges shall have over range protection and blowout protectors.

Pressure Gauges sensing element and movement shall be suitable for process conditions and minimum of SS 316. The case shall be of Stainless Steel minimum. In the selection of material for wetted parts, compatibility with Process fluids shall be the primary selection criteria.

##### **Pressure Transmitter**



All the Transmitters shall be SMART type with two wire, 4 to 20 mA DC output, and load driving capability of 600 ohms at 24V DC and shall have the HART, protocol facility.

Accuracy shall be equal to or better than 0.075% of span.

All wetted parts of the transmitter shall be as suitable for process conditions and minimum of SS316 and process connections shall be 1/2" NPT.

All the instruments cable entry shall be M20. All electric connections shall be carried out through certified terminal blocks within a certified terminal box furnished as part of the Transmitter.

All the field-mounted transmitters shall be furnished with a mounting bracket for a 2" pipe yoke and Sunshade.

Transmitters shall be installed at 1200 mm elevation from the approach level and where they are easily viewed by an operator and are easily accessible for maintenance.

**c. Density Transmitter**

Density transmitter shall be SMART type with two wire, 4 to 20 mA DC output, load driving capability of 600 ohms at 24V DC and shall have the HART protocol facility. Accuracy shall be equal to or better than  $\pm 0.15\%$  of full reading.

**d. Motor Operated Valve**

Motor Operated Valve shall conform to the general requirement outlined in Specification for Motor Operated Valve Actuator.

**e. Thermal Relief Valve**

Thermal Relief Valves shall be sized and designed according to API RP 520. Thermal Relief valves shall be 3/4" x 1" flanged with the minimum orifice sized 0.38 cm<sup>2</sup> modified nozzle type. Thermal Relief Valve complete body and nozzle shall be of SS material.

**f. Other Valves**

All valve design shall be as per applicable Valve specification and Piping Specification.

**Piping**

All skid-mounted piping & pressure containing components shall be designed and constructed. In accordance with ASME B 31.3 and shall meet & comply the requirements specified in the project deliverables listed in this Specification. Process wetted parts material shall be suitable for wet sour gas service and shall comply with NACE MR0175 / ISO 15156.

Where welding is carried out, the welding procedure and the welder or welding operator shall be qualified under the provision of ASME B 31.3. All welds subject to line pressure shall comply with the requirements of section IX of the ASME boiler & Pressure Vessel code.

### **5.3 Non- Custody Transfer Applications**

**Ultrasonic Flowmeters**

Multi-path Ultrasonic Flowmeter shall be designed for all gas Metering Non-Custody Transfer applications also, comply with international standards for accuracy, rangeability, bi-directional flow, calibration and testing procedures. Overall accuracy of the Non Custody Flow Metering shall be  $\pm 0.15\%$  of rate of flow.

**Turbine Flowmeters**

Turbine Flow meter shall be designed for all gas Metering Non-Custody Transfer applications also, comply with international standards for accuracy, rangeability,





bidirectional flow, calibration and testing procedures. Overall accuracy of the Non Custody Flow Metering shall be  $\pm 0.25\%$  or better of rate of flow.

#### **5.4 Name Plate**

All Instruments/valves shall be provided with an identification plate, with all data clearly stamped on a corrosion resistant plate permanently attached to each instrument/valve by means of rivets or pins and shall indicate, as a minimum, the following:

- a. Name of the Manufacturer or trade Mark
- b. Manufacturer's model/type number
- c. Instrument tag number
- d. Serial number
- e. Year of manufacture
- f. Range & calibration (including units of measurement)
- g. Body rating (including units)
- h. Electrical safety (type of protection)

All information on the nameplate shall be die-stamped or deep engraved.

#### **6 FABRICATION AND PAINTING**

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Metering Skid. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein. Painting of Metering Skid shall be in accordance with Standard Painting Specifications.

Painting shall be such that there is no rust formation on the Metering Skid when exposed continuously to the corrosive atmosphere. All carbon steel bolting shall be hot dip galvanized or cadmium plated and bi-chromated.

Aluminium components shall be anodized then coated with epoxy paint.

The Supplier's painting standard will be considered as an alternative offer provided it meets or exceeds the preceding requirements.

#### **7 INSPECTION AND TESTING**

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for metering skid shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the inspection and testing plan for proprietary items / special items for approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, calibration test and any other before Factory Acceptance Testing (FAT).

Instrumentation components shall meet the inspection and testing requirements of BP RP 32-1.

All materials and equipment shall be factory tested before shipment in the presence of Purchaser's representative. No material shall be transported to site until all required tests have been carried out and equipment is certified as ready for shipment. Acceptance of equipment or the exemption of inspection or tests thereof, shall in no way absolve Supplier of the responsibility for delivering equipment meeting the requirements of the specifications. Following tests shall be included.



- a. Material test certificate, hydrostatic test certificate, type test certificate for pilot pressure control valves, slam shut valves, pressure relief valve and for all piping/valves of skid.
- b. Testing to demonstrate set-point accuracy and actuation time for slam shut valves.
- c. Testing to demonstrate the set point accuracy for self-actuated pressure control valves for the complete range of pressure and flow conditions.
- d. Calibration certificate for pressure relief valve for set pressure and all field instruments.
- e. Seat tightness test for self-actuated pressure control valves, slam shut valves, pressure relief valve.
- f. Test certificate for all field instruments such as PG, TG, OPT etc.
- g. Certificates from statutory body for limit switch being flame proof and weatherproof.
- h. Skid piping material testing and NOT of welds as per PMS.
- i. The hydro testing of complete skid shall be performed.
- j. Leak test of complete skid shall be carried out with air/ N2.
- k. Skid functional testing considering metering, pressure regulation, limiting and safety characteristics.

Supplier shall perform the usual standard tests to maintain quality control procedures. Purchaser shall submit these test certificates for review before starting inspection. Supplier shall be responsible for testing and complete integration of the system. Detailed procedures of test and inspection shall be submitted by the supplier for review before order and mutually agreed upon.

Inspection will be done by the Purchaser or authorized representative at Vendor's shop. For this inspection, labour, consumable, equipment and utilities as required shall be in Vendor's scope.

Testing and inspection works have to be carried out at Bidder's works or works designated by the Bidder.

## **7.1 Factory Acceptance Testing (FAT)**

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Metering Skids, complete with the project approved tags and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Metering Skid.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

## **7.2 Witnessing**

Flow Metering System and its associated instrumentation supplied in accordance with this Specification are subject to the minimum inspection requirements. Testing is to involve all components and subcomponents of the Flow Metering Skid. The Vendor is responsible to perform a complete functionality test of the Flow Metering Skid.



### 7.3 Test and Inspection Schedule

The Vendor shall submit an inspection and test plan and check list detailing the inspection and tests with their acceptance criteria for approval by the Purchaser.

In addition, the following tests and inspections shall be performed by the Manufacturer and may be witnessed or executed by Purchaser or his Representative when so specified.

### 7.4 Visual Inspection

A visual inspection and physical check shall be made for compliance of the material with requirements of the Specifications of the original Purchase Order and all subsequent change orders including the relevant attachments and with Manufacturer's catalogue description and certified drawings furnished. Included are:

- a. Check for satisfactory workmanship, materials compliance and freedom from surface defects and broken glass;
- b. Check for compliance with certified drawings including dimensions;
- c. Check for all accessories on purchase order;
- d. Check for required cable length, if any;
- e. Check paint for imperfections.

Verify that each component has a tag of corrosion resistant material permanently fastened to the unit and stamped with information. Verify that all terminals for interconnecting wiring between units are accessible for connecting and checking. Terminal blocks should be numbered and where 2 or more are present, should have block identification. Interconnecting cables shall be colour coded or numbered.

All electrical wiring shall be checked for continuity and insulation test.

### 7.5 Functional Testing

Each Flow Metering System shall be accurately calibrated and tested by the Manufacturer at the normal working conditions specified in the attached Data Sheet. All test equipment used for testing shall have traceability to national standards.

### 7.6 Hydro - Testing

All piping along with piping components shall be hydro-tested in accordance with ANSI 831.3 and the piping material Specifications prior to the application of internal coating, external paint and insulation. Instruments shall be hydro tested as per piping material Specifications.

### 7.7 Radiographic Testing

10% of pipe needs shall be radiographic tested. The remaining shall be subjected to either magnetic particle test or dye penetration tests as applicable.



## **7.8 Flow Calibration**

Individual transmitters, flow computer and other instrument etc. shall be calibrated at Vendor's works. All equipments used for calibration shall have valid calibration certificate having traceability to National Institute of Standards & Technology or equivalent.

Each Flow meter & transmitter (Other than Master Meter) shall be calibrated for the complete flow rates with water at accredited facility. The meter factor shall be burnt in the flow transmitter.

The master meter & transmitter shall be calibrated at NMI accredited facility at similar flow, pressure and temperature conditions. Alternately the Master Meter can also be proved using mobile prover having valid calibration certificate from the internationally accredited laboratory at site.

Each skid shall be recalibrated at site in-situ with master meter. The flow test shall conform to API Standards and shall be carried at different flow rates. The meter factor shall be configured in the flow transmitter.

The flow meter shall be calibrated for Bi-directional measurement for the complete flow rates at accredited facility.

## **7.9 Site Acceptance Testing (SAT)**

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the Company / Owner's representative. SAT shall be performed on the Metering System as per the approved test procedure. A comprehensive test procedure in compliance with the Standard specification shall be developed and issued to Company / Owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Metering System functions correctly and properly in accordance with the specified requirements.

## **7.10 Certificates of Acceptance**

At the satisfactory conclusion of the FAT, a factory Certificate of Acceptance shall be provided by the Vendor for signature by the Company.

At the satisfactory conclusion of the SAT (Site Acceptance Test) a final Certificate of Acceptance shall be prepared by the Vendor.

Attached shall be all test records, receipt for documentation and spare parts plus any other pertinent records regarding the Vendor's delivery. The document becomes a Certificate of Final Site Acceptance, which Company shall review and approve

Material certificates shall be furnished for Flow Metering System and its accessories in accordance to BS EN 10204, 3.1 b Type B.

Hazardous Area Certificates for electrical / instrument components suitable for Zone-1 shall be issued by a recognized approval authority.

The Vendor shall supply test documentation in accordance with the Specifications, covering all the tests, which are to be performed during the implementation stages and the installation & commissioning Phase. The Vendor shall supply all relevant test and calibration certificates applicable to the instrumentation equipment.

Vendor shall submit the Certification for Custody Transfer for the following Instruments

The Control Room Mounted Flow Computer offered shall be certified by a suitable authority of the country of origin for use in Custody Transfer applications.



The Ultrasonic Flow Meter / Turbine Flow Meter shall have certification for custody transfer application.

The Vendor shall furnish the regulations of the certifying authority considered by him for custody transfer applications (EN334). If other instruments are also needed to be certified as per the regulations the same shall be complied with.

## **8 MARKING, PACKING AND SHIPMENT**

Following FAT completion, Vendor responsible for Metering System shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed and secured for transit to site without damage.

Vendor shall provide and submit his standard 'Marking, Packing and Shipping Procedures' for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the job Site.

After inspection and testing, equipment shall be completely free of water and dry before start of preparation for shipment.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

All openings shall be sealed. Flanged openings shall be protected with wood, threaded connections' shall be protected with forged steel or moulded plastic screwed plugs.

All mechanical or machined surfaces subject to atmospheric corrosion prior to installation on site shall be treated with an easily removable rust preventative.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Each individual crate shall be marked on the top and at least one side with the following

- a. Contract no. and name
- b. Consignee's name and address
- c. Company's order no. and item no
- d. Description of goods.

Initial spare parts shall be packed separately from the main equipment. The box or carton shall be clearly marked 'Initial Spares'. Furthermore each, spare part shall have its part number clearly identified and attached.

### **8.1 Rejection**

Vendor shall make his offer in detail, with respect to every item of the Purchaser's specification. Any offer not conforming to this shall be summarily rejected.

## **9 SPARES & ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in job Specification.



The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following:

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Metering Skid for Company's review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

## **10 DOCUMENTATION**

The following documentation shall be fulfilled by the Vendor, if it is not covered in job Specification.

### **10.1 Documentation Required with Technical Bid**

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specifications
- b. Bill of Materials including Vendor list, details for third party items
- c. Catalogues and manuals
- d. Quality Assurance Plan
- e. Any other documents

The Vendor shall provide at the time of tendering a complete detailed engineering package in accordance with the Purchaser's data requirement and shall include but not necessarily be limited to the same.

### **10.2 Documentation Required for Approval**

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval

- a. Standard Specifications.
- b. Bill of Materials including Vendor list, details for third party items
- c. Catalogues and manuals
- d. Sizing calculations
- e. Skid general arrangement drawings
- f. JB wiring drawings
- g. Assembly drawings with overall dimensions



- h. Detailed sectional drawings showing all parts with reference numbers and material specifications
- i. Welding, heat treatment, inspection, and testing procedures
- j. Calibration certificates
- k. Material test certificates
- l. Procedures for FAT
- m. Quality Assurance Plan
- n. Any other documents

### **10.3 Installation, Testing & Commissioning**

The Metering Skid supplier shall assist during erection, testing and commissioning of skids at site. The bidders shall indicate separate pricing for this purpose in their offers, if applicable.

### **10.4 Guarantee / Warranty**

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranted items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.

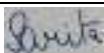


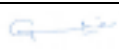
The Job Specifications / Data sheets shall be referred for any specific warranty / guarantee.



## VCS Quality Services Pvt. Ltd.

### STANDARD SPECIFICATION FOR INSTRUMENTATION CABLES

VCS-SS-IN-5801\_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	RB	VB	KNC	AD
00	23.05.2018	ND	UM	KP	AD
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed





**STANDARD SPECIFICATION  
FOR  
INSTRUMENTATION CABLES**

**DOCNO: VCS-SS-IN-5801  
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<b>REVISION RECORD</b>						
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		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



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## **ABBREVIATION**

ASTM	American Society of Testing and Materials
AWG	American Wire Gauge
BS	British Standards
DC	Direct Current
DIN	Deutsches Institute for numbering
EPR	Ethylene Propylene Rubber
F&G	Fire and Gas
IEC	International Electro-technical Commission
IS	Indian Standards
PVC	Polyvinyl Chloride



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## **1 SCOPE**

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of Cables along with its spares and accessories.

## **2 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.

### 3 REFERENCE DOCUMENTS

#### 3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

IEC-332-3 Part 3	Tests on bunched wires and cables
IEC 584-3 Part	Extension and compensating cables – Tolerances identification system
IEC-60332 Part 3	Tests on electric and optical fibre cables under fire conditions - Test for vertical flame spread of vertically mounted bunched wires or cables
IEC-60331	Fire-Resisting Characteristics of Electric Cables
ASTM D 2863	Test method for measuring the minimum oxygen concentration to support candle like combustion of plastics (Oxygen index)
BS-5308 Part 1	Specification for Polyethylene insulated cables
BS-5308 Part 2	Specification for PVC insulated cables
DIN-50049	Document on Material Testing
IS-1554 Part 1	PVC insulated (heavy duty) electric cables-working voltage up to and including 110 V
IS-2633	Method for testing uniformity of coating on zinc coated articles
IS-3975	Mild steel wires, formed wires and tapes for armouring cables
IS-5831	PVC insulation and sheath of electric cables
IS-8784	Thermocouple compensating cables

#### 3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.



## **4 MATERIALS**

Materials selected shall be in accordance with the Data Sheets and Company's Standard Specifications. Type and material of extension Cable shall be as per IS-5831 and IEC 584-3 where applicable.

Cable cores shall be of annealed electrolytic tinned copper conductor with PVC jackets conform to IS-5831. Insulation shall be Mica-glass / EPR or silicon rubber for F&G. signal/control Cables. Armouring shall be of galvanized steel wire / strip armour conforming to IS-1554. Screening / shielding shall be of black Aluminium backed Mylar / Polyester foil.

## **5 DESIGN**

The following design requirement covers the general requirements of Instrument Cables and accessories etc., but for the exact requirements and applications, the relevant, specific job Specifications and design basis shall be referred and complied.

### **5.1 Signal and Control Cables**

#### **5.1.1 Type – I (Single Pair / Triad Shielded Cable)**

Each core shall be 1.5 mm<sup>2</sup>, made of 7 stranded annealed electrolytic copper conductor. Each strand shall be 0.53 mm dia.

Primary insulation shall be 85°C polyvinyl chloride (PVC) as per IS-5831 Type-C. Thickness shall be 0.5 mm minimum.

A pair or triad shall have twisted cores and number of twists shall be not less than 10 per meter. Colour of core insulation shall be black-blue in pair and black-blue-brown in a triad.

Individual pair and triad shall be shielded. Shield shall be Aluminium backed by Mylar / polyester tape with the metallic side down helically applied with either side 25 % overlap or 100% coverage. Minimum shield thickness shall be 0.05 mm. Drain wire shall be 0.5 mm<sup>2</sup> multistrand bare tinned annealed copper conductor. The drain wire shall be in continuous contact with Aluminium side of the shield.

Inner and outer jacket shall be made of extruded flame retardant 90°C PVC to IS 5831 - Type ST2. Oxygen index of PVC shall be over 30 %. Temperature Index shall be over 250°C. The thickness of the jacket shall be as per IS-1554 Part-1.

Inner jacket colour shall be black. Outer jacket colour shall be black, except for cables to be used in intrinsically safe systems it shall be light blue. A rip cord shall be provided for inner jacket.

Armour over inner jacket shall be of galvanized steel wire / flat as per IS-1554 Part-1.

Tolerance in overall diameter of cable shall be within  $\pm 2$  mm over offered value.

#### **5.1.2 Type – II (Multipair / Multitriad Cable with Individual Pair Shield and Overall Shield)**

a. Generally the Cable shall be same as single pair shielded Cable except conductor sizes shall be 0.5 mm<sup>2</sup> made of 7 strands of annealed electrolytic copper conductor. Each strand shall be of 0.3 mm dia.

b. Overall shield shall be of Aluminium backed up by Mylar / polyester tape helically applied with the metallic side down with either side 25% overlap or 100% coverage. Minimum shield thickness shall be 0.075 mm. Drain wire shall be similar to individual pair drain wire and shall be of the overall shield.

c. Overall twist of all pair / triads shall be as per Vendor's standard.

- d. A pair of communication wire shall be provided for multipair / multitriad cables. Each wire shall be 0.5 mm<sup>2</sup> of plain annealed single or multistrand copper conductor with 0.4 mm thick 85°C PVC insulation. Insulation shall be green and red colour coded.
- e. Pair identification shall be with numbers at interval of not more than 250 mm as per vendor's standards.

**5.1.3 Type – III (Multipair / Multitriad Cable with Only Overall Shield)**

- a. These Cables shall be same as type-II cables except that the individual pair / triad shall not have shielding.

**5.1.4 Type - IV (Multipair / Multitriad Cable with Individual Pair Shield and Overall Shield)**

- a. The Cable shall be same as Type II except conductor size shall be 1.5 mm<sup>2</sup> made of 7 stranded annealed electrolytic copper conductor. Each strand shall be of 0.53 mm dia.

**5.1.5 Type – V (Multipair / Multitriad Cable with Overall Shield only)**

- a. The Cable shall be same as type IV except that the individual pair / triad shall not have the shielding.

**5.2 Fire and Gas Cables shall be fire resistant and shall meet all the Specifications mentioned above and:**

- a. Insulation shall be Mica-Glass / EPR or silicon rubber.
- b. The inner sheath shall be applied with a low smoke fire resisting compound.
- c. Suitable filler material (if necessary) shall be filled.
- d. Outer sheath shall be made up of low smoke, heat and oil resistant and flame retardant material.
- e. Circuit integrity of the Cable shall be maintained for a minimum period of 3 hours as per IEC-60331.
- f. The outer jacket colour shall be orange.

**5.3 Thermocouple Extension Cables**

Type and material of extension cable shall be as per IS-5831 and IEC-584-3 where applicable.

**5.3.1 Type – I (Single Pair Shielded Cable)**

- a. Each core shall be made of 16 AWG solid conductors.
- b. Primary insulation shall be 85°C polyvinyl chloride (PVC) as per IS 5831 Type C. Thickness shall be 0.5 mm minimum. Colour coding shall be as per IS-8784 Table-5.
- c. The cores of the pair shall be twisted and number of twists shall be not less than 10 per meter. The pair shall be shielded. Shield shall be Aluminium backed by Mylar / polyester tape bonded together helically applied with the metallic side down with either side 25% overlap and 100% coverage. Minimum shield thickness shall be 0.05 mm. Drain wire shall be 0.5 mm<sup>2</sup> multistrand bare tinned annealed copper conductor. The drain wire shall be continuous contact with Aluminium side of the shield.
- d. Inner and outer jacket shall be made of extruded flame retardant 90°C PVC to IS 5831- Type ST2. Oxygen index of PVC shall be over 30 %. Temperature index shall

be over 250°C. The thickness of the jacket shall be as per IS-1554 part-1. Inner jacket and outer jacket colour shall be as per IS-8784. A rip cord shall be provided for inner jacket.

- e. Armour over inner jacket shall be of galvanized steel wire/flat as per IS-1554 Part-I.
- f. Tolerance in overall diameter of cable shall be within  $\pm 2$  mm over offered value.

### 5.3.2 Type – II (Multipair Cable with Individual Shield and Overall Shield)

- a. The Cable shall be same as single pair shielded cable except for following;
  - i. Each core shall be 20 AWG solid conductor.
  - ii. In addition to individual pair shield overall shield shall be provided. Overall shield shall be of Aluminium backed up by Mylar / polyester tape helically applied with metallic side down either side 25% overlap or 100% coverage. Minimum shield thickness shall be 0.075 mm. Drain wire shall be similar to individual pair drain wire and shall be in continuous contact with the aluminium side of the overall shield.
  - iii. Overall twist of all pair shall be as per Vendor's standard.
  - iv. A pair of communication wire shall be provided for multipair cables. Each wire shall be 0.5 mm<sup>2</sup> of plain annealed single or multistrand copper conductor with 0.4 mm thick 85°C PVC insulation. Insulation shall be green and red colour coded.
  - v. Pair identification shall be with numbers at interval of not more than 250 mm as per Vendor's standard.

### 5.3.3 Type – III (Multipair Cable with Individual Pair Shield and Overall Shield)

- a. The Cable shall be same as type II except conductor size shall be 16 AWG.

## 5.4 Electrical Characteristics

### 5.4.1 Cable parameters L/R ratio, capacitance shall conform to intrinsic safety requirements for IS cables. Limitations for cable parameter shall be as follows:

- a. Maximum DC resistance of the conductor of the completed cable shall not exceed 12.3  $\Omega$ /km at 20°C for cables with 1.5 mm<sup>2</sup> conductors and 39.7  $\Omega$ /km at 20°C for cables with 0.5 mm<sup>2</sup> conductors.
- b. Mutual capacitance between any core and screen shall not exceed 250 pF/m at 1 KHz. Capacitance between any cores or screen shall not exceed 400 pF/m at 1 KHz.
- c. L/R ratio of adjacent core shall not exceed 40  $\mu$ H/ $\Omega$  for cables with 1.5 mm<sup>2</sup> conductors and 25  $\mu$ H/ $\Omega$  for cables with 0.5 mm<sup>2</sup> conductors.
- d. Electrostatic noise rejection ratio shall be minimum 76 dBA.
- e. Drain wire resistance including screen shall not exceed 30  $\Omega$ /km.
- f. Core inductance shall not exceed 4 mH/Km.
- g. Values shall be derived under the fault condition in the cable which produces the worst case parameters for intrinsic safe cables.

All Cables shall have insulation voltage rating of 600 / 1100 V.





## **5.5 Name Plate**

All Instrument Cable shall be marked as per Manufacturer's standard and shall have a permanently attached stainless steel plate with the following, as a minimum detail:

- a. Tag number as per Data Sheet;
- b. Manufacturer's name;
- c. Details of the Cable;
- d. Length of the Cable in meters contained in the drum;
- e. Gross weight;
- f. Direction of rotation of drum for unwinding by means of an arrow;
- g. Purchase Order number.

## **6 FABRICATION AND PAINTING**

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Cables. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein.

## **7 INSPECTION AND TESTING**

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Instrument Cables shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing for Approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, and any other before Factory Acceptance Testing (FAT).

### **7.1 Factory Acceptance Testing (FAT)**

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Instrument Cables, complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Instrument Cables.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- 7.1.1 Standard Type Test certificate shall be furnished for Cables similar to those being offered,
  - a. Cable shall be flame retardant to IEC-60332 part-III category A.
  - b. Cables required for F&G applications shall be as per IEC-60331.



- 7.1.2 Standard Routing Test (to be carried out by the manufacturer during various stages of manufacturing, test certificates shall be furnished)
- Insulation resistance, voltage test and spark test as per 8S-5308 part-II and sheath test as per IS-5831;
  - Armor test as per IS-3975;
  - Cable capacitance, L/R ratio and inductance test;
  - Conductor resistance test in Ohms/km;
  - Thermo emf tests for thermocouple extension cables.
- 7.1.3 Standard Acceptance Test shall be carried out in the presence of Purchaser or his authorized representatives,
- Continuity test;
  - Voltage test as per 8S-5308 part-II;
  - L/R ratio and capacitance values test;
  - Oxygen index test as per ASTM D 2863 latest edition;
  - Conductor resistance and drain wire resistance;
  - Dimensional check for overall diameter and under armor outer armor diameter;
  - Fire resistant test / certificate review (when specified);
  - Tests for uniformity of galvanization of armor as per IS-2633;
  - Check for drum length and overall length tolerances.

## **7.2 Site Acceptance Testing (SAT)**

A SAT shall be carried out on completion of the installation of the Cables at site which shall be witnessed by the company / owner's representative. SAT shall be performed as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Cables functions correctly and properly in accordance with the specified requirements. SAT mainly consists of the following inspections:

- Continuity test
- Conductor resistance and drain wire resistance
- Drum length and overall length tolerances
- Any other test, if required.

## **8 MARKING, PACKING AND SHIPMENT**

Following FAT completion, Vendor ensure that all Cables, associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard "Marking, Packing and Shipping Procedures" for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.



Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Cables shall be dispatched in wooden drums, securely battened with take-off end fully protected against damage

The ends of the Cable shall be sealed with suitable PVC / Rubber caps to prevent ingress of moisture.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

## **9 SPARES AND ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Instrument Cables for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

## **10 DOCUMENTATION**

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

### **10.1 Documentation Required with Technical Bid**

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;
- e. Any other documents.

### **10.2 Documentation Required for Approval**

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;



- c. Catalogues, Manuals and relevant drawings and documents;
- d. Dimensional drawings;
- e. Material test certificates;
- f. Procedures for FAT;
- g. Quality Assurance Plan;
- h. List for spare parts for start-up and for 2 years of operation.

### **10.3 Guarantee & Warranty**

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design .The cost of correction / replacement of any warranty items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.

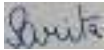



The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



## VCS Quality Services Pvt. Ltd.

### STANDARD SPECIFICATION FOR JUNCTION BOXES AND CABLE GLANDS

VCS-SS-IN-5802\_02

					
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**STANDARD SPECIFICATION  
FOR  
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01	18.01.2020					Format change and document numbering is revised.
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		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



**STANDARD SPECIFICATION  
FOR  
JUNCTION BOXES AND CABLE GLANDS**

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**ABBREVIATION**

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
FAT	Factory Acceptance Test
IEC	International Electro-technical Commission
IP	Ingress Protection
IS	Indian Standards
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
SAT	Site Acceptance Test



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## **1 SCOPE**

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of Junction Boxes and Cable Glands along with its accessories which include the following types:

- a. Electrical junction boxes
- b. Pneumatic junction boxes
- c. Cable glands.

## **2 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.



### 3 REFERENCE DOCUMENTS

#### 3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

ASME B1.20.1	Pipe Threads
DIN 50049	Document on Material Testing
IS 5	Colours for ready mixed paints and enamels.
IS 2147	Degree of Protection provided for Enclosures
IS 2148	Flame proof Enclosure of Electrical Apparatus.
IEC 529	Degree of Protection by providing Enclosures
IEC 79	Electrical Apparatus for Explosive Gas Atmosphere
EN 837	Pressure Gauges Part-t: Bourdon Type Pressure Gauges, Dimensions, Metrology, Requirements and Testing

#### 3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.

### 4 MATERIALS

Materials selected of the Junction Boxes and Cable Glands shall be in accordance with the Data Sheets and Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

### 5 DESIGN

#### 5.1 Junction Boxes

Junction Boxes shall be either of the following type as specified in Data Sheets.

- a. Weather proof Junction Boxes.
- b. Weather proof and flameproof Junction Boxes.



The enclosure shall be as per IS-2147 and IP-65 for weather proof Junction Boxes and for flameproof it shall be as per IS-2148 suitable for the area classification specified.

Number of entries and locations shall be as per Data Sheets and all the cable entries shall be bottom entries.

Junction Boxes shall be provided with telephone sockets and plugs for connection of hand powered telephone set.

#### 5.1.1 Electrical Junction Boxes

Material shall be die-cast aluminium of minimum 5 mm thick (LM-6 alloy)

Flame proof Junction Boxes shall have detachable cover which is fixed to the box by means of cadmium plated triangular head /hexagonal head screws.

Weatherproof Junction Boxes shall have doors which shall be hinged type and these shall be fixed by plated countersunk screws.

Flameproof Junction Boxes shall have a warning engraved/integrally cast on the cover as given below;

"Isolate power supply elsewhere before opening."

Terminals shall be spring loaded, vibration proof, clip- on type, mounted on nickel plated steel rails complete with end cover and clamps for each row.

All terminals shall be suitable for accepting minimum 2.5 sq. mm copper conductor, in general. However, for power supply distribution boxes, terminal detail shall be as per job specification/data sheets.

The Junction Box shall be sized for termination of all cores and screens including spares without the need for more than 1 core per terminal. In addition a minimum of 10 % spare terminals shall be provided, unless specified otherwise in Data Sheet.

The Junction Boxes shall have sufficient space to ensure ease of termination. Sizing shall be done with due consideration for accessibility and maintenance in accordance with the following guidelines;

- a. 50 to 60 mm between terminals and sides of box parallel to terminal strip for upto 50 terminals and additional 25 mm for each additional 25 terminals.
- b. 100 to 120 mm between terminals for up to 50 terminals and additional 25 mm for each additional 25 terminals.
- c. Bottom/top of terminal shall not be less than 100mm from bottom/top of the Junction Box.

Terminals shall be marked as per various types indicated in Data Sheets.

Shall be provided with external earthing lugs.

#### 5.1.2 Pneumatic Junction Boxes

Pneumatic Junction Boxes shall be made of 3 mm thick hot rolled steel. They shall have necessary neoprene gasket between door and body. Door shall be flush with the box and shall be hinged type and provided with wing nuts.

Single tube entries shall be suitable for 6 mm 0.0 copper tube with bulk head fittings. Multi tube bundle entry shall be suitable for the data furnished in Data Sheets.

### 5.2 Cable Glands, Plugs and Reducers / Adaptors

Cable Glands shall be supplied by Vendor whenever specified.

Cable Glands shall be double compression type for use with armoured cables.



The Cable Glands shall be of nickel plated brass material unless specified otherwise in Data Sheet.

The Cable Glands shall be weather proof. Whenever specified they shall also be flameproof and certificate from statutory body shall be furnished.

Cable Glands shall be supplied to suit the Cable dimensions indicated along with tolerance indicated in Data Sheets. Various components like rubber ring, metallic ring, metallic cone and the outer/inner nuts etc. shall be capable of adjusting to the above tolerances of Cable dimensions.

Each Cable Gland shall be supplied as a kit complete with locknut, shroud, and earth tag and sealing washer with proper identification of Gland size. Shrouds provided for additional protection to the Cable Gland termination. Earth tag shall be of nickel plated brass material.

Reducers/Adaptors shall be supplied as per details indicated in Data Sheets. They shall be nickel plated brass. These shall be weather proof in general. These shall also be flame proof wherever specified and certificate from statutory body for flame proofness shall be furnished.

Stopper plugs to seal spare cable entries in the Instrument Junction Boxes shall be provided wherever specified in Data Sheet. They shall be of nickel plated brass for metallic Junction Boxes and glass fibre reinforced polyamide for non-metallic junction boxes.

Plugs shall be certified flameproof when used with Flameproof Junction Boxes.

All Cable Glands and accessories such as reducers, adaptors, stopper plugs shall be stamped with type and size of Cable Glands, type and size of entry thread and the relevant approval details.

## **5.3 Name Plate**

All Junction Boxes shall be marked as per Manufacturer's standard and shall have a permanently attached stainless steel plate with the following, as a minimum detail:

- a. Tag number as per Purchaser's Data Sheets.
- b. Type of enclosure such as terminal capacity, size, IP rating, serial no etc.
- c. Name of Manufacturer.
- d. Type of explosion protection (as applicable)
- e. Name of certifying agency and certificate number

The Tag no shall be generally white character on red background for fire & gas, white character on blue background for intrinsically safe circuits and black character on white background for all other applications.

## **6 FABRICATION AND PAINTING**

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Junction Boxes and Cable Glands. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein. Painting of Junction Box shall be in accordance with Standard Painting Specifications.

Surface shall be prepared for painting. It shall be smooth and devoid of rust and scale

Two coats of lead - free base primer and two final coats of lead free epoxy based paint shall be applied both for interior and exterior surfaces.



The colour shall be as specified in Data Sheets.

## **7 INSPECTION AND TESTING**

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Junction Box and Cable Glands shall be carried out as per approved Inspection and Test Plan. Vendor shall submit the Inspection and Testing for Approval. Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like Certificate from statutory body for suitability to install in specified area classification, dimensional test report, material test, calibration test and any other before Factory Acceptance Testing (FAT).

### **7.1 Factory Acceptance Testing (FAT)**

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Junction Box and Cable Glands complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Junction Box and Cable Glands.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Visual inspection
- b. Calibration
- c. Functional test

A certificate to detail the results and records obtained during the FAT shall be made available for ratification by the Vendor on the date of test.

### **7.2 Site Acceptance Testing (SAT)**

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the company / owner's representative. SAT shall be performed on the Junction Box and Cable Glands as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Junction Box and Cable Glands functions correctly and properly in accordance with the specified requirements.

## **8 MARKING, PACKING AND SHIPMENT**

Following FAT completion, Vendor responsible for the Junction Box and Cable Glands shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard "Marking, Packing and Shipping Procedures" for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.



Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Each packing shall have its weight clearly marked on it and shall be identified with the contents, purchase order no and item number.

All entries shall be installed with plastic plugs to prevent unwanted material and insects entering the instrument junction boxes.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

## **9 SPARES AND ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Junction Box and Cable Glands, for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

## **10 DOCUMENTATION**

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

### **10.1 Documentation Required with Technical Bid**

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;

### **10.2 Documentation Required for Approval**

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications, Data Sheets;



- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogues, Manuals and relevant drawings and documents;
- d. Dimensional drawings;
- e. Calibration certificates;
- f. Material test certificates;
- g. Procedures for FAT;
- h. Quality Assurance Plan;

### **10.5 Guarantee & Warranty**

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design .The cost of correction / replacement of any warranty items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.

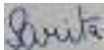



The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



## VCS Quality Services Pvt. Ltd.

### STANDARD SPECIFICATION FOR INSTRUMENT TUBE FITTINGS

VCS-SS-IN-5803\_02

					
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**STANDARD SPECIFICATION  
FOR INSTRUMENT TUBE FITTINGS**

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		Rakesh Bhardwaj	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



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## **ABBREVIATION**

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
BS	British Standards
FAT	Factory Acceptance Test
IS	Indian Standards
ISA	Instrument Society of America
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
NPT	Nominal Pipe Thread
SAT	Site Acceptance Test
SS	Stainless Steel



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## **1 SCOPE**

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of instrument tube fittings which includes the following types :-

- a. SS compression fittings (for SS tube)
- b. Brass compression fittings (for copper tube)

## **2 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.



### 3 REFERENCE DOCUMENTS

#### 3.1 Codes & Standards

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

##### **American Society of Mechanical Engineers**

ASME B1.20.1	Pipe Threads
ASME B 16.5	Steel Pipe Flanges and Flanged Fitting
ASME B 16.20	Ring Joint Gaskets and Grooves for Steel Pipe Flanges
ASME B16.11	Forged Steel Fittings -Socket Welding and Threaded

##### **British Standards**

BS-4368	Carbon and Stainless Steel Compression Couplings for Tubes -Part-IV
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##### **Instrument society of America**

ISA RP 42.1	Nomenclature for Instrument tubing fittings
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##### **Indian Standards**

IS-319	Specification for free cutting Brass Bars, Rods and Sections
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#### 3.2 Order of Precedence

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.

### 4 MATERIALS

Materials selected shall be in accordance with the Data Sheets and Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.



## **5 DESIGN**

### **5.1 SS Tube Fittings**

Nomenclature of all Tube Fittings shall be as per ISA RP 42.1.

Fittings shall be of flare less compression type and four - piece (for double compression type) construction consisting of two ferrules, nut and body suitable for use on SS tubes conforming to ASTM A 269 TP 316 with hardness in the range of RB 70 to 79.

All the parts shall be of SS 316.

Hardness of the ferrules shall be in the range of RB 85-90 so as to ensure a hardness difference of the order of 5 to 10 between Tube and Fittings, for better sealing.

Nuts and ferrules of a particular size shall be interchangeable for each type.

Spanner hold shall be metric.

Threaded ends of Fittings shall be NPT as per ANSI B 1.20.1.

Vendor shall ensure that the ferrules and nuts supplied for fittings shall be suitable for the sample Tube which shall be supplied during manufacture.

Specific techniques like Silver plating shall be used over threading in order to avoid jamming and galling.

### **5.2 Copper Tube Fittings**

Nomenclature of all Tube Fittings shall be as per ISA RP 42.1.

Fittings shall be of flare less compression type and of three- piece construction consisting of ferrule, nut and body suitable for use on copper tubes conforming to ASTM B 68/B 68M hardness not exceeding RB 50.

All parts shall be manufactured from Brass as per IS 319 bar stock and nickel plated.

For better grip, Vendor shall maintain hardness difference between tube and ferrule and indicate the same along with the offer.

Nuts and ferrules of a particular size shall be interchangeable for each type.

Threaded ends of Fittings shall be NPT as per ANSI B 1.20.1.

Spanner hold shall be metric.

Vendor shall ensure that the ferrules and nuts supplied for fittings shall be suitable for sample tube which shall be supplied during manufacture.

### **5.3 Name Plate**

No separate nameplates are required on the Fittings. However, a Manufacturer's name / trademark should be punched on a visible place on the body of each Fittings for easy identification.

## **6 FABRICATION AND PAINTING**

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Instrument Tube Fittings. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein.



## 7 INSPECTION AND TESTING

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Instrument Tube Fittings shall be carried out as per approved Inspection and Test Plan.

Type test for the products shall be according to 8S-4368 Part IV which shall necessarily include the following:-

- a. Hydrostatic proof pressure test
- b. Minimum hydrostatic burst pressure test
- c. Disassembly and reassembly test
- d. Minimum static gas pressure (vacuum) test
- e. Maximum static gas pressure test
- f. Hydrostatic impulse and vibration test.

The type test results shall be made available for scrutiny during inspection.

Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, calibration test and any other before Factory Acceptance Testing (FAT).

### 7.1 Factory Acceptance Testing (FAT)

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Instrument Tube Fittings complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Instrument Tube Fittings.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Hydrostatic Test: SS Tube Fittings shall be subjected to hydrostatic test at the following pressures.  
For 6 mm Fittings, at 80 kg/cm<sup>2</sup>.  
For 1/2" Fittings, at 153 kg/cm<sup>2</sup> or 400 kg/cm<sup>2</sup> at 38°C, as specified in the Data Sheets. The ratings are based on usage in piping classes with flange ratings up to 600#, 900# and 1500# respectively.  
Brass compression Fittings shall be subjected to hydrostatic test at the following pressure:  
For 1/4" Fittings, at 10 kg/cm<sup>2</sup>, 3/8 " at 80 kg/cm<sup>2</sup>, at 38° C.  
During and after the hydrostatic test, the tubes shall not show any leaks or rupture.
- b. Pneumatic Pressure Test: The Fittings shall be tested at 7 kg/cm<sup>2</sup> of dry air. During and after the test, tubes shall not show any leaks or rupture.
- c. Disassembly and Reassembly Test.



d. Hardness verification. Test for hardness shall be done on parent material for the ferrules.

e. Dimensional test report

A certificate to detail the results and records obtained during the FAT shall be made available for ratification by the Vendor on the date of test.

## **7.2 Site Acceptance Testing (SAT)**

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the company / owner's representative. SAT shall be performed on the Instrument Tube Fittings as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Instrument Tube Fittings functions correctly and properly in accordance with the specified requirements.

## **8 MARKING, PACKING AND SHIPMENT**

Following FAT completion, Vendor responsible for the Instrument Tube Fittings shall ensure that all equipment and associated materials and accessories are designed properly, marked and packed, and secured for transit to site without damage.

Vendor shall provide and submit his standard "Marking, Packing and Shipping Procedures" for review by Company / Owner.

Vendor shall specify any conditions, normal or special, to be verified in intermediate storage and during transport.

Equipment shall be suitably packed including any dismantling, transit fastening and bracing necessary to prevent distortion or damage during transit.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by Company's inspectors. All costs occasioned by such rejection shall be to account of the Vendor.

## **9 SPARES AND ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Instrument Tube Fittings, for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.





## **10 DOCUMENTATION**

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

### **10.1 Documentation Required with Technical Bid**

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;
- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;
- e. Any other documents.

### **10.2 Documentation Required for Approval**

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Material test certificates;
- d. Procedures for FAT;
- e. Quality Assurance Plan;

### **10.3 Guarantee & Warranty**

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

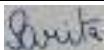



Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor.



## VCS Quality Services Pvt. Ltd.

### STANDARD SPECIFICATION FOR FLOW COMPUTER

VCS-SS-IN-5909\_02

					
02	11.05.2022	SV	KNC	HK	GVW
01	18.01.2020	RB	VB	KNC	AD
00	23.05.2018	ND	UM	KP	AD
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed



**STANDARD SPECIFICATION  
FOR  
FLOW COMPUTER**

**DOCNO: VCS-SS-IN-5909  
Rev No : 02**

<b>REVISION RECORD</b>						
<b>Rev.</b>	<b>Revision Date</b>	<b>Prepared by</b>	<b>Checked by</b>	<b>Approved by</b>	<b>Authorized by</b>	<b>Revision Description</b>
00	23.05.2018	Neha Dev	Udit Manichanda	K.Prasanth	Anupam Das	
01	18.01.2020					Format change and document numbering is revised.
		Rakesh Bhardwaj	Vinod Babu	Kedarnath Chakraborty	Anupam Das	
02	11.05.2022					VCS QMS Integration
		Sarita Verma	Kedar Nath Chakraborty	Hashim khan	GV Walimbe	



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## **ABBREVIATION**

GPA	Gas Processors Association
ASME	American Society of Mechanical Engineers
NFPA	National Fire Protection Association
FAT	Factory Acceptance Test
IEC	International Electro-technical Commission
IP	Ingress Protection
GC	Gas Chromatograph
USM	Ultrasonic Meter
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
NPT	Nominal Pipe Thread
SAT	Site Acceptance Test
SS	Stainless Steel



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## **1 SCOPE**

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of Flow Computer along with its accessories.

## **2 DEFINITIONS**

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

Owner/ Purchaser/ Company	Owner of the particular Project (Project Specific).
Consultant	The party which comes out all or part of the engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
Bidder/ Manufacturer / Supplier / Vendor	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
Works/ Shop	The place where the ITEM / UNIT is fabricated and tested and transported to Purchaser.
Datasheet	Technical data provided by the Purchaser / Owner / Company.
Standard Specification	Specifications Developed as Standard by the Company.
Job Specification	Specifications Developed pertaining to particular project / Job in regard.
Material Requisition	Requisition as raised to Supplier for Quotation of the item
Purchase Requisition	Requisition as raised to Supplier for Procurement of the item
Purchase Order	Legal Order supplied to Supplier for procurement of the Engineered Item
Site	The work place where the equipment is installed and commissioned.



### **3 REFERENCE DOCUMENTS**

#### **3.1 Codes & Standards**

The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the Purchaser's enquiry.

AGA Report no. 3	Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids
AGA Report No. 7	Measurement of Gas by Turbine Meters
AGA Report No. 9	Measurement of Gas by Multi-Path Ultrasonic Meters
AGA Report No. 10	Speed of sound in natural gas and other related hydrocarbon gases
ISO 6976	Natural gas - Calculation of calorific values, density, relative density and Wobbe index from composition
GPA 2172	Calculation of Gross Heating Value, Relative Density, Compressibility and Theoretical Hydrocarbon Liquid Content for Natural Gas Mixtures for Custody Transfer
GPA 2145	Table of Physical Properties for Hydrocarbons and Other Compounds of Interest to the Natural Gas Industry
IEC 60079-0	Explosive atmospheres - Part 0: Equipment - General requirements
IEC 60079-1	Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures “d”
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60801	Electromagnetic Compatibility For Industrial-process Measurement And Control Equipment - Radiated Electromagnetic Field Requirements
ASME B 1.20.1	Pipe Threads, General Purpose, Inch
ASME B 16.5	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
ASME B 16.20	Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed
EN 10204	Metallic Products – Types of Inspection documents
NFPA 496	Purged and pressurized enclosures for electrical equipments



### **3.2 Order of Precedence**

In the event of conflict between Specifications, Data sheets, related standards, codes etc., the order of precedence shall be as follows:

- a. Data sheets
- b. Job Specifications
- c. Standard Specifications
- d. Codes and Standards

Vendor shall refer the matter to the Purchaser for clarification and only after obtaining the approval in writing, the same should proceed with the manufacture of the items in question.

## **4 MATERIALS**

Materials selected shall be in accordance with the Data Sheets and Standard Specifications. For corrosion service the material selected shall be in compliance with the requirements of NACE MR-0175 / ISO-15156 latest editions.

## **5 DESIGN**

The flow Computer shall be either field mounted or installed in the control/ equipment room and should have operator interface for configuration and data display.

Flow computers shall perform all required calculations for custody transfer application using latest relevant AGA standards.

Field mounted flow computers, if located in hazardous area, shall be certified for use in classified area as per relevant sections of IEC 60079. Ingress protection for field mounted flow computers shall be IP65 in accordance with IEC 60529.

Flow computers in equipment room shall be rack (within panel)/ wall mountable as mentioned in datasheet. If wall mountable then the ingress protection shall be IP 54 in accordance with IEC 60529.

All software and firmware with licenses shall be in the name of owner. Manufacturer shall provide an undertaking to upgrade free of cost all software and firmware to the latest version and to incorporate all algorithm corrections and changes in line with latest industry standards for a period of ten years from the date of supply of the system

The offered flow computer shall be certified for custody transfer application from NMI/ PTB or equivalent.

The enclosure material of the flow Computers shall be manufacturer standard.

Flow computers shall be individual microprocessor based devices specifically designed to perform flow related calculations. Each flow computer shall be dedicated to a single meter run.

Measurement data inside the flow computer shall be protected against tampering via any serial port or networked connections.

Configuration and operating parameters shall be protected by either a hardware key lock switch or by multi-level password protection.



Field instruments from the meter run shall be directly connected to the flow computer to ensure signal integrity and to prevent tampering.

Flow computers shall remain unaffected by radio transmissions (Levels of permissible RFI shall be as per IEC 60801). Band-pass and / or band stop filters shall be fitted, as necessary.

## 5.1 Display Unit

LCD display shall be available in front panel of flow computers with at least 10 character display. Resolution of display shall be such that the time interval between rollovers of each total, when operating at maximum flow rate is greater than three calendar months.

The following data shall be available on front panel display as a minimum:-

- a. Gross/ Standard/ Mass/ Energy Volume Flow Rate
- b. Gross/ Standard/ Mass/ Energy Volume Total
- c. Stream downstream Temperature/ Pressure
- d. Standard Compressibility/ Compressibility (In use/ Calculated/ Keypad)
- e. Standard Density/ Density (In use/ Calculated/ Keypad)
- f. Calorific Values (In use/ Calculated/ Keypad)
- g. Gas Compositional Data
- h. AGA 8 variables, constants and results
- i. Meter Status (Flow/ No Flow/ Maintenance)
- j. Time/ Date
- k. Maintenance Mode (entry/ exit)
- l. Security Mode
- m. Meter Status and Diagnostics

Reset of any totals through front panel display shall be through suitable access privilege.

## 5.2 Security

Provision shall be available to view/ Modify data of flow computers through access privileges from front panel display.

Typically four access levels shall be defined namely Administrator, Engineer, Technician and Operator.

Access control shall be available for the following:-

- a. Displays
- b. Reports
- c. Acknowledge Alarms
- d. Modify/ Change
- e. Diagnostics
- f. Remote Access

g. Create/ Delete/ Modify users

Manufacturer shall define the access privileges and submit document to owner along with procedure for system administrator for review/ approval and it shall also be part of documentation.

### 5.3 Calculations

Flow computer will do volume/ flow calculation in standard metric units as per relevant AGA standard. Reference conditions for calculations shall be as specified in datasheet.

Super compressibility/ compressibility of gas shall be calculated as per AGA 8 (full version) using the composition available from gas chromatograph (GC).

Energy related calculations shall be in accordance with ISO 6976 and/ or GPA 2172 with tables from GPA 2145. It shall be possible for user to select either one of the standard or both for the calculations. Reference conditions shall be same as used for volume/ flow calculations.

For Ultrasonic meter, speed of sound (SOS) calculations as per AGA Report no 10 shall be available for comparing the SOS obtained from USM and SOS obtained from GC. Manufacturer shall inform the acceptable limit for the variance and incorporate necessary logics, alarms in the flow computer design.

Parameters and characteristics of flow meter required for computation shall be keyed into the flow computer. Any change in the parameters would require suitable privilege level passwords and shall be captured in audit trail. Manufacturer shall provide detailed procedure for changing of flow meter parameters in flow computer.

All calculations shall be using third party certified math blocks with programmed logics to meet the requirement. Certificates of math blocks shall be submitted to owner as part of documentation.

The following features shall be available as a minimum in all flow computers: -

- a. Read flow, temperature (deg C), Pressure (bar g)
- b. Read Gas chromatograph (Mole %)
- c. Distinguish grade of gas
- d. Log time and delivery of each grade of gas
- e. Calculate "Z"
- f. Indicated actual volume flow rate
- g. Standard volume flow rate
- h. Volume total
- i. Energy flow rate
- j. Energy total
- k. Hourly logs
- l. Daily logs
- m. Audit Logs
- n. Error log
- o. Line up meter via RTU, Check Meters (Prove), and use corrected meter factors
- p. Read USM alarm and diagnostic data.

- q. Should have one spare RS 232 / 485 Modbus port.
- r. Each flow computer will have dual TCP Ethernet Communication path to control system.
- s. Communicate with the GC controller via serial link using Modbus RTU protocol
- t. Control station flow rated based on local or remote set point from station control system.
- u. Should manage meter runs through station control system based on flow to maintain the system accuracy.
- v. Respond to orderly Shutdown and start-up of metering station in response to ESD.

#### **5.4 Automatic Calibration Software**

The calibration software (to be enabled using security code) in flow computer shall allow for the calibration of the following constituent components of the metering facility:-

- a. Pressure Transmitters
- b. Temperature Transmitters
- c. Differential pressure transmitters

The software shall guide each calibration by an instructive step-by-step procedure. Calibration software with the following features shall be provided:

- a. User editing of computer field and test equipment data
- b. Automatic test equipment certification check
- c. Viewing and printing of individual calibration test sheets
- d. Printing of complete set of individual week's test sheets

On completion of the procedure an output form shall be printed giving all details of "as found" values and "as left", in cases where adjustment and changes to instrument report is done and a remark column shall be provided where there is no change. The form shall print the current date and signature boxes. The report form sheet shall be alterable.

#### **5.5 Historical Data, Alarms, Reports and Logs**

The flow computer shall be able to store for future reference events, alarms and trend data.

Historical data storage shall comprise of last 30 days alarms and events, important measurement parameters for a period of one year based on FIFO basis. It should be possible to retrieve this data and be able to manipulate it to produce displays and reports from any of the workstations on the network.

There shall be three categories of alarm that shall be raised and logged by the flow computers. The generated alarms shall also be capable of being routed to a local dot matrix printer. The alarms are as below:-

- a. Computer Alarms

This generally shall comprise of Cold Start, Warm Start, Battery Fail, RAM Fail, ROM Fail, Reset Required, Total Rollover etc.

- b. System Alarms

This generally shall comprise of Temperature Under range/ Over range, Pressure Over Range/ Over Range, Dew Point Under Range/ Over Range, Moisture Under range/ Over Range etc.

c. Process Alarms

This generally shall comprise of Temperature Low/ High, Pressure Low/ High, Dew Point Low/ High, Moisture Low/ High etc.

## 5.6 Diagnostics and Error Handling

The flow computers shall have self-diagnostic feature and any failure in the computers or deviations beyond high-low limits of all inputs shall be displayed as an alarm and logged. Also an alarm contact shall be available for extension of the contact to the supervisory system. Alarms shall not reset automatically and must be acknowledged by operator before resetting.

In the case where the parameters received are deemed invalid, the flow computer shall alarm the incident and proceed with the last valid value in memory. This shall be true for all inputs such as the gas composition, specific gravity and heating value. Keypad default values shall not be used, unless specified by the Operator.

The memory content of the flow computer shall not be lost in the event of failure or interruption of the power supply. The equipment shall be provided with internal battery backup.

The flow computer shall have hardwired interfaces to the supervisory system for hardware failure and instantaneous corrected flow rate.

## 5.7 Power Supply

Manufacturer to note that the UPS power supply available shall be 110 V AC  $\pm 10\%$ , 50 Hz  $\pm 3\%$ . Further rectifier / transformer if required to achieve the desired working voltage shall be provided by the manufacturer.

The system performance shall be within specifications even when the supply voltage varies by  $\pm 10\%$  of specified value and supply frequency varies by  $\pm 3$  HZ of specified value.

Manufacturer to ensure that there is no damage to any component of the offered system because of black outs / brown outs. Manufacturer to indicate steps to be taken for fail safe operation under power failure.

## 5.8 Electric Transients

The flow computer shall have provisions for protection against system errors and hardware damage resulting from electrical transients on power or signal wiring. These electrical transients include power line faults, lightning strikes, and lightning-induced surges on power or signal cables. The manufacturer shall clearly describe the method used to provide the electrical transient protection which shall comply with the guidelines of IEC 61000-2.

The flow computer shall operate satisfactorily not only independently, but also in conjunction with other equipment, which is placed nearby. The operation of flow computer shall not be adversely affected by interference voltages and fields reaching it from external sources, and also will not in itself, be a source of interference that might adversely affect the operation of other equipment.

Design of equipment, components and assemblies shall consider RFI/EMI control. The design shall ensure easy serviceability and also ensure that integrity of RFI/EMI protection features, such as screening, shall not degrade under normal maintenance conditions.

## 5.9 Communication Interfaces

The various types (hardwired, serial or Ethernet) and numbers of output shall be as defined in the datasheet.

Protocol for Ethernet and serial communication shall be Modbus RTU. Manufacturer shall furnish the complete Modbus database including message structures, frame structures, synchronizing / timing signals, memory locations for data addressability and interface software driver details for owner's review and approval prior to proceeding with software/ hardware configuration.

Flow computers shall be serially interfaced to gas chromatograph for transfer of gas compositions etc. Manufacturer shall be totally responsible for this interface and the same shall be demonstrated by manufacturer during FAT.

Hardwired digital outputs shall be potential free and analogue signals in 4 to 20 mA format shall be isolated type capable of driving 600 ohms load resistance. All outputs shall be user configurable.

Data available through Ethernet and serial communication shall be user configurable and shall be finalized with owner prior to implementation. Any addition or deletion to the data highway shall not require reconfiguration and/or programming and shall be capable of being accomplished while the flow computer is "on-line".

Upon failure of any data link, an alarm shall be generated to alert the user and shall be logged in system memory.

There shall be a dedicated communication port for connecting a laptop (not in scope of supply) for configuration, diagnostics, report generation etc. Software required for the same shall be included in the scope of supply.

Dedicated port for printer shall be available.

## 5.10 Name Plate

Each flow computer shall have a stainless steel name plate attached firmly to it at a visible place either by riveting or screwed to case, furnishing the following information:-

- a. Tag number as per owner's data sheet
- b. Manufacturer's name and trademark
- c. Model number and manufacturer's serial number
- d. Electrical classification and Ingress protection

## 6 FABRICATION AND PAINTING

Vendor shall obtain approval in writing from the Purchaser before start of fabrication of Flow Computer. Vendor shall submit the required Specification, drawings & documents for approval. Also Vendor shall refer the relevant codes and standards for manufacturing herein.

## 7 INSPECTION AND TESTING

### 7.1 General Requirements

- i. The Manufacturer shall ensure all equipment used for inspection and testing purposes is calibrated and certified.



- ii. The Manufacturer shall record all inspection and testing activity on the appropriate inspection certificate.
- iii. The inspection and testing shall be carried out as per Company approved inspection and test plan (ITP) prior to marking and shipment of materials.

## **7.2 Testing of Materials**

Manufacturer shall carry out all chemical and mechanical testing of materials in accordance with applicable material specification and requirement specified under section 5 of this specification.

## **7.3 Witnessed Inspection**

- i. The flow computers shall be offered for pre dispatch inspection for following as minimum:-
  - a. Visual Inspection and Dimensional checks.
  - b. Performance test including simulation of all calculations and verification with third party certified software.
  - c. Demonstration of correct operation of all diagnostic and maintenance functions
  - d. Effects of variation in power supply voltage and frequency.
  - e. Review of all certificates and test reports.
- ii. In the event when witness inspection is not carried out by owner, manufacturer shall anyway complete the tests and test documents for the same shall be submitted to owner for scrutiny and approval prior to dispatch.

## **7.4 Factory Acceptance Testing (FAT)**

Prior to FAT, Vendor shall submit to the Company a detailed FAT procedure, for review and approval, listing all the Flow Computer complete with the project approved tags, and highlighting the inspection and testing requirements of all such devices. FAT shall be carried out as per approved Inspection and Test Plan. FAT shall be carried out prior to shipment of the Flow Computer.

FAT procedures shall be submitted at least 4 weeks prior to FAT testing taking place. FAT shall be carried out at the manufacturing facilities. The tests shall be witnessed by the Company or their approved representative. FAT procedure will be signed off by the Vendor and Company or their approved representative at the successful completion and conclusion of testing.

The FAT shall be consisting of the following as a minimum:

- a. Visual inspection
- b. Dimensional check
- c. Calibration
- d. Functional test

## **7.5 Site Acceptance Testing (SAT)**

A SAT shall be carried out on completion of the installation of the equipment at site which shall be witnessed by the company / owner's representative. SAT shall be



performed on the Flow Computer as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.

The Site Acceptance Test (SAT), in general, shall demonstrate that the Flow computer functions correctly and properly in accordance with the specified requirements.

## **8 MARKING, PACKING AND SHIPMENT**

- i. Proper care shall be taken in shipping complete system to ensure safety of the electronics, display units and exposed parts.
- ii. All items shall be packed in sea-worthy crates or boxes. Cable entries shall be protected with plastic caps to prevent damage/entry of foreign matter.
- iii. A packing list shall be prepared for each case and attached therein in a waterproof plastic sleeve. The data to be recorded on each packing list shall contain following:
  - a. Name and Address of Manufacturer;
  - b. Purchase Order number;
  - c. Case identification number;
  - d. Overall dimensions in meter;
  - e. Gross weight of the case;
  - f. Itemized list of the contents

## **9 SPARES AND ACCESSORIES**

The following spare philosophy shall be followed in case it is not covered in Job Specification.

The Vendor shall include recommended Spare Parts List for start-up, pre-commissioning and two years operation as per the following;

- a. Itemized recommended spare parts list for start-up and pre-commissioning.
- b. Itemized recommended spare parts list for two years operation.

Vendor shall recommend accessories and special tools required for operation and maintenance of Flow Computer, for Company review.

All the spare parts furnished by Vendor shall be wrapped and packaged to preserve an original as-new condition under normal conditions of storage. The same parts shall be properly tagged with stainless steel tags and coded so that later identification as to their intended equipment usage shall be clear.

All items supplied shall be packaged separately and clearly marked as "Spare Parts" and shipped with the equipment.

## **10 DOCUMENTATION**

The following documentation shall be fulfilled by the Vendor, if it is not covered in Job Specification.

### **10.1 Documentation Required with Technical Bid**

During bidding stage Vendor shall submit in his offer the following documents as a minimum:

- a. Standard Specification, Data Sheets;





- b. Bill of Materials including Vendor list, details of third party items;
- c. Catalogues and Manuals;
- d. Quality Assurance Plan;
- e. A list of accessory items together with Manufacturer's name and part number;
- f. Any other documents.

## **10.2 Documentation Required for Approval**

Upon placement of Purchase Order, Vendor shall submit as a minimum the following drawings, documents and specifications for the Company's approval:

- g. Specifications, Data Sheets;
- h. Bill of materials including Vendor list, details for third party items;
- i. Catalogues, Manuals and relevant drawings and documents;
- j. Dimensional drawings;
- k. Calibration certificates;
- l. Material test certificates;
- m. Procedures for FAT;
- n. Quality Assurance Plan;
- o. Any Other documents.

## **10.3 Guarantee & Warranty**

Vendor shall guarantee that the complete scope of supply shall be safely and reliably meet all of the requirements of this Company Specification.

Vendor shall provide warranty support for a period of 12 months from the date of supply or 18 months from the date of manufacturing. Warranty shall apply to defective material workmanship and facility design. The cost of correction / replacement of any warranty items shall be borne by the Vendor, as per the purchase conditions of the Material / Purchase Requisition.

The Job specifications / Data sheets shall be referred for any specific warranty / guarantee.



**DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) SOCKET WELDED (PIPING CLASS -30HC)****PMC****VCS QUALITY SERVICES PVT. LTD.****GENERAL SPECIFICATION**

Process Fluid	NG	ANSI Pressure Rating	800#
Design Temperature	(-)29°C to 65°C	Design Pressure	49 barg
Size, Inch (DN)	Less than 2" (50)		
Valve Type	Full Bore, Floating Ball		
End Connection Type	Socket Welded	Design Standard	BS EN ISO 17292
Face Finish	Not Applicable	Locking Arrangement	As per P&ID

**VALVE DESIGN CONDITIONS**

Corrosion Allowance	1.5 mm	Design Factor	0.5
Installation	Above Ground	Stem Ext Length (mm)	Not Applicable

**VALVE OPERATION**

Actuation Type	Not Applicable	Type of Actuator	Not Applicable
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**PUP PIECE DETAILS**

100mm extension pups in ASTM A106 Gr.B, Sch 160 (for 3/4") and Sch XS (for 1 1/2")

**VALVE MATERIAL SPECIFICATION**

PART DESCRIPTION	MATERIAL SPECIFIED	MATERIAL OFFERED (Equivalent or Higher)
Body	ASTM A105	
Ball	13% Cr Steel	
Body Seat	RPTFE/ DELRIN	
Gland	13% Cr Steel	
Stem (No Casting)	13% Cr Steel	
Body Seal	Grafoil	
Stem Seal	Grafoil	
Body Studs/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H	

**TESTING REQUIREMENT**

Hydrostatic Test Pressure & Time	Body: 205.94 barg & 30 Minutes	Seat: 152 barg & 30 Minutes
Pneumatic Test Pressure & Time	5.49 - 6.86 barg & 15 Minutes	
Hardness Test	248 HV10 max.	
Charpy Impact Test @ Temperature	Yes (at -29°C)	
Anti-Static Testing Requirement	As per BS EN ISO 17292	
Fire Safe Test	API 607 / API 6FA	

**DOCUMENT NO.**

C261162-00-PP-DS-2001A						
	C1	31.07.2025	YK	AS	DK	ISSUED FOR BID
SHEET NO.	1 OF 2	REV	DATE	PRPD	CHKD	APVD
						REMARKS



**DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) SOCKET WELDED (PIPING CLASS -30HC)**

**PMC**

**VCS QUALITY SERVICES PVT. LTD.**

**Valve Painting Specification :**

1	Surface Preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
2	For above ground installation - Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.
3	Lock open/ lock close requirement : <b>As indicated in P&amp;ID / Schedule of Rates (SOR).</b>

**NOTES :**

1	This Data Sheet shall be read in conjunction with Tender Documents & Specifications.
2	Material test certificates and hydrostatic test reports shall be furnished prior to dispatch.
3	Gland Packing Assembly shall permit repair of gland packing under full line pressure.
4	Detailed dimensional drawings showing cross-section with part numbers and materials shall be submitted for purchaser's approval prior to manufacture of the valves.
5	All valves shall be provided with valve position indicator.
6	Separate wrench shall be provided with each wrench operated valve.
7	Stops shall be provided to ensure positive alignment of ball with ports and ensure proper installation of handle.
8	The Charpy Impact Test temperature specified in datasheet shall supersede the specification requirements.
9	Painting procedure of valves shall be as per Manufacturer's standard.
10	All tests shall be as per BS EN 12266.
11	Inspection and Testing shall be as per attached QAP, this datasheet, BS EN 12266, other relevant standards.
12	Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.

DOCUMENT NO.							
C261162-00-PP-DS-2001A							
		C1	31.07.2025	YK	AS	DK	ISSUED FOR BID
SHEET NO.	2 OF 2	REV	DATE	PRPD	CHKD	APVD	REMARKS

**DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) FLANGE END (PIPING CLASS - 30HC, 300#)****PMC****VCS QUALITY SERVICES PVT. LTD.****GENERAL SPECIFICATION**

<b>Process Fluid</b>	NG	<b>ANSI Pressure Rating</b>	300#
<b>Design Temperature</b>	(-)29 °C to 65 °C	<b>Design Pressure</b>	49 barg
<b>Size, Inch (DN)</b>	Less than 2" (50)		
<b>Valve Type</b>	Full Bore / Reduced Bore, Floating Ball		
<b>End Connection Type</b>	Flange End	<b>Design Standard</b>	BS EN ISO 17292
<b>Face Finish</b>	ASME B16.5, 300#, RF/125AARH	<b>Locking Arrangement</b>	As per P&ID
<b>Material Requisition Item No.</b>			

**VALVE DESIGN CONDITIONS**

<b>Corrosion Allowance</b>	1.5 mm	<b>Design Factor</b>	0.5
<b>Installation</b>	Above Ground	<b>Stem Ext Length (mm)</b>	Not Applicable

**VALVE OPERATION**

<b>Actuation Type</b>	Not Applicable	<b>Type of Actuator</b>	Not Applicable
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**PUP PIECE DETAILS**

Not Applicable

**VALVE MATERIAL SPECIFICATION**


<b>PART DESCRIPTION</b>	<b>MATERIAL SPECIFIED</b>	<b>MATERIAL OFFERED (Equivalent or Higher)</b>
<b>Body</b>	ASTM A105	
<b>Ball</b>	13% Cr Steel	
<b>Body Seat</b>	RPTFE/ DELRIN	
<b>Gland</b>	13% Cr Steel	
<b>Stem (No Casting)</b>	13% Cr Steel	
<b>Body Seal</b>	Grafoil	
<b>Stem Seal</b>	Grafoil	
<b>Body Studs/ Nuts</b>	ASTM A193 Gr. B7/ A194 Gr. 2H	

**TESTING REQUIREMENT**

<b>Hydrostatic Test Pressure &amp; Time</b>	Body: 73.5 barg & 30 Minutes	Seat: 53.9 barg & 30 Minutes
<b>Pneumatic Test Pressure &amp; Time</b>	5.49 - 6.86 barg & 15 Minutes	
<b>Hardness Test</b>	248 HV10 max.	
<b>Charpy Impact Test @ Temperature</b>	Yes (at -29 °C)	
<b>Anti-Static Testing Requirement</b>	As per BS EN ISO 17292	
<b>Fire Safe Test</b>	API 607 / API 6FA	


**DOCUMENT NO.****C261162-00-PP-DS-2001B****SHEET NO.****1 OF 2****C1****31.07.2025****YK****AS****DK****ISSUED FOR CLIENT REVIEW****REV****DATE****PRPD****CHKD****APVD****REMARKS**

[illegible]

 Energising Quality		<b>DATA SHEET OF FE/BW, ABOVEGROUND, MANUAL BALL VALVE</b> <b>DN 50 TO DN 300 (NPS 2" to NPS 12"), RATING 300# ,</b> <b>PIPING CLASS - 30HC, SPLIT /WELDED BODY DESIGN</b>		DOC. NO.: C261162-00-PP-DS-2001C		
				No. of Pages : 02	Revision	
					C1	
				31.07.2025		
<b>Location</b>		-		<b>MR No.</b>		
<b>Sr. No.</b>		-		<b>P.O No.</b>		
				#		
1	<b>GENERAL</b>	Valve Manufacturer				
2		Tag Numbers / Material Requisition Item No.		Refer Material Requisition (MR)		
3		Company's Specification No.		VCS-SS-PP-2004		
4		Category		Station Piping Ball Valve		
5		Pipeline Line No		Not Required		
6		Class		30HC		
7	<b>DESIGN AND TEST REQUIREMENTS</b>	Size		DN 50 (NPS 2") to DN 300 (NPS 12")		
8		Type of Valve		Trunnion Mounted, Double Block and Bleed, Antistatic, Vent Drain/ Flush Connection with Anti Blowout Stem, Split Body Design/ Fully Welded Body Design as specified in MR, Tight Shut Off (As Applicable)		
9		Type of Port (Full/ Reduced)		Refer Material Requisition		
10		Design Temperature (°C)	Maximum	65		
11			Minimum	-29		
12		Corrosion Allowance (mm)		1.5		
13		Installation (Aboveground/Underground)		AboveGround		
14		Service		Natural Gas (NG)		
15		End Connection		Refer Material Requisition		
16		Flange Face Finish		RF/125AARH for Flanged Ends (As applicable)		
17		Design Standards		API 6D		
18		End Connection Standard		ANSI B16.5 for Flanged Ends (As applicable)/ ANSI 16.25 for Butt Welded Ends (As applicable)		
19		ASME Class		300#		
20		Stem Extension Requirement (If required, Note - 20)		Not Required		
21		Length of Stem Extension		Not Applicable		
22		Orientation of Stem		Perpendicular to Valve axis		
23		Type of Valve Operator		DN ≤ 100 mm (4") - Wrench / Lever - Pull Force 350N max. DN ≥ 150 mm (6") - Gear Operated		
24		Valve Actuator Operating Time		Not Applicable		
25		Requirement of Locking Mechanism (LO / LC)		Refer Material Requisition		
26		Length of Pup Piece / Nipple (mm), (If Required) (Note-16) (Integrally welded to the BW valve on each side)		Required for Welded End Valves, as per Standard Valve Specification		
27		Pup Piece Size / Material Grade / Schdeule/ Thickness (Note-16)		As per Piping Material Specification		
28		Operator Specification No.		Not Applicable		
29		Valve Design Pressure (kg/cm <sup>2</sup> )		49 kg/cm <sup>2</sup>		
30		Hydrostatic Test Pressure (kg/cm <sup>2</sup> ) & Time		Body : 73.5 kg/cm <sup>2</sup> & Test Duration - 30 Minutes	Seat : 54 kg/cm <sup>2</sup> & Test Duration 30 Minutes	
31		Pneumatic Test Pressure (kg/cm <sup>2</sup> ) & Time		7.0 kg/cm <sup>2</sup> & Test Duration - 15 Minutes		
32		Charpy Impact Test (° C)		Yes (at -29 °C)		
33		Fire Safe Design (Note-25)		API 6FA / ISO10497		
34		Anti Static Testing Requirement		As per API 6D Latest Edition		
35		Hardness Test		248 HV10 max		
36		Painting (Note-21)		As per specification (Suitable for Highly Corrosive Environment) Note-21		
37	Operator Data Sheet No.		Not Applicable			
38	<b>PROCESS DATA</b> (Applicable for Actuator)	Flow (Min/Nor/Max) (m <sup>3</sup> /hr)		Not Applicable		
39		Pressure (Min/Nor/Max) (barg)		Not Applicable		
40		Temperature (Min/Nor/Max) (° C)		Not Applicable		
41		Max Shutoff DP (barg)		Not Applicable		
42		Viscosity (cP)		Not Applicable		
43		Density (Kg/m <sup>3</sup> )		Not Applicable		
44		Mol . Wt		Not Applicable		
45		Sp Heat Ratio (Cp/Cv)		Not Applicable		
46		Compressibility (Z)		Not Applicable		
47		Ambient Temperature		Not Applicable		
48	<b>CONNECTING PIPE DETAIL</b>	Outside Diameter (Inch)		DN 50 (NPS 2") to DN 300 (NPS 12")		
49		Thickness (mm) / Schedule		As per Piping Material Specification		
50		Pipe Material		As per Piping Material Specification		
51		Design Code		ASME B31.8		
52		ASME Rating		300#		
53		Piping Class		30HC		
54		Orientation of Pipe		Suitable for all orientation		

 Energising Quality		<b>DATA SHEET OF FE/BW, ABOVEGROUND, MANUAL BALL VALVE          DN 50 TO DN 300 (NPS 2" to NPS 12"), RATING 300# ,          PIPING CLASS - 30HC, SPLIT /WELDED BODY DESIGN</b>		<b>DOC. NO.: C261162-00-PP-DS-2001C</b>		
				<b>No. of Pages : 02</b>	<b>Revision</b>	
					<b>C1</b>	
		<b>31.07.2025</b>				
<b>Location</b>	-	<b>MR No.</b>	-			
<b>Sr. No.</b>	-	<b>P.O No.</b>	#			
55	<b>VALVE MATERIAL</b>	<b>Part Description</b>	<b>Material Specified</b>	<b>Material Offered (By Bidder)</b>		
56		Body	<b>ASTM A216 GR. WCB/ASTM 105</b>			
57		Ball (Single Piece, Solid Construction)	<b>SS-304 / SS-316 (Solid) OR (ASTM A105/ ASTM A216 Gr. WCB) + 75 micron ENP</b>			
58		Seat Rings (No Casting)	<b>(AISI 4140 +75 micron ENP)/ AISI 410/ SS 304/ SS 316</b>			
59		Seat Seal	<b>Primary Devlon V/ PEEK/ Viton with Secondary Metal to Metal</b>			
60		Stem (No Casting)	<b>(AISI 4140 +75 micron ENP)/ AISI 410 / SS 304 / SS 316</b>			
61		Stem Seal	<b>GRAFOIL / R-PTFE</b>			
62		Body Seal	<b>GRAFOIL / R-PTFE</b>			
63		Gland	<b>13% Cr. Steel/ SS 316 / SS 304 / ASTM A105</b>			
64		Stud Bolts/Nut	<b>ASTM A 193 Gr. B7/ ASTM A 194 Gr. 2H</b>			
65	Handle / Lever / Hand Wheel	<b>Carbon Steel</b>				
66	<b>DATA TO BE PROVIDED BY VENDOR (if Applicable)</b>	Valve Model No.		*		
67		Flow Coefficient, Kv (Cubic Meters per Hour)		*		
68		Valve Cavity Volume(CC)	Open position	*		
69			Closed position	*		
70		Operator Manufacturer / Model No.		*		
71		Break-away Torque Under Max. Diff Pressure(Nm)		*		
72	Running Torque (Open - Close/Close - Open) (Nm)		*			
73	<b>NOTES:</b>	<b>1. Bidder to submit in offer, Soft Seal details and type, grade &amp; class selected with manufacturer's recommendation like Pressure-Temperature Curve/Table for not to damage the soft seal during welding of valve ends at site.</b>				
74		<b>2. This Data Sheet shall be read in conjunction with Material Requisition, Piping Material Specification, valve Specification &amp; other Tender Documents.</b>				
75		<b>3. Dimension / Input Data as &amp; where marked " * " shall be supplied by Vendor.</b>				
76		<b>4. Manufacturer shall have valid API 6D license to use API monogram. API monogram is required.</b>				
77		<b>5. Valve design shall ensure repair of stem seals / packing under full line pressure.</b>				
78		<b>6. 100.0 % Valve castings shall undergo Radiographic Examination.</b>				
79		<b>7. Valves shall have support foot &amp; lifting lugs as per valve Specification.</b>				
80		<b>8. Valve design shall ensure repair of stem seals / packing under full line pressure.</b>				
81		<b>9. Wrench operated valves shall be supplied with wrench.</b>				
82		<b>10. The Charpy Impact temperature shall be -29°C as specified in data sheet and it shall superceded the Specification (VCS-SS-PP-2004) requirement at 0°C</b>				
83		<b>11. A supplementary air seat test as per API 6D (Annex I, Para I.9 Type II) shall be carried out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.</b>				
84		<b>12. Design of weld end valves shall be such that during field welding operations, the soft seals or plastic components of the valve (where ever used) is not liable to be damaged. The manufacture shall furnish necessary field welding instructions and post-weld test procedure to demonstrate integrity and leak-tightness of valves after field welding operations.</b>				
85		<b>13. Gear operators, when provided, shall have a self-locking provision and shall be fully encased in water proof/ splash proof enclosure and shall be filled with suitable grease</b>				
86		<b>14. For the manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N.</b>				
87		<b>15. Manufacturer shall also indicate the number of turns of hand wheel in case of gear operators (along with their offer) required for Operating the valve from full open to full close position. The numbers of turn shall not exceed 250 for valves sizes up to 24" and 450 for valve size above 24".</b>				
88		<b>16. Adequacy for Length of pup piece/ Nipple shall be confirmed by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment. These nipples shall be welded to the valve body by the manufacturer before fitting the packings, seats &amp; seals.</b>				
89		<b>17. Name plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25</b>				
90		<b>18. Valve body &amp; other pressure containing parts shall be designed as per ASME Sec-VIII Div-I. Minimum thickness shall not be less than ASME B16.34.</b>				
91		<b>19. For tag No./ Fluid Data/ Operating Data refer Process Document , P&amp;IDs</b>				
92		<b>20. Stem extension length shall be finalized during drawing approval stage after award of order.</b>				
93		<b>21. For the valves to be installed underground the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy(Powercrete R-95) with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating</b>				
94		<b>22. Bidder shall clearly write all / any deviation against each part material of valve in the space provided for. Wherever bidder agrees with company's spec bidder shall indicate "agreed". Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve.</b>				
95		<b>23. All Elastomeric material used for pressure tight sealing or drip sealing shall be of anti Explosive Decompression type and must be certified according to testing Procedures. Manufacturer shall submit test certificate confirming conformance with Anti Explosive Decompression. Manufacturer shall confirm the suitability of soft sealing and seating material for the pressure and temperature &amp; service mentioned above in this data sheet.</b>				
96		<b>24. Not only during commissioning, but also during life cycle of all valves, sediments/corrosion deposits/ silica/ mill scale of less than 40 mesh percent in process fluid have to be tolerated by all valves with malfunctioning.</b>				
97		<b>25. Fire Safe test certificate qualifying the valves as per API 6FA/ API 607/ ISO 10497 carried out in last 10 years shall be furnished.</b>				
98		<b>26. Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve. Vendor to guarantee the suitability of seat/ seal material for the given service condition</b>				
99		<b>27. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.</b>				
100		<b>28. Cyclic test is required. The valve shall be subjected to at least 200 open close cycle with maximum differential pressure corresponding to valve rating.</b>				
101		<b>29. Stem seal / body seal, gland packing materials shall be provided with corrosion inhibitor.</b>				
102		<b>30. Vendor to guarantee the suitability of seat/ seal material for the given service condition</b>				
103						

		<b>DATA SHEET OF FE/BW, CHECK VALVE, DN 50 TO DN 300 (NPS 2" to NPS 12"), RATING 300# , PIPING CLASS - 30HC</b>		<b>JOB NO : C261162</b>			
				<b>DOC. NO.: C261162-00-PP-DS-2002D</b>			
				<b>No. of Pages : 02</b>	<b>Revision</b> <div>C1</div> <div>31.07.2025</div>		
<b>Location</b>		-		<b>MR No.</b>		-	
<b>SR.NO</b>		-		<b>P.O No.</b>		#	
1	<b>GENERAL</b>	Valve Manufacturer					
2		Tag Numbers / Material Requisition Item No.		<b>Refer Material Requisition (MR) Item No</b>			
3		Company's Specification No.		<b>VCS-SS-PP-2006</b>			
4		Category		-			
5		Pipeline Line No		<b>Not Required</b>			
6		Class		<b>30HC</b>			
7	<b>DESIGN AND TEST REQUIREMENTS</b>	Size		<b>DN 50 (NPS 2") to DN 300 (NPS 12")</b>			
8		Type of Valve		<b>Swing Type</b>			
9		Type of Port (Full / Reduced)		<b>Not Applicable</b>			
10		Design Temperature (° C)	Maximum	<b>65</b>			
11			Minimum	<b>-29</b>			
12		Corrosion Allowance (mm)		<b>1.5</b>			
13		Installation (Aboveground/Underground)		<b>Aboveground</b>			
14		Service		<b>Natural Gas (NG)</b>			
15		End Connection		<b>ANSI B16.5 for Flanged Ends (As applicable)/ ANSI 16.25 for Butt Welded Ends (As applicable)</b>			
16		Flange Face Finish		<b>RF/125AARH for Flanged Ends (As applicable)</b>			
17		Design Standards		<b>API 6D</b>			
18		End Connection Standard		<b>ANSI B16.5 for Flanged Ends (As applicable)</b>			
19		ASME Class		<b>300#</b>			
20		Stem Extension Requirement		<b>Not Applicable</b>			
21		Length of Stem Extension		<b>Not Applicable</b>			
22		Orientation of Stem		<b>Not Applicable</b>			
23		Type of Valve Operator		<b>As per Standard Specification</b>			
24		Valve Actuator Operating Time		<b>Not Applicable</b>			
25		Requirement of Locking Mechanism (LO / LC)		<b>Not Applicable</b>			
26		Length of Pup Piece / Nipple (mm), (If Required) (Note-16) (Integrally welded to the BW valve on each side)		<b>Not Applicable</b>			
27		Pup Piece Size / Material Grade / Schdeule/ Thickness (Note-16)		<b>Not Applicable</b>			
28		Operator Specification No.		<b>Not Applicable</b>			
29		Valve Design Pressure (barg)		<b>49 kg/cm<sup>2</sup></b>			
30		Hydrostatic Test Pressure (barg) & Time		<b>Body : 73.5 kg/cm<sup>2</sup> &amp; Test Duration - 30 Minutes</b>		<b>Seat : 54 kg/cm<sup>2</sup> &amp; Test Duration 30 Minutes</b>	
31		Pneumatic Test Pressure (barg) & Time		<b>7.0 kg/cm<sup>2</sup> &amp; Test Duration - 15 Minutes</b>			
32		Charpy Impact Test (° C)		<b>Yes (at -29 °C)</b>			
33		Fire Safe Design (Note-17 )		<b>API 6FA / ISO10497</b>			
34		Anti Static Testing Requirement		<b>As per API 6D Latest Edition</b>			
35		Hardness Test		<b>248 HV10 max</b>			
36		Painting (Note-14)		<b>As per specification (Suitable for Highly Corrosive Environment)</b>			
37	Operator Data Sheet No.		<b>Not Applicable</b>				
38	<b>PROCESS DATA (Applicable for Actuator)</b>	Flow (Min/Nor/Max) (m <sup>3</sup> /hr)		<b>Not Applicable</b>			
39		Pressure (Min/Nor/Max) (barg)		<b>Not Applicable</b>			
40		Temperature (Min/Nor/Max) (° C)		<b>Not Applicable</b>			
41		Max Shutoff DP (barg)		<b>Not Applicable</b>			
42		Viscosity (cP)		<b>Not Applicable</b>			
43		Density (Kg/m <sup>3</sup> )		<b>Not Applicable</b>			
44		Mol . Wt		<b>Not Applicable</b>			
45		Sp Heat Ratio (Cp/Cv)		<b>Not Applicable</b>			
46		Compressibility (Z)		<b>Not Applicable</b>			
47		Ambient Temperature		<b>Not Applicable</b>			
48	<b>CONNECTING PIPE DETAIL</b>	Outside Diameter (Inch)		<b>Size 2" to 16"</b>			
49		Thickness (mm) / Schedule		<b>As per Piping Material Specification</b>			
50		Pipe Material		<b>As per Piping Material Specification</b>			
51		Design Code		<b>ASME B31.8</b>			
52		ASME Rating		<b>300#</b>			
53		Piping Class		<b>30HC</b>			
54		Orientation of Pipe		<b>Suitable for all orientation</b>			

 ENERGISING QUALITY		DATA SHEET OF FE/BW, CHECK VALVE, DN 50 TO DN 300 (NPS 2" to NPS 12"), RATING 300# , PIPING CLASS - 30HC			JOB NO : C261162		
					DOC. NO.: C261162-00-PP-DS-2002D		
					No. of Pages : 02	Revision	
C1 31.07.2025							
Location		-			MR No.		-
SR.NO		-			P.O No.		#
55	VALVE MATERIAL	Part Description	Material Specified		Material Offered (By Bidder)		
56		Body	ASTM A216 Gr.WCB/ ASTM A105				
57		Cover	ASTM A216 Gr.WCB/ ASTM A105				
58		Disc	STELLITED-6				
59		Seat Ring	STELLITED-6				
60		Disc Hinge	SS 304 / SS 316				
61		Hinge Pin	SS 304 / SS 316 ( NO CASTING)				
62		Body Stud	ASTM A320 GR.L4				
63	Body Nut	ASTM A194 GR.4/ GR.7					
66	Cover Gasket	SP WIND SS316 - CA FILLER					
67	DATA TO BE PROVIDED BY VENDOR (if Applicable)	Valve Model No.			*		
68		Flow Coefficient, Kv (Cubic Meters per Hour)			*		
69		Valve Cavity Volume(CC)	Open position		*		
70			Closed position		*		
71		Operator Manufacturer / Model No.			*		
72		Break-away Torque Under Max. Diff Pressure(Nm)			*		
73		Running Torque (Open - Close/Close - Open) (Nm)			*		
74	NOTES	<b>NOTES:</b> 1. Bidder to submit Soft Seal details and type, grade & class selected with manufacturer's recommendation like Pressure-Temperature Curve/Table for not to damage the soft seal during 2. This Data Sheet shall be read in conjunction with Piping Material Specification, valve Specification & other Tender Documents. 3. Dimension / Input Data as & where marked " * " shall be supplied by Vendor. 4. Manufacturer shall have valid API 6D license to use API monogram. 5. Full inspection by radiography shall be carried out on all welds of pressure containing parts. Acceptance criteria shall be as per ASME B31.4 or ASME B 6. 100.0 % Valve castings shall undergo Radiographic Examination. 7. Valves shall have support foot & lifting lugs as per valve Specification. 8. All Check Valves 3" & above shall be provided with drain connection with plug as per ASME B 16.34 in a position suitable to drain the valve completely. 9. Valve seat shall be non renewable and integral type. 10. The Charpy Impact temperature specified in this data sheet shall superceded the test requiremetn specified in Valve Specification (VCS-SS-PP-2006) at 0oC 11. Name plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25 12. Valve body & other pressure containing parts shall be designed as per ASME Sec-VIII Div-I. Minimum thickness shall not be less than ASME B16.34. 13. For tag No./ Fluid Data/ Operating Data refer Process Document , P&IDs 14. For the valves to be installed underground the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy (Powercrete R-95 with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating 15. Bidder shall clearly write all / any deviation against each part material of valve in the space provided for. Wherever bidder agrees with company's spec bidder shall indicate "agreed". 16. Adequacy for Length of pup piece/ Nipple shall be confirmed by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment.These nipples shall be welded to the valve body by the manufacturer before fitting the packings, seats & seals. 17. Bidder to confirm that in offered valves, there shall not be any external leakage during fire and valve is capable of handling fire for the mentioned time as specified in API 6FA/ ISO 10497/API 6FD. Bidder also to confirm that in case of fire, the valve shall be unseated from the closed position against the high test pressure and moved to the fully open position i.e. In case of fire, valve shall complete one open-close cycle. 18. As a evidence that offered valve are fire safe design, Bidder can submit Fire Test Certificate (Approved & Certified by Governing TPIA) of earlier tested valve of similar design & size.(Qualification Size as per API 6FA/ ISO 10497/API 6FD Codes)					
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## DATA SHEET : PLUG VALVE (LESS THAN 2.0 INCH) FLANGED END (PIPING CLASS - 30HC, 300#)

<b>PMC</b>	<b>VCS QUALITY SERVICES PVT. LTD.</b>						
<b>GENERAL SPECIFICATION</b>							
<b>Process Fluid</b>	NG	<b>ANSI Pressure Rating</b>	300#				
<b>Design Temperature</b>	(-)29 °C to 65 °C	<b>Design Pressure</b>	49 barg				
<b>Size, Inch (DN)</b>	Less than 2" (50)						
<b>Valve Type</b>	Regular Pattern						
<b>End Connection Type</b>	Flanged End	<b>Design Standard</b>	BS 5353				
<b>Face Finish</b>	ASME B16.5, 300#,RF/125AARH	<b>Locking Arrangement</b>	As per P&ID				
<b>VALVE DESIGN CONDITIONS</b>							
<b>Corrosion Allowance</b>	1.5 mm	<b>Design Factor</b>	0.5				
<b>Installation</b>	Above Ground	<b>Stem Ext Length (mm)</b>	Not Applicable				
<b>VALVE OPERATION</b>							
<b>Actuation Type</b>	Not Applicable	<b>Type of Actuator</b>	Not Applicable				
<b>PUP PIECE DETAILS</b>							
100mm extension pups at both ends, Pipe material and thickness as per PMS							
<b>VALVE MATERIAL SPECIFICATION</b>							
<b>PART DESCRIPTION</b>	<b>MATERIAL SPECIFIED</b>		<b>MATERIAL OFFERED (Equivalent or Higher)</b>				
<b>Body</b>	ASTM A105						
<b>Plug (Lubricated)</b>	ASTM A105 + 75 microns ENP						
<b>Stem (No Casting)</b>	(AISI 4140 + 75 microns ENP Coating)/ AISI 410						
<b>Stem Seal</b>	GRAFOIL/ PTFE V-RINGS + GRAFOIL						
<b>Gland</b>	ASTM A 105						
<b>Gland Packing</b>	Graphite/ PTFE						
<b>Gasket</b>	N.A						
<b>Body Studs/ Nuts</b>	ASTM A193 Gr. B7/ A194 Gr. 2H						
<b>Lubricant Screw</b>	Manufacturer's Standard						
<b>TESTING REQUIREMENT</b>							
<b>Hydrostatic Test Pressure &amp; Time</b>	Body: 73.5 barg & 30 Minutes		Seat: 53.9 barg & 30 Minutes				
<b>Pneumatic Test Pressure &amp; Time</b>	7 barg & 15 Minutes						
<b>Hardness Test</b>	248 HV10 max.						
<b>Charpy Impact Test @ Temperature</b>	Yes (at -29 oC)						
<b>Fire Safe Test</b>	API 607 / API 6FA						
<b>DOCUMENT NO.</b>							
<b>C261162-00-PP-DS-2003A</b>							
		<b>C1</b>	<b>31.07.2025</b>	<b>YK</b>	<b>AS</b>	<b>DK</b>	<b>ISSUED FOR BID</b>
<b>SHEET NO.</b>	<b>1 OF 2</b>	<b>REV</b>	<b>DATE</b>	<b>PRPD</b>	<b>CHKD</b>	<b>APVD</b>	<b>REMARKS</b>



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1	Surface Preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
2	For above ground installation - Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.
3	Lock open/ lock close requirement : <b>As indicated in P&amp;ID / Schedule of Rates (SOR).</b>

1	This Data Sheet shall be read in conjunction with Tender Documents & Specifications.
2	Material test certificates and hydrostatic test reports shall be furnished prior to dispatch.
3	Gland Packing Assembly shall permit repair of gland packing under full line pressure.
4	Valve shall have an inherent feature using the line pressure to ensure that the line pressure cannot cause taper locking of the plug / plug movement into the taper i.e. valves shall be of " pressure balanced design"
5	All valves shall be provided with valve position indicator.
6	Separate wrench shall be provided with each wrench operated valve.
7	Stops shall be provided to ensure positive alignment of plug with ports and ensure proper installation of handle.
8	Valve body & other pressure containing parts shall be designed as per ASME Sec-VII Div.-1. Minimum thickness shall not be less than ASME B16.34.
9	The Charpy Impact Test temperature specified in datasheet shall supersede the specification requirements.
10	Valve design shall ensure repair of stem seals / packing under full line pressure.
11	Painting procedure of valves shall be as per Manufacturer's standard.
12	Inspection and Testing shall be done as per data sheet, specification & BS:12266 (Part-I).
13	Minimum port area for regular pattern shall be 55%.
14	26. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.





DOCUMENT NO.							
C261162-00-PP-DS-2003A							
		C1	31.07.2025	YK	AS	DK	ISSUED FOR BID
SHEET NO.	2 OF 2	REV	DATE	PRPD	CHKD	APVD	REMARKS



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### STANDARD SPECIFICATION FOR ASSORTED PIPES

VCS – SS – PP - 2503

					
01	30.06.2022	RP	MC	HK	GW
00	28.01.2020	MB	AK	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	: If printed
CONTROLLED COPY	: If in soft and signed

## REVISION RECORD

Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	12.10.2019					
		MB	AK	AD	SK	
01	30.06.2022					VCS QMS Integration
		RP	MC	HK	GW	

## **ABBREVIATIONS:**

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing & Materials
BHN	Brinell Hardness Number
BIS	Bureau of Indian Standards
E.FS.W	Electric Fusion Weld
E.R.W	Electric Resistance Weld
HAZ	Heat Affected Zone
HIC	Hydrogen Induced Cracking
IBR	Indian Boiler Regulations
IGC	Inter Granular Corrosion
IS	Indian Standard
LT	Low Temperature
MR	Material Requisition
NACE MR	National Association of Corrosion Engineers : Material Requirement
NB	Nominal Bore
NPT	Nominal Pipe Thread
PMI	Positive Material Identification
PR	Purchase Requisition
SMYS	Specified Minimum Yield Strength
SS	Stainless Steel

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## 1. GENERAL

1.1. All pipes and their dimensions, tolerances, chemical composition, physical properties, heat treatment, hydrostatic test and other testing and marking requirements shall conform to the latest codes and standards specified in the material requisition (MR). Supplier shall strictly comply with MR/ PR stipulations and no deviations shall be permitted.

### 1.2. Testing

1.2.1. Test reports shall be supplied for all mandatory tests as per the applicable material specifications. Test reports shall also be furnished for any supplementary tests as specified in the MR & Clauses 1.10 & 1.11.

1.2.2. Material test certificates (physical property, chemical composition & heat treatment report) shall also be furnished for the pipes supplied.

1.2.3. PMI shall be performed as per the scope and procedures at supplier's work.

### 1.3. Manufacturing Processes

1.3.1. Steel made by acid Bessemer process shall not be acceptable.

1.3.2. All longitudinally welded pipes should employ only automatic welding.

1.4. Pipe shall be supplied in single or double random length of 4 to 7 and 7 to 14 meters respectively.

1.5. a. Seamless and E.R.W. pipes shall not have any circumferential seam joint in a random length. However, in case of E.F.S.W pipe, in one random length one welded circumferential seam of same quality as longitudinal weld is permitted. This weld shall be at least 2.5 m from either end. The longitudinal seams of the two portions shall be staggered by 90°. Single random length in such cases shall be 5 to 7 m.

b. Unless otherwise mentioned in the respective material code, E.F.S.W pipes < 36" shall not have more than one longitudinal seam joint and E.F.S.W pipes ≥ 36" shall not have more than two longitudinal seam joints.

1.6. Pipe with screwed ends shall have NPT external taper pipe threads conforming to ASME/ANSI B1.20.1 up to 1.5" NB & IS 554 for 2" to 6" NB.

1.7. Pipe with beveled ends shall be in accordance with ASME B16.25. Weld contours shall be as follows

Material	Wall Thickness	Weld Contour
Carbon Steel Except Low Temp. Carbon Steel	Up to 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Up to 10 mm	Figure 4
	> 10 mm & Up to 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

- 1.8. Galvanized pipes shall be coated with zinc by hot dip process conforming to IS 4736 / ASTM A 153.
- 1.9. All austenitic stainless steel pipes shall be supplied in solution annealed condition. All types of 321 or 347 stainless steel pipes shall be in a stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to the normal solution annealing. Soaking time & holding temp. for stabilizing heat treatment shall be 4 hrs & 900°C respectively.
- 1.10. **I.G.C. (Inter Granular Corrosion) Test for Stainless Steels**
- 1.10.1. For all austenitic stainless steel pipes inter-granular corrosion test shall have to be conducted as per following:  
ASTM A262 Practice "B" with acceptance criteria of "60 mils/year (max.)".  
OR  
ASTM A262 Practice E with acceptance criteria of no cracks at 20X magnification and microstructure to be observed at 250X magnification shall ensure the absence of any cracks/ fissures. When testing is conducted as per practice 'E' photograph of microstructure shall be submitted for record.
- 1.10.2. When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg.SS 309, 310, 316, 316H etc.) ASTM A262 Practice "C" with acceptance criteria of "15 mils/year (max.)" shall have to be conducted
- 1.10.3. For the IGC test as described in 1.10.1 & 1.10.2, two sets of samples shall be drawn from each solution annealing lot; one set corresponding to highest carbon content and the other set corresponding to the highest pipe thickness.
- 1.11. All welded pipes indicated as 'CRYO' & 'LT' in MR shall be impact tested per requirement & acceptance criteria of ASME B31.3. The impact test temperature shall be -196°C & -45°C for stainless steel and carbon steel respectively unless specifically mentioned otherwise in MR.
- 1.12. **NACE/HIC Requirements**



- 1.12.1. Pipes under "NACE" category and those designated as "HIC1" shall meet the requirements given in NACE MR-0103 unless mentioned otherwise.
- 1.12.2. Pipes made from plates and designated as "HIC1" shall meet the HIC requirements of specification unless mentioned otherwise
- 1.13. Specified heat treatment for carbon steel and alloy steel and solution annealing for stainless steel pipes shall be carried out after weld repairs. Number of weld repairs at the same spot shall be restricted to maximum two by approved repair procedure.
- 1.14. For black or galvanized pipes to IS 1239, the minimum percentage of elongation shall be 20%.
- 1.15. All 1Cr-1/2Mo and 1 ¼ Cr-1/2Mo seamless pipes shall be normalized and tempered.
- 1.16. For all welded alloy steel pipes with mandatory requirement of heat treatment and radiography, radiography shall be performed after heat treatment.
- 1.17. For Hydrogen service pipes following special requirements shall also be met:
  - 1.17.1. All carbon steel pipes having wall thickness 9.53 mm (0.375") and above shall be normalized. Cold drawn pipes shall be normalized after the final cold draw pass for all thicknesses.
  - 1.17.2. All alloy steel (Cr-Mo) pipes shall be normalized and tempered. The normalizing and tempering shall be a separate heating operation and not a part of the hot forming operation. The maximum room temperature tensile strength shall be 100,000 psig.
  - 1.17.3. For carbon steel Pipes, hardness of weld and HAZ shall be 200 BHN (max.). For alloy steel Pipes, hardness of weld and HAZ shall be 225 BHN (max.).
  - 1.17.4. For all austenitic stainless steels, the weld deposit shall be checked for ferrite content. A Ferrite No.(FN) not less than 3% and not more than 10% is required to avoid sigma phase embrittlement during heat treatment. FN shall be determined by Ferrite scope prior to post weld heat treatment.
  - 1.17.5. For all Carbon steel and Alloy steel pipes with wall thickness over 20mm, Charpy-V Notch impact testing shall be carried out in accordance with paragraph UG-84 of ASME Section VIII, Div-1 for weld metal and base metal from the thickest item per heat of material and per heat treating batch. Impact test specimen shall be in complete heat treated condition and accordance with ASTM A370. Impact energies at 0°Celsius shall average greater than 27J (20 ft-lb) per set of three specimens, with a minimum of 19J (15 ft-lb).
- 1.18. For dual grades of SS where specified, chemical composition and mechanical

properties of both grades specified shall be ensured.

## 2. IBR PIPES

### 2.1. IBR Documentation

- 2.1.1. Pipes under purview of IBR shall be accompanied with IBR certificate original in Form III-A duly approved and countersigned by IBR authority/local authority empowered by the Central Boiler Board of India (Photocopy of the original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance) or Form III-D [for well-known pipe manufacturers as per IBR] signed by Manufacturer's authorized representative. Well known pipe manufacturers, as recognized by IBR, shall submit a duly attested copy of Form XVI-G along with Form III-D.
- 2.1.2. For materials 1¼ Cr - ½ Mo (ASTM A335 Gr.P11 / A691 Gr. 1¼Cr), 2¼Cr - 1Mo (ASTM A335 Gr.P22 / A691 Gr. 2¼Cr) & 9Cr -1Mo-V (A335 Gr.P91/A691 Gr.91), Form III-A approved by IBR shall include the tabulation of Et, Sc & Sr values for the entire temperature range given below. Et, Sc & Sr values shall be such that throughout the temperature range

$$\begin{array}{lcl} E_t/1.5 & \geq & \\ S_r/1.5 & \geq & S_A \\ S_c & \geq & \end{array}$$

where,

- $S_A$  Allowable stress at the working metal temperature.
- $E_t$  Yield point (0.2% proof stress at the working metal temperature)
- $S_c$  The average stress to produce elongation of 1%(creep) in 100000 hrs at the working metal temperature.
- $S_r$  The average stress to produce rupture in 100000 hrs at the working metal temperature and in no case more than 1.33 times the lowest stress to produce rupture at this temperature

Temp (°F) Material	SA (psi)											
	500	600	650	700	750	800	850	900	950	1000	1050	1100
A335 Gr.P11	17200	16700	16200	15600	15200	15000	14500	12800	9300	6300	4200	2800
A691	18900	18300	18000	17600	17300	16800	16300	15000	9900	6300	4200	2800

Temp (°F) Material	SA (psi)											
	500	600	650	700	750	800	850	900	950	1000	1050	1100
Gr. 1½ Cr												
A335 Gr.P22 / A691 Gr. 2½ Cr	17900	17900	17900	17900	17900	17800	14500	12800	10800	7800	5100	3200
A335 Gr.P91/ A691 Gr.91	28100	27700	27300	26700	25900	24900	23700	22300	20700	18000	14000	10300

Note : S<sub>A</sub> values shall be as per the latest edition prevailing.

2.2. For carbon steel pipes under IBR the chemical composition shall conform to the following:

Carbon (max) : 0.25%

Others (S, P, Mn) : As prescribed in IBR.

The chemical composition as indicated in this clause is not applicable for pipes other than IBR services.

### 3. ACCEPTABLE DEVIATIONS

3.1. Pipes to IS 3589 Gr.410 are acceptable in place of IS 3589 Gr.330.

3.2. Pipes of Grades SS317 of corresponding material are acceptable in place of Grades SS316 or SS316(2.5 Mo min.).

3.3. Pipes of Grades SS317L of corresponding material are acceptable in place of Grades SS316L or SS316L(2.5Mo min.).

3.4. Seamless pipes are acceptable in place of welded pipes except in the case of welded SS321/SS321H pipes with nominal thickness greater than 9.53mm.

### 4. HYDROSTATIC TEST

4.1. All pipes shall be hydrostatically tested.

4.2. The mill test pressure shall be as follows:

4.2.1. Seamless, E.R.W. & Spiral Welded

a) Carbon Steel

Material Std.	Test Pressure Std.
ASTM A106 Gr.B	ASTM A530
API 5L Gr.B, Seamless	API 5L
API 5L, E.R.W.	API 5L
API 5L, Spiral	API 5L
ASTM A333 Gr.3 & 6, Seamless	ASTM A530
ASTM A333 Gr.3 & 6, E.R.W.	ASTM A530

b) Seamless Alloy Steel

Material Std.	Test Pressure Std.
ASTM A335 Gr.P1, P12, P11, P22, P5, P9	ASTM A530
ASTM A268 TP 405, TP410	ASTM A530

c) Seamless Stainless Steel

Material Std.	Test Pressure Std.
ASTM A312 Gr.TP 304, 304L, 304H, 316, 316L, 316H, 321, 347.	ASTM A999

d) Seamless Nickel Alloy

Material Std.	Test Pressure Std.
ASTM B161 UNS No. 2200	ASTM B161
ASTM B165 UNS No. 4400	ASTM B165
ASTM B167 UNS No. 6600	ASTM B167
ASTM B407 UNS No. 8800	ASTM B407

e) Welded Nickel Alloy

Material Std.	Test Pressure Std.
ASTM B725 UNS No. 2200,4400	ASTM B725
ASTM B517 UNS No. 6600	ASTM B517

ASTM B514 UNS No. 8800	ASTM B514
------------------------	-----------

#### 4.2.2. Electric Fusion Weld

##### a) Carbon Steel & Alloy Steel E.FS.W (16" & above)

Material Std	Test Pressure Std.
API 5L Gr.B ASTM A671 Gr.CC65, 70 (Cl.32) ASTM A672 Gr.C60, 65, 70 (Cl.12,22) ASTM A671 Gr.CF60, 65, 66, 70 (Cl.32) ASTM A691 Gr. ½ Cr, 1Cr, 1¼ Cr, 2¼ Cr, 5Cr, 9Cr (Cl.42)	P = 2ST/D S = 90% of SMYS Except for API 5L Gr.B S = 85% of SMYS For API 5L Gr.B T = Nominal Wall Thickness D = O.D of Pipe

##### b) Stainless Steel E.FS.W (2" to 6")

The hydrostatic test pressure in kg/cm<sup>2</sup> for the following materials shall be as given below :

**Material Gr.1** :ASTM A312 TP 304 / 304H / 316 / 316H / 321 / 347 welded.

**Material Gr.2** :ASTM A312 TP 304L / 316L welded.

Size	Pipe Schedule : 10S		Pipe Schedule : 40S		Pipe Schedule : 80S	
	Material Gr. 1	Material Gr.2	Material Gr.1	Material Gr.2	Material Gr.1	Material Gr.2
2"	100	80	155	130	230	190
3"	80	60	155	130	230	190
4"	80	50	155	130	230	190
6"	65	35	90	75	155	130

##### c) Stainless Steel E.FS.W (8" and above).

Material Std	Test Pressure Std.
ASTM A358 TP 304L, 304, 304H, 316L,316, 316H, 321, 347 (Classes 1, 3 & 4)	P = 2ST/D S = 85% of SMYS T = Nominal Wall Thickness D = O.D of Pipe

ASTM A358 TP 304L, 304, 304H, 316L, 316, 316H, 321, 347 (Classes 2 & 5)	<p>P = 2ST/D</p> <p>S = 72% of SMYS</p> <p>T = Nominal Wall Thickness</p> <p>D = O.D of Pipe</p>
---	--

#### 4.2.3. Carbon Steel Pipe to BIS Standards

Material Std	Test Pressure Std.
IS 1239	IS 1239
IS 3589	IS 3589

- 4.3. Hydrostatic pressure testing shall be performed using iron free water, which is clean and free of silt. Maximum chloride content in water for hydrostatic testing for SS piping shall be 50 ppm.

### 5. MARKING AND DESPATCH

- 5.1. All pipes shall be marked in accordance with the applicable codes, standards and specifications. In addition the purchase order number, the item code & special conditions like "IBR", "CRYO", "NACE", "H2" etc. shall also be marked.
- 5.2. Pipes under "IBR", "CRYO", "NACE" & "H2" shall be painted with one circumferential stripe of colour red, light purple brown, canary yellow & white respectively for easy identification. Width of stripe shall be 12mm for pipe sizes less than 3" and 25mm for pipes 3" and above.
- 5.3. Paint or ink for marking shall not contain any harmful metal or metallic salts such as zinc, lead or copper which cause corrosive attack on heating.
- 5.4. Pipes shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.
- 5.5. Pipes shall be protected from rust & corrosion
- 5.6. Rust preventive used on machined surfaces to be welded shall be easily removable with a petroleum solvent and the same shall not be harmful to welding.
- 5.7. Both ends of the pipe shall be protected with the following material:
- |              |   |                               |
|--------------|---|-------------------------------|
| Plain end    | : | Plastic cap                   |
| Bevel end    | : | Wood, Metal or plastic cover  |
| Threaded end | : | Metal or plastic threaded cap |
- 5.8. Pipes may be provided with plastic push-fit type end caps/ steel caps without belt wire.

- 5.9. Steel end protectors to be used on galvanized pipes shall be galvanized. Plastic caps can also be used as end protectors for galvanised pipe ends.







Energising Quality

**VCS QULITY SERVICES PVT. LTD.**

**STANDARD SPECIFICATION  
FOR  
SEAMLESS FITTINGS AND FLANGES  
{SIZE UPTO DN 400MM (16")}**





**VCS – SS – PP - 2024**

					
					
					
					
01	29.08.2022	RP	MC	HK	GW
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	28.01.2020					Issued as Standard Specification
		MB	MC	AD	SK	
01	29.08.2022					VCS QMS Integration
		RP	MC	HK	GW	

#### ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell hardness number
HAZ	Heat Affected Zone
MSS-SP	Manufacturers Standardization Society - Standard Practice
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council
CE	Carbon Equivalent
LTCS	Low Temperature Carbon Steel
LPG	Liquefied Petroleum Gas

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## 1.0 SCOPE

This Technical specification specifies the minimum requirements for the design, manufacture and supply of following carbon steel flanges (such as welding neck flanges, blind flanges, spectacle blinds, spacers and blind etc.) and seamless fittings (such as tees, elbows, reducers, caps, outlets etc.) size DN up to 400 mm (16") to be installed in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

## 2.0 REFERENCE DOCUMENTS

Reference has been made in this specification to the latest edition (edition enforce at the time of issue of enquiry unless specified otherwise) of the following Codes, Standards and Specification.

### **AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)**

B31.4 : Pipeline Transportation system for liquid Hydrocarbon & other liquids.

B 31.8 : Gas Transmission and Distribution Piping Systems.

B16.5 : Pipe Flanges and Flanged Fitting.

B16.9 : Factory made Wrought Butt Weld Fittings.

B 16.11 : Forged Steel Fittings, Socket welding and Threaded.

B 16.48 : Steel Line Blanks.

Section VIII : Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels.

Section IX : Welding and Brazing Qualifications.

### **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

A370 : Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

### **MANUFACTURERS STANDARDIZATION SOCIETY (MSS)**

SP-25 : Standard Marking System for Valves, Fittings, Flanges and Unions.

SP-97 : Forged Carbon Steel Branch Outlet Fittings-Socket Welding, Threaded and Butt Welding Ends

In case of conflict between various requirements of this specification and the requirements of above referred Codes and Standards, more stringent requirement shall apply unless otherwise agreed by Purchaser.

## 3.0 MATERIALS

The Material of flanges & fittings shall be as indicated in purchase requisition. In addition, the material shall also meet the requirements specified hereinafter.

### 3.1 The Carbon Steel used for the manufacture of flanges and fittings shall be fully killed.

- 3.2** The carbon equivalent (CE) shall not exceeding 0.45, based on check analysis calculated in accordance with following.

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

- 3.3** For flanges and fittings specified to be used for gas service or LPG service, Charpy V-notch test shall be conducted on each heat of steel. Unless specified otherwise, the Charpy V-notch test shall be conducted at 0° C in accordance with the impact test provisions of ASTM A 370 for flanges and MSS-SP-75 for all fittings.

The average absorbed impact energy values of three full-sized specimens shall be 27 joules. The minimum impact energy value of any one specimen of the three specimens analyzed as above shall not be less than 22 Joules.

When Low Temperature Carbon Steel (LTCS) materials are specified for flanges and fittings in Purchase Requisition, the Charpy V-notch test requirements of applicable material standard shall be complied with.

- 3.4** For flanges and fittings specified to be used for Gas service or LPG service, Hardness test shall be carried out as per ASTM A 370 for each heat of steel used. A full thickness cross section shall be taken for this purpose and the maximum hardness of base metal, Weld metal and heat affected zone shall not exceed 248 HV<sub>10</sub>.
- 3.5** In case of RTJ (Ring Type Joint) flanges, the groove hardness shall be minimum 140 BHN. Ring Joint flanges shall have octagonal section of Ring joint.

## **4.0 DESIGN AND MANUFACTURE**

- 4.1** Flanges such as weld neck flanges and blind flanges shall conform to the requirements of ASME B 16.5.
- 4.2** Spectacle blind and spacer & blind shall conform to the requirements of ASME B 16.48.
- 4.3** Fittings such as tees, elbows, reducers, etc. shall be seamless type and shall conform to ASME B 16.9 for sizes DN 50mm (2") to DN 400mm (16") (both sizes included) and ASME B 16.11 for sizes DN 15mm (1½") & below.
- 4.4** Fittings such as weldolets, sockolets, nippolets, etc. shall be manufactured in accordance with MSS-SP-97.
- 4.5** Repair by Welding on flanges and fitting is not permitted.
- 4.6** All butt weld ends shall be bevelled as per ASME B 16.5/ ASME B 16.9/ MSS-SP-97, as applicable
- 4.7** Type, face and finish of flanges shall be as specified in purchase requisition. The interpretation of range of face finish shall be as follows:

Serrated Finish/125 AARH	: Serration with 125 to 250µ in AARH.
63 AARH	: 32 to 63µ in AARH.

- 4.8** Flanges and fittings manufactured from bar stock are not acceptable.

## 5.0 INSPECTION AND TESTS

The Manufacture shall perform all inspections and tests in accordance with the requirements of this specification and the relevant codes, at his works, prior to shipment. Such inspection and testing shall include, but not be limited to, the following:

### 5.1 TESTING OF MATERIALS

Chemical composition and mechanical tests including yield strength, ultimate tensile strength, impact test, elongation and hardness shall be carried out for each heat of steel used as per the applicable standard as referred to in this specification.

### 5.2 VISUAL INSPECTION AND DIMENSIONAL CHECK

All flanges and fittings shall be visually inspected. The internal and external surface of the flanges and fittings shall be free from any strikes, gauges and other detrimental defects.

Dimensional checks shall be carried out on finished products as per ASME B 16.5 for flanges, ASME B 16.48 for spacers and blinds and ASME B 16.9/MSS-SP-97 as applicable for fittings and as per this specification.

### 5.3 NON-DESTRUCTIVE EXAMINATION

All finished wrought weld ends subject to welding in field, shall be 100% tested for lamination type defects by ultrasonic test. Any lamination larger than 6.35 mm shall not be acceptable.

- 5.4** The Purchaser reserves the right to perform stage wise inspection and witness tests as indicated above, at the Manufacturer's works, prior to shipment. The Manufacturer shall give reasonable notice of date and time for such inspection and shall provide reasonable access and facilities required for inspection, to the Purchaser's Inspector.

The Purchaser reserves the right to require additional testing, at any time, to confirm Or further investigate a suspected fault. All costs incurred shall be for the Manufacturer's account. In no case shall any action of the Purchaser, or his Inspector, relieve the Manufacturer of his responsibility for material, design, quality, or Performance of the materials concerned. Inspection and tests performed/witnessed by the Purchaser's Inspector shall in no way relieve the Manufacturer of his obligation to perform the required inspection and tests.

## 6.0 PAINTING

Once all inspection and test have been carried out all external surface shall be thoroughly cleaned to remove grease, dust & rust. Standard mill coating shall be applied on external surface to protect against corrosion during transmit and storage. The coating shall be removable type in field.

## 7.0 MARKING

All Flanges & fittings shall be stamped with the requirements of applicable dimensional manufacturing standard. The marking shall also include following:

- PO Number.
- Item Code.

## **8.0 TEST CERTIFICATES**

Manufacture who intends bidding for fittings must possess the records of a successful proof test, in accordance with the provision of ASME 16.9/MSS-SP-75, as applicable.

Manufacturer shall furnish the following certificates:

- Test certificates relevant to the chemical analysis and mechanical properties, including hardness of the materials used for manufacture of flanges and fittings in accordance with the requirement of relevant standards and this specification.
- Test reports on radiography, ultrasonic and magnetic particle examination.
- Certificates for each fitting stating that it is capable of withstanding without leakage a test pressure, which results in a hoop stress equivalent to 100% of the specified minimum yield strength for the pipe with which the fitting is to be attached without impairment of serviceability.

## **9.0 PACKING & SHIPPING**

Ends of all fittings and weld neck flanges shall be suitable protected to avoid any damage during transit. Metallic or high impact plastic bevel protected shall be provided for flanges and fittings. Flanges face shall be suitably protected to avoid any damage during transit.

## **10.0 DOCUMENTATION**

The Manufacturer shall supply documentation in accordance with the Vendor Data Requirements List (VDRL) as attached with Purchase Order.







ENERGISING QUALITY

## VCS QUALITY SERVICES PVT.LTD.





### STANDARD SPECIFICATION FOR PIPELINE BALL VALVES

VCS-SS-PP-2004

					
04	29.04.2022	RP	MC	HK	GW
03	07.01.2022	SR	MC	HK	HK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY : If printed

CONTROLLED COPY : If in soft and signed

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	23.06.2017					Issued as Standard
		AS	SM	AD	SK	
01	22.05.2019					Revised based on API 6D 24 <sup>TH</sup> Edition.
		BS	MC	AD	SK	
02	28.01.2020					Documents Formatting, numbering updated from SS-PL-004 to VPC-SS-PP-2004, vent drain Diagram updated, other Detail updated as marked
		MB	MC	AD	SK	
03	07.01.2022					Revised as Marked
		SR	MC	HK	HK	
04	29.04.2022					VCS QMS Integration
		RP	MC	HK	GW	



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**ABBREVIATIONS:**

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell Hardness Number
DN	Nominal Size
HAZ	Heat Affected Zone
LC	Lock Close (valve locked in full close position)
LO	Lock Open (valve locked in full open position)
MSS-SP	Manufacturers Standardization Society - Standard Practice
NDT	Non Destructive Testing
NPS	Nominal Pipe Size
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council
MPI	Magnetic Particle Inspection
DP	Dye Penetrant

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## 1 SCOPE

This specification covers the minimum requirements for design, manufacture, testing and supply of carbon steel ball valves of size DN 50 mm (2") and above and ASME pressure rating Class 150# thru 900# for use in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

## 2 REFERENCE DOCUMENTS

All valves shall be manufactured and supplied in accordance with the American Petroleum Institute (API) Specification 6D, latest edition (edition in force at the time of issue of enquiry), Specification for Pipeline and Piping Valves, with additions and modifications as indicated in the following sections of this specification.

Reference has also been made in this specification to the latest edition (edition in force at the time of issue of enquiry) of the following Codes, Standards and Specifications.

### 2.1 American Society of Mechanical Engineers (ASME)

B31.3	:	Process Piping.
B31.4	:	Pipeline Transportation System for Liquid and Slurries.
B 31.8	:	Gas Transmission and Distribution Piping Systems.
B16.5	:	Pipe Flanges and Flanged Fittings.
B16.10	:	Face to Face and End to End Dimensions of Valves.
B 16.25	:	Butt Welding Ends.
B 16.34	:	Valves-Flanged, Threaded and Welding Ends.
B 16.47	:	Large Diameter Steel Flanges.
Section VIII	:	Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels.
Section IX	:	Welding and Brazing Qualifications.

### 2.2 American Petroleum Institute (API)

1104	:	Specification for Welding of Pipelines and Related Facilities.
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### 2.3 American Society for Testing and Materials (ASTM)

A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
B 733	:	Auto catalytic (Electro less) Nickel - Phosphorus Coatings on Metal.

## 2.4 Manufacturers Standardization Society (MSS)

- SP-6 : Standard Finishes for contact faces of Pipe Flanges and Connecting – End Flanges of Valves and Fittings.
- SP-44 : Steel Pipeline Flanges.

## 2.5 Steel Structures Painting Council (SSPC)

- SSPC-VIS-I : Steel Structures Painting Council Visual Standard-Guide and Reference Photographs for Steel Surfaces prepared by Dry Abrasive Blast Cleaning.

- 2.6** In case of conflict between the requirements of this specification, API 6D and the Codes, Standards and Specifications referred above, the requirements of this specification shall govern.

## 3 MATERIALS

- 3.1** The material of major components of the ball valves shall be as indicated in Valve Data Sheet. Remaining components shall be as per Manufacturer's standard (suitable for the service indicated in the data Sheet) and shall be subjected to approval by Company. In addition, the material shall also meet the requirement specified hereinafter.

All process-wetted parts, metallic and non-metallic, sealant and lubricants shall be suitable for the service specified by the Company. Manufacturer shall confirm that all wetted parts are suitable for treated water/ seawater environment, which may be used during field testing.

Non-metallic parts of the valves (including O-rings, soft seals etc.) intended for hydrocarbon gas service shall be resistant to explosive decompression.

- 3.2** Carbon steel used for the manufacture of valves shall be fully killed.
- 3.3** The carbon equivalent ( $CE_{I\!W}$ ) of valve end connections which are subject to further field welding by Company shall not exceed 0.43 on check analysis for each heat of steel used, as calculated by the following formula:

$$CE_{I\!W} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

## 3.4 Charpy V-Notch Test Requirements

Charpy V-notch test on each heat of base material shall be conducted for all pressure containing parts such as Body, End Flanges, Stem and Welding Ends as well as Bolting materials for pressure containing parts.

Test procedure for Charpy V-Notch Test shall conform to ASTM A370.

For Carbon Steel, alloy steel & Stainless Steel (except Austenitic Grades) Materials, The impact test temperature shall be 0 °C or minimum design temperature indicated in valve

data sheet / MR, whichever is lower. The average absorbed energy value of three full sized specimens shall be 27 J (for materials with Specified Minimum Tensile Strength  $\leq 100,000$  psi)/ 34 J (for materials with Specified Minimum Tensile Strength  $> 100,000$  psi). The minimum impact energy value of any one specimen of the three specimens analysed as above, shall not be less than 22 J (for materials with Specified Minimum Tensile Strength  $\leq 100,000$  psi)/ 26 J (for materials with Specified Minimum Tensile Strength  $> 100,000$  psi).

For Low Temperature Carbon Steel Materials, the impact test temperature shall be as per requirement of Material Standard or minimum design temperature indicated in valve data sheet/MR, whichever is lower. The average absorbed energy value of three full sized specimens shall be 27 J (for materials with Specified Minimum Tensile Strength  $\leq 100,000$  psi)/ 34 J (for materials with Specified Minimum Tensile Strength  $> 100,000$  psi). The minimum impact energy value of any one specimen of the three specimens analysed as above, shall not be less than 22 J (for materials with Specified Minimum Tensile Strength  $\leq 100,000$  psi)/ 26 J (for materials with Specified Minimum Tensile Strength  $> 100,000$  psi).

Where the material specification requires impact values to be higher than specified in the above paragraphs, the higher values shall apply.

For duplex & super duplex stainless steel the Charpy V-Notch test values and test temperature shall be as per API 6D.

### 3.5 Hardness Test Requirements

For valves specified to be used for Gas service or LPG service, Hardness test shall be carried out as per ASTM A370 for each method of manufacture and each heat of steel used in the manufacture of valves. A full thickness cross section shall be taken for this purpose and the maximum hardness of the materials of valve components shall not exceed 248 HV<sub>10</sub>.

### 3.6 Electroless Nickel Plating Requirements

For all such valves where Carbon Steel/Low temperature carbon steel is used as ball material, the ball shall have 75 micrometers (0.003 inches) thick Electro less Nickel Plating (ENP) as per ASTM B 733 with following classification:

- SC2, Type II, Class 2.

The hardness of plating shall be minimum 50 RC.

## 4 DESIGN AND CONSTRUCTION REQUIREMENTS

### 4.1 General

Valve design shall meet the requirements of API Specification 6D and shall be suitable for the service conditions indicated in the Valve Data Sheet. The ASME Boiler & Pressure Vessel Code, Section VIII, Div 1 shall be used to design the valve body. Allowable stress requirements shall comply the provisions of above code. Also, corrosion allowance indicated in Valve Data Sheet shall be considered in valve design; however, the minimum wall thickness shall not be less than the minimum requirement of ASME B16.34. The

manufacturer shall have valid license to use API monogram on valves manufactured as per API 6D.

## 4.2 Valve Installation

Valves shall be suitable for either buried or above ground installation as indicated in Valve Data Sheet/ Material requisition.

## 4.3 Valve Body

4.3.1 For above ground valve, valve body design shall be either fully welded or bolted type. For buried valves, valve body design shall be fully welded type only. Valve body joints with threads are not permitted.

4.3.2 Ball mounting shall be trunnion or pivot type only. Valve design shall minimize the possibility of debris ingress into the trunnion as far as practicable

## 4.4 Ball

Ball shall be of single piece, solid type construction.

## 4.5 Valve Bore Configuration

Valves shall be Full bore (FB) or Reduced bore (RB) as indicated in the Valve Data Sheet.

### Full Opening Valve

Full bore valves shall be suitable for the passage of all types of pipeline pigs including instrumented intelligent pigs and regular cleaning, batching and scraper pigs on regular basis without causing damage to either the valve component or the pig. The full bore, valve shall provide an unobstructed profile for pigging operations in either direction. Full bore valves shall be designed to minimize accumulation of debris in the seat ring region to ensure that valve movement is not impeded. The bore of full bore butt-welded & flanged valves shall be in line with Connecting pipe as stated in valve data sheet or Valve MR, however in any case it shall not be less than the minimum required shown in Client Ball Valve specification & API 6D.

### Reduced Opening Valve

The bore size of reduced bore valve shall correspond to that of a full-bore valve of smaller nominal diameter as indicated in Table- 4.5 below. For sizes of a particular rating not covered in API 6D, the bore size of the reduced bore valve shall be as per manufacturer`s Standard.

TABLE – 4.5			
Nominal Valve Size	Nominal Valve Size for Reduced Bore	Nominal Valve Size	Nominal Valve Size for Reduced Bore
DN mm (NPS inches)	DN mm (NPS inches)	DNmm (NPSinches)	DNmm (NPS inches)
50 (2)	40 (1.5)	600 (24)	500 (20)

80 (3)	50 (2)	650 (26)	550 (22)
100 (4)	80 (3)	700 (28)	600 (24)
150 (6)	100 (4)	750 (30)	600 (24)
200 (8)	150 (6)	800 (32)	650 (26)
250 (10)	200 (8)	850 (34)	700 (28)
300 (12)	250 (10)	900 (36)	750 (30)
350 (14)	250 (10)	950 (38)	800 (32)
400 (16)	300 (12)	1000 (40)	850 (34)
450 (18)	350 (14)	1050 (42)	900 (36)
500 (20)	400 (16)	1200 (48)	1050 (42)
550 (22)	450 (18)		

#### **4.6 Seat Design**

The valves shall either be a soft seated valve or metal seated valve or with primary metal-to metal contact and secondary soft seats or seat design shall be as indicated in valve data sheet.

For soft seated valves, Metal seat rings may be provided with soft insert. The same shall be positively locked in position in Metal seat rings.

For valves with primary metal to metal contact and secondary soft seats, O-rings or other seals if used for drip tight sealing shall be encased in a suitable groove in such a manner that it cannot be removed from seat ring and there is no extrusion during opening or closing operation of valve at maximum differential pressure corresponding to valve class rating. The seat rings shall be so designed as to ensure sealing at low as well as high differential pressures.

**4.7** Valves shall be designed to withstand a sustained internal vacuum of at least 1 (one) mille-bar in both open and closed positions.

#### **4.8 Double Block & Bleed Design**

Valves shall have double block and bleed feature to facilitate complete flush, drain and venting of the valve body cavity. Cavity relief pressure shall be as per API 6D.

#### **4.9 Sealant Injection**

Full bore valves of nominal valve size DN 200 mm (8") & above and Reduced Bore valves of nominal valve size DN 250 mm (10") & above, shall have provision for secondary sealant injection under full line pressure for seat and stem seals. All sealant injection connections shall be provided with block valve and an internal non-return valve. Valve design shall have a provision to replace the sealant injection fitting under full line pressure. Location and arrangement of sealant points shall be as per Fig 4.9.

#### **4.10 Vent & Drain**

Valves shall be provided with vent and drain connections. Location and arrangement of

vents and drains shall be as per Fig. 4.9. Body vent and drain shall be provided with valves (Ball or Plug type). Number and size shall be as per Fig. 4.9.

Valve design shall ensure repair of stem seals/ packing under full line pressure.

#### **4.11 Support Foot**

Full bore valves of nominal valve size DN 200 mm (8") & above and Reduced bore valves of nominal valve size DN 250 mm (10") & above, shall be equipped with support foot and lifting lugs unless specified otherwise. Tapped holes and eyebolts shall not be used for lifting lugs. Height of support foot shall be kept minimum. The location and size of support foot/ lifting lugs shall ensure unrestrictive operation of vent/ drain valves. The design of support foot shall be such that it shall take minimum double the weight of the valve assembly.

**4.12** Valve design shall be such as to avoid bimetallic corrosion between carbon steel and high alloy steel components. Suitable insulation shall be provided as required.

**4.13** The valve body cavity over-pressure shall be prevented by self-relieving seat rings/ assemblies. Valve Cavity relief pressure when added to the valve pressure rating shall not exceed 133% of the pressure rating of the valve at its maximum specified design temperature.

#### **4.14 Valve Ends**

Valve ends shall be either flanged/ or butt welded or one end flanged and one end butt welded as indicated in the Valve Data Sheet. Flanges of the flanged end cast/ forged body valves shall be integrally cast/ forged with the body of the valve. Face to face/ end to end dimensions shall conform to API 6D. Face-to-face and end-to-end dimensions for valve sizes not specified in API 6D shall be in accordance with ASME B 16.10. Face-to-face and end-to-end dimensions not shown in API 6D or in ASME B 16.10 shall be as per Manufacturer Standard and shall be subject to approval by Company.

Flanged ends, if specified, shall have flanges as per ASME B16.5 for valve sizes up to DN 600 mm (24") excluding DN 550 mm (22"), as per MSS-SP-44/ ASME B 16.47 Series A for valve sizes DN 550 mm (22") and for DN 650 mm (26 inches) and above. Flange face shall be either raised face or ring joint type (RTJ) as indicated in Valve Data Sheet. Flange face finish shall be serrated or smooth as indicated in Valve Data Sheet. In case of RTJ flanges, the groove hardness shall be minimum 140 BHN.

Butt weld end preparation shall be as per ASME B 16.25. The thickness of the pipe to which the valve has to be welded shall be as indicated in the Valve Data Sheet. In case difference exists between thickness of welding ends of valve and connecting pipe, the welding ends of valve shall have bevel preparation as per ASME B31.4 or ASME B31.8 as applicable.

In case of all Butt welded end valves (including soft seated valves or valves with primary metal to metal and secondary soft seats), actual yield strength of valve body shall not be less than 2/3<sup>rd</sup> of the specified minimum yield strength (SMYS) of the connecting pipe material.

For soft seated valves with Butt welded end, valves shall be provided with pup pieces on



either side of length 200 mm each for size up-to 8" & 250 mm for size 10" and above, with material as specified in valve data sheet. Length of pup piece shall be confirmed by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment. Pup piece thickness shall be calculated for the class rating. Vendor shall provide for each type (considering size, grade and thickness of the pup pieces used for all offered valves) of pup piece, test rings (500 mm long) from pup piece material for field weld procedure qualification. Valves shall be tested along-with pup piece.

- 4.15** Design of weld end valves shall be such that during field welding operations, the soft seals or plastic components of the valve (where ever used) is not liable to be damaged. The manufacturer shall furnish necessary field welding instructions and post-weld test procedure to demonstrate integrity and leak-tightness of valves after field welding operations.

#### **4.16 POSITION INDICATORS**

Valve shall be provided with ball position indicator and stops of rugged construction at the fully open and fully closed positions. For actuated valves, additionally mechanical means of position indicator shall be provided.

#### **4.17 STEM EXTENSIONS**

When stem extension requirement is indicated in Valve Data Sheet, the valves shall have the following provisions.

- a. Valves provided with stem extension shall have water proof outer casing. Length of stem extension shall be as indicated in Valve Data Sheet. The length indicated corresponds to the distance between centerline of the valve opening and the top of mounting flange for valve operating device (gear operator/ power actuator as applicable).
- b. In case of below Ground LTCS valves, Stem extension material shall be equivalent to stem material.
- c. Vent and drain connections and sealant injection lines shall be terminated adjacent to the valve operator by means of suitable piping anchored to the valve body. The pipe used shall be API 5L Gr. B/ ASTM A 106 Gr. B, with Sch 160 for carbon steel valves and ASTM A 333 Gr 6, with Sch 160 for Low temperature carbon steel valves or the material shall be as specified in valve data sheet. The material of fittings for Carbon Steel valve shall be ASTM A105/ ASTM A234 Gr. WPB and material for the fittings for low temperature carbon steel valves shall be ASTM A 350 Gr LF2 Cl 1 or the material shall be as specified in valve data sheet. The fittings and valve end shall be Socket welded ANSI class 6000# as per ASME B 16.11 (For piping class up to 600#) and BW end (For Piping Class 900#).
- d. Stem extension and stem housing design shall be such that the complete assembly will form a rigid unit giving positive drive under all conditions with no-possibility of free movement between valve body, stem extension or its operator.
- e. Outer casing of stem extension shall have 3/8" or 1/2" NPT plugs at the top and bottom, for draining and filling with oil to prevent internal corrosion.
- f. The Stem Extension shall be self-relieving.

#### 4.18 OPERATING DEVICES

- a. Valves shall have a power actuator or manual operator as indicated in the Valve Data Sheet. In case of manual operator, valve sizes,  $DN \leq 100$  mm (4") shall be wrench operated and valve sizes,  $DN \geq 150$  mm (6") shall be gear operated. The length of wrench shall not be longer than twice the face to face or end to end dimension of the valve. Each wrench operated valve shall be supplied with wrench. Valve design shall be such that damage due to malfunctioning of the operator or its controls will only occur in the operator gear train or power cylinder and that damaged parts can be replaced without the valve cover being removed.
- b. The power actuator shall be in accordance with the Company Specification issued for the purpose and as indicated in the Valve and Actuator Data Sheet. Operating time shall be as indicated in Valve Data Sheet. Valve operating time shall correspond to full close to full open/ full open to full close under maximum differential pressure corresponding to the valve rating. For actuated valves, the actuator's rated torque output shall be 1.25 times the break torque required to operate the ball valve under the maximum differential pressure corresponding to the Valve Class Rating.
- c. For the manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N. However, failing to meet above requirement, vendor shall offer gear operated valves. Manufacturer shall also indicate the number of turns of hand wheel in case of gear operators (along with their offer) required for Operating the valve from full open to full close position. The numbers of turn shall not exceed 250 for valves sizes up to 24" and 450 for valve size above 24".
- d. Direction of operation of hand wheel or wrench shall be in clock-wise direction while closing the valve. Hand wheels shall not have protruding spokes.
- e. Gear operators, when provided, shall have a self-locking provision and shall be fully encased in water proof/ splash proof enclosure and shall be filled with suitable grease.

**4.19** The tolerance on internal diameter and out of roundness at the ends for welded ends valves shall be as per connected pipe specification as indicated in the Valve Data Sheet.

#### 4.20 LOCKING DEVICES

When indicated in Material Requisition/Data sheet/ Tender, valves shall have locking devices to lock the valve either in full open (LO) or full close (LC) positions. Locking devices shall be permanently attached to the valve operator and shall not interfere with operation of the valve.

#### 4.21 WELDING

All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Section IX. The procedure qualification shall also include impact test and hardness test when required as per Clause 3.4 to 3.5 of this specification and shall meet the requirements as specified therein.

#### 4.22 REPAIR WELDING

Repair by welding is not permitted for fabricated and forged body valves. However, repair

by welding as per ASME B16.34 is permitted for cast body valves. Such repairs shall be carried out at casting supplier's care only. Repair shall be carried out before any heat treatment of casting is done. Repair welding procedure qualification shall also include impact test and hardness test when required as per Clause 3.4 to 3.5 of this specification and shall meet the requirements as specified therein. Heat treatment and radiography shall be repeated after the weld repair.

- 4.23** No Casting is permitted for stem and stem extended material of all valve. Valve stem shall be capable of withstanding the maximum operating torque required to operate the valve against the maximum differential pressure corresponding to applicable class rating. The combined stress shall not exceed the maximum allowable stresses specified in ASME section VIII, Division 1. For power actuated valves, the valve stem shall be designed for maximum output torque of the selected power actuator (including gear box, if any) at valve stem.
- 4.24** Wherever specified for the part of valve in valve data sheet, minimum thickness of stelliting shall be 1.6mm
- 4.25** All Soft seated valves shall be fire safe design and qualified as per API 6FA/ API 607/ ISO 10497.
- 4.26** Soft-seated valves shall have antistatic device.

## **5 INSPECTION & TESTS**

- 5.1** The Manufacturer shall perform all inspection and tests as per the requirements of this specification and the relevant codes, prior to shipment, at his works. Such inspection and tests shall be, but not limited to, the following:
- 5.2** All valves shall be visually inspected. The internal and external surfaces of the valves shall be free from any strikes, gouges and other detrimental defects. The surfaces shall be thoroughly cleaned and free from dirt, rust and scales.
- 5.3** Dimensional check on all valves shall be carried out as per the Company approved drawings.
- 5.4** Chemical composition and mechanical properties shall be checked as per this specification and relevant material standards, for each heat of steel used.
- 5.5** Non-destructive examination of individual valve material and component consisting of but not limited to castings, forgings, plates and assembly welds shall be carried out by the Manufacturer.
  - a. Body castings of all valves shall be radio graphically examined as per ASME B16.34. Procedure and acceptance criteria shall be as per ASME B 16.34. The extent of the radiography shall be as under:

<b>Pressure Class Rating</b>	<b>Valve Size</b>	<b>Extent of Radiography</b>
ANSI 150 # Class	≤ DN 600 mm (24")	Nil
	≥ DN 650 mm (26")	100%

ANSI 300 # Class	≤ DN 400 mm (16")	Nil
	≥ DN 450 mm (18")	100%
ANSI 600 # Class and above	All sizes	100%

Radiography shall be performed after the final heat treatment also.

All castings shall be wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall, comply with ASME B 16.34.

- b. All valves, with body fabricated from plates or made by, forgings, shall be ultrasonically examined in accordance with the procedure and acceptance standard as per ASME B16.34.

All forgings shall be Wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall comply with ASME B16.34.

- c. Bodies and bonnets made by welded assembly of segments of castings, forgings, plates or combinations thereof shall be examined, as applicable, by methods of 5.5 (a) for cast components or 5.5 (b) for forged components and plates.

**5.6** Full inspection by radiography shall be carried out on all welds of pressure containing parts. Acceptance criteria shall be as per ASME B 31.4 or ASME B31.8 as applicable and API 1104.

**5.7** Welds, which in Company's opinion cannot be inspected, by radiographic methods, shall be checked by ultrasonic or magnetic particle methods and acceptance criteria shall be as per ASME Sec. VIII , Division 1, Appendix 12 and, Appendix 6 respectively.

**5.8** All finished wrought weld ends subject to welding in field shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.

- a. Weld ends of all cast valves subject to welding in field shall be 100% radio graphically examined and acceptance criteria shall be as per ASME B16.34.

- b. After final machining, all bevel surfaces shall be inspected by dye penetrant or wet magnetic particle methods. All defects longer than 6.35 mm are rejected, as are the defects between 6.35 mm and 1.59 mm that are separated by a distance less than 50 times their greatest length. Rejectable defects must be removed. Weld repair of bevel surface is not permitted.

**5.9** All valves shall be tested in compliance with the requirements of API 6D. During pressure testing, valves shall not have sealant lines and other cavities filled with sealant, grease or other foreign material: The drain, vent and sealant lines shall be either included in the hydrostatic shell test or tested independently. Test pressure shall be held for at least 30 minutes for both Shell & seat Test. No leakage is permissible during hydrostatic testing. The body cavity self-relieving feature meeting the requirements of clause 4.13 of this specification shall also be checked.

**5.10** A supplementary air seat test as per API 6D (Annex I, Para I.9 Type II) shall be carried

out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.

**5.11** Valves shall be subjected to Operational Torque Test as per API 6D (Annex I, Para I.6) under hydraulic pressure equal to maximum differential pressure corresponding to the applicable ANSI class rating of valve. It shall be established that the force required to operate the valve does not exceed the requirements stated in section 4.18 (C) of this specification.

**5.12** Power actuated valves shall be tested after assembly of the valve and actuator, at the valve Manufacturer's works. At least five Open-Close-Open cycles without internal pressure and five Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating shall be performed on the valve actuator assembly. The time for Full Open to Full Close shall be recorded during testing. If required, the actuator shall be adjusted to ensure that the opening and closing time is within the limits stated in Valve Data Sheet.

Hand operator provided on the actuator shall also be checked after above testing, for satisfactory manual over-ride performance.

These tests shall be conducted on minimum one valve out of a lot of five (5) valves of the same size, rating and the actuator model/ type. In case, the tests do not meet the requirements, retesting/ rejection of the lot shall be decided by the Company's Inspector.

**5.13** Subsequent to successful testing as specified in clause 5.11 and 5.12 above, one (1) valve out of the total ordered quantity shall be randomly selected by the Company Representative for cyclic testing as mentioned below:

- a. The valve shall be subjected to at least 100 Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating.
- b. Subsequent to the above, the valve shall be subjected to hydrostatic test and supplementary air seat test in accordance with clause 5.9 and 5.10.

In case this valve fails to pass these tests, the valve shall be rejected and two more valves shall be selected randomly and subjected to testing as indicated above. If both valves pass these tests, all valves manufactured for the order (except the valve that failed) shall be deemed acceptable. If either of the two valves fails to pass these tests, all valves shall be rejected or each valve shall be tested at the option of manufacturer.

Previously carried out test of similar nature shall be considered acceptable if the same has been carried out by Manufacturer in last two years. Valves of two sizes below and two sizes above the size of valve previously tested, and rating similar or one rating lower of valve tested previously, shall be qualified.

**5.14** Checks shall be carried out to demonstrate that the dissimilar metals used in the valves are successfully insulated as per the requirement of clause 4.12 of this specification.

**5.15** Anti-Static testing for soft seated valves in accordance with L.5 of API 6D.

**5.16** Company reserves the right to perform stage wise inspection and witness tests as indicated in clause 5.1 above at Manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to the Company's

Inspector. Company reserves the right to require additional testing at any time to confirm or further investigate a suspected fault. The cost incurred shall be to Manufacturer's account.

In no case shall any action of Company or his inspector shall relieve the Manufacturer of his responsibility for material, design, quality or operation of valves.

Inspection and tests performed/ witnessed by the Company's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

## **6 TEST CERTIFICATES**

Manufacturer shall submit the following certificates in accordance with EN 10204 3.2.

- a. Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for the valve construction as per the relevant standards.
- b. Report on heat treatment carried out.
- c. Test certificates of hydrostatic and pneumatic tests complete with records of timing and pressure of each test.
- d. Test reports of radiograph and ultrasonic inspection, MPI and DP Inspection
- e. Test report on operation of valves conforming to clause 5.11, 5.12 and 5.13 of this specification.
- f. All other test reports and certificates as required by API 6D and this specification.

The certificates shall be considered valid only when signed by Company's Inspector. Only those valves which have been certified by Company's Inspector shall be dispatched from Manufacturer's works.

## **7 PAINTING**

Valve surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint. Surface preparation shall be carried out by shot blasting to SA-2 ½ / SSPC-SP10. For Coastal area, painting shall be suitable for industrial marine environment. For the valves to be installed underground, when indicated in Valve Data Sheet, the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating.

## **8 MARKING & SHIPMENT**

- 8.1** All valves shall be marked as per API 6D. The units of marking shall be metric except nominal diameter, which shall be in inches.
- 8.2** Valve ends shall be suitably protected to avoid any damage during transit. All threaded and machined surfaces subject to corrosion shall be well protected by a coat of grease or other suitable material. All valves shall be provided with suitable protectors for flange faces, securely attached to the valves. Bevel ends shall be protected with metallic or high impact plastic bevel protectors.
- 8.3** All sealant lines and other cavities of the valve shall be filled with sealant before shipment.

- 8.4** Packaging and shipping instructions shall be as per API 6D.
- 8.5** The serial number of each valve indicated on its name plate shall appear on all required documentation in accordance with EN 10204 3.2.
- 8.6** Name Plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25
- 8.7** All valves shall be transported with ball in fully opened condition
- 8.8** On packages, following shall be marked legibly with suitable marking ink:
- Order Number
  - Manufacturer's Name
  - Valve size and rating
  - Tag Number
  - Serial Number

## **9 SPARES & ACCESSORIES**

- 9.1** Manufacturer shall furnish list of recommended spares and accessories for valves required during start-up and commissioning and supply of such spares shall be included in the price quoted by Manufacturer.
- 9.2** Manufacturer shall furnish list of recommended spares and accessories required for two years of normal operation and maintenance of valves and price for such spares shall be quoted separately.

## **10 DOCUMENTATION**

Documentation to be submitted by Manufacturer to Company is summarized below. Number of Copies (Hard copies / soft copies etc.) shall be as indicated in CONTRACT document.

- 10.1** At the time of bidding, Manufacturer shall submit the following documents:
- Reference list of similar ball valves manufactured and supplied in last seven years indicating all relevant details including project, year, client, location, size, rating, service etc.
  - Torque curves for the power actuated valves along with the break torque, running torque for the valve stem and maximum allowable stem torque.
  - Copy of valid API 6D Certificate.
  - Fire Safe test certificate qualifying the valves as per API 6FA/ API 607/ ISO 10497 carried out in last 10 years shall be furnished.
  - Details of support foot including dimensions and distance from valve centreline to bottom of support foot.
  - List of recommended spares required during start-up and commissioning & 2 years of normal operation and maintenance.



10.2 After placement of order, the Manufacturer shall submit the following drawings, documents and specifications for Company's approval:

- a. General arrangement & detailed sectional drawings showing all parts with reference numbers and material specifications, overall dimensions and features. Number of turns of hand wheel required for operating the valve from full open to full close position for Gear Operated valves, painting/ coating scheme, Complete dimensional details of support foot (where applicable), shall be indicated in the GA.

Manufacture of valves shall commence only after approval of the above documents. Once the approval has been given by Company, any changes in design, material and method of manufacture shall be notified to Company whose approval in writing of all changes shall be obtained before the valve is manufactured.

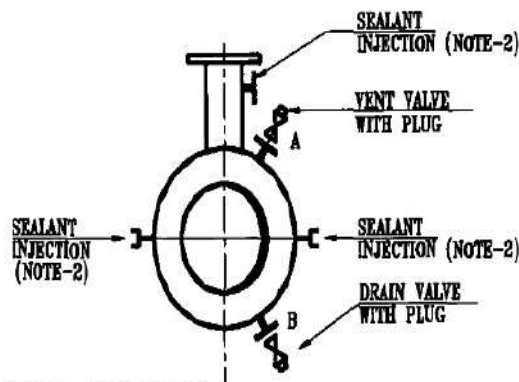
10.3 Within 30 days from the approval date, Manufacturer shall submit to Company the approved drawings, documents and specifications as listed in clause 10.2 above.

10.4 Prior to shipment, Manufacturer shall submit to Company following:

- a. Test certificates as per clause 6.0 of this specification.
- b. Manual for installation, erection, maintenance and operation instructions including a list of recommended spares for the valves.

10.5 All documents shall be in English language only.

### ABOVE GROUND INSTALLATION



### FULL BORE VALVES

VALVE SIZE, DN(mm)	A, DN(mm)	B, DN(mm)
50 TO 150	-	15
200 TO 800	15	25
650 & ABOVE	15	40

### REDUCED BORE VALVES

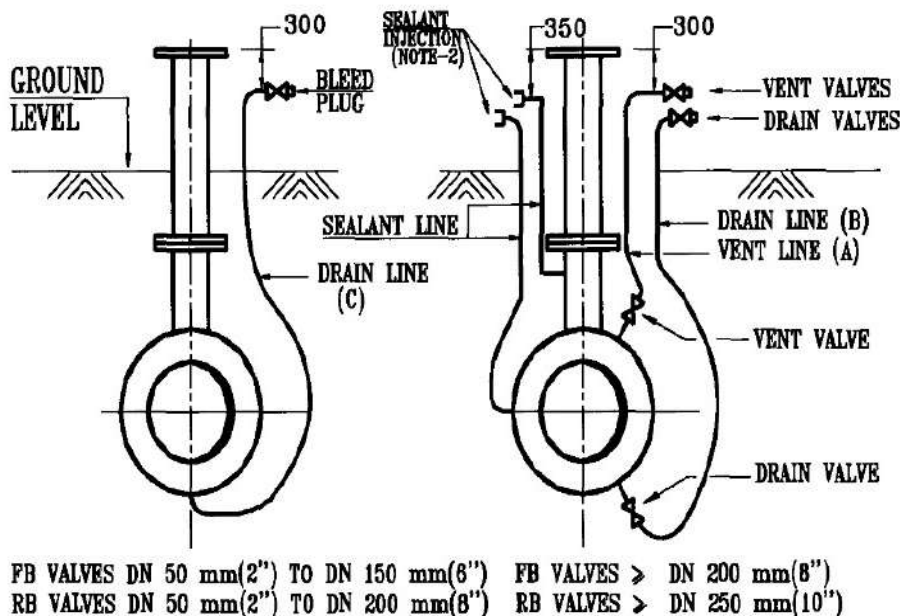
VALVE SIZE, DN(mm)	A, DN(mm)	B, DN(mm)
50 TO 200	-	15
250 TO 750	15	25
ABOVE 750	15	40

### NOTES:-

- 1 ALL VALVES (BALL OR PLUG) AND PLUGS FOR A AND B SHALL BE APPROVED BY THE PURCHASER.
- 2 SEALANT POINTS SHALL BE PROVIDED FOR FULL BORE VALVES OF NOMINAL VALVE SIZE 200 mm (8") & ABOVE AND REDUCED BORE VALVES OF NOMINAL VALVE SIZE, DN 250 mm (10") AND ABOVE ONLY. SEALANT LINES SHALL HAVE PROVISION TO REPLACE THE SEALANT INJECTION FITTING UNDER FULL LINE PRESSURE. SEALANT LINES SHALL HAVE BLOCK VALVE & INTERNAL NON RETURN VALVE.
- 3 ALL VENT/DRAIN CONNECTION SHALL BE WELDED WITH THE BODY.



## UNDERGROUND INSTALLATION



### FULL BORE (FB) VALVES

VALVE SIZE, DN(mm)	A, DN(mm)	B, DN(mm)	C, DN(mm)
50 TO 150	-	-	15
200 TO 300	25	25	-
350 TO 600	25	25	-
650 & ABOVE	40	40	-

### REDUCED BORE (RB) VALVES

VALVE SIZE, DN(mm)	A, DN(mm)	B, DN(mm)	C, DN(mm)
50 TO 200	-	-	15
250 TO 400	25	25	-
450 TO 750	25	25	-
800 & ABOVE	40	40	-

### NOTES:-

- 1 ALL VALVES (BALL OR PLUG) AND PLUGS FOR A AND B SHALL BE APPROVED BY THE PURCHASER.
- 2 SEALANT POINTS SHALL BE PROVIDED FOR FULL BORE VALVES OF NOMINAL VALVE SIZE 200 mm (8") & ABOVE AND REDUCED BORE VALVES OF NOMINAL VALVE SIZE, DN 250 mm (10") AND ABOVE ONLY. SEALANT LINES SHALL HAVE PROVISION TO REPLACE THE SEALANT INJECTION FITTING UNDER FULL LINE PRESSURE. SEALANT LINES SHALL HAVE BLOCK VALVE & INTERNAL NON RETURN VALVE.
- 3 ALL VENT/DRAIN CONNECTION IN BURIED SECTION SHALL BE OF WELDED CONSTRUCTION. ALL PIPING INCLUDING VALVE ENDS IN BURIED PORTIONS OF VENT & DRAIN SHALL BE WELDED TYPE.





**FIGURE-4.9**



## VCS QUALITY SERVICES PVT.LTD.





### STANDARD SPECIFICATION FOR ASSORTED VALVES

VCS – SS – PP - 2504

					
01	30.06.2022	RP	MC	HK	GW
00	28.01.2020	MB	AK	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed

## REVISION RECORD

Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	28.01.2020					
		MB	AK	AD	SK	
01	30.06.2022					VCS QMS Integration
		RP	MC	HK	GW	

### **ABBREVIATIONS:**

AARH	:	Arithmetic Average Roughness Height
ANSI	:	American National Standards Institute
API	:	American Petroleum Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing & Materials
BGO	:	Bevel Gear Operator
BHN	:	Brinell Hardness Number
BIS	:	Bureau of Indian Standards
BS	:	British Standard
BVIS	:	Bureau Veritas Industrial Services
BW	:	Butt Weld
CAT	:	Category
CS	:	Carbon Steel
DFT	:	Dry Film Thickness
DNV	:	Det Norske Veritas
DP	:	Dye-Penetrant
IBR	:	Indian Boiler Regulations
IGC	:	Inter Granular Corrosion
IS	:	Indian Standard
LT	:	Low Temperature
LTCS	:	Low Temperature Carbon Steel
MOV	:	Motor Operated Valve
MP	:	Magnetic Particle
MR	:	Material Requisition
NDT	:	Non Destructive Testing
PM	:	Positive Material Identification
PO	:	Purchase Order
PR	:	Purchase Requisition
RFQ	:	Request for Quotation
SCRD	:	Screwed
SS	:	Stainless Steel
SW	:	Socket Weld

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## **1. GENERAL**

- 1.1** Vendor shall supply valves in accordance with the valve specification sheets along with auxiliaries, if any, such as gear operator, bypasses, drains, locking arrangements etc. wherever specified in the specification sheets, subject notes and other enclosures to the material requisition (MR).
- 1.2** Vendor shall quote in strict accordance with the valve data/ specification sheets, subject technical notes and all other enclosures to the MR. For all valves, no deviations whatsoever shall be accepted.
- 1.3** All codes and standards for manufacture, testing, inspection etc. shall be of latest editions as on issue date of Material Requisition.

## **2. DOCUMENTATION**

- 2.1** For all valves, vendor shall submit the following documents with the offer:
- 2.1.1 Manufacturers complete descriptive and illustrative catalogue/ literature.
- 2.1.2 Detailed dimensioned cross section drawing with parts/ material lists, weight etc.
- 2.1.3 Drawings for valves with accessories like gear operator, hydraulic/ pneumatic operator, motor, extension bonnet, extended stems with stands, bypass etc. giving major salient dimensions.
- 2.1.4 One copy of the valve specification sheets signed as "Accepted" by the manufacturer. Deviations, if any shall be marked as applicable on the valve specification sheet.
- 2.1.5 If the valve is regretted or has no deviation, the manufacturer shall write clearly on valve specification sheets as "Regret" or "No Deviation".
- 2.1.6 On failure to submit documents as specified in clauses 2.2.1 to 2.2.6 above, the offer is likely to be rejected.
- 2.2** The following documents shall be submitted in soft and hard copy after placement of the order.
- 2.2.1 For all valves to manufacturers' standard specified in MR/valve specification sheet, detailed dimensioned cross section drawing with parts, materials, weight, etc. shall be submitted for records/information/ review.
- 2.2.2 Test report shall be supplied for all mandatory tests as per the applicable code. Test reports shall also be furnished for any supplementary tests as specified in clauses 3.15.
- 2.2.3 Material test certificates (physical properties, chemical composition & heat treatment report) of the pressure containing parts shall be furnished for the valves supplied. Material test certificates for the other parts shall also be furnished for verification during inspection.
- 2.3** Catalogues/Drawings (6 sets) shall be submitted in hard copies (6 sets) and soft copies (2 CDs/DVDs) along with delivery for Purchaser's record for all categories/ types of valves.

## **3. DESIGN AND CONSTRUCTION**

- 3.1** Valve shall be designed, manufactured, tested, inspected and marked as per the manufacturing standards, design codes and standards indicated in the respective valve specification sheets. Any conflict between the requisition, enclosures, specification

sheets and referred standards/ codes shall be brought to the notice of the purchaser for clarifications and resolution, before proceeding with the manufacture. The purchaser's decision shall be final and binding to the vendor. The drawings submitted for review shall not include any deviations except as communicated in writing in Deviation permits. The Drawings shall be reviewed only for design and construction features.

- 3.2** All flanged valves shall have flanges integral (except forged valves) with the valve body. Flange face finish shall be normally specified in the valve specification sheet as 125 AARH etc. The interpretation for range of face finish shall be as follows:

Stock Finish	: 1000 p. in AARH max.
125 AARH	: Serrations with 125 to 250 p in AARH
63 AARH	: 32 to 63 p. in AARH

- 3.3** For all weld end valves with bevel end as per ASME B 16.25, the contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour
Carbon Steel (Except Low Temp. Carbon Steel)	Upto 22 mm	Figure 2 Type A
	> 22 mm	Figure 3 Type A
Alloy Steel, Stainless Steel & Low Temp. Carbon Steel	Upto 10 mm	Figure 4
	> 10 mm & Upto 25 mm	Figure 5 Type A
	> 25 mm	Figure 6 Type A

Valve ends shall match thickness of the connecting pipe. Sloping of inside contour of valves shall be done wherever necessary to achieve this.

- 3.4** For flanged valves with ring joint flanges the hardness shall be as follows:

Flange Material	Min. Hardness of Groove (BHN)
Carbon Steel	140
1% Cr to 5% Cr, 9% Cr	150
Type 304, 316, 321, 347	160
Type 304L, 316L	140

- 3.5** Following requirements for check valves shall be met over and above the valve specification sheet requirements:

- 3.5.1** Unless specified otherwise in the data sheet all check valves 3" & above (except in 900#, 1500# & 2500# rating) shall have a drain boss at location "G" (Refer Fig.No.1 of ASME B16.34) where pocket is formed in valve body. A tapped drain hole with plug shall be provided as per ASME B 16.34. Threads shall be as per ASME B 1.20.1 (Taper) NPT.
- 3.5.2** For heavy check valves, provisions shall be available for lifting by way of lugs, eye bolts and other such standard devices.

**3.6** If an overlay weld-deposit is used for the body seat ring seating surface, the corrosion resistance of the seat ring base material shall be at least equal to the corrosion resistance of the material of the shell.

**3.7** Following valve bypass requirements shall be met:

3.7.1 By-pass requirement for Gate valves shall be as follows unless otherwise mentioned.

ASME 150 Class	On sizes 26" and above
ASME 300 Class	On sizes 16" and above
ASME 600 Class	On sizes 6" and above
ASME 900 Class	On sizes 4" and above
ASME 1500 Class	On sizes 4" and above
ASME 2500 Class	On sizes 3" and above

3.7.2 The by-pass piping arrangement shall be such that clearance between main valve body and bypass assembly shall be the minimum possible for layout reasons. Vendor shall follow the sketch enclosed in this Specification No. SS-PI-012\_A1.

3.7.3 By-pass valve shall be a globe valve. The sizes shall be as under:

On main valve ≤ 4"	:	1/2"
On main valve 6" to 8"	:	3/4"
On main valve 10" & above	:	1"

By-pass piping shall be of same metallurgy as main valve. The by-pass piping, fittings and valve tag numbers shall be as specified in Piping Material Specification (PMS).

**3.8** Vendor shall supply the by-pass valve duly tested and fitted to the main valve. Valves with by-pass shall have the direction of flow marked on the main valve. By-pass attachment to the main valve body shall not be screwed. All fillet welds for by-pass installation shall be 100% examined by DP/MP test and Butt-weld joints shall be 100% examined by radiography.

**3.9** Valve body / bonnet shall be forged / cast as specified. Forgings are acceptable in place of casting but not vice-versa.

**3.10** Stem shall be forged or machined from forged / rolled bar. No casting is permitted. However, integral stem of cast material is acceptable for Plug valves.

**3.11** Stellite/ hardfacing by deposition shall be minimum 1.6 mm.

**3.12** Renewable seat rings shall be seal welded for valves of size 3" and above to prevent loosening in service.

**3.13** For Low Temperature & Cryogenic valve requirements, refer Specification. No. SS-PI-012\_A2 unless otherwise specified.

**3.14** For all austenitic stainless steel valves Inter Granular Corrosion (IGC) test shall be conducted as per the following:

3.14.1 ASTM A262 Practice 'B' with acceptance criteria of '60 mils/year (max.)' for all



materials forged, rolled, wrought and casting.

Or

ASTM A262 Practice 'E' with acceptance criteria of 'No cracks as observed from 20X magnification' for all materials other than castings. Microscopic structure to be observed from 250X magnification' in addition.

3.14.2 When specifically asked for in MR for high temperature application of some grades of austenitic stainless steel (eg. SS309, 310, 316, 316H etc) ASTM A262 Practice 'C' with acceptance criteria of '15 mils/year (max.)' shall be conducted.

3.14.3 For the IGC test as described in Clauses 3.15.1 & 3.15.2, two sets of samples shall be drawn from each solution annealing lot. One set shall correspond to the highest Carbon content and the other to the highest pressure rating. When testing is conducted as per practice 'E', of the microscopic structure shall be submitted for record.

**3.15** All types of 321 or 347 stainless steel valves shall be in a stabilized heat treated condition. Stabilizing heat treatment shall be carried out subsequent to the normal solution annealing. Soaking temperature and holding time for stabilizing heat treatment shall be 900°C and 4 hours respectively.

**3.16** Spiral wound bonnet gaskets are to be provided with inner/ outer ring except when encapsulated gaskets type body-bonnet joints are employed. Outer ring may be avoided case of non-circular spiral wound gasket used in 150# valve provided the outermost layer of spiral touches the bolts ascertaining the centering.

**3.17** All Stainless Steel Castings shall be solution heat treated.

**3.18** Only normalized and tempered material shall be used in the following specifications:

**Castings** : A217 Gr.WC1, A217 Gr.WC4, A217 Gr.WC5, A217 Gr.WC6, A217 Gr.WC9, A217 Gr.C5, A217 Gr.C12

**Forgings** : A182 Gr.F11 C1.2, A182 Gr.F12 C1.2

### **3.19 Ball / Plug / Butterfly Valves**

3.19.1 As a prequalification, fire safe test as per API 607/ API 6FA/ BS EN ISO 10497 (Supersedes BS 6755 Part II) shall be carried out on soft seated ball, plug & butterfly valves and also on lubricated plug valves The test shall be witnessed and certified by a approved third party inspection agency unless otherwise specified. The vendor has to submit test certificate for the particular design of the valve offered, if fire safe design is required as per the Valve Material Specification sheet.

3.19.2 Each valve shall be supplied with a lever / wrench except for gear operated / motor operated valves.

3.19.3 Soft-seated ball, plug & butterfly valves shall be supplied with antistatic devices.

3.19.4 BW / SW end ball valves shall have pipe nipple/ pup piece welded to each end of the valve. As specified in valve datasheets nipples/ pup piece are to be welded prior to assembling Teflon seats / seals. Specifications of the nipples shall be as indicated in the MR.

3.19.5 The face-to-face dimensions of all ball valves shall be same as those of gate valves of the corresponding ANSI class (except 10" onwards in Class 150 where the face-to-face dimensions shall be as per API 6D long patterns).

3.19.6 The ball of ball valve shall not protrude outside the end flanges of valve.

3.19.7 All Ball valves shall be of floating ball/ trunnion mounted type as per following:

150#	8" & below 10" & above	Floating ball Trunnion mounted
300#	4" & below 6" & above	Floating ball Trunnion mounted
600# & above	1.5" & below 2" & above	Floating ball Trunnion mounted

3.19.8 Unless otherwise specified in the data sheets/ MR, bore of all reduced bore ball valves shall be limited to one size lower than the nominal bore.

**3.20** The MOVs are to be installed in an open area and the actuators shall be suitable for all weather conditions. The testing of complete assemblies of MOVs along with the actuators shall be done by the supplier at his works.

**3.21** Ends of flanged valves of 22" size shall match corresponding flanges to MSS-SP44 unless otherwise specified.

**3.22** Yoke material shall be same as bonnet material where maximum temperature specified is more than 427°C.

#### **4. OPERATION**

**4.1** Gear operation shall be provided as under:

Valve Type	Class	Size Requiring Gear-Operator
Gate Valve, Globe Valve & Diaphragm Valve	150 Class	12" and larger
	300 Class	12" and larger
	600 Class	10" and larger
	900 Class	6" and larger
	1500 Class	3" and larger
	2500 Class	3" and larger
Ball Valve / Plug Valve (Other than pressure balance plug valves)	150 Class	6" and larger
	300 Class	6" and larger
	600 Class	4" and larger
	900 Class	3" and larger
	1500 Class	3" and larger
Butterfly Valve	150, 300 Class	6" and larger

For sizes lower than these ranges, hand wheel / lever / wrench shall be provided. For pressure balance plug valves manufacturer's recommendation shall be acceptable provided the requirements specified in clause 4.6 are met.

- 4.2** Gear operator shall be provided, with position indicators for open / close positions and with limit stops. (Limit stops are not applicable for gate and globe valves).
- 4.3** Where gear operator is not called for as per Clause 4.1 but vendor recommends a gear operator, the same shall be highlighted.
- 4.4** Gear operator shall be so designed as to operate effectively with the differential pressure across the closed valve equal to the cold non-shock pressure rating.
- 4.5** Ball, plug and butterfly valves, shall have "Open" position indicators with limit stops.
- 4.6** Hand wheel diameter shall not exceed 750mm and lever length shall not exceed 500mm on either side. Effort to operate shall not exceed 35 Kg at hand wheel periphery. However, failing to meet the above requirements, vendor shall offer gear operated valve and quote as per clause 4.3.

## **5. INSPECTION AND TESTING**

- 5.1** Every valve shall be subjected to all the mandatory tests and checks called in the respective codes/ data sheet by any third party as approved by the purchaser. For IBR valves refer clause 7.0.
- 5.2** Every valve, its components and auxiliaries must be subjected to all the mandatory tests and checks called for in the respective codes, data sheets etc. by the manufacturer.
- 5.3** Though the extent of inspection shall be as under, exact extent withhold points shall be decided by company/ company representative and recorded in the form of inspection plan. In case of third party inspection, the inspection plan shall be approved by the purchaser.

### **Forged Valves:**

1. Visual and dimensional inspection.
2. Review of material test certificates.
3. Any mandatory or supplementary test.
4. Hydrostatic test on 10% valves selected on random basis.
5. Strip check is required for 1% of total ordered quantity of Gate & Globe valves (min. 1 No.) for each Valve sheet no., however, strip check is not required for CS/ Brass/ Bronze material valves with 13% Cr/ Brass/ Bronze trims.

### **Cast Steel Valves:**

1. Visual and dimensional inspection.
2. Review of material test certificates.
3. Review of radiographs/radiographic reports or any other NDT tests wherever applicable as per data sheet.
4. Any mandatory or supplementary test.
5. Hydrostatic test 100% for body, 10% other test.
6. Strip check is required for 1% of total ordered quantity of Gate & Globe valves (min. 1 No.) for each Valve sheet no., however, strip check is not required for CS/ Brass/ Bronze material valves with 13% Cr/ Brass/ Bronze trims.

Samples for strip check shall be selected at random and shall generally be in the highest size in the lot.

- 5.4** In case of motor operated or actuator operated valves, functional/ operational checks as per the requirements of the specifications shall be made on each valve.

## **6. RADIOGRAPHY OF CAST VALVES**

- 6.1** Valve castings shall undergo radiographic examination as specified below.

Material	Rating	Size Range	Radiography
All	150#	24" and below	NIL**
		26" and above*	100%
	300#	16" and below	NIL**
		18" and above	100%
	600# & above	All sizes	100%

\* No radiography is required for valves of size 26" and above in cooling water service.

\*\*For sizes 24" & below in 150# and 16" & below in 300#, radiography percentage if specifically mentioned in individual valve material spec sheet shall govern.

Radiography specified as random 10% or 20% etc. in the respective valve data sheet implies 10% or 20% etc. of number of valves ordered against each item number with a minimum of one valve against each item.

- 6.2** Radiography procedure, areas of casting to be radiographed shall be as per ASME B 16.34 and acceptance criteria shall be as per ASME B 16.34 Annexure-B. However for areas of casting to be radiographed for types of valves not covered in ASME B 16.34, vendor shall radiograph castings in line with ASME B 16.34.
- 6.3** For random radiography wherever specified in individual data sheets, the sampling shall be per size of the quantity ordered for each foundry.
- 6.4** Radiography wherever specified in the data sheets or as per clause 6.1 shall be done by X-ray / Gamma-ray to get the required sensitivity.

## **7. IBR CERTIFICATION**

- 7.1** For valves described "IBR", valves shall be in accordance with the latest IBR (Indian Boiler Regulation) including the requirements specified in the specification.
- 7.2** For SW / BW end carbon steel valves under IBR, the chemical composition shall conform to the following:

**Carbon (Max)** : **0.25%**

**Others (S, P, Mn)** : **As per IBR**

- 7.3** Valves coming under the purview of "IBR"(Indian Boiler Regulations) shall each be individually accompanied by IBR certificate original in Form III-C duly approved by IBR authority / local authority empowered by the Central Boiler Board of India. Photocopy

of original certificate duly attested by the local boiler inspector where the supplier is located is the minimum requirement for acceptance.

**7.4** All "IBR" valves shall be painted red in body-bonnet / body-cover joint.

## **8. MARKING**

**8.1** Valve markings, symbols, abbreviations etc. shall be in accordance with MSS-SP-25 or the standard referred in specification sheet as applicable. Vendor's name, valve rating, material designation, nominal size, direction of flow (if any) etc. shall be integral on the body.

**8.2** Each valve shall have a corrosion resistant tag giving size, valve tag / code no., securely attached to the valve body.

**8.3** Paint or ink for marking shall not contain any harmful metal or metal salts such as zinc, lead or copper which cause corrosive attack on heating.

**8.4** Carbon Steel / Alloy Steel valves shall be painted with one coat of inorganic zinc silicate (minimum DFT 65 to 75 microns).

## **9. DESPATCH**

**9.1** Valve shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.

**9.2** Valves shall be protected from rust, corrosion and any mechanical damage during transportation, shipment and storage.

**9.3** Rust preventive on machined surfaces to be welded shall be easily removable with a petroleum solvent or shall not be harmful to welding.

**9.4** Each end of valve shall be protected with the following materials:

Flange Face	:	Wood or Plastic Cover
Bevelled End	:	Wood or Plastic Cover
SW & SCRD. End	:	Plastic Cap

**9.5** End protectors of wood / plastic to be used on flange faces shall be attached by at least three bolts and shall not be smaller than the outside diameter of the flange. However, plastic caps for SW & SCRD end valves shall be press fit type.

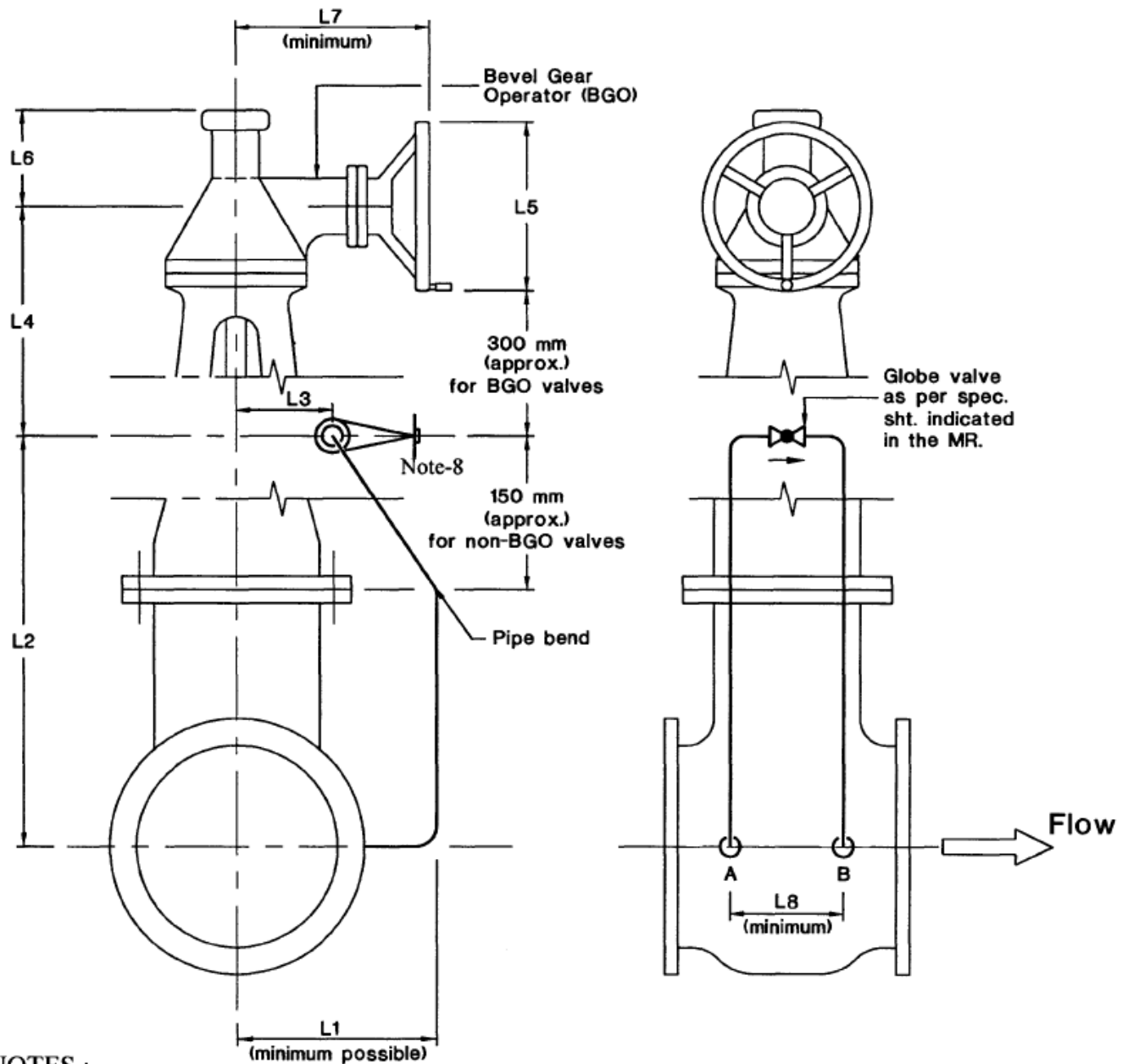
**9.6** End protectors to be used on beveled end shall be securely and tightly attached.

**9.7** For special service valves additional requirement for dispatch shall be as prescribed in data sheet.

## **10. ATTACHMENTS**

SS-PI-012_A1	:	Bypass Piping Arrangement
SS-PI-012_A2	:	Special Requirements for Low Temperature and Cryogenic Valves

**BYPASS PIPING ARRANGEMENT  
(SS-PI-012-A1)**



**NOTES :**

1. The orientation & location of hand wheel of bevel gear operator & the bypass arrangement shall be strictly as per this sketch.
2. The bypass connection ends shall be socket welded up to 600# and butt welded for 900# and above rating.
3. The bypass arrangement shall be properly clamped to & supported by the body of the main valve.
4. Basic design of bypass shall be to MSS-SP-45.
5. Material of bypass pipe & 90° elbows shall be same or equivalent to the body material.
6. Sketch is applicable for both BGO & NON-BGO Valves.

- 
7. Vendor shall furnish dimensions L1 to L8.
  8. Stem shall not be horizontal in the case of CRYO Valves

## **SPECIAL REQUIREMENTS FOR LOW TEMPERATURE & CRYOGENIC VALVES (SS-PI-012-A2)**

### **11. SCOPE**

All valves of Low Temperature Carbon Steel (LTCS) and all grades of austenitic (CRYO) materials are categorized as cryogenic valves. All these valves shall have extended bonnet as per BS 6364 except check valves.

Following qualification criteria shall be met by the valve vendors to quote valves for cryogenic services:

### **12. QUALIFICATION CRITERIA**

- I. Both cryogenic test (clause 2.1) and reference list (clause 2.2) together shall be for vendor qualification and vendor shall furnish the same, along with his offer.
- II. Vendors who do not have cryogenic test reports and reference list covering valves of all materials and ratings required by MR, should confirm / furnish the following for consideration of their offer:
  - a. Evidence of having conducted successfully at least one cryogenic test as per BS 6364. Test certificate shall be furnished with the offer.
  - b. Vendor shall confirm to conduct cryogenic test per clauses 2.1 & 2.3 for the remaining valves not later than 12 weeks from the date of purchase order.
  - c. Vendor shall also furnish reference list for valves supplied for non-cryo service if reference list referred in 2.2.1 does not cover all the sizes of MR.

Offers of vendors who do not comply with above requirements would be rejected.

#### **12.1 Cryogenic Test**

Vendors to furnish copies of cryogenic test certificate for tests conducted as per given below:

- 12.1.1 Test shall be as per BS 6364.
- 12.1.2 Test temperature, unless specifically called for otherwise in the individual MR, shall be -45°C for LTCS and -196°C for all grades of austenitic stainless steel.
- 12.1.3 Tests carried out on a particular size of one type of valve, pressure rating and material shall qualify all sizes equal to and below the test valve size for the same type, pressure rating and material. In case of austenitic SS any one grade would qualify for all other grades of austenitic SS.
- 12.1.4 Tests should have been witnessed and certified by approved third party inspection agencies.
- 12.1.5 Cryogenic test need not be conducted for every order. Test conducted previously and witnessed by inspection agencies listed above shall be considered acceptable and need not be repeated.

#### **12.2 Reference List**



Vendor shall furnish reference list for valves supplied for cryogenic service indicating the name of client, year of supply, size, material, pressure rating, type of valve and quantity.

**12.3 Post Order Testing Procedure**

12.3.1 Before conducting post order testing, vendor shall submit the following for approval:

- a. Test procedure (as per BS 6364).
- b. Cross-section drawing of the valve with material of construction.
- c. Schematic of test rig (as per BS 6364) with complete details.

12.3.2 Test has to be conducted irrespective of the service on largest size for each type of valve and for each material and class rating. Vendor shall offer one, two or three valves for selection of test valve by inspector depending upon whether quantity of largest valve in the order is one, two or three and more than three respectively.

In the event of failure of the test valve to meet the specification requirements, the vendor shall conduct test on two more valves. These two valves which pass test successfully, are of lower size, then the qualification will be valid only to sizes upto which test has been conducted successfully.

12.3.3 In case of non-conductance of cryogenic test(s) within 12 weeks or failure in the test(s) conducted after receipt of order, the owner reserves the right to invoke any of the of the purchase order including cancellation of the purchase order at the risk and cost of vendor.

- 13.** Bonnet extension, wherever specified in the valve sheet to BS 6364 shall be for "non cold box application" unless otherwise specified in the MR. Even if not called for in valve sheet, valves indicated as "LT" or "CRYO" shall be supplied with bonnet extension.
- 14.** Bonnet and Gland extension joints shall be of butt welded/integrally cast construction.
- 15.** Repair welding procedure for austenitic stainless steel valves in "CRYO" service shall have to be qualified for impact test as per ASME B31.3. Minimum acceptable impact energy shall be 20 J or lateral expansion of 0.38 mm at temperature of -196°C.
- 16.** Wherever impact test of SS studs / nuts is called for in the data sheet, the impact value shall be 27 J at the intended service temperature specified in the data sheets.



## VCS QUALITY SERVICES PVT. LTD.

### STANDARD SPECIFICATION FOR PLUG VALVES

VCS – SS – PP - 2051

00	03.05.2022	SR	MC	HK	HK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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CONTROLLED COPY	:	If in soft and signed

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**ABBREVIATIONS:**

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell Hardness Number
DN	Nominal Size
HAZ	Heat Affected Zone
LC	Lock Close (valve locked in full close position)
LO	Lock Open (valve locked in full open position)
MSS-SP	Manufacturers Standardization Society - Standard Practice
NDT	Non Destructive Testing
NPS	Nominal Pipe Size
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council
MPI	Magnetic Particle Inspection
DP	Dye Penetrant

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## 1.0 **SCOPE**

This Specification covers the minimum requirements for design, manufacture, testing and supply of carbon steel plug valves of size DN 50 mm (2") and above and ANSI pressure rating Class 150# thru 900# for use in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

## 2.0 **REFERENCE DOCUMENTS**

- 2.1 All valves shall be manufactured and supplied in accordance with the American Petroleum Institute (API) Specification 6D, Latest Edition with additions and modifications as indicated in the following sections of this specification.
- 2.2 Reference has also been made in this specification to the latest edition (edition enforce at the time of issue of enquiry unless specified otherwise) of the following Codes, Standards and Specification.

### **AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)**

B31.3	:	Process Piping.
B31.4	:	Pipeline Transportation System for Liquid Hydrocarbon & Other Liquids.
B 31.8	:	Gas Transmission and Distribution Piping Systems.
B16.5	:	Pipe Flanges and Flanged Fittings.
B16.10	:	Face to Face and End to End Dimensions of Valves.
B 16.25	:	Butt Welding Ends.
B 16.34	:	Valves-Flanged, Threaded and Welding Ends.
B 16.47	:	Large Diameter Steel Flanges.
Section VIII	:	Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels.
Section IX	:	Welding and Brazing Qualifications.

### **AMERICAN PETROLEUM INSTITUTE (API)**

1104	:	Specification for Welding Pipelines and Related Facilities.
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### **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
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B 733 : Auto catalytic (Electroless) Nickel - Phosphorus Coatings on Metal.

### MANUFACTURERS STANDARDIZATION SOCIETY (MSS)

SP-6 : Standard Finishes for Contact Faces of Pipe Flanges and Connecting – End Flanges of Valves and Fittings.

SP-44 : Steel Pipeline Flanges.

### STEEL STRUCTURES PAINTING COUNCIL (SSPC)

VIS-I : Visual Standard.

- 2.3** In case of conflict between the requirements of this specification, API 6D and the Codes, Standards and Specifications referred in clause 2.2 above, the requirements of this specification shall govern.

Order of precedence shall be as follows:

- Data Sheets
- This Specification
- API 6D Specification
- Other Referred Codes & Standards
- Manufacturer's Standard

## 3.0 MATERIALS

- 3.1** The Material for Construction of major components of the Plug valves shall be as indicated in Valve Data Sheet. Other components shall be as per Manufacturer's standard (suitable for the service conditions indicated in the Valve Data Sheet) and shall be subject to approval by Company.

All process-wetted parts, metallic and non-metallic, and lubricants shall be suitable for the service specified by the Company. Manufacturer shall confirm that all wetted parts are suitable for treated water/ seawater environment, which may be used during field testing.

- 3.2** Carbon steel used in the manufacture of valves shall be fully killed.
- 3.3** The carbon equivalent (CE) of valve end connections which are subject to further field welding by Company shall not exceed 0.45 on check analysis for each heat of steel used, as calculated by the following formula:

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

## 3.4 CHARPY V-NOTCH TEST REQUIREMENTS

- 3.4.1** For valves specified to be used for Gas service or LPG service, Charpy V-notch test, on each heat of base material shall be conducted as per API 6D, for all pressure containing parts such as body,

end flanges and welding ends as well as bolting material for pressure containing parts. Unless specified otherwise, the Charpy Impact test shall be conducted at 0°C or minimum design temperature indicated in valve data sheet / MR, whichever is lower. Test procedure shall conform to ASTM A 370. The average absorbed energy value of three full sized specimens shall be 27 J. The minimum impact energy value of any one specimen of the three specimens analyzed as above shall not be less than 22 J.

- 3.4.2 When Low Temperature Carbon Steel (LTCS) materials are specified in Valve Data Sheet or offered by Manufacturer, the Charpy V-notch test requirements of applicable material standard shall be complied with.

### 3.5 HARDNESS TEST REQUIREMENTS

For Valves specified to be used for Gas service or LPG service, Hardness test shall be carried out as per ASTM A 370 for each method of manufacture and each heat of steel used in the manufacture of valves. A full thickness cross section shall be taken for this purpose and the maximum hardness of the materials of valve components such as base material of body and principal parts of the valve such as plug, stem, etc shall not exceed 248 HV<sub>10</sub>.

### 3.6 ELECTROLESS PLATING REQUIREMENTS

For all such valves where Carbon Steel is used as plug material, the plug shall have 75 micrometers (0.003 inches) thick Electroless Nickel Plating (ENP) as per ASTM B 733 with following classification:

- SC2, Type II, Class 2.

The hardness of plating shall be minimum 50 RC.

Manufacturer shall ensure that the adhesive strength of plating is sufficient so as to prevent peeling of plating during operation of the valve.

## 4.0 DESIGN AND CONSTRUCTION REQUIREMENTS

### 4.1 GENERAL

Valve design shall meet the requirements of API Specification 6D and shall be suitable for the service conditions indicated in the Valve Data Sheet. The valve body and other pressure containing parts shall be designed in compliance with ASME Boiler & Pressure Vessel Code, Section VIII, Div1. Allowable stress requirements shall comply the provisions of ASME B31.3. Also corrosion allowance indicated in Valve Data Sheet shall be considered in valve design. However, the minimum wall thickness shall not be less than the minimum requirement of ASME B16.34. The manufacturer shall have valid license to use API monogram on valves manufactured as per API 6D.

All process-wetted parts, metallic and non-metallic, shall be suitable for the fluids and service specified by the Purchaser

### 4.2 VALVE PATTERN

Valve pattern area shall be as specified in the following table:-

<b>ANSI Pressure Rating</b>	<b>SIZE RANGE, DN MM (INCH)</b>	<b>PATTERN</b>
Class 150 #	50-100 (2- 4)	Short
	150-300 (6 – 12)	Regular
	350(14) & above	Venturi
Class 300 #	50 -100(2 – 4)	Short
	150 - 250 (6 -10)	Regular
	300 (12) & above	Venturi
Class 600 #	50 - 250 (2 – 10)	Regular
	300 (12) & above	Venturi
Class 900 #	50 - 250 (2 – 10)	Regular
	300 (12) & above	Venturi

#### **4.3 PLUG DESIGN**

The valves shall have an inherent feature to ensure that under line pressure cannot cause taper locking of plug/ plug movement in to the taper, i.e. valves shall be of “Pressure-Balanced” design type.

**4.4** Cover shall be bolted to the valve body and screwed connections are not acceptable.

**4.5** Soft seats to achieve a seal between plug and body are not permitted.

#### **4.6 SEALANT INJECTION REQUIREMENT**

All valves shall have the provision for secondary sealant injection under full line pressure for seat and stem seals. All sealant injection connection shall be provided with an internal non-return valve. Valve design shall have a provision (e.g. Ball Type Check Valve/ Needle Valve) to replace the sealant injector fitting under full line pressure. Location and arrangement of sealant injection points shall be as per Fig - 4.6. Valves shall have vent and drain connections as per API 6D.

**4.7** Valves shall be designed to withstand a sustained internal vacuum of at least 1 (one) milli-bar in both open and closed positions.

**4.8** Valve design shall ensure repair of gland packing under full line pressure.

#### **4.9 VALVE ENDS**

- a. Valve ends shall be either flanged/ or butt welded or one end flanged and one end butt welded as indicated in the Valve Data Sheet. Flanges of the flanged end cast/ forged body valves shall be integrally cast/ forged with the body of the valve. Face to face/ end to end dimensions shall conform to API 6D. Face-to-face and end-to-end dimensions for valve sizes not specified in API 6D shall be in accordance with ASME B 16.10. Face-to-face and end-to-end



dimensions not shown in API 6D or in ASME B 16.10 shall be as per Manufacturer Standard and shall be subject to approval by Company.

- b. Flanged ends, if specified, shall have flanges as per ASME B16.5 for valve sizes up to DN 600 mm (24") excluding DN 550 mm (22") and as per MSS-SP-44/ ASME B 16.47 Series A for valve sizes DN 550 mm (22") and for DN 650 mm (26") and above. Flange face shall be either raised face or ring joint type (RTJ) as indicated in Valve Data Sheet. Flange face finish shall be serrated or smooth as indicated in Valve Data Sheet. In case of RTJ flanges, the groove hardness shall be minimum 140 BHN.
- c. Butt weld end preparation shall be as per ASME B 16.25. The thickness of the pipe to which the valve has to be welded shall be as indicated in the Valve Data Sheet. Valves shall be without transition pups. In case difference exists between thickness of welding ends of valve and connecting pipe, the welding ends of valve shall have bevel preparation as per ASME B31.4 or ASME B31.8 as applicable.

#### 4.10 POSITION INDICATORS

Valve shall be provided with Plug position indicator and stops of rugged construction at the fully open and fully closed positions.

#### 4.11 VALVE INSTALLATION

Valves shall be suitable for either buried or above ground installation as indicated in Valve Data Sheet, material Requisition & P&IDs

#### 4.12 LOCKING DEVICES

When indicated in Material Requisition, valves shall have locking devices to lock the valve either in full open (LO) or full close (LC) positions. Locking devices shall be permanently attached to the valve operator and shall not interfere with operation of the valve.

- 4.13 Valves of size NPS 8" and larger shall be equipped with lifting lugs. Tapped holes and eye bolts shall not be used for lifting lugs.

#### 4.14 STEM EXTENSIONS

When stem extension requirement is indicated in Valve Data Sheet, the valves shall have the following provisions.

- a. Valves provided with stem extension shall have water proof outer casing. Length of stem extension shall be as indicated in Valve Data Sheet. The length indicated corresponds to the distance between centerline of the valve opening and the top of mounting flange for valve operating device (gear operator/ power actuator as applicable).
- b. Seat sealant injection lines shall be extended and terminated adjacent to the valve operator by means of suitable piping anchored to the valve body/ stem housing. The pipe used shall be API 5L Gr. B/ ASTM A 106 Gr. B, with Sch 160. Fittings shall be ASTM A105/ ASTM A 234 Gr. WPB, Socket welded ANSI class 6000.
- c. Sealant injection lines shall be extended and terminated adjacent to the valve operator in manner as indicated in (b) above

- d. Stem extension and stem housing design shall be such that the complete assembly will form a rigid unit giving positive drive under all conditions with no-possibility of free movement between valve body, stem extension or its operator.
- e. Outer casing of stem extension shall have 3/8" or 1/2" NPT plugs at the top and bottom, for draining and filling with oil to prevent internal corrosion.

**4.15** The valve stem shall be capable of withstanding the maximum operating torque required to operate the valve against the maximum differential pressure as per the appropriate class. The combined stress shall not exceed the maximum allowable stresses specified in the ASME Section VIII Div 1.

For Power Actuated Valves, the valve stem shall be designed for maximum output torque of the selected power actuator (including gear box, if any) at the valves stem

The valve stem shall have anti-blowout feature with antistatic device. The valve stem may be integral with plug or be a separate component.

#### **4.16 OPERATING DEVICES**

- a. Valves shall have a power actuator or manual operator as indicated in the Valve Data Sheet. In case of manual operator, valve sizes, DN  $\leq$  100 mm (4") shall be wrench operated and valve sizes, DN  $\geq$  150 mm (6") shall be gear operated. Each wrench operated valve shall be supplied with wrench. Valve design shall be such that damage due to malfunctioning of the operator or its controls will only occur in the operator gear train or power cylinder and that damaged parts can be replaced without the valve cover being removed.
- b. The power actuator shall be in accordance with the Company Specification issued for the purpose and as indicated in the Valve and Actuator Data Sheet. Operating time shall be as indicated in Valve Data Sheet. Valve operating time shall correspond to full close to full open/ full open to full close under maximum differential pressure corresponding to the valve rating. For actuated valves, the actuator's rated torque output shall be at least 1.25 times the break torque required to operate the valve under the maximum differential pressure corresponding to the valve class rating.
- c. For the manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N. Manufacturer shall also indicate the number of turns of hand wheel (In case of gear operators) required for operating the valve from full open to full close position. Operating device shall be designed for easy operation of valve under maximum differential pressure corresponding to the valve rating
- d. Direction of operation of hand wheel or wrench shall be in clock-wise direction while closing the valve. Hand wheels shall not have protruding spokes.
- e. Gear operators, when provided, shall have a self-locking provision and shall be fully encased in water proof/ splash proof enclosure and shall be filled with suitable grease.

#### **4.17 WELDING**

All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Section IX, except that only positions 5G and 2G shall qualify all-positional welding. The procedure qualification shall also include impact test and hardness test when

required as per Clause 3.4 and 3.5 of this specification and shall meet the requirements as specified therein.

#### 4.18 REPAIR WELDING

Repair by welding is not permitted for fabricated and forged body valves. However repair by welding as per ASME B16.34 is permitted for cast body valves. Such repairs shall be carried out at casting supplier's care only. Repair shall be carried out before any heat treatment of casting is done. Repair welding procedure qualification shall also include impact test and hardness test when required as per Clause 3.4 and 3.5 of this specification and shall meet the requirements as specified therein.

- 4.19 The tolerance on internal diameter and out of roundness at the ends for welded ends valves shall be as per connected pipe specification as indicated in the Valve Data Sheet

### 5.0 INSPECTION AND TESTS

- 5.1 The Manufacturer shall perform all inspection and tests as per the requirements of this specification and the relevant codes, prior to shipment, at his works. Such inspection and tests shall be, but not limited to, the following:
- 5.2 All valves shall be visually inspected. The internal and external surfaces of the valves shall be free from any strikes, gouges and other detrimental defects. The surfaces shall be thoroughly cleaned and free from dirt, rust and scales.
- 5.3 Dimensional check on all valves shall be carried out as per the Company approved drawings.
- 5.4 Chemical composition and mechanical properties shall be checked as per this specification and relevant material standards, for each heat of steel used.
- 5.5 Non-destructive examination of individual valve material and component consisting of but not limited to castings, forgings, plates and assembly welds shall be carried out by the Manufacturer.
- a. Valve castings of all valves shall be radiographically examined at the cover and body portion, seat location, flanged body ends and circumference of ends to be field welded as per ASME B 16.34. Procedure and acceptance criteria shall be as per ASME B 16.34. The extent of the radiography shall be as under:

PRESSURE CLASS RATING	VALVE SIZE	EXTENT OF RADIOGRAPHY
ANSI 150 # Class	All Sizes	Nil
ANSI 300 # Class	≤ DN 400 mm (16")	Nil
	≤ DN 450 mm (18")	100%
ANSI 600 # Class above	All Sizes	100%

All castings shall be wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall, comply with ASME B 16.34.

b. All forgings shall be by ultrasonic method. Inspection procedure and acceptance shall comply with Annexure E of ASME B16.34.

**5.6** Areas, which in Company's opinion cannot be inspected, by radiographic methods, shall be checked by ultrasonic or magnetic particle methods and acceptance criteria shall be as per ASME Sec. VIII (2007 edition), Division 1, Appendix 12 and Appendix 6 respectively.

**5.7** Weld ends of all cast valves subject to welding in field shall be 100% radiographically examined and acceptance criteria shall be as per ASME B16.34.

After final machining, all bevel surfaces shall be inspected by dye penetrate or wet magnetic particle methods. All defects longer than 6.35 mm are rejected, as are the defects between 6.35 mm and 1.59 mm that are separated by a distance less than 50 times their greatest length. Rejectable defects must be removed. Weld repair of bevel surface is not permitted.

All finished wrought weld ends subject to welding in field shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.

**5.8** All valves shall be tested in compliance with the requirements of API 6D. The drain, vent and sealant lines shall be either included in the hydrostatic shell test or tested independently. Test pressure shall be held for duration mentioned in API 6D. Hydrostatic shell testing shall ensure that the whole of the shell is subjected to the test pressure. If necessary, the empty shell shall be pressure tested prior to assembly of the plug. The drain, vent and sealant lines shall be either included in the hydrostatic shell test or tested independently

**5.9** No leakage is permissible during hydrostatic testing. After pressure testing and acceptance, valves shall be thoroughly drained and dried. Drying of valves internal shall be with compressed air and lint free rags. The internal surfaces shall be coated with suitable water dispelling anti-corrosion fluid. To ensure total coverage, the valve shall be placed in the half open position, filled with the fluid and drained.

**5.10** A supplementary air seat test as per API 6D shall be carried out for all valves. No leakage is allowed. Test pressure shall be held for at least 15 minutes.

**5.11** Manufacturer who intends bidding must submit at bid stage, certificate and report for successful fire safe tests for all types of valves in accordance with BS:6755 (Part-II)/ API 6FA, as applicable in Valve Data Sheet. Failure to comply with the requirement shall be a cause of rejection of the offer

**5.12** Valves shall be subjected to an Operational Torque Test as per API 6D under hydraulic pressure equal to maximum differential pressure corresponding to the applicable ANSI class rating of valve. For manually operated valves, testing shall confirm that the torque required to operate the valve does not exceed 4.16 (c) of this specification.

**5.13** Power actuated valves shall be tested after assembly of the valve and actuator, at the valve Manufacturer's works. At least five Open-Close-Open cycles without internal pressure and five Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating shall be performed on the valve actuator assembly. The time for Full Open to Full Close shall be

recorded during testing. If required, the actuator shall be adjusted to ensure that the opening and closing time is within the limits stated in Valve Data Sheet.

Hand operator provided on the actuator shall also be checked after above cyclic testing, for satisfactory manual over-ride performance.

These tests shall be conducted on minimum one valve out of a lot of five (5) valves of the same size, rating and the actuator model/ type. In case, the tests do not meet the requirements, retesting/ rejection of the lot shall be decided by the Company's Inspector.

- 5.14** Company reserves the right to perform stage wise inspection and witness tests as indicated in clause 5.1 above at Manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to the Company's Inspector. Company reserves the right to require additional testing at any time to confirm or further investigate a suspected fault. The cost incurred shall be to Manufacturer's account.

In no case shall any action of Company or his inspector shall relieve the Manufacturer of his responsibility for material, design, quality or operation of valves.

Inspection and tests performed/ witnessed by the Company's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

## **6.0 TEST CERTIFICATES**

Manufacturer shall submit the following certificates in accordance with EN10204 3.2.

- a. Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for the valve construction as per the relevant standards.
- b. Report on heat treatment carried out.
- c. Test certificates of hydrostatic and pneumatic tests complete with records of timing and pressure of each test.
- d. Test reports of radiograph and ultrasonic inspection, MPI and DP Inspection.
- e. Test report on operation of valves conforming to clause 5.0 of this specification.
- f. All other test reports and certificates as required by API 6D and this specification.

The certificates shall be considered valid only when signed by Company's Inspector. Only those valves which have been certified by Company's Inspector shall be dispatched from Manufacturer's works.

## **7.0 PAINTING**

Valve surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint. Surface preparation shall be carried out by shot blasting to SP-6 in accordance with "Steel Structures Painting Council - Visual Standard SSPC-VIS-1". For the valves to be installed underground, when indicated in Valve Data Sheet, the external surfaces of buried portion of the valve shall be painted with three coats of suitable coal tar epoxy resin with a minimum dry film thickness of 300 microns.

Manufacturer shall indicate the type of corrosion resistant paint used, in the drawings submitted for approval

## **8.0 MARKING & SHIPMENT**

- 8.1** All valves shall be marked as per API 6D. The units of marking shall be metric except nominal diameter, which shall be in inches. Marking shall be done by die-stamping on the bonnet or on the housing. However, for buried valves the marking shall be done on the above ground portion of the stem housing only.
- 8.2** Valve ends shall be suitably protected to avoid any damage during transit. All threaded and machined surfaces subject to corrosion shall be well protected by a coat of grease or other suitable material. All valves shall be provided with suitable protectors for flange faces, securely attached to the valves. Bevel ends shall be protected with metallic or high impact plastic bevel protectors.
- 8.3** All sealant lines and other cavities of the valve shall be filled with sealant before shipment.
- 8.4** Packaging and shipping instructions shall be as per API 6D.
- 8.5** On packages, following shall be marked legibly with suitable marking ink:
- a. Order Number
  - b. Manufacturer's Name
  - c. Valve size and rating
  - d. Tag Number
  - e. Serial Number

## **9.0 SPARES AND ACCESSORIES**

- 9.1** Manufacturer shall furnish list of recommended spares and accessories for valves required during start-up and commissioning and supply of such spares shall be included in the price quoted by Manufacturer.
- 9.2** Manufacturer shall furnish list of recommended spares and accessories required for two years of normal operation and maintenance of valves and price for such spares shall be quoted separately.

## **10.0 DOCUMENTATION**

- 10.1.** The Manufacturer shall supply documentation in accordance with the Vendor Data Requirements List (VDRL) as attached with Purchase Order/ Material requisition. If not mentioned below minimum documentation shall be followed.

At the time of bidding, the bidder shall submit the following documents:

- a) General arrangement/ assembly drawings showing all features and relative positions & sizes of vents, drains, gear box & other external parts together with overall dimensions.



- b) Sectional drawing showing major parts with reference numbers and material specification.
- c) Reference list of similar plug valves manufactured and supplied in last five years, indicating all relevant details including project, year, client, location, size rating, service, etc.
- d) Torque curves for the power actuated valves along with break torque and maximum allowable stem torque. In addition, sizing criteria and torque calculations shall also be submitted for power actuated valves.
- e) Descriptive technical catalogues of the Manufacturer.
- f) Copy of valid API 6D certificate, wherever applicable.
- g) Details of support foot, including dimensions and distance from valve centre line to bottom of support foot.
- h) Quality Assurance Plan enclosed with this tender duly signed, stamped and accepted.

**The drawings to be submitted alongwith the bid shall be in total compliance with the requirement of technical specification and data sheets of the valves with no exception & deviation.**

10.2. Within two weeks of placement of order, the manufacturer shall submit six copies of, but not limited to, the following drawings, documents and specifications for approval :

- a) Design drawings and relevant calculations for pressure containing parts and other principle parts.
- b) Detailed sectional arrangement drawing showing all parts with reference numbers and materials specification.
- c) Assembly drawings with overall dimensions & clearances required and showing all features. Drawing shall also indicate the numbers of turns of handwheel (in case of gear operator) required for operating the valve from full open to full close position and the painting scheme.
- d) Welding, heat treatment, testing and quality control procedures.
- e) Details of corrosion resistant paint to be applied on the valves.
- f) Design calculation for pressure containing parts.

Manufacture of valves shall commence only after approval of the above documents. Once approval has been given by Purchaser, any change in design, material and method of manufacture shall be notified to the Purchaser, whose approval in writing for all changes shall be obtained before the valves are manufactured.

10.3. Within 30 days from the approval date, Manufacturer shall submit one reproducible and six copies of the approved drawings, documents and specification as listed in clause 10.2 of this specification.

10.4. Prior to shipment, Manufacturer shall submit one reproducible and six copies of following

t certificates as listed in clause 7.0 of this specification.

- b) Manual for installation, erection instructions, maintenance and operation instructions, including a list of recommended spares for the valves

10.5. All documents shall be in English Language.

## **11.0 GUARANTEE**

11.1 Manufacturer shall guarantee that the materials and machining of valves and fittings comply with the requirements in this specification and in the Purchase Order.

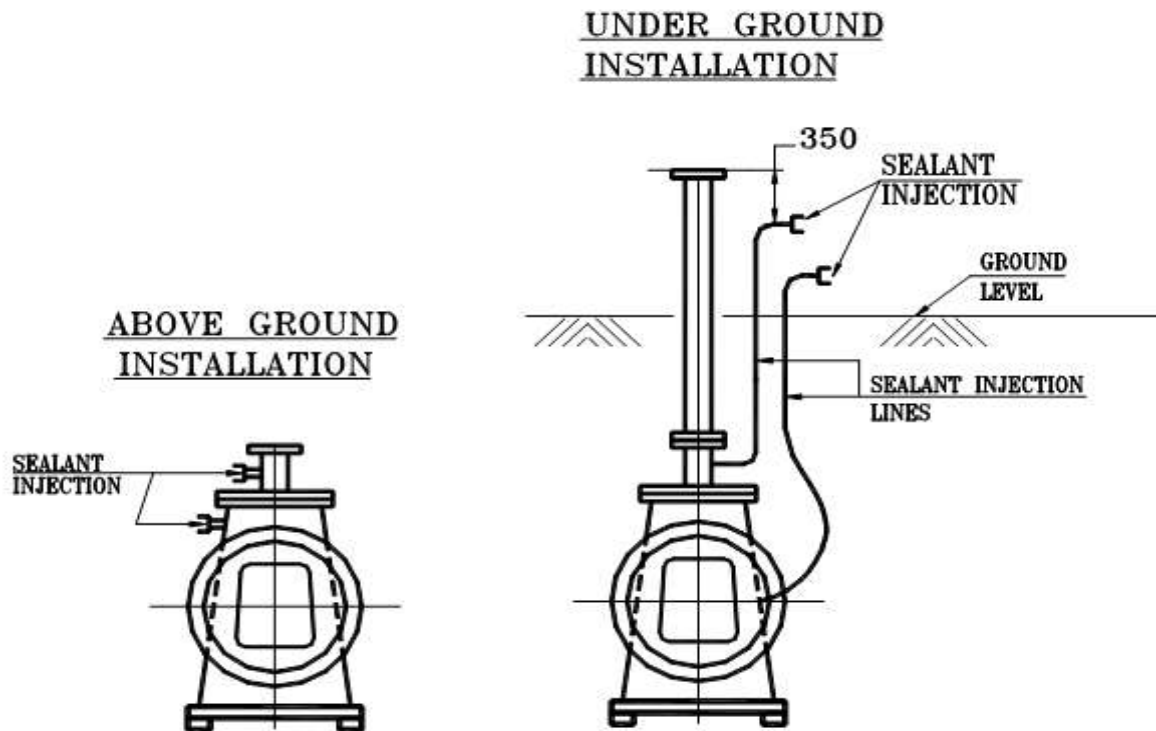
11.2 Manufacturer is bound to replace or repair all valve parts which should result defective due to inadequate engineering or to the quality of materials and machining.

11.3 If valve defect or malfunctioning cannot be eliminated, Manufacturer shall replace the valve without delay.

11.4 Any defect occurring during the period of Guarantee shall be attended to by making all necessary modifications and repair of defective parts free of charge to the Purchaser as per the relevant clause of the bid document.

11.5 All expenses shall be to Manufacturer's account.





**FIGURE- 4.6**







ENERGISING QUALITY

## VCS QUALITY SERVICES PVT. LTD.





### STANDARD SPECIFICATION FOR CHECK VALVES

VCS – SS – PP -2006

					
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		SR	MC	HK	HK	
04	07.01.2022					VCS QMS Integration
		RP	MC	HK	GW	

**ABBREVIATIONS:**

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
ASME	American Society of Mechanical Engineers
API	American Petroleum Institute
DN	Nominal Size
EN	European Committee for Standardization
ISO	International Standards Organization
MSS	Manufacturers Standardization Society
NACE	National Association of Corrosion Engineers
NDE	Non Destructive Examination
NPS	Nominal Pipe Size
UT	Ultrasonic Testing

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## 1.0 SCOPE

This Specification covers the minimum requirements for design, manufacture and supply of carbon steel check valves of size DN 50 mm (2" NB) to DN 600 mm (24" NB) and ANSI Class 150# thru 900# for use in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

## 2.0 REFERENCE DOCUMENTS

- 2.1** All valves shall be manufactured and supplied in accordance with the American Petroleum Institute (API) Specification 6D, latest edition in force at the time of issue of enquiry, Specification for Pipeline & Piping valves with additions and modifications (alternations) as indicated in the following sections of this Specification.
- 2.2** Reference has also been made in this specification to the latest edition (edition in force at the time of issue of enquiry) of the following Codes, Standards and Specifications.

### AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- |                 |   |  |
|-----------------|---|--|
| B 31.4          | : | Pipeline Transportation Systems for Liquids and Slurries                     |
| B 31.8          | : | Gas Transmission and Distribution Piping Systems                             |
| B 31.3          | : | Process Piping   |
| B 16.5          | : | Steel Pipe Flanges and Flanged Fittings                                      |
| B 16.25         | : | Butt-welding Ends  |
| B 16.10         | : | Face to Face and End to End Dimensions of Valves                             |
| B 16.34         | : | Valves – Flanged, Threaded, and Welding End                                  |
| B 16.47         | : | Large Diameter Steel Flanges   |
| Sec.VIII.Div.1: |   | Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels |
| Sec. IX         | : | Boiler and Pressure Vessel Code – Welding and Brazing Qualifications         |

### AMERICAN PETROLEUM INSTITUTE (API)

- |      |   |  |
|------|---|--|
| 1104 | : | Specification for Welding Pipelines and Related Facilities |
| 6D   | : | Specification for Valves                                   |
| 6FA  | : | Fire Test for Valves                                       |
| 6FD  | : | Fire Test for Check Valves                                 |

- Std. 594 : Check Valves: Wafer, Wafer-Lug, and Double Flanged Type
- Std. 598 : Valve Inspection & Testing

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

- A 105 : Specification for Forgings, Carbon Steel for Piping Components
- A 216 : Specification for Steel Castings, Carbon, Suitable for Fusion Welding for High Temperature Service
- A 182 : Specification for Austenitic Stainless Steel
- A 234 : Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
- A 350 : Specification for Carbon and Low Alloy Steel Forgings Requiring Notch Toughness Testing for Piping Components
- A 351 : Specification for Casings, Austenitic – Ferritic (Duplex) Pressure Containing Parts
- A 370 : Mechanical Testing of Steel Products

**MANUFACTURERS STANDARDIZATION SOCIETY (MSS)**

- SP-25 : Standard Marking System for Valves, Fittings, Flanges and Unions
- SP-6 : Standard Finishes for Contact Faces of Pipe Flanges and Connecting End Flanges of Valves and Fittings
- SP-44 : Steel Pipeline Flanges
- SP-53 : Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components- Magnetic Particle Examination Method.

- 2.3** In case of conflict between the requirements of this specification, API 6D and the Codes, Standards and Specifications referred in clause 2.2 above, the requirements of this specification shall govern.

**3.0 MANUFACTURER'S QUALIFICATION**

Manufacturer who meets the following requirements shall be considered as qualified.

- 3.1** The Manufacturer shall have a valid license to use API Monogram for his supply of valves with similar design and material of construction.
- 3.2** Manufacturer shall submit the proof of evidence that he offered similar design of valves as specified in this specification are supplied in the last five years and functioning satisfactorily.

The manufacturer shall submit valid API 6D certificate.

## 4.0 MATERIALS

4.1 Material for major components of the valves shall be as indicated in Valve Data Sheet. Other components shall be as per Manufacturer's standard (suitable for the service conditions indicated in Data Sheet) and shall be subject to approval by the Company. In addition, the material shall also meet the requirements hereinafter.

4.2 All process wetted parts, metallic and non-metallic, and lubricants shall be suitable for the service specified by the Purchaser. Manufacturer shall confirm that all wetted parts are suitable for treated water/ sea water environment which may be used during field testing.

Nonmetallic components of valves intended for hydrocarbon gas service shall be resistance to explosive decompression.

4.3 Carbon Steel used in the manufacture of valves shall be fully killed.

4.4 Based on product analysis, Carbon Equivalent (CE) shall not exceed 0.43 for each heat of steel used for welding of valve end connections by the Company.

$$CE = C + Mn/ 6 + (Cr + Mo + V)/ 5 + (Ni + Cu)/ 15$$

Carbon content shall not exceed 0.23%, Sulphur content of maximum 0.035% and Phosphorous maximum content of 0.035%.

## 4.5 CHARPY V-NOTCH TEST REQUIREMENTS

Charpy V-notch test on each heat of base material shall be conducted for all pressure containing parts such as Body, End Flanges and Welding Ends as well as Bolting materials for pressure containing parts.

Test procedure for Charpy V-Notch Test shall conform to ASTM A370.

For Carbon Steel, alloy steel & Stainless Steel (except Austenitic Grades) Materials, the impact test temperature shall be 0°C or minimum design temperature indicated in valve data sheet, whichever is lower. The average absorbed energy value of three full sized specimens shall be 27 J (for materials with Specified Minimum Tensile Strength <100,000 psi)/ 34 J (for materials with Specified Minimum Tensile Strength >100,000 psi). The minimum impact energy value of any one specimen of the three specimens analysed as above, shall not be less than 22 J (for materials with Specified Minimum Tensile Strength <100,000 psi)/ 26 J (for materials with Specified Minimum Tensile Strength >100,000 psi).

For Low Temperature Carbon Steel Materials, the impact test temperature shall be as per requirement of Material Standard or minimum design temperature indicated in valve data sheet, whichever is lower. The average absorbed energy value of three full sized specimens shall be 27 J (for materials with Specified Minimum Tensile Strength <100,000 psi)/ 34 J (for materials with Specified Minimum Tensile Strength >100,000 psi). The minimum impact energy value of any one specimen of the three specimens analysed as above, shall not be less than 22 J (for materials with Specified Minimum Tensile Strength <100,000 psi)/ 26 J (for materials with Specified Minimum Tensile Strength >100,000 psi).

Where the material specification requires impact values to be higher than specified in the above paragraphs, the higher values shall apply.

Result of Charpy Test shall be recorded.



#### 4.6 HARDNESS TEST REQUIREMENTS

Hardness test shall be carried out as per ASTM A 370 for each method of manufacture and each heat of steel used in the manufacture of valves. A full thickness cross section shall be taken for this purpose and the maximum hardness of the materials of valve components shall not exceed 248 HV<sub>10</sub>.

Result of Hardness Test shall be recorded.

#### 5.0 DESIGN AND CONSTRUCTION REQUIREMENTS

- 5.1 Only Swing type Check Valves meeting the requirements of API Specification 6D are acceptable.

Valve design shall meet the requirements of API Specification 6D and shall be suitable for the service conditions indicated on the Valve Data Sheet. The ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 shall be used to design the valve body. Allowable stress requirements shall meet the provisions of above code. In addition, corrosion allowance indicated in Valve Data Sheet shall be considered in valve design. However, minimum wall thickness shall not be less than minimum requirements of ASME B 16.34.

Manufacturer shall have a valid licence to use API 6D monogram for manufacture of Check Valves.

- 5.2 The disc hinge shall be mounted on the valve body and shall not be attached to the valve body cover for swing check valves. Valve body cover joint shall be of bolted design and screwed covers shall not be used. For 900# class valve, cover shall be pressure seal type.
- 5.3 Valve shall be provided with non-renewable integral type seats as indicated in Valve Data Sheets. Non-renewable seats shall be of a design, which does not require renewal over the design life of the valve.
- 5.4 Unless specified otherwise in data sheet all check valves 3" and above, shall be provided with, drain connection as per the Manufacturer's standard. Drain tapping shall be provided with plug as per ASME B 16.34 in a position suitable to completely drain the valve with valve in either horizontal or vertical position.
- 5.5 Wherever specified for the parts of valve in valve datasheets, minimum thickness of stelliting shall be 1.6 mm

#### 5.6 VALVE ENDS

Valve ends shall be either flanged/ or butt welded or one end flanged and one end butt welded as indicated in the Valve Data Sheets and as per API 6D. Flanges of the flanged end cast body valves shall be integrally cast with the body of the valve. Face to face/ end to end dimensions shall conform to API 6D, valve sizes which are not specified in API 6D shall be in accordance with ASME B 16.10 or as per Manufacturer Standard and shall be subject to approval by Company.

- 5.7 Flanged end, if specified, shall have flanges as per ASME B 16.5 for valve sizes up to DN 600 mm (NPS 24") excluding DN 550 mm (NPS 22") and as per MSS SP-44/ ASME B 16.47 Series A for valve sizes DN 550 mm (NPS 22") and for DN 650 mm (NPS 26") and above. Flange face shall be either raised face or ring joint type as indicated in Valve Data

Sheet. Smooth finish when specified shall be 125 to 250 AARH. In case of the RTJ flanges, the groove hardness shall minimum 140 BHN.

**5.8** Butt weld end preparation shall be as per ANSI B 16.25. The thickness of the pipe to which the valve has to be welded shall be as indicated in the Valve Data Sheet. Valves shall be without transition pups. In case difference exists between thickness of valve neck end and connecting pipe. The bevel end shall be prepared as per ANSI B 31.4 or ANSI B 31.8 as applicable.

**5.9** Valve sizes DN 200 mm (NPS 8") and above shall be equipped with lifting lugs. Tapped holes and eye bolts shall not be used for lifting lugs.

**5.10** An arrow indicating the direction of flow shall be embossed or cast on the body of all valves.

#### **5.11 WELDING**

All welds shall be made by welders with welding procedures qualified in accordance with the provisions of ASME Section IX.

#### **5.12 REPAIR WELDING**

Repair by welding is permitted for cast body valves subject to written approval by Company and shall be carried out as per ASME B 16.34. Repair shall be carried out before any heat treatment of casting is done. Repair welding procedure qualification shall also include impact test and hardness test when required as per Clause 4.5 and 4.6 of this specification and shall meet the requirements as specified therein. Heat treatment and radiography shall be repeated after the weld repair.

### **6.0 INSPECTION AND TESTS**

**6.1** The Manufacturer shall perform all inspection and tests as per the requirements of this specification and the relevant Codes, Standards and Specifications, prior to shipment at his works but not limited to the following.

**6.2** All valves shall be visually inspected. The internal and external surfaces of the valves shall be free from any strikes, gauges, dirt, rust, scales and other detrimental defects.

**6.3** Dimensional check on valves shall be carried out as per the Company approved drawings.

**6.4** Chemical composition and mechanical properties, including hardness shall be checked as per the relevant material Standards and this Specification for each heat of steel used.

**6.5** The Manufacturer shall carry out nondestructive examination of individual valve materials and components consisting of, but not limited to, forgings, plates and assembly welds.

**6.6** Body castings of all valves of all valves shall be radiographically examined as per ASME B 16.34. Procedure and acceptable criteria shall be as per ASME B 16.34. The extent of radiography as follows.

Pressure Class Rating	Valve Size	Extent of Radiography
ANSI 150# class	≤ DN 600 mm (24") ≥ DN 650 mm (26")	Nil 100%
ANSI 300# class	≤ DN 400 mm (16") ≥ DN 450 mm (18")	Nil 100%
ANSI 600# class & 900# class	All Sizes	100%

Radiography shall be performed after the final heat treatment also.

All castings of valves of size NPS 20" & above shall be wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall comply with ASME B16.34.

**6.7** All valves, with body fabricated from plates or made by forgings, shall be ultrasonically examined in accordance with the procedure and acceptance standard of Appendix IV of ASME B 16.34.

**6.8** All forgings of valves of size NPS 20" & above shall be wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall comply with ASME B 16.34.

All finished wrought weld ends subject to welding in field shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.

Weld ends of all cast valves subject to welding in field shall be 100% radiographically examined and acceptance criteria shall be as per ASME B 16.34.

After final machining, all bevel surfaces shall be inspected by dye penetrant or wet magnetic particle methods. All defects longer than 6.35 mm are not acceptable. Weld repair of bevel surface is not permitted.

**6.9** All valves shall be tested in compliance with the requirements of API 6D. Hydrostatic test pressure shall be held for at least 30 minutes. No leakage is permissible during hydrostatic testing.

**6.10** A supplementary air seat test as per API 6D (Annex I, Para I.9 Type II), shall be carried out for all valves. No leakage is allowed. Test pressure shall be held for at least 15 minutes.

**6.11** Company reserves the right to perform stage wise inspection and witness tests as indicated in clause 6.0 above at Manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to the Company's Inspector. Company reserves the right to require additional testing at any time to confirm or further investigate a suspected fault. The cost incurred shall be to Manufacturer's account.

In no case shall any action of Company or its Inspector relieve the Manufacturer of his responsibility for material, design, quality or operation of valves.

Inspection and tests conducted/ witnessed by the Company's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

## 7.0 TEST CERTIFICATES

The manufacturer shall submit following test certificates.

- a. Mill test certificates relate to the chemical analysis and mechanical properties of the materials used for the valve construction as per the relevant Standards.
- b. Test certificates of hydrostatic and pneumatic tests complete with records of timing and pressure of each test.
- c. Test reports of radiography, ultrasonic, magnetic particle inspection as applicable.
- d. All other certificates and test reports as required by API 6D and this Specification.

The certificates shall be valid only where signed by Company's Inspector. Only those valves which have been certified by the Company's Inspector shall be dispatched from Manufacturer's work.

## 8.0 PAINTING

- 8.1 Valve surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint. Surface preparation shall be carried out by shot blasting to SA-2 1/2 / SSPC-SP10. For the valves to be installed underground, when indicated in Valve Data Sheet, the external surfaces of buried portion of the valve shall be painted with 100% solid high build epoxy with a minimum dry film thickness of 800 microns or 1.5 mm thick polyurethane coating.

## 9.0 MARKING AND SHIPMENT

- 9.1 All valves shall be marked as per API 6D. The units of marking shall be metric except nominal diameter, which shall be in inches.
- 9.2 Valve ends shall be suitably protected to avoid any damage during transit. All threaded and machined surfaces shall be well protected by a coat of grease or other suitable material to avoid the corrosion. All valves shall be provided with suitable protectors for flange faces, securely attached to the valves. Bevel ends shall be protected with metallic or high impact plastic level protectors.
- 9.3 All sealant lines and other cavities of the valve shall be filled with sealant before shipment.
- 9.4 Packaging and shipping instructions shall be as per API 6D.
- 9.5 On packages, the following shall be marked legibly with suitable marking ink:
  - a. Order Number
  - b. Manufacturer's Name
  - c. Valve Size And Rating
  - d. Tag No
  - e. Serial No

## 10.0 SPARES & ACCESSORIES

- 10.1** Manufacturer shall furnish list of recommended spares and accessories for valves for valves required for startup and commissioning and supply of such spares shall be included in the price quoted by manufacturer.
- 10.2** Manufacturer shall furnish list of recommended spares and accessories for two years of normal operation and maintenance of valves and price of such spares shall be quoted by separately.

## 11.0 DOCUMENTATION

The Manufacturer shall supply documentation in accordance with the Vendor Data Requirements List (VDRL) as attached with Purchase Order.

Documentation to be submitted by Manufacturer to Company is summarized below. Number of Copies (Hard copies / soft copies etc.) shall be as indicated in CONTRACT document.

- 11.1** At the time of bidding, Manufacturer shall submit the following documents:
- a. Reference list of similar check valves manufactured and supplied in last seven years indicating all relevant details including project, year, client, location, size, rating, service etc.
  - b. Copy of valid API 6D Certificate.
  - c. List of recommended spares required during start-up and commissioning and 2 years of normal operation & maintenance.
- 11.2** After placement of Order, the Manufacturer shall submit, but not limited to, the following drawings, documents and specifications for Company's approval:
- a. Detailed sectional & General arrangement drawings showing all parts with reference numbers and materials specification, overall dimensions & features, painting/ coating scheme.
  - b. Details of corrosion resistant paint to be applied on the valves.

Manufacture of valves shall commence only after approval of the above documents.

- 11.3** Within two weeks from the approval date, Manufacturer shall submit to Company all approved drawings, documents and specifications as listed in clause 11.2 above. Manufacturer shall also submit manual for installation, erection & maintenance instructions.
- 11.4** Prior to shipment, Manufacturer shall submit to Company the test certificates as listed in clause 7.0 of this specification. All reports shall be submitted in electronic format also.
- 11.5** All documents shall be in English language only.







ENERGISING QUALITY

## VCS QUALITY SERVICES PVT. LTD.





### TECHINICAL NOTES FOR BOLTS AND NUTS

VCS-SS-PP-2510

					
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## Abbreviations:

ASME	The American Society of Mechanical Engineers
ASTM	The American Society for Testing and Materials
MR	Material Requisition
SS	Stainless Steel



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1.0	GENERAL.....	5
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## **1.0 GENERAL**

**1.1** The process of manufacture, heat treatment, chemical & mechanical requirements and marking for all stud bolts, m/c bolts, jack screws & nuts shall be in accordance with the codes/standards and specifications given in the requisition. The applicable identification symbol in accordance with the material specification shall be stamped on each bolt and nut. Supplier shall strictly comply with MRIPR stipulations and no deviation shall be permitted.

## **1.2 Testing**

1.2.1. Test reports shall be supplied for all mandatory tests as per the relevant material specifications.

1.2.2. Material test certificate shall also be furnished. (Heat Analysis, Product Analysis and Mechanical Requirement)

1.2.3. Stress Rupture Test as detailed in ASTM A453 shall be carried out for all ASTM A453 bolting material irrespective of the temperature.

1.2.4. Refer Specification no VCS-PL-ITP-0012 for 'Inspection & Test Plan for Bolting Material'.

**1.3** All bolting shall be as per ASME B 18.2.1 for studs, M/c bolts and jackscrews and ASME B 18.2.2 for nuts.

**1.4** Threads shall be unified (UNC for up to 1" dia and 8UN for > 1" dia) as per ASME B1.1 with class 2A fit for studs, M/c bolts and jackscrews and class 2B fit for nuts.

**1.5** Stud bolts shall be threaded full length with two heavy hexagonal nuts unless otherwise specified. Length tolerance shall be in accordance with the requirement of Table D2 of Annexure-D of ASME B 16.5.

**1.6** The nuts shall be double chamfered, semi-finished, heavy hexagonal type and shall be made by the hot forged process and stamped as per respective material specification.

**1.7** Heads of jackscrews and m/c bolts shall be heavy hexagonal type. Jackscrew end shall be rounded.

**1.8** Each size of studs & m/c bolts with nuts and jackscrews shall be supplied in separate containers marked with size and material specifications. 'CRYO' shall be marked additionally in case 'CRYO' is specified in the requisition.

**1.9** All items shall be inspected and approved (stage-wise) by VCS.

**1.10** The heat treatment for stud bolts & nuts shall be as per code unless mentioned otherwise.

**1.11** All austenitic stainless steel bolts, nuts, screws shall be supplied in solution annealed condition unless specified otherwise in the material specification.

**1.12** Any additional requirements specified in the requisition shall be fully complied with.

**1.13** Stud bolts, nuts & jackscrews shall be impact tested wherever specified in the material specification and also where the material specification is indicated as "CRYO". For S.S. nuts and bolts minimum impact energy absorption shall be 27 Joules and test temperature shall be -196DC unless mentioned otherwise. For other materials impact energy and test shall be as per respective code.

**1.14** Bolts/nuts of material of construction B7M/2HM shall be 100% Hardness tested as per supplementary requirement S3 of ASTM A193.

- 
- 1.15** When specified as galvanized, the studs, M/C bolts and nuts shall be 'hot dip zinc coated' in accordance with requirements of 'class C' of 'ASTM A 153'. As an alternative, electro-galvanizing as per IS 1573, 'Service Grade Number 2' is also acceptable.
- 1.16** All Stud Bolts of Bolt diameter size 1" and above shall be provided with three nuts irrespective of whatever has been specified elsewhere in the MR.
- 1.17** Bolting shall be protected by non-corrosive oil or grease before dispatch to prevent rusting.
- 1.18** For stud bolt diameters not covered in ASTM A320, mechanical properties shall match the values specified for the matching grades and stud bolt diameters in ASTM A 193.
- 1.19** In cases where the lengths of Stud/Machine bolts specified in the MR are not multiples of 0.25", the length supplied shall be equal to the specified length rounded up to the next higher 0.25".
- 1.20** All Specialties mentioned in item description like "IBR", "L T", "H2", etc. other than **"CRYO"** & **"NACE"** shall be ignored.
- 2.0 ACCEPTABLE DEVIATIONS**
- 2.1 Nuts to ASTM A194Gr.7 are acceptable in place of ASTM A194Gr 4.
- 2.2 Stud Bolts to ASTM A453 Gr.660 C1.B are acceptable in lieu of ASTM A453 Gr.660C1.A and vice versa



## VCS QUALITY SERVICES PVT. LTD.





### TECHINICAL NOTES FOR GASKETS

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## Abbreviations:

AARH	Average Arithmetic Root Height
BHN	Brinell Hardness Number
CS	Carbon Steel
MR	Material Requisition
PMI	Positive Material Identification
RTJ	Ring Type Joint

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1.0	GENERAL.....	5
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## 1.0 GENERAL

- 1.1** All gaskets shall conform to the codes/standards and specifications given in the requisition. Supplier shall strictly comply with MR/PR stipulations and no deviations shall be permitted.
- 1.2** Process of manufacture, dimensions and tolerances not specified in requisition shall be in accordance with the requirements of the manufacturer's standards.
- 1.3 Testing**
- 1.3.1. Test reports shall be supplied for all mandatory tests for gaskets as per the standards specified in the requisition.
- 1.3.2. Chemical composition and hardness of RTJ gaskets shall also be furnished in the form of test reports on samples.
- 1.3.3. For Spiral wound material following shall be furnished:
- Manufacturer's test certificate for filler material and spiral material as per the relevant material specifications.
  - Manufacturer's test certificate for raw materials and tests for compressibility! seal- ability & recovery as per the relevant material specifications.
- 1.3.4. Refer Specification no VCS-PL-ITP-0013 for 'Inspection & Test Plan for Gaskets'.
- 1.4** Full face gaskets shall have bolt holes punched out.
- 1.5** Filler material for spiral wound gaskets shall not have any colour or dye.
- 1.6** All spiral wound gaskets shall be supplied with Outer ring. Material of the outer ring shall be CS unless otherwise specified in the MR.
- 1.7** For spiral wound gaskets, material of Inner Compression ring shall be same as Spiral Strip material. Inner rings shall be provided for all Spiral Wound Gaskets.
- 1.8** Hardness of metallic RTJ gaskets shall not exceed the values specified below unless otherwise specified in MR:

Ring Gasket Material	Maximum Hardness (BHN)
Soft Iron	90
Carbon steel	120
5 Cr. $\frac{1}{2}$ Mo	130
Type 304, 316, 321, 347	140
Type 304L, 316L	120
Inconel UNS N06625	200
Incoloy UNS N08825	190
Duplex SS UNS N032205, N031803	230

- 1.3.5. Face finish of metallic RTJ gaskets shall be 32 to 63 AARH.



- 1.3.6. Gaskets of different types and sizes shall be placed in separate shipping containers and each container clearly marked with the size, rating, material specification and item code.
- 1.3.7. All items shall be inspected and approved by VCS.
- 1.3.8. Any additional requirements specified in the requisition, shall be fully complied with.
- 1.3.9. Non-metallic ring gaskets as per ASME B 16.21 shall match flanges to ASME B 16.5 upto 24" and to ASME B 16.47B above 24" unless specified otherwise.
- 1.3.10. Spiral wound gasket as per ASME B 16.20 shall match flanges to ASME B 16.5 upto 24" and to ASME B 16.47B above 24" unless specifically mentioned otherwise.
- 1.3.11. The following abbreviations have been used in the Material Requisition for Spiral Wound Gaskets:

(I)	:	Inner Ring
(O)	:	Outer Ring
GRAFJL	:	Grafoil Filler
- 1.3.12. Specialties mentioned in item description like "IBR", "LT", "HICI", "H2", etc. shall be ignored.



**PROJECT NUMBER: C261162**



**PIPING MATERIAL SPECIFICATION**

Total Sheets

30

**DOCUMENT NO.**

C261162

00

PP

PMS

2001

**HPOIL GAS PRIVATE LIMITED  
(HOGPL)**

**CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL  
AREAS OF DIMAPUR NAGALAND**

C1	31.07.2025	ISSUED FOR CLIENT REVIEW	YK	AS	DK
<b>REV</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>PREP</b>	<b>CHKD</b>	<b>APPR</b>



## CITY GAS DISTRIBUTION PROJECT AT GEOGRAPHICAL AREAS OF DIMAPUR NAGALAND

### ABBREVIATION

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AARH	Arithmetic Average Roughness Height
BS	British Standards
CS	Carbon Steel
MS	Mild Steel
IS	Indian Standard Code
NFPA	National Fire Protection Association
OISD	Oil Industry Safety Directorate
PNRGB	Petroleum & Natural Gas Board
ERW	Electric Resistance Welding
BE	Bevel End
BW	Butt Welded
FF	Flat Face
PBE	Plain Bevel End
PE	Plain End
RF	Raised Face
SCRF	Screwed End - Female
SCRM	Screwed End - Male

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### 1.0 CODES AND STANDARDS

The Project shall be designed, constructed and tested in accordance with the latest edition and amendments of the following codes and standards.

API 6D	:	Specification for Pipeline Valves (Gate, Plug, Ball, Check)
API 6FA	:	Specification for fire test for valves
API 6FB	:	Specification for fire test for end connections
API 598	:	Valve Inspection & Testing
API 599	:	Metal Plug Valves – Flanged, Threaded & Welded Ends
API 600	:	Steel Gate Valves Flanged & Butt Welding Ends, Bolted and Pressure Seal Bonnets
API 602	:	API 602 Compact steel gate valves-Flanged, threaded, welding and extended body Ends
API 607	:	Fire test for soft seated Quarter Turn Valves
API 608	:	Metal Ball Valves – Flanged, Threaded & Welding Ends
API 609	:	Butterfly Valves: Double Flanged, Lug and Wafer Type
API 1104	:	Welding of Pipeline & Related Facilities
API 5L	:	Specification for line pipe
ASME B1.1	;	Unified Inch Screw Thread
ASME B1.2	:	Gauges and Gauging for Unified Screw threads
ASME 1.20.1	:	Pipe threads
ASME 16.11	:	Forged Fittings, Socket Welding & Threaded
ASME 16.14	:	Ferrous Pipe Plugs, Bushings and Locknuts with Pipe Thread
ASME 16.34	:	Valves Flanged, Threaded and Welding Ends
ASME 16.36	:	Orifice Flanges
ASME 16.47	:	Large Diameter Steel Flanges
ASME 16.48	:	Spectacle Blind Flange
ASME 16.5	:	Pipe flanges and flanged fittings, steel nickel alloy and other special alloy

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ASME 16.9	:	Factory-made wrought steel butt welding fittings
ASME 16.10	:	Face to Face and End to End dimensions of Valves
ASME 16.20	:	Metallic gaskets for pipe flanges - ring-joint, spiral-wound and jacketed
ASME 16.21	:	Non-metallic flat gaskets for pipe flanges
ASME 16.25	:	Butt welding ends
ASME 18.2.1	:	Stainless Steel Hex Bolt
ASME 18.2.2	;	Nuts for General Applications
ASME 31.3	:	Process Piping
ASME 31.8	:	Gas Transmission and Distribution Piping Systems
ASME 36.10	:	Welded and seamless wrought steel pipe
ASME 36.19	:	Stainless Steel Pipe
ASME B46.1	:	Surface Texture
ASME SEC VIII	:	Boiler and Pressure Vessel Code
ASME IX	:	Welding and Brazing Qualifications
ASTM 105	:	Forgings, Carbon Steel for Piping Components
ASTM 106	:	Standard specification for seamless carbon steel pipe for high temperature service
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 193	:	Standard specification for alloy-steel and stainless steel bolting materials for high-temperature service
ASTM 194	:	Standard specification for carbon and alloy steel nuts for bolts for high pressure and high temperature service
ASTM A216	:	Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A 234	:	Standard specification for piping fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures

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ASTM A240	:	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A262	:	Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A312	:	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A351	:	Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts
ASTM A358	:	Standard Specification for Electric-Fusion-Welded Austenitic Chromium-Nickel Stainless Steel Pipe for High-Temperature
ASTM A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A403	:	Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A435	:	Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates
ASTM A515	:	Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A516	:	Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A672	:	Standard Specification for Electric-Fusion-Welded Steel Pipe for High-Pressure Service at Moderate Temperatures
ASTM A694	:	Standard Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service
ASTM A700	:	Standard Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment
ASTM A790	:	Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Pipe
ASTM A815	:	Standard Specification for Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping
ASTM A860	:	Standard Specification for Wrought High-Strength Ferritic Steel Butt-Welding Fittings
ASTM E165	:	Standard Practice for Liquid Penetrant Testing for General Industry

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ASTM G48	:	Standard Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of
ISO 5208	:	Industrial valves - pressure testing of valves
ISO 6506	:	Metallic materials — Brinell hardness test — Part 1: Test method
ISO 6507	:	Metallic materials — Vickers hardness test — Part 1: Test method
ISO 6508	:	Metallic materials — Rockwell hardness test — Part 1: Test method
ISO 10497	:	Testing of valves – fire type testing requirements
IS 1239 (Part-1)	:	Mild Steel Tubes, Tubulars and other wrought steel fittings-specification
IS 3589	:	Steel Pipes for water and sewage (168.3 to 2 540 mm outside diameter)
MSS SP 6	:	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
MSS-SP-25	:	Standard marking systems for valves, fittings, Flanges and Union
MSS-SP-43	:	Wrought stainless steel and Butt welding fittings
MSS SP 44	:	Steel Pipe Line Flanges
MSS SP 45	:	Drain and By-pass Connections
MSS SP 53	:	Quality Standard for Steel Castings and Forgings for Valves, Flanges, Fittings, and Other Piping Components - Magnetic Particle Examination Method
MSS SP 55	:	Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components - Visual Method for Evaluation of Surface Irregularities
MSS SP 95	:	Swaged Nipples and Bull Plugs
MSS-SP-75	:	High Test Wrought Butt welding fittings
MMS-SP-97	:	Integrally Reinforced Forged Carbon steel Branch Outlet Fitting –Socket Welding, Threaded and Butt welding ends
BS 6755-1	:	Testing of valves: Part 1: Specification for production pressure testing requirements

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BS 6755-2	:	Testing of valves: Part 2: Specification for fire-testing requirements
BS 5352	:	Specification for steel wedge gate, globe and check valves 50 mm and smaller for the petroleum, petrochemical and allied industries
BS 1868	:	Specification for Steel check valves (flanged and butt-welding ends) for the petroleum, petrochemical and allied industries
BS 1873	:	Specification for steel globe and globe stop and check valves (flanged and butt-welding ends) for the petroleum, petrochemical and allied industries
BS EN 10204	:	Metallic Products – Types of Inspection Documents
BS EN ISO 15761	:	Steel gate, globe and check valves for sizes DN 100 and smaller, for the petroleum and natural gas industries
BS EN ISO 10434	:	Bolted bonnet steel gate valves for the petroleum, petrochemical and allied industries
OISD 106	:	Pressure Relief & Disposal System
OISD 118	:	Layouts for Oil & Gas Installations
OISD 130	:	Inspection of Piping System
OISD 244	:	Storage and handling of Petroleum Products at depots and terminals including standalone crude oil storage facilities
OISD STD-116	:	Fire Protection Facilities for Petroleum Refineries and Oil/Gas Processing Plants
OISD STD-117	:	Fire Protection Facilities for Petroleum Depots, Terminals, Pipeline Installations & Lube oil
OISD STD-144	:	Liquefied Petroleum Gas (gas
OISD STD-141	:	Design, Construction & Inspection Requirement for Cross Country Liquid Hydrocarbon Pipelines
OISD STD-226	:	Cross Country NG Pipeline
PNGRB	:	Petroleum and Natural Gas Regulatory Board
NFPA 30	:	Flammable and Combustible Liquids Code

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## **2.0 MATERIAL SPECIFICATIONS**

Individual piping class has been generally designed to cover a set of service operating within pressure-temperature consideration as per ASME B16.5/ B16.34 or part of it. Deviations of material from class specifications may occur due to specific design conditions and/or availability. These deviations are permissible if they equal or better the individual class requirements and shall be subjected to approval on case-to-case basis.

## **3.0 CLASS DESIGNATION CODE**

The piping class designation shall generally be combination of two digits and two to four letters e.g. 60HCML, 60HC, 60HLT, 30HC, 15HLT etc. as follows:

First two numerals letter indicates ASME class rating, e.g.

60	-	600 Class
30	-	300 Class
15	-	150 Class

The first alphabet indicates differences in the Fluid Services within the same class rating and material, e.g. H stands for Hydrocarbon, W stands for Water, etc.

The last one or two letter (as applicable) indicates type of material, e.g.

C	-	Carbon steel
LT	-	Low Temperature (Carbon Steel)
ML	-	Mainline (Last two letter i.e ML in 60HCML)

## **4.0 TECHNICAL REQUIREMENTS**

### **4.1 General Notes**

1. All piping materials selected under this specification shall be in compliance with the project specification.
2. Material selections shall comply with the maximum pressure and temperature limitation as specified in the service summary.
3. Substitution of equivalent materials is subject to approval of the VCS/CLIENT. All requests for substitution shall be accompanied with sufficient data, drawings and descriptive details to permit evaluation by the VCS/CLIENT.
4. Cast iron, ductile or malleable iron, aluminum, plastic or copper-bearing alloys shall not be used in hydrocarbon service.
5. Piping design pressure is based on flange maximum-allowable working pressure, unless otherwise noted in Job Specification.

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6. When required, impact testing shall comply with applicable standards and material specifications.
7. All gaskets shall be asbestos free.
8. Aluminum jumper shall be provided across the flanged joint and length of the bolt shall be taken such that at least two threads remain exposed after the nut for fixing the continuity jumper.

### 4.2 Other Piping class

#### For 900# LTCS (90 HLT) piping Class,

- Flange shall be WN, RTJ, CL 900, ASTM A350 GR.LF2 & Schedule/ Thickness shall be to match the connected pipe.
- Pipe material shall be as defined under 60HLT i.e., SMLS, C.S., ASTM A333 Gr.6, BE. Schedule /thickness shall correspond to 900# pressure
- Fittings (Tee, Elbow, reducer, Cap etc.) Material shall be BW, ASTM A420 WPL6 & Schedule/ Thickness shall be to match the connected pipe.
- Gasket Shall be Soft iron octagonal ring type joint gasket, CL 900, RTJ
- Bolting Shall be Stud bolts, ASTM A320 Gr.L7 with 2 heavy hexagonal nuts to ASTM A194 Gr.7

#### For 300# LTCS (30 HLT) piping Class,

- Material for Pipes, Flanges, fittings, gasket, bolting etc. shall be same as specified under 60HLT, schedule/ thickness shall correspond to 300# pressure

### 4.3 Units

1. All units are expressed in SI system with the exception of nominal pipe sizes (NPS) and bolting diameters, which are in inches.
2. Pressures are gauge pressures (in bars) and temperatures are in degrees Celsius (°C).
3. Pressures and Temperatures ratings are based ASME 16.5.

## 5.0 PIPES

- Carbon steel pipe shall be made by open hearth, electric furnace or basic oxygen process only. The steel used shall be made with fine grain structure. The grade and wall thickness of various sizes of pipes shall be as per piping material specification for the applicable class.

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- Pipe dimensions shall be in accordance with API 5L/ ASME B 36.10 / IS 1239 /IS 3589 for carbon steel.
- For butt weld end, bevel shall be in accordance with API 5L or ASME B16.25. Where difference in thickness of matching pipe ends exist, bevels for such matching pairs shall be prepared in accordance with ASME B 31.8.
- Pipes shall be supplied with beveled end. Beveling shall be in accordance with ASME B16.25. Where plain end pipes are specified, as for small bore pipes for socket welded piping, the pipes shall be supplied with square cut ends.
- Pipe shall preferably be supplied in double random lengths. Each length of pipe shall be subject to a hydrostatic test in accordance with the relevant code. Single random lengths will be accepted where specified in the Job Specification or for small diameter pipes or where double random lengths are unavailable.
- All pipe threads shall conform to American Standard taper as per ASME B 1.20.1 NPT, unless otherwise specified.
- Dimensions of socket weld ends shall confirm to ASME B 16.11. Bore shall match pipe OD and pipe ID.
- Pipe to pipe joints shall be made as follows:

For sizes upto & including DN40

Socket weld/ As per Piping Class

For size DN50 and above

Butt Welded

### 6.0 FITTINGS

- Carbon steel fittings shall meet the requirements of A105 and A234 as applicable. Carbon steel forgings shall be supplied with a maximum carbon content of 0.25% and CE of 0.45% by product analysis. Fittings manufactured from pipe shall comply with requirements specified for pipe.
- Fully killed carbon steel shall be used in the manufacture of fittings. The fitting shall have carbon equivalent not exceeding 0.45, based on check analysis.
- Threaded joints, if used, shall conform to American Standard taper as per ASME B1.20.1 NPT.
- Where austenitic stainless steel fittings are specified, they shall conform to ASTM A182 or A403 and the same material requirements specified for austenitic stainless steel pipe.
- Dimensions of metallic butt weld fittings shall be in accordance with ASME B16.9, with socket weld and threaded fittings to ASME B16.11.
- All 90° butt weld elbows shall be long radius (1.5D) unless space limitations dictate otherwise & VCS/CLIENT approval is given.

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- For fittings made of carbon steel, the beveled surface of the welding end shall be subjected to wet magnetic particle examination in accordance with practice E709. Personnel performing the examination shall be qualified in accordance with ASNT-TC-1A.
- For fittings made of wrought austenitic stainless steel, preferably, all the surfaces shall be liquid penetrate tested in accordance with Practice E165. Personnel performing the examination shall be qualified in accordance with ASNT-TC-1A.
- Repair by welding of wrought fittings shall not be allowed, without VCS/CLIENT approval.
- Welding components used for joining unequal wall thickness and/or yield strength materials shall be beveled in accordance with ASME B16.25, the properties of the welding material shall correspond to higher strength material.
- Beveled end fittings shall be of same thickness as that of attached pipe.
- Dimensions of socket welded/screwed fittings shall conform to ASME B 16.11. Swage shall be as per BS 3799.
- Dimensions of steel butt welded fittings shall be as per ASME B 16.9/ MSS SP 75 (As per piping class).
- All welded fittings shall be 100% examined by radiography in accordance with the ASME Sec. V article 2. Radiographic examination shall be carried out after final heat treatment.
- Bore of socket welded fittings shall suit outside diameter (OD) of pipe and its thickness.
- Butt welding ends shall conform to ASME B 16.25 as applicable.
- Integrally reinforced forged branch fittings such as Sockolet, Weldolet etc. shall be as per MSS-SP-97. Fittings not covered in ASME B16.9 and MSS-SP-97 shall conform to manufacturer's standard.
- Fittings thickness tolerances shall match pipe thickness tolerance.

### Threaded and Socket Weld Fittings

- Threaded and socket-welded fittings shall comply with ASME B16.11.
- Bushings, street elbows and close nipples may be used only with permission of the Client.
- Threaded half couplings are prohibited.
- Threads shall be per ASME B1.20.1 tapered.
- Thread sealant shall be Teflon tape.
- Fittings shall be marked and shipped in crates, grouped according to pressure/class rating where possible.

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- Pipe fittings, other than non-metallic shall be supplied with wall thickness and nominal sizes that meet the requirements of ASME B36.10M, B36.19M, B16.9, B16.11 and where allowed, B16.28.

### 7.0 BENDS

- Unless otherwise specified for process piping, elbow of radius  $R = 1.5 D$  shall only be used.
- In order to accommodate changes in vertical and horizontal alignment in piggable section of pipeline, Elastic bends/ Cold field bends/ Hot formed long radius bends shall be used. Radius of bend shall be as per Design Basis.

$D$  = Specified Outside Diameter

- Miters shall not be used.

### 8.0 FLANGES

- Pressure Temperature rating of flanges shall conform to B16.5/ MSS-SP44/ B16.47 Series A, as applicable.
- Dimensions of flanges shall be in accordance with B16.5/ MSS-SP44/ B16.47 Series A, as applicable.
- Weld-neck flanges and socket-weld flanges shall be provided with bore to match the attached pipe.
- Repair by welding is not permitted.
- Neck of weld neck (WN) flanges shall suit pipe bore and thickness.
- Bore of socket welded (SW) flanges shall suit pipe O.D. and its thickness.
- Threads for screwed flanges, if used, shall conform to American Standard taper as per ASME B 1.20.1 NPT.
- Sizes for blind flanges shall be indicated by nominal pipe size.
- Flange face finish for raised face flanges shall be as per ASME B16.5/ ASME B 16.47/ MSS SP 44 as applicable. For RTJ flanges groove finish shall be 32-63 micro inches AARH as per MSS-SP-6. Hardness of groove surface shall be minimum 140 BHN.
- Butt welding ends of WN flanges shall conform to ASME B 16.25.
- Spectacle blind/spacer & blinds shall be in accordance with ASME B 16.48/ manufacturer's standard.
- Two jackscrews, 180° apart shall be provided for all RTJ flange assemblies and Spacer blind/ Figure 8 assemblies. Holes for jackscrews shall be drilled and tapped at site. Jackscrews shall be as per ASTM A193 Gr. B7. Heads of jackscrews shall be heavy hexagonal type and jackscrew end shall be rounded. Dimensions shall be as per ASME B18.2.1.

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- Flanges shall be packed and shipped in such a way as to prevent damage of machined parts.
- All machined or threaded parts shall be protected in accordance with ASTM A700. Suitable protection shield, or cover shall be provided on the gasket contact surface.
- Carbon steel forgings shall be supplied with a maximum carbon content of 0.25% and CE of 0.45% by product analysis.
- The finish of contact faces of pipe flanges & connecting end flanges of valves & fittings shall be governed by ASME B16.5 & following:  
Roughness requirements (Finish: AARH standards per ASME B46.1):
  - a) Raised Face (RF): Serrated finish 125 to 250  $\mu$ inRa.
  - b) Flat Face (FF): Serrated finish 125 to 250  $\mu$ inRa.
  - c) Ring Type Joint (RTJ): Extra-smooth finish 63  $\mu$ inRa max.
- Flat face flanges, unless specified on the Piping Specifications, shall not be used without specific VCS/CLIENT approval. Full-face gaskets shall be used with flat-face flanges as per ASME B16.20.
- All flanged joints shall be installed with a single gasket between contact faces.
- Spectacle blank (figure 8 blank), blank (blind) & spacer shall confirm to the requirement of ASME B16.48 up to sizes 24". For 150#, 300# and 600# spectacle blank shall be used up to 8", blank (blind) & spacer for sizes 10" & above.

### 9.0 GASKETS

- Spiral wound metallic gasket with Graphite filled winding with SS304 inner ring and CS outer ring/ Soft iron octagonal ring type joint gasket, and shall conform to ASME B 16.20/ API 601
- Spiral wound gaskets shall be as per the following:
  - a) 0.175" (4.5mm) nominal thickness.
  - b) SS 316 windings.
  - c) Flexible super filler or equal.
  - d) Soft steel Centering ring 0.125" thick.
  - e) Design to ASME B16.20.
- Spiral wound gaskets shall have SS 316 windings with flexible graphite "fire rated" filler or approved equal, confirming to ASME B16.20.
- Ring type joint gaskets shall be oval or octagonal in section and shall conform to ASME B16.20 or to API 6A (as applicable).

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- Gasket hardness shall be as per ASME B16.20.
- Non-metallic gaskets, graphite coated or fiber reinforced gasket conforming to ASME B16.21 shall be used for potable water systems after approval of VCS/CLIENT.
- For Fire Water Compressed Non asbestos (CNAF) Full face gasket, 3mm Thick according to ASME B16.21 shall be used.
- Spiral wound gasket shall be self-aligning type.
- **Insulating Gasket:** Insulating gasket will generally be used when bolting dissimilar metal flanges. Insulating set is comprised of one phenolic resin central gasket with neoprene coating on faces, one phenolic sleeve per bolt, two phenolic washers per bolt and two steel washers per bolt, packed in an individual box. When bolting copper nickel, stainless steel or duplex stainless steel flanges together, similar sleeves and washers, less phenolic resin gasket, shall be utilized in conjunction with specified stud bolts and gaskets.

### 10.0 BOLTING & THREADS

- Nuts for stud bolts shall be American Standard Hexagon Heavy Series and double chamfered.
- Dimension and tolerances for stud bolts and nuts shall be as per ASME B18.2.1 and 18.2.2 with full threading to ASME B 1.1 Class 2A thread for bolts and Class 2B for nuts. Diameter and length of stud bolts shall be as per ASME B16.5/ASME B16.47 with full threading.
- Threads for nuts shall be as per ASME B 1.1 as follows:

Nuts for stud bolts Dia ¼" to 1"	:	UNC-2B
Nuts for stud bolts Dia 1⅛" to 3¼"	:	8UN-2B
- Threads for stud bolts shall be as per ASME B 1.1, as follows:

Stud bolts Dia ¼" to 1"	:	UNC-2A
Stud bolts Dia 1⅛" to 3¼"	:	8UN-2A
- Threads for threaded pipe, fitting, flanges and valve shall be in accordance with B1.20.1 taper threads, unless specified otherwise.
- Heads of jack screws shall be heavy hexagonal type. Jack screw end shall be rounded. Stud bolts shall be fully threaded with two hexagonal nuts.

### 11.0 THREAD SEALANT

- Threaded joints shall be made with 1" wide PTFE jointing tape.

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### 12.0 VALVES

- Valve ends shall be as per valve data sheets for various piping class.
- Sectionalizing valves, Block valves and other isolation valves installed on the main pipeline shall be ball valves with butt welding ends. All inline isolation valves on the mainline (pipeline) shall be full bore valves to allow smooth passage of cleaning as well as intelligent pigs.
- All buried valves shall be provided with stem extension shall have Butt Welded ends as per relevant specification/ data sheet.
- All valves in the piggable section of pipeline and Main Process Flow Line shall be Full Opening valve as per API 6D. Other valves shall be Reduced Opening type unless specified otherwise in P&ID.
- Flange dimensions and face finish of flanged end valves shall conform to clause 11.0 of this specification.
- Butt welding ends of Butt Welded valves shall conform to ASME B 16.25.
- Face to face and end to end dimensions shall conform to applicable standards.
- Valves shall conform to following standards unless specified otherwise in piping material specification for various piping class.

#### **Flanged/Socket Welded end valves (1½" and below)** **Design STD. for Process lines**

Gate Valves	:	API 602/ ISO 15761
Globe Valves	:	API 602/ ISO 15761
Check Valves	:	API 602/ ISO 15761
Ball Valve	:	API 6D / ISO 17292
Plug Valve	:	BS 5353

#### **Flanged/Butt Welded end valves (2" and above)** **Design STD. for Process Lines**

Gate Valves	:	API 600/ ISO 10434
Globe Valves	:	BS 1873
Check Valves	:	API 6D/ BS 1868
Ball Valve	:	API 6D
Plug Valve	:	API 6D

- Actuated valves shall have electric motor or Electro Hydraulic or Pneumatic actuator.

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- Actuated valves shall be as per P & IDs. The actuator shall have provision for remote operation as per P & IDs. All Actuated valves shall have additional provision of hand wheel operation.
- Valve selection shall be in accordance with the relevant Piping Standard & P&ID.
- Valves size 2" and above which are described as Outside Screw and Yoke (OS&Y) with rising stem and non-rising hand wheel shall be provided with stem protectors and visual position indicators.
- Valves provided with integral by-passes shall conform to the same Piping Specification as the principal valve. The bypass valve shall be a globe or ball valve. The manufacturer of the principal valve shall furnish and install the bypass complete with valve.
- Handwheels shall be made of carbon steel, ductile iron, or malleable iron.
- Chain wheel operator when required by Job Specification and shall be adequate for the pressure and temperature with chain guides. Chain operated valves, size 10-inch and larger, shall be provided with an impact hammer. Hammer-blow operators shall not be provided for cast-iron valves or valves with cast-iron wheels.
- Valves shall be bi-directional unless valve construction specifically renders this requirement impractical – e.g. Globe, Ball and Needle valves. For uni-directional valves, an indicator showing flow direction shall be engraved or cast/forged into the valve body.
- Vent and drain valves shall comply with the Job Specification and shall be adequate for the pressure and temperature limitation indicated in the relevant Material Specification.
- Valve position indicators shall be designed so as to prevent incorrect orientation on valve assembly.
- Quarter turn valve handles shall be lever lock type as specified in the purchase requisition or data sheet.
- Gearbox operators shall be sized to provide an output torque of at least 150% of the maximum required valve operating torque. Gearbox ratios shall be 60:1 maximum for valves 8" and smaller and 120:1 maximum for valves 10" and larger. Maximum operating force required to operate the valve shall be within 25 Kgf. Where indicated in the Job Specification, gear operators are to be supplied and shall be the manufacturer's standard heavy duty models selected to provide the valve torque requirements. Gear boxes shall be fitted with position indicators, have self-locking mechanisms, and be fully sealed and protected to suit a very corrosive marine environment.
- Bonnet gaskets may be to the manufacturer's standard, provided that the standard is equal to, or better than, that of associated flange gaskets.

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- All manual operated valves shall be provided with wrench / hand wheel or gear operator as specified here in below:

Type of Valve	Class Rating	Size(DN) mm	Operator
Gate	150 & 300	Upto 250	Hand Wheel
		300 and above	Gear Operator
	600	Upto 200	Hand Wheel
		250 and above	Gear Operator
Globe	150 & 300	Upto 250	Hand Wheel
		300 and above	Gear Operator
	600	Upto 200	Hand Wheel
		250 and above	Gear Operator
Ball	150 & 300	Upto 100	Wrench
		150 and above	Gear Operator
	600	Upto 50	Wrench
		100 and above	Gear Operator

- In addition to above requirement whenever indicate in datasheet all pressure containing parts of valves shall be impact tested according to API 6D Para 7.3 even if design temperature is greater than  $-20^{\circ}\text{F}$  ( $-29^{\circ}\text{C}$ ).
- All valves shall be marked in accordance with MSS SP-25.
- Vendor to provide valid API monogram for API designed valves
- Hydrostatic test fluid shall have a chlorine content of less than 200 ppm for carbon steel valves and less than 30ppm for stainless steel valves.
- Material certificate per BS EN 10204 Type 3.2 or COMPANY approved certificate shall be provided for all the pressure containing parts of the valves.
- All valves shall be shipped in the closed position except ball valves, which shall be shipped in the open position.

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- Valve ends, and stuffing box shall be covered with close fitting protectors (e.g. plastic caps) to protect the machined parts and prevent ingress of dirt and moisture.

### 13.0 QUICK OPENING END CLOSURE

Quick opening end closure to be installed on scraper traps shall be designed in accordance with Section VIII of ASME Boiler and Pressure Vessel Code and equipped with safety locking devices in compliance with Section VIII, division 1, ASME Boiler and Pressure Vessel Code.

### 14.0 VENTS AND DRAINS

- All above ground piping, vents and drains shall be provided with isolation valve. Vents and drains size shall be as follows:

Line Size	Vent/ Drain Size	Description
Upto DN40	DN20	SW, flanged with Ball valve for isolation
DN50 and above	As per P&ID	BW, flanged with isolation valve as per P&ID

- High point vents and low point drains required for hydrostatic testing shall be of size DN 20 consisting of threadolet and plug.

### 15.0 PIPING SPECIALITY ITEMS


- Primary material Pipeline specialty items viz. flow tees, insulating joints, LR bends etc. has been shown under 60HCML piping class however detailed design shall be as per respective data sheets and specification.
- For mainline items, corrosion allowance shall be as per respective data sheet.

### 16.0 INSULATING GASKET, SLEEVE AND WASHER

The insulating gasket shall consist of a PTFE (Teflon) spring-energized face seal, or an elastomeric O-ring, seated in an isolating laminate, which shall be permanently bonded to a high strength metal gasket core. Due to this unique pressure activated sealing mechanism, the gasket requires far less bolt stress to seal than any other gasket. The gasket inner diameter shall be exactly matched to the flange bore to eliminate turbulent flow and flange face erosion/ corrosion. The seal elements shall be replaceable in the reusable gasket retainer. The core of gasket shall be made of annealed 316 stainless steel or other metals including duplex and Inconel etc.

Insulating gasket shall include the following applications,

- Flange isolation in conjunction with cathodic protection.

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- Isolation between dissimilar metals to prevent galvanic corrosion.
- Mating mismatched ring-joint to raised-face flanges.
- Eliminate fluid trap corrosion between ring-joint (RTJ) flanges where high concentrations of CO<sub>2</sub>, H<sub>2</sub>S and other aggressive hydrocarbon media are present.
- Eliminate turbulence and flow induced erosion between ring-joint (RTJ) flanges.
- Protect against coating impingement on coated flange faces.
- To seal between flanges subjected to vibration/ cavitation.

### 19.1 Insulating Gaskets, Sleeves and Washer Materials Properties

Compressive Strength	:	65000 psi
Average Dielectric Strength	:	15 kV or more
Electrical Resistance	:	>1 MΩ (When tested with 500-1000 V DC merger)
Max. Operating Temperature	:	302°F (150°C)
Min. Operating Temperature	:	(-) 200°F (-129°C)
Water Absorption	:	5%
Flexural Strength	:	70000 psi
Tensile Strength	:	50000 psi
Bond Strength	:	18 MPa
Shear Strength	:	152 Mpa

### 19.2 Seal Material

The sealing elements shall intended to provide an impervious barrier through which no contained media or other substance can penetrate. The composite retainer backing material behind the seal remains uncontaminated and thus permanently holds the seal in place in a static, fully encapsulated manner.

Viton as a seal material shall consist following properties,

- General purpose oilfield elastomer.
- Excellent resistance to aliphatic hydrocarbons, glycols and H<sub>2</sub>S.
- Good resistance to aromatic hydrocarbons.

#### Isolating Sleeve

Mylar as a seal material shall consist following properties,

- Spiral wound Mylar is a general purpose material recommended for bolting application with flange temperatures below 250°F.

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- Material shall be fair resistance to crushing, cracking, breaking and thread pinch.

Isolating washer: 1/8" (0.125) Thick washer

Steel Washer: ZPS standard – Zinc plated steel washers.

Butt weld (BW) ends of the insulating assembly shall be protected by metallic or high impact plastic bevel protectors.

The dimensions of insulating components (gaskets, sleeves and washers) shall be as indicated in Data Sheet. The insulating gasket and washers shall have adequate compressive strength to permit proper tightening of flange bolts for leak proof joint.

The insulating material shall be suitable for pressure and temperature indicated in Data Sheet under connecting pipeline details and shall be resistant to the fluid to be handled through the pipeline.

I.D. and O.D. of insulating washers shall be designed to fit over insulating sleeves and within spot faces on flanges.

After the hydrostatic test, insulating flange assembly shall be tested with air at 5 kg/cm<sup>2</sup> for 10 minutes. The tightness shall be checked by immersion or with a frothing agent. No leakage shall be accepted.

Insulating gasket, sleeve and washer after the field hydrostatic test shall be tested for dielectric integrity at 5000 V A.C., 50 Hz for one minute and the leakage current before and after shall be equal. Testing time, voltage and leakage shall be recorded and certified. The test shall be carried out in dry conditions.

### 17.0 CHARPY V-NOTCH TEST & HARDNESS TEST

All Carbon Steel materials used in the manufacture of pressure containing components for sizes 2" & above shall be impact tested at (-)29°C for CS/ (-)45°C for LTCS and checked for hardness. Charpy V-notch impact tests are required for the base metal, weld metal and heat-affected zone (HAZ).

Unless specified otherwise in detailed specification the impact test values and hardness values shall be as follows:

#### Impact Test Values

Specified minimum tensile strength (MPA)	Average of three specimen (J)	Minimum for single specimen (J)
<=586	27	21
587-688	27	21

#### Hardness Test Values:

Hardness shall not exceed 248 HV<sub>10</sub>.

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## **Appendix – A**

### **Piping Class – Index**

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### Piping Class – Index

Piping Specification	Rating	C. A. (MM)	Basic Material	Service	Remarks
30HC	300	1.5	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON- LETHAL- HYDROCARBONS	-

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## **Appendix – B**

### **Piping Class**

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<b>PIPE CLASS</b>	<b>30HC</b>
DESIGN CODE	ASME B31.8
RATING	300#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Non-IBR
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

### Temperature (Deg. C) and Pressure (Kg/cm<sup>2</sup>g) Ratings

Temperature	-29	38	93	149	204	260	316
Pressure	52.02	52.02	47.45	46.05	44.64	42.18	40.66

### NOTES:

- All vents and drains shall be provided with gate valve with blind flange assembly unless otherwise indicated in P&ID.
- NDT of welds shall be as follows:
  - Radiography : All butt welds 100%
  - MPI : Socket welds 100%
- Piping design as per ASME B 31.8, OISD 226 & PNGRB Guidelines
- Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 29°C.
- Corrosion allowance of 1.5 mm has been considered for terminal piping.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- For valves, refer valve data sheets as enclosed.
- Design Factor 0.5
9. Ball Valve to be used in main pipeline shall have butt welded ends.

ITEM	SIZE	DESCRIPTION
Maintenance joints	ALL	Flanged, to be kept minimum
Pipe joints	1.5" & BELOW	SW coupling
	2.0" & ABOVE	Butt welded
Drains	ON LINES <= 1.5"	Refer std. drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. drawing

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### Branch Table

<b>CODES</b>	<b>DESCRIPTION</b>
T	Tees
W	Weldolet
S	Sockolet

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch . / Thk	Dmn. STD	Material (Charpy)	Description
<b>PIPE GROUP</b>						
PIPE	00.500	00.750	XS	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	01.000	02.000	XS	B-36.10	ASTM A 106 GR. B	PE, SEAMLESS
PIPE	03.000	03.000	STD	B-36.10	ASTM A 106 GR. B (CHARPY)	BE, SEAMLESS
PIPE	04.000	4.000	6.4MM	B-36.10	ASTM A 106 GR. B (CHARPY)	BE, SEAMLESS
PIPE	6.000	18.000	STD	B-36.10	ASTM A 672 Gr B65 CL-12 (CHARPY)	BE, SEAMLESS
NIPPLE	00.500	01.500	M	B-36.10	ASTM A 106 GR. B	PBE, SEAMLESS
<b>FLANGE GROUP</b>						
FLNG.SW	00.500	01.500		B-16.5	ASTM A 105	300, RF/125AARH
FLNG.WN	02.000	18.000		B-16.5	ASTM A 105 (CHARPY)	300, RF/125AARH
FLNG.BLIND	00.500	01.500		B-16.5	ASTM A 105	300, RF/125AARH
FLNG.BLIND	02.000	18.000		B-16.5	ASTM A 105 (CHARPY)	300, RF/125AARH
FLNG.FIG.8	00.500	01.500		ASME- B 16.48	ASTM A 105	300, FF/125AARH

Item	Lower Size (Inch)	Upper Size (Inch)	Sch . / Thk	Dmn. STD	Material (Charpy)	Description
FLNG.FIG.8	02.000	08.000		ASME- B 16.48	ASTM A 105 (CHARPY)	300, FF/125AARH
SPCR&BLND	10.000	18.000		ASME- B 16.48	ASTM A 105 (CHARPY)	300, FF/125AARH
<b>FITTING GROUP</b>						
ELBOW.90	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
ELBOW.90	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
ELBOW.90	02.000	18.000		B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW, 1.5D
ELBOW.45	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
ELBOW.45	01.000	01.500		B-16.11	ASTM A 105	SW, 3000

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ELBOW.45	02.000	18.000		B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW, 1.5D
T. EQUAL	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
T. EQUAL	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
T. EQUAL	02.000	18.000		B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
T.RED	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
T.RED	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
T.RED	02.000	18.000		B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. CONC	02.000	18.000		B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. ECC	02.000	18.000		B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
SWAGE. CONC	00.500	03.000		BS-3799	ASTM A 105 (CHARPY)	PBE
SWAGE. ECC	00.500	03.000		BS-3799	ASTM A 105 (CHARPY)	PBE
CAP	00.500	00.750		B-16.11	ASTM A 105	SCRIF, 6000
CAP	01.000	01.500		B-16.11	ASTM A 105	SCRIF, 3000
CAP	02.000	18.000		B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
PLUG	00.500	00.750		B-16.11	ASTM A 105	SCRM, 6000
PLUG	01.000	01.500		B-16.11	STM A 105	SCRM, 3000
CPLNG.FULL	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
CPLNG.FULL	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.HALF	00.500	0.750		B-16.11	ASTM A 105	SW, 6000
Item	Lower Size (Inch)	Upper Size (Inch)	Sch . /Thk .	Dmn. STD	Material (Charpy)	Description
CPLNG.HALF	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.LH	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
CPLNG.LH	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.RED	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
CPLNG.RED	01.000	01.500		B-16.11	ASTM A 105	SW, 3000

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O'let						
SOCKOLET	00.500	00.750		MSS-SP97	ASTM A 105	SW, 6000
SOCKOLET	01.000	01.500		MSS-SP97	ASTM A 105	SW, 3000
WELDOLET	02.000	08.000		MSS-SP97	ASTM A 105 (CHARPY)	BW
VALVE GROUP						
VLV.GATE	00.500	01.500		API-602	BODY-ASTM A 105, TRIM- STELLITED, STEM 13%	SW, 800, 3000, B-16.11
VLV.GATE	02.000	18.000		API 600/ ISO 10434	BODY-ASTM A 105/ ASTM A 216 GR.WCB STELLITED, STEM- SS304	FLGD, 300, B-16.5, RF/125AARH
VLV.GLOBE	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 105, TRIM- STELLITED, STEM- 13%	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	18.000		BS 1873	BODY-ASTM A 105 / ASTM A 216 GR.WCB, TRIM-13% CR. STEEL	FLGD, 300, B-16.5, RF/125AARH
VLV.CHECK	00.500	01.500		BS EN ISO 15761	BODY-ASTM A 105, TRIM- STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	18.000		API-6D/BS-1868	BODY-ASTM A 105 / ASTM A 216 GR.WCB	FLGD, 300, B-16.5, RF/125AARH
VLV.BALL	00.500	01.500		BS EN ISO 17292	BODY-ASTM A 105,	SW, 800, B-16.11, RF/125AARH
VLV.BALL	02.000	18.000		API-6D	BODY-ASTM A 216 GR.WCB/ ASTM 105	FLGD, 300, B-16.5, RF/125AARH
VLV.BALL	02.000	18.000		API-6D	BODY-ASTM A 216 GR.WCB/ASTM 105,	BW, 300, B-16.25
VLV.PLUG	00.500	01.500		BS-5353	BODY-ASTM A 105, PLUG-A105 +0.003" ENP	SW, 800#, 3000, B-16.11
VLV.PLUG	02.000	18.000		API-6D	BODY- A 216GR. WCB, PLUG: A216 GR.WCB + 0.003" ENP	FLGD, 300, B-16.5, RF/125AARH
VLV.PLUG	02.000	18.000		API-6D	BODY-ASTM A 216 GR.WCB, PLUG: A216 GR.WCB + 0.003"ENP	BW, 300, B-16.25
BOLT GROUP						

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BOLT.STUD	00.500	18.000		B-18.2	BOLT: A193 GR. B7, NUT: A194	
<b>GASKET</b>						
GASKET	00.500	18.000		B-16.20- ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300
GASKET	26.000	18.000		B-16.20- ANSI B16.47A	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300

Note: For Valve Material, valve data sheet shall also be referred, stringent requirement among data sheet and above details shall be followed.

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**PROJECT NUMBER: C261162**



HPOIL GAS

**ITP FOR INSTRUMENT ITEMS**

Total Sheets

4

**Document No**

C261162

00

IN

ITP

5004

# **HPOIL GAS PRIVATE LIMITED CITY GAS DISTRIBUTION PROJECT IN NAGALAND STATE GAS**

## **SUPPLY OF CHECK METERING SKID AT DIMAPUR FOR THE STATE OF NAGALAND**

C1	31.07.25	Issued for Client Review	PS	AS	PK
<b>REV</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>PREP</b>	<b>CHKD</b>	<b>APPR</b>





# SUPPLY OF CHECK METERING SKID AT DIMAPUR FOR THE STATE OF NAGALAND



## INSTRUCTIONS FOR FILLING UP:

1. QAP shall be submitted for each equipment separately with breakup of assembly / sub-assembly & part/component or for group of equipment having same specification.
2. Use numerical codes as indicated for extent of inspection & tests and submission of test certificates & documents. Additional codes & description for extent of inspection & test may be added as applicable for the plant and equipment's.
3. Separate identification number with quantity for equipment shall be indicated wherever equipment having same specifications belonging to different facilities are grouped together.
4. Weight in kilogram must be indicated under column 5 for each item. Estimated weights may be indicated wherever actual weights are not available.

### ABBREVIATION USED:

CONTR: Contractor  
MFR: Manufacturer  
TPI: Third Party Inspection Agency  
\*: Vendor / Bidder to provide  
P: Performer, R: Review; W: Witness

**EN 10204, Type 3.2 certificates shall be provided for bought out items. Those shall be inspected by TPI appointed by Vendor**

## CODES FOR EXTENT OF INSPECTION, TESTS, TEST CERTIFICATES & DOCUMENTS :

CODE DESCRIPTION	CODE DESCRIPTION	CODE DESCRIPTION	CODE DESCRIPTION
1. Visual 2. Dimensional 3. fitment & alignment 4. Physical Test (Sample) 5. Chemical test(Sample) 6. Ultrasonic test 7. Magnetic particle test(MPT) 8. Radiography test 9. Dye Penetrant test 10. Measurement of IR value a) Before HV test b) After HV test 11. High voltage test/Dielectric Test	12. Routine test as per relevant IS other standard 13. Type test as per relevant IS/ other standard 14. Impulse Test 15. Partial Discharge Test 16. Heat run risk test/temper 17. Enclosure protection test 18. Calibration 19. Noise & Vibration 20. Test certificate of bought out components 21. Tank pressure test 22. Paint shed vibration	23. Short time rating 24. Operational & functional test 25. Over speed test 26. Flame proof Test 27. Clearance and creepage distance 28. Acceptance test 29 Honing Test 30 Hydro test/ Shell leak test 31 Pneumatic Seat leak test 32 Impact test	D1. Approved GA Drawing. D2. Approved single line/ schematic diagram D3. Test certificates D4. Approved Bill of materials D5. Un-priced P.O. copy D6. Calibration certificates of all measuring instrument And gauges.

Equipment Details							Inspection & Test								
S No.	Item	Identification Number	Qty	Weight Kg	Exp Date of Inspec tion	MFR Name & Address	In-Process Stage			Final Inspection			Test certificate & Document to be submitted to NRL	Acceptance Criteria standards/ IS/BS/ASM E/ Norms and documents	Rem ark / Sam pling Plan
							MFR	CONTR & TPI	NEGD CL	MFR	CONTR & TPI	NEGDCL			
1.	Gauges	Refer P&ID	*	*	*	NEGDCL Approved	1,2,3,4 ,5 – P	-	-	1,2,3,1 8,20 –	1,2,3,18,20 -R ,24 - W	1,2,3,18, 20,24 –R	1,2,3,4,5,18,20, 24,D3, D6	D3,D6, Tech.spec	100%

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# SUPPLY OF CHECK METERING SKID AT DIMAPUR FOR THE STATE OF NAGALAND



									P						
2.	RTD	Refer P&ID	*	*	*	NEGDCL Approved	1,2,3,4 ,5 - P	-	-	1,2,3,1 8,20 - P	1,2,3,18,20 -R ,24 - W	1,2,3,18, 20,24 -R	1,2,3,4,5, 18,20,24,D3,D6	D3,D6, Tech. spec	100%
3.	Transmitters	Refer P&ID	*	*	*	NEGDCL Approved	1,2,3,4 ,5 - P	-	-	1,2,3,1 8,20 - P	1,2,3,18,20 -R ,24 - W	1,2,3,18, 20,24 -R	1,2,3,4,5, 18,20,24,D3,D6	D3, D6, Tech. spec	100%
4.	Thermowells	Refer P&ID	*	*	*	NEGDCL Approved	1,2,3,4 ,5 - P	-	-	1,2,3,1 8,20 - P	1,2,3,18,20 -R ,24 - W	1,2,3,18, 20,24 -R	1,2,3,4,5, 18,20,24,D3,D6	D3, D6, Tech.spec	100%
5.	Relief Valve	Refer P&ID	*	*	*	NEGDCL Approved	1,2,3,4 5,8,30, 32 - P	-	-	1,2,3,5 ,8,20,1 8,24,3 1 - P	1,2,3,5,8,20,1 8,24,30, 31,32 -R	1,2,3,5,8 ,20,18, 24,30,31 ,32 -R	1,2,3,5,8,18,20, 24, 30,31,32D1, D3,D4,D6	D3, D6, Tech.spec	100%
6.	Turbine Flow meter	Refer P&ID	*	*	*	NEGDCL Approved	1,2,3,4 , 5 - P	-	-	1,2,3,1 8,20 - P	1,2,3,18,20 - R, 24 - W	1,2,3,18, 20, 24 R	1,2,3,4,5,18,20, 24,D3, D6	D3, D6, Tech.spec	100%
7.	RPD Meter	Refer P&ID	*	*	*	NEGDCL Approved	1,2,3,4 , 5 - P	-	-	1,2,3,1 8,20 - P	1,2,3,18,20 - R, 24 - W	1,2,3,18, 20, 24 R	1,2,3,4,5,18,20, 24,D3, D6	D3, D6, Tech.spec	100%
8.	Flow Computer	Refer P&ID	*	*	*	NEGDCL Approved	1,2,3,4 ,5 - P	-	-	1,2,3,1 8,20 - P	1,2,3,18,20 -R ,24 - W	1,2,3,18, 20,24 -R	1,2,3,4,5, 18,20,24,D3,D6	D3, D6, Tech.spec	100%
9.	MOV Actuator	Refer P&ID	*	*	*	NEGDCL Approved	1,2,3,4 ,5 - P	-	-	1,2,3,1 8,20 - P	1,2,3,18,20 -R ,24 - W	1,2,3,18, 20,24 -R	1,2,3,4,5, 18,20,24,D3,D6	D3, D6, Tech.spec	100%



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10.	FAT Procedure	-	-	-	-	NEGDCL Approved	-	-	-	P	R	R	FAT Procedure	Test record	100%
11.	SAT Procedure	-	-	-	-	NEGDCL Approved	-	-	-	P	R	R	SAT Procedure	Test record	100%
12.	Factory Acceptance Test	As per approved P&ID, GAD, datasheets, FAT	*	*	*	NEGDCL Approved				1,2,3,1 2,24 Loop check, Power on, Cal. verification	1,2,3,12,24 Loop check, Power on, Cal. verification	1,2,3,12,24 Loop check, Power on, Cal. verification	FAT Test Report	Approved FAT procedure and other relevant doc.	100%
13.	Site Acceptance Test	As per approved P&ID, GAD, datasheets, SAT procedure, FAT Report	*	*	*	NEGDCL Approved				1,2,3,1 2,24 Loop check, Power on, Cal. verification	1,2,3,12,24 Loop check, Power on, Cal. verification	1,2,3,12,24 Loop check, Power on, Cal. verification	SAT Test Report	Approved SAT procedure and other relevant doc.	100%

## Notes:

- 1) The QAP for the Complete Fabricated Metering Skid shall be submitted by the Vendor in accordance with the Test Procedures mentioned in the Doc No. VCS-SS-IN-5601 Rev.02 attached elsewhere in the Tender Document.
- 2) The QAP for Individual Items of the Skid shall be submitted by the Vendor in accordance with Tests mentioned in this QAP and the Test Procedures mentioned in the Standard Specification of each individual item.



## VCS QUALITY SERVICES PVT. LTD.

### INSPECTION AND TEST PLAN FOR BALL VALVE VCS – ITP – PP – 2007

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04	27/05/2022	SR	MC	HK	GW
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Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
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CONTROLLED COPY	:	If in soft and signed

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	16/06/2017					
		GS	ADE	AD	SK	
01	20/01/2020					Formatting update, Doc Numbering change from VCS-SD-ITP-007 to VCS-ITP-PP-2007
		AG	MC	AD	SK	
02	19/05/2020					Revised as Marked
		AG	MC	AD	SK	
03	19/12/2021					Revised as Marked
		SR	MC	HK	HK	
04	27/05/2022	<i>R. Jain</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	Revised as Marked
		SR	MC	HK	HK	

**ABBREVIATIONS:**

CE	Carbon Equivalent	NDT	Non-Destructive Testing
DCN	Dispatch Clearance Note	PO	Purchase Order
DFT	Dry Film Thickness	PQR	Procedure Qualification Record
DPT	Dye Penetrant Testing	PR	Purchase Requisition
HT	Heat Treatment	RT	Radiography Testing
ITP	Inspection and Test Plan	TC	Test Certificate
IC	Inspection Certificate	TPI or TPIA	Third Party Inspection Agency
IGC	Inter Granular Corrosion	UT	Ultrasonic Testing
IR	Inspection Report	VDR	Vendor Data Requirement
IRC	Inspection Release Certificate	WPQ	Welders Performance Qualification
MPT / MT	Magnetic Particle Testing	WPS	Welding Procedure Specification
MTC	Material Test Certificate		

**LEGENDS:**

**H** - Hold (Do not proceed without approval)

**W** - Witness (Give due notice, work may proceed after scheduled date)

**P** - Perform

**R** - Review

**RW** - Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)]

### 1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of Ball Valves.

### 2.0 REFERENCE DOCUMENTS:

PO / PR / Standards referred there in / Job specifications / Approved documents.

### 3.0 INSPECTION AND TEST REQUIREMENTS:

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
1.0	PROCEDURES							
1.1	Hydrostatic Test, NDT and Other Procedures	Documented Procedures	100%		Procedure Documents	-	H	R
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%		WPS ,PQR & WPQ	-	H	W- New R- Existing
1.3	Pre-Qualification Tests	Fire safe, Cryogenic & Other Test as applicable	As per PR/Purchase Specification		Acceptance Report	-	H	H (If new)
2.0	RAW MATERIAL							
2.1	Forging / Casting:							
	1) Body	Visual & Dimension	100%	Material & Technical Specification	Inspection Report	H	H	-
	2) End Piece	Chemical: Chemical Analysis IGC (For SS component)	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
	3) Ball							
	4) Seat Ring							
	5) Pup Piece (as applicable)	Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	W (Note-1)

**INSPECTION AND TEST PLAN  
FOR  
BALL VALVE**

**DOC NO: VCS-ITP-PP-2007  
Rev No : 04**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
		Impact Test (@ - 29°C): for CS Impact Test (@ - 45°C): for LTCS	All Heats	Material & Technical Specification / ASME B 16.34	Test Report	H	R	W (Note-1)
		Non-Destructive Examination (NDT): Radiography (100% Critical Area)	100%	Material & Technical Specification / ASME B 16.34	RT Report	H	R (RT-Film review)	R (RT-Film review)
		Non-Destructive Examination (NDT): Magnetic Particle Examination (100% exterior & accessible interior)	100%	Material & Technical Specification / ASME B 16.34	MPI Report	H	R	R
		ENP (For Ball): Visual, Thickness & Hardness	100%	25 microns (min) & 50 HRC (min)	Vendor Test Certificate	H	R	R
<b>3.0</b>	<b>INCOMING / BOF ITEMS</b>							
3.1	Stem	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
3.2	Fasteners	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	H	R	R
		Impact Test (@ - 29°C): for CS Impact Test (@ - 45°C): for LTCS	All Heats	Material & Technical Specification / ASME B 16.34	Test Report	H	R	R
3.3	Gaskets, Gear units, Gland, Packings, etc.	Physical / Chemical Properties	100%	Material & Technical Specification	Test Certificates & Lab Report	H	R	R



**INSPECTION AND TEST PLAN  
FOR  
BALL VALVE**

**DOC NO: VCS-ITP-PP-2007  
Rev No : 04**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
4.0	MACHINED COMPONENTS							
4.1	Body, Connector, Ball & Seat Ring	Surface examination & Dimension Inspection: Visual & Measurement	100%	Manufacturer’s Drawing	Inspection Reports	100%	R	R
5.0	IN-PROCESS							
5.1	Body & Connector joint welding	Non-Destructive Examination (NDT): Magnetic Particle Examination (MPI)	100%	ASME Sec VIII - Appendix V & VI	MPI Report	100%	R	R
5.2	Valve & Pup Piece Bevel Ends joint welding	Non-Destructive Examination (NDT): Radiography (100% on weld joint)	100%	ASME B16.34	RT Report	100%	R (RT-Film review)	R (RT-Film review)
6.0	FINAL INSPECTION							
6.1	Finished Valve Assembly: Pressure Test & Final Inspection	Shell Test: Hydrostatic	100%	Testing Procedure as per Code	Test Record	-	H	RW
6.2		Seat Test: Hydrostatic				-	H	RW
6.3		Seat Test: Pneumatic				-	H	RW
6.4		Functional Test - Actuated Valve @ Atm. Pressure & Max. Diff. Pressure: Operation- Open / Close				-	H	RW
6.5		Double Block & Bleed: Hydrostatic				-	H	RW
6.6		Final Inspection: Visual, Dimension, TC Verification, Special Requirements & Marking as per sale order	100%	Approved GA Drawing (if applicable)	Test Report	-	H	RW
6.7		Anti-Static Test	100%	API 6D & Technical Specification	Test Record	-	H	RW

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS / METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUB VENDOR	VENDOR	TPIA
6.8		Fire Safe Test	100%	API-6FA / ISO-10497	Fire safe type test report	-	H	R
6.9	Final Stamping	Stamping Of Accepted Valves	Stamping of Valves which are witnessed by VCS/TPIA	As per Tender Specification	Inspection Report	-	H	H
6.10	Strip Test	Component integrity, PMI of BOM	One per size per rating	-	Test report	H	H	H
<b>7.0</b>	<b>PAINTING &amp; PACKING</b>	Surface examination & DFT Inspection: Visual & Measurement	100%	As per Tender Specification	Painting Record	-	H	R
<b>8.0</b>	<b>DOCUMENTATION &amp; INSPECTION CERTIFICATE(IC)</b>	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	As per Tender Specification	Vendor TC & IC	-	H	H
<b>9.0</b>	<b>FINAL DOCUMENTATION &amp; SUBMISSION OF REPORTS</b>	Compilation of IR/IRC/DCN/MTC/DRGS./VDR	100%	EN 10204 type 3.2/3.1 certification as specified in valve datasheet (Note-1)	Compliance Certificate	-	H	-

**NOTES (As applicable):**

1. If the certification is specified as EN 10204 Type 3.1 in Data sheet / Material Requisition, then 'W' may be replaced with 'R' with Material Traceability.
2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.






ENERGISING QUALITY

## VCS QUALITY SERVICES PVT. LTD.

### INSPECTION AND TEST PLAN FOR GATE/GLOBE/CHECK VALVES VCS –ITP –PP –2008

02	27/05/2022	SR	MC	HK	GW
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
UNCONTROLLED COPY	:	If printed			
CONTROLLED COPY	:	If in soft and signed			

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	22/04/2020					Revised as Marked
		MB	MC	AD	SK	
01	19/12/2021					Revised as Marked
		SR	MC	HK	HK	
02	27/05/2022	<i>R. Jaisankar</i>				Revised as Marked
		SR	MC	HK	GW	

<b>ABBREVIATIONS:</b>			
CE	Carbon Equivalent	NDT	Non-Destructive Testing
DCN	Dispatch Clearance Note	PO	Purchase Order
DFT	Dry Film Thickness	PQR	Procedure Qualification Record
DPT	Dye Penetrant Testing	PR	Purchase Requisition
HT	Heat Treatment	RT	Radiography Testing
IC	Inspection Certificate	TC	Test Certificate
IR	Inspection Report	TPI or TPIA	Third Party Inspection Agency
IRC	Inspection Release Certificate	UT	Ultrasonic Testing
ITP	Inspection and Test Plan	VDR	Vendor Data Requirement
MPT/MT	Magnetic Particle Testing	WPQ	Welders Performance Qualification
MTC	Material Test Certificate	WPS	Welding Procedure Specification
<b>LEGENDS:</b>			
<b>H</b> - Hold (Do not proceed without approval)			
<b>W</b> - Witness (Give due notice, work may proceed after scheduled date)			
<b>P</b> - Perform			
<b>R</b> - Review			
<b>RW</b> - Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)]			

### 1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of Valves.

### 2.0 REFERENCE DOCUMENTS:

PO / PR / Standards referred there in / Job specifications / Approved documents.

### 3.0 INSPECTION AND TEST REQUIREMENTS:

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>1.0</b>	<b>Procedure</b>						
1.1	Hydrostatic Test, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS, PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	-	H	W- New R- Existing

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>2.0</b>	<b>Material Inspection</b>						
2.1	Castings & Forgings (Body, Bonnet, Disc, Stem, Body ring)	Chemical, Mechanical, Heat Treatment, NDT & Other Properties as applicable	100%	Test Certificates	H	R	W (Note-1)
2.2	Castings & Forgings (Body, Bonnet, Disc, Stem, Body ring)	Visual & Dimension	100%	Inspection Report	H	H	-
2.3	Body and Bonnet Castings	Radiography Examination	As per PR / Purchase Specification	Films and report	H	R (RT-Film review)	R (RT-Film review) (Note-1)
2.4	Bars for Trim material	Chemical Analysis	Each Heat	Test Certificates& Lab Report	H	R	R
2.5	Gaskets, Gear units, Fasteners, Gland, Packings, etc.	Physical / Chemical Properties	100%	Test Certificates& Lab Report	H	R	R

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
2.6	Actuators as applicable	Performance, Statutory Certificates as applicable	100%	Test Certificates& Lab Report	H	H	R
<b>3.0</b>	<b>In Process Inspection</b>						
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection Reports	-	H	R
3.2	Machining of components	Visual / Dimension	100%	Inspection Reports	-	H	-
<b>4.0</b>	<b>Final Inspection</b>						
4.1	Hydrostatic / Pneumatic Test	Hydrostatic Test – Shell Pneumatic Test – Seat & Back Seat	As per PR / Purchase Specification	Test Report	-	H	RW
4.2	Visual / Dimension	Surface & Dimension Check	100%	Test Report	-	H	RW
4.3	Final Stamping	Stamping Of Accepted Valves	Stamping of Valves which are witnessed by TPIA.	Inspection Report	-	H	H



SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.4	Strip Test	Component integrity, PMI of BOM	One per size per rating	Test report	H	H	H
<b>5.0</b>	<b>Painting</b>						
5.1	Painting and Colour coding as applicable	Visual / DFT Check	100%	Inspection Report	-	H	R
<b>6.0</b>	<b>Documentation &amp; IC</b>						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC & IC	-	H	H
<b>7.0</b>	<b>Final Documentation &amp; Submission of Reports</b>	Compilation of IR/IRC/DCN/MTC/DRGS. /VDR	100%	Compliance Certificate (Note-1)	-	H	-

**NOTES (As applicable):**

1. If the certification is specified as EN 10204 Type 3.1 in Data sheet / Material Requisition, then 'W' may be replaced with 'R' with Material Traceability.
2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.






ENERGISING QUALITY

## VCS QUALITY SERVICES PVT. LTD.

### INSPECTION AND TEST PLAN FOR PLUG VALVES VCS – ITP – PP – 2009

00	27/04/2022	<i>R. Srinivasan</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	27/04/2022	R. Srinivasan				Issued as standard ITP
		SR	MC	HK	GW	

**INSPECTION AND TEST PLAN  
FOR  
PLUG VALVE**

**DOC NO: VCS-ITP-PP-2009**  
**Rev No : 00**

<b>ABBREVIATIONS:</b>			
CE	Carbon Equivalent	NDT	Non-Destructive Testing
DCN	Dispatch Clearance Note	PO	Purchase Order
DFT	Dry Film Thickness	PQR	Procedure Qualification Record
DPT	Dye Penetrant Testing	PR	Purchase Requisition
HT	Heat Treatment	RT	Radiography Testing
IC	Inspection Certificate	TC	Test Certificate
IR	Inspection Report	TPI or TPIA	Third Party Inspection Agency
IRC	Inspection Release Certificate	UT	Ultrasonic Testing
ITP	Inspection and Test Plan	VDR	Vendor Data Requirement
MPT/MT	Magnetic Particle Testing	WPQ	Welders Performance Qualification
MTC	Material Test Certificate	WPS	Welding Procedure Specification
<b>LEGENDS:</b>			
<b>H</b> - Hold (Do not proceed without approval)			
<b>W</b> - Witness (Give due notice, work may proceed after scheduled date)			
<b>P</b> - Perform			
<b>R</b> - Review			
<b>RW</b> - Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)]			

## 1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of Valves.

## 2.0 REFERENCE DOCUMENTS:

PO / PR / Standards referred there in / Job specifications / Approved documents.

## 3.0 INSPECTION AND TEST REQUIREMENTS:

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>1.0</b>	<b>Procedure</b>						
1.1	Hydrostatic Test, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS, PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	-	H	W- New R- Existing

**INSPECTION AND TEST PLAN  
FOR  
PLUG VALVE**

**DOC NO: VCS-ITP-PP-2009  
Rev No : 00**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>2.0</b>	<b>Material Inspection</b>						
2.1	Castings & Forgings (Body, Cover, Plug, Stem)	Chemical, Mechanical, Heat Treatment, NDT & Other Properties as applicable	100%	Test Certificates	H	R	W (Note-1)
2.2	Castings & Forgings (Body, Cover, Plug, Stem)	Visual & Dimension	100%	Inspection Report	H	H	-
2.3	Body, Cover and Plug Castings	Radiography Examination	As per PR / Purchase Specification	Films and report	H	R (RT-Film review)	R (RT-Film review) (Note-1)
2.4	Bars for Trim material	Chemical Analysis	Each Heat	Test Certificates& Lab Report	H	R	R
2.5	Gaskets, Gear units, Fasteners, Gland, Packings, etc.	Physical / Chemical Properties	100%	Test Certificates& Lab Report	H	R	R

**INSPECTION AND TEST PLAN  
FOR  
PLUG VALVE**

**DOC NO: VCS-ITP-PP-2009  
Rev No : 00**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
2.6	Actuators as applicable	Performance, Statutory Certificates as applicable	100%	Test Certificates & Lab Report	H	H	R
<b>3.0</b>	<b>In Process Inspection</b>						
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection Reports	-	H	R
3.2	Machining of components	Visual / Dimension	100%	Inspection Reports	-	H	-
<b>4.0</b>	<b>Final Inspection</b>						
4.1	Hydrostatic / Pneumatic Test	Hydrostatic Test – Shell Pneumatic Test – Seat	As per PR / Purchase Specification	Test Report	-	H	RW
4.2	Visual / Dimension	Surface & Dimension Check	100%	Test Report	-	H	RW
4.3	Final Stamping	Stamping Of Accepted Valves	Stamping of Valves which are witnessed by TPIA.	Inspection Report	-	H	H

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.4	Strip Test	Component integrity, PMI of BOM	One per size per rating	Test report	H	H	H
<b>5.0</b>	<b>Painting</b>						
5.1	Painting and Colour coding as applicable	Visual / DFT Check	100%	Inspection Report	-	H	R
<b>6.0</b>	<b>Documentation &amp; IC</b>						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC & IC	-	H	H
<b>7.0</b>	<b>Final Documentation &amp; Submission of Reports</b>	Compilation of IR/IRC/DCN/MTC/DRGS. /VDR	100%	Compliance Certificate (Note-1)	-	H	-

**NOTES (As applicable):**

1. If the certification is specified as EN 10204 Type 3.1 in Data sheet / Material Requisition, then '**W**' may be replaced with '**R**' with Material Traceability.
2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.








ENERGISING QUALITY

## VCS QUALITY SERVICES PVT. LTD.

### INSPECTION AND TEST PLAN FOR FLANGES & SPECTACLE BLINDS VCS – ITP – PP – 2003

01	19/12/2021	SR	MC	HK	GW
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	22/04/2020					
		MB	MC	AD	SK	
01	19/12/2021	R. Ganesan				Revised as Marked
		SR	MC	HK	GW	

<b>ABBREVIATIONS:</b>			
CE	Carbon Equivalent	NDT	Non-Destructive Testing
DCN	Dispatch Clearance Note	PO	Purchase Order
HT	Heat Treatment	PR	Purchase Requisition
IC	Inspection Certificate	RT	Radiography Testing
IR	Inspection Report	TC	Test Certificate
IRC	Inspection Release Certificate	TPI or TPIA	Third Party Inspection Agency
ITP	Inspection and Test Plan	UT	Ultrasonic Testing
MPT/MT	Magnetic Particle Testing	VDR	Vendor Data Requirement
MTC	Material Test Certificate		
<b>LEGENDS:</b>			
<b>H</b> - Hold (Do not proceed without approval)			
<b>W</b> - Witness (Give due notice, work may proceed after scheduled date)			
<b>P</b> - Perform			
<b>R</b> - Review			
<b>RW</b> - Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)]			

## 1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of Flanges, Spectacle Blinds & Drip Rings.

## 2.0 REFERENCE DOCUMENTS:

PO / PR / Standards referred there in / Job specifications / Approved documents.

## 3.0 INSPECTION AND TEST REQUIREMENTS:

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>1.0</b>	<b>Procedure</b>						
1.1	Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	-	H	R
<b>2.0</b>	<b>Material Inspection</b>						
2.1.	Raw Material Inspection	Chemical, Mechanical, Properties	100%	Test Certificates	-	H	R
<b>3.0</b>	<b>In Process Inspection</b>						

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.1	Heat Treatment	Stress Relieving, Normalising, Tempering, Solution Annealing, Stabilization Heat Treatment etc. as applicable	100%	HT Chart	-	H	R
3.2	Identification of Test Samples	Product Chemical, Mechanical, Impact and Other test as applicable	One/Heat/Lot	Test Report	-	H	H
3.4	Product Analysis (As applicable)	Chemical Composition	As per PR/Purchase Specification	Test Reports	-	H	R
3.5	Destructive Testing	Mechanical, Impact and Other test as applicable	One/Heat/Lot	Test Reports	-	H	H
3.6	MPI	Surface & Internal Imperfections	As per PR/Purchase Specification	NDT Reports	-	H	R
<b>4.0</b>	<b>Final Inspection</b>						
4.1	Final Inspection	1. Visual 2 Dimensions 3. Hardness 4. Marking etc	100%	Inspection Report	-	H	W

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.2	PMI Check	Chemical	As per Spec.	Inspection Report	-	H	RW
4.3	Final Stamping	Stamping Of Accepted Flanges & Spectacle Blinds	Stamping of Valves which are witnessed by TPIA.	Inspection Report	-	H	H
<b>5.0</b>	<b>Painting</b>						
5.1	Rust Preventive Coating & Colour Coding	Visual & Colour Coding as applicable	100%	Inspection Report	-	H	-
<b>6.0</b>	<b>Documentation &amp; IC</b>						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC & IC	-	H	H
<b>7.0</b>	<b>Final Documentation &amp; Submission of Reports</b>	Compilation of IR/IRC/DCN/MTC/DRGS. /VDR	100%	Compliance Certificate (Note-1)	-	H	-

**NOTES (As applicable):**

1. If the certification is specified as EN 10204 Type 3.1 in Datasheet / Material Requisition, then '**W**' may be replaced with '**R**' with Material Traceability.
2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.



## VCS QUALITY SERVICES PVT. LTD.

### INSPECTION AND TEST PLAN FOR FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW) VCS – ITP – PP – 2005

01	19/12/2021	<i>R. Srinivasan</i> SR	<i>[Signature]</i> MC	<i>[Signature]</i> HK	<i>[Signature]</i> GW
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	22/04/2020					
		MB	MC	AD	SK	
01	19/12/2021	<i>R. Gopinathan</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	Revised as Marked
		SR	MC	HK	GW	





**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005  
Rev No : 01**

<b>ABBREVIATIONS:</b>			
CE	Carbon Equivalent	PMI	Positive Material Identification
DCN	Dispatch Clearance Note	PO	Purchase Order
DFT	Dry Film Thickness	PQR	Procedure Qualification Record
DPT	Dye Penetrant Testing	PR	Purchase Requisition
HT	Heat Treatment	RT	Radiography Testing
IC	Inspection Certificate	TC	Test Certificate
IR	Inspection Report	TPI or TPIA	Third Party Inspection Agency
IRC	Inspection Release Certificate	UT	Ultrasonic Testing
ITP	Inspection and Test Plan	VDR	Vendor Data Requirement
MPT/MT	Magnetic Particle Testing	WPQ	Welders Performance Qualification
MTC	Material Test Certificate	WPS	Welding Procedure Specification
NDT	Non-Destructive Testing		
<b>LEGENDS:</b>			
<b>H-</b> Hold (Do not proceed without approval)			
<b>W-</b> Witness (Give due notice, work may proceed after scheduled date)			
<b>P-</b> Perform			
<b>R-</b> Review			
<b>RW-</b> Random Witness [As specified or 10% (min. 1 no. of each size and type of Bulk item)]			



**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005  
Rev No : 01**

**1.0 SCOPE:**

This Inspection and Test Plan covers the minimum testing requirements of Forged, Seamless & Welded Fittings.

**2.0 REFERENCE DOCUMENTS:**

PO / PR / Standards referred there in / Job specifications / Approved documents.

**3.0 INSPECTION AND TEST REQUIREMENTS:**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>1.0</b>	<b>Procedure</b>						
1.1	Heat Treatment / NDT	Documented Procedures	100%	Procedure Documents	-	H	R
1.2	WPS, PQR & WPQ	Welding Parameters & Qualification Record	100%	WPS, PQR & WPQ	-	H	W- New R- Existing
<b>2.0</b>	<b>Material Inspection</b>						
2.1	Raw Material Identification (Billets, Rounds, Pipes, Coil, Plates, etc.)	Chemical and Mechanical Properties, Size & Steel making practice etc	100%	Mill test certificate, Vendor's Inspection Report	-	H	R

**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005  
Rev No : 01**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
<b>3.0</b>	<b>In Process Inspection</b>						
3.1	Welding	Welding Parameters as per WPS / PQR	100%	Inspection Reports	-	H	-
3.2	Heat Treatment	Stress Relieving, Normalising, Tempering, Solution Annealing, Stabilization Heat Treatment etc. as applicable	100%	HT chart	-	H	R
3.3	RT For Fittings As Applicable	Weld defects	PR / Purchase Specification	RT films & Reports	-	H	R (RT film review)
3.4	Identification of Test Samples	Product Chemical, Mechanical, Impact, Hardness and other test as applicable	One/Heat/Lot	Test Reports	-	H	H

**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005  
Rev No : 01**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.5	Product Analysis	Chemical Composition	PR/ Purchase Specification	Test Reports	-	H	R
3.6	Destructive Testing	Mechanical, Impact, Hardness and Other test as applicable	One/Heat/Lot	Test Reports	-	H	H
3.7	MPT/LPT	Surface & Internal Imperfections	PR/ Purchase Specification	NDT Reports	-	H	R
<b>4.0</b>	<b>Final Inspection</b>						
4.1	Visual and Dimensional Inspection (VDI)	Surface finish, Dimensions, Marking etc	100%	Inspection report	-	H	RW
4.2	PMI Check	Chemical Check	As Per Spec./Code	Inspection report	-	H	RW

**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005  
Rev No : 01**

SL.NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
4.3	Final Stamping	Stamping of accepted Items	100%	Inspection report	-	H	H
<b>5.0</b>	<b>Painting</b>						
5.1	Rust Preventive Coating & Colour Coding	Visual Inspection & Colour Coding	100%	Inspection report	-	H	-
<b>6.0</b>	<b>Documentation &amp; IC</b>						
6.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC & IC	-	H	H
<b>7.0</b>	<b>Final Documentation and Submission of Reports</b>	Compilation of IR/IRC/DCN/MTC/DRGS. /VDR	100%	Compliance Certificate (Note-1)	-	H	-



**INSPECTION AND TEST PLAN  
FOR  
FORGED, SEAMLESS & WELDED FITTINGS (16" NB & BELOW)**

**DOC NO: VCS-ITP-PP-2005  
Rev No : 01**

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**NOTES (As applicable):**

1. If the certification is specified as EN 10204 Type 3.1 in Datasheet / Material Requisition, then '**W**' may be replaced with '**R**' with Material Traceability.
2. ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.



## VCS QUALITY SERVICES PVT. LTD.

### INSPECTION AND TEST PLAN FOR ASSORTED PIPES

VCS – ITP – PP – 2021

01	19/12/2021	<i>R. Jainivasan</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed

REVISION RECORD						
Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	22/04/2020					
		MB	MC	AD	SK	
01	19/12/2021	<i>R. Jainivasan</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	Revised as Marked
		SR	MC	HK	GW	



<b>ABBREVIATIONS:</b>			
CE	Carbon Equivalent	NDT	Non-Destructive Testing
HT	Heat Treatment	PO	Purchase Order
DCN	Dispatch Clearance Note	PMI	Positive Material Identification
IC	Inspection Certificate	PR	Purchase Requisition
IR	Inspection Report	TC	Test Certificate
IRC	Inspection Release Certificate	TPI or TPIA	Third Party Inspection Agency
ITP	Inspection and Test Plan	VDR	Vendor Data Requirement
MPT / MT	Magnetic Particle Testing		
<b>LEGENDS:</b>			
<b>H-</b> Hold (Do not proceed without approval)			
<b>W-</b> Witness (Give due notice, work may proceed after scheduled date).			
<b>P-</b> Perform			
<b>R-</b> Review			
<b>RW</b> - Random Witness (As specified or 10% (min.1 no. of each size and type of Bulk item))			

## 1. SCOPE

This Inspection and Test Plan covers the minimum testing requirements of small sizes and Assorted length Pipes.

## 2. REFERENCE DOCUMENTS:

PO/PR/ Standards referred there in/ Job specifications /Approved documents.

## 3. INSPECTION AND TEST REQUIREMENTS:

SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
1.0	Pipe Inspection						
1.1	Pipe Inspection	Chemical & Mechanical Properties	100%	Test Certificates and marking on pipe (EN 10204 Type 3.2)	-	H	R
2.0	Final Inspection (In case of non-availability of 3.2 Certificate)						
2.1	Hydrostatic Testing	Leak Check	100%	Test Report	-	H	R
2.2	1) Visual 2) Dimension 3) Marking w.r.t MTC	Surface Condition, Straightness, End Finish, Bevel Angle, Root Face, Outer Dia., Thickness, Length, End Finish, Marking etc	100%	Inspection Report	-	H	RW

SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
2.3	PMI Check	Chemical Check	As Per Spec.	Inspection Report	-	H	RW
2.4	Identification of Test Samples	Product Chemical, Mechanical, Impact and Other test as applicable	As Per Spec. / Code	Test Reports	-	H	H
2.5	Product Analysis	Chemical Composition	As Per Spec. / Code	Test Reports	-	H	R
2.6	Destructive Testing	Mechanical, Impact, and Other test as applicable	As Per Spec. / Code	Test Reports	-	H	H
2.7	PMI Check	Chemical Check	As Per Spec. / Code	Inspection Report	-	H	RW
2.8	Final Stamping	Stamping Of Accepted Pipes	Stamping of Pipes	Inspection Report	-	H	H

SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB VENDOR	VENDOR	TPIA
3.0	Painting						
3.1	Rust Preventive Coating & Colour Coding	Visual Inspection & Colour Coding	100%	Inspection Report	-	H	-
4.0	Documentation & IC						
4.1	Documentation & Inspection Certificate (IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Vendor TC/IR/IRC/DCN/DRGS. /VDR (Note-1)	-	H	-

**NOTES (As applicable):**

- Items shall be accepted based on EN 10204 type 3.2/3.1 certification as specified in material requisition.
- ITP shall be submitted including but not limited to the item/activity covered above. Any item/activity identified and required for the completeness shall also be covered in the ITP submitted by the manufacturers.



## CHECKLIST - TECHNICAL

VCS-SD-CK-001

### CHECKLIST – TECHNICAL

Bidder confirms following, as a minimum, has been enclosed in the offer.

S.NO.	Requirements	Compiled by Bidder(Tick)
1	Reference List of previous supply of Procured item	<input type="checkbox"/>
2	Filled – up Data Sheets, duly signed and stamped by bidder enclosed.	<input type="checkbox"/>
3	List of recommended commissioning spares and accessories for Procured item.	<input type="checkbox"/>
4	List of recommended spares and accessories for two year normal operation for procured item.	<input type="checkbox"/>
5	Compliance statement duly filled and stamped enclosed.	<input type="checkbox"/>
6	GA & assembly drawings, cross section drawings including part list & material list enclosed.	<input type="checkbox"/>
7	Other technical details & vendor's product catalogues enclosed.	<input type="checkbox"/>

0	25.05.2017	ISSUED AS STANDARD	AS	GS	AD
REV	DATE	DESCRIPTION	PREP	CHK	APPR



## COMPLIANCE STATEMENT

VCS-SD-CS-001

### COMPLIANCE STATEMENT

S.No	Requirement	Bidder's Confirmation
1	Bidder confirms that all materials proposed by the bidder are same/ superior to those specified in specification/ data sheets enclosed.	
2	Bidder confirms that the offer is in total compliance with the Technical requirements of the Material Requisition. Bidder confirms that deviation expressed or implied anywhere else in the offer shall not be considered valid.	
3	Bidder confirms that all spares and accessories required for two years of normal operation have been quoted separately.	
4	Bidder confirms that prices for start-up/commissioning spares and accessories have been included in the quoted items.	
5	Bidder confirms that in the event of securing order for the requisitioned item(s), good for manufacturing drawings of ordered item(s) shall have complete details with dimensions, part list and material list including back-up calculations in the first submission, failing which the vendor shall be solely responsible for any likely delay in delivery of item(s).	

**Bidder's Signature with Stamp**

0	25.05.2017	ISSUED AS STANDARD	AS	GS	AD
REV	DATE	DESCRIPTION	PREP	CHK	APPR



## DEVIATION SHEET

VCS-SD-DS-001

### DEVIATION/ EXCEPTION/ CLARIFICATION SHEET

Sr. No.	Contractor's Inquiry Reference	Contractor's Requirement	Proposed Deviation by Supplier, with Technical Justification	Cost Impact, if any	Contractor's Conclusions

#### NOTES

- 1- Bidder confirms that apart of from the deviations/exceptions/clarifications listed above, the bid is in full compliance with Inquiry requisition.
- 2- Bidder shall submit this sheet duly filled up and signed by him along with his bid. In case there is no deviation, then also supplier shall submit this sheet along with his bid indicating NIL deviation.

(Contractor's Name and Signature with Seal)

0	25.05.2017	ISSUED AS STANDARDS	AS	GS	AD
REV	DATE	DESCRIPTION	PREP	CHK	APPR



## DRAWINGS & DOCUMENTS

VCS-SD-DD-001

### INFORMATION/ DOCUMENTS / DRAWINGS TO BE SUBMITTED BY SUCCESSFUL BIDDER

Successful Bidder shall submit four copies unless noted otherwise, each of the following:

1. Inspection & test reports for all mandatory tests as per the applicable code as well as test reports for any supplementary tests, in nicely bound volumes.
2. Filled in Quality Assurance Plan (QAP) for Purchaser's/ Consultant's approval. These QAPs shall be submitted in two copies within 15 days from LOI/ FOI.
3. Detailed completion schedule activity wise (Bar Chart), within one week of placement of order.

Note : All drawings, instructions, catalogues, etc., shall be in English language and all dimensions shall be metric units.

0	25.05.2017	ISSUED AS STANDARDS	AS	GS	AD
REV	DATE	DESCRIPTION	PREP	CHK	APPR





## INSTRUCTION TO BIDDER

VCS-SD-ITB-001

### INSTRUCTION TO BIDDERS

1. Bidder to note that no correspondence shall be entered into or entertained after the bid submission.
2. Bidder shall furnish quotation only in case he can supply material strictly as per this Material Requisition and specification/data sheet forming part of Material Requisition.
3. If the offer contains any technical deviations or clarifications or stipulates any technical specifications (even if in line with MR requirements) and does not include complete scope & technical / performance data required to be submitted with the offer, the offer shall be liable for rejection.
4. Bidder must submit all documents as listed in checklist with his offer.
5. Supplier must note that stage wise inspection for complete fabrication, testing including the raw material inspected to be carried out.
6. Vendors for bought out items to be restricted to the approved vendor list attached with bid document. Approval of additional vendor if required, for all critical bought out items shall be obtained by the supplier from the purchaser before placement of order. Credentials/PTR of the additional vendor proposed to be submitted by supplier for review and approval of Purchaser/ Purchaser's representative

0	25.05.2017	ISSUED AS STANDARDS	AS	GS	AD
REV	DATE	DESCRIPTION	PREP	CHK	APPR



## LIST OF SPARES

VCS-SD-LS-001

### LIST OF SPARES

S.No.	Part No.	Description	Quantity(Minimum)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

0	25.05.2017	ISSUED AS STANDARD	AS	GS	AD
REV	DATE	DESCRIPTION	PREP	CHK	APPR



## REFERENCE LIST

VCS-SD-RL-001

### REFERENCE LIST

SI No.	Project	Year of Supply	Client , Address and Contact No.	Email	Size and Rating / thk	Service

|| Bidder's Signature with stamp

0	25.05.2017	ISSUED AS STANDARDS	AS	GS	AD
REV	DATE	DESCRIPTION	PREP	CHK	APPR