



GAIL (INDIA) LIMITED
(A.GOV'T OF INDIA UNDERTAKING)

GAIL KHERA PROJECT

BID DOCUMENT

FOR

PROCUREMENT OF CARTRIDGE GAS FILTERS

VOL II OF II – TECHNICAL

(BID DOCUMENT NO11/0330E/WGI/GAIL/02-R0)

LIMITED INTERNATIONAL COMPETITIVE BIDDING



DELIVERS. EVOLVES.

WHOLE LIFE SOLUTIONS FOR PIPELINE AND SUBSEA SYSTEMS

ISSUED BY



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1.0 SCOPE OF SUPPLY

1.1 General

This Specification covers the requirement of scope of supply of Cartridge type Filters intended to be used as an alternative system of the existing Filters at GAIL - Khera Compressor Station, Ujjain, MP. The scope of supply covers the design, engineering, procurement of material, manufacturing, assembly at shop, inspection, testing, painting & supervision of installation and commissioning, shipment and documentation requirements of all following items in accordance with the requirements of this Requisition.

For commissioning of Filters, skilled engineers shall actually commission these items at site.

1.2 DESCRIPTION OF EQUIPMENT and/or SERVICES

ITEM NO.	DESCRIPTION	TAG NO.	QTY
1.0	Horizontal Cartridge Filter of capacity 18.0 MMSCMD (with Inlet & Outlet size 30" NB & 30" NB, ANSI Rating 600#) complete with all accessories, Nozzles, Supports, Quick Opening Closer (QOEC), Instruments like Pressure Gauge, Differential Pressure Indicator cum transmitter, Pressure Safety Valve etc., Isolation Valves, Interconnecting Piping, Pipe-Fittings, Flanges with bolts, nuts & gaskets for all nozzles as per attached Sketches, Data Sheets and Technical Specifications.	56-F-101D 56-F-101E	2 Sets
2.0	200% Gasket as Spares for each Filter	~	2 Sets
3.0	100% Fasteners as Spares for each Filter	~	2 Sets
4.0	Door Seal for QOEC (02 Nos. for each QOEC)	~	4 Sets
5.0	Cartridge Element as quoted for each Filter	~	1 Set
6.0	Supervision of Erection and Commissioning by Vendor for days. Vendor to quote per diem rates, inclusive of all expenses like travel, boarding, lodging etc.	~	MAD

2.0 REMARKS

2.1 Supplier's Compliance

Supplier shall submit his bid in full compliance with the requirements of this MR and attachments. Bidder shall include the following statement in his bid:

We certify that our bid is fully complying with your enquiry dated and referenced

Compliance with this material Requisition in any instance shall not relieve the Vendor of his responsibility to meet the specified performance.



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2.2 Compliance with Specification

The supplier shall be completely responsible for the design and engineering, materials, fabrication, testing, inspection & transfer of above material to nominated delivery point strictly in accordance with the MR & all attachments thereto.

2.3 Supplier's Scope

Supplier's scope of work includes the equipment with all internals & accessories shown on the data sheets, specifications and all unmentioned parts necessary for a satisfactory operation & testing except those which are indicated to be out of Supplier's supply.

2.4 Inspection

Supplier shall submit with his bid a list of 3 well known international Third Party inspection Agencies as per enclosed vendor list, which he intends to use for inspection. This agency will issue all relevant certificates as per specification & codes.

Inspection shall also be performed by a designated Third Party Inspection agency and/or purchaser as set out & specified in the codes & particular documents forming this MR.

3.0 SPECIAL INSTRUCTIONS TO BIDDERS

3.1 Bidder to note that no correspondence shall be entered into or entertained after the bid submission.

3.2 Bidder shall furnish quotation only in case he can supply material strictly as per this Material Requisition and specification/data sheets forming part of Material Requisition.

3.3 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.

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

3.6 Bidder must submit all documents as listed in checklist along with his offer.

3.7 Supplier must note that stage wise inspection for complete fabrication, testing including the raw material inspection to be carried out.

3.8 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.

3.9 All material shall be delivered at GAIL-Khera Compression Station, Ujjain, MP.

4.0 INFORMATION/ DOCUMENTS/ DRAWINGS TO BE SUBMITTED BY SUCCESSFUL BIDDER

Successful Bidder shall submit six copies unless noted otherwise, each of the following:

4.1 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.

4.2 Material test certificates (physical property, chemical composition, make, heat treatment report, etc.) as applicable for items in nicely bound volumes.



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- 4.3 Statutory test certificates, as applicable.
 - 4.4 Filled in Quality Assurance Plan (QAP) for Purchaser's/ Consultant's approval. These QAPs shall be submitted in four copies with in 15 days from LOI/ FOI.
 - 4.5 WPS & PQR, as required.
 - 4.6 Within two (2) weeks of placement of order, the detailed fabrication drawings along with process and mechanical design calculations for Purchaser's/Consultant's approval.
 - 4.7 Detailed completion schedule activity wise (Bar Chart), within one week of placement of order.
 - 4.8 Weekly & fortnightly progress reports for all activities including procurement.
 - 4.9 Purchase orders of bought out items soon after placement of order.
 - 4.10 Manufacturer's drawings for bought out items, in 4 copies, for Purchaser's/Consultant's approval within 4 weeks.
 - 4.11 Manufacturer related information for design of civil foundation & other matching items within 6 weeks of FOI / LOI.
 - 4.12 All approved drawings / design calculation / maintenance / operating manual documents as well as inspection and test reports for Owner's / Consultants reference / record in nicely category-wise bound volumes separately.
 - 4.13 A list of documents to be furnished along with supply.
 - 4.14 Vendor to furnish filled up documents / formats as per "Appendix 9" - "Special instruction to Bidders" along with the offer.
- Note: All drawings, instructions, catalogues, etc., shall be in English language and all dimensions shall be metric units.

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CLIENT JOB NO.

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TOTAL SHEETS

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1.0 GENERAL

This specification together with all data sheets and specifications enclosed covers the requirements for design, engineering, procurement of material, manufacturing, assembly at shop, inspection, testing, painting & supervision of installation and commissioning, shipment and documentation requirements along with all the accessories.

In the event of any conflict between this specification, datasheets, related standards codes etc., the more stringent shall apply.

1.1 Datasheet for Filter, Pressure Safety Valve, Pressure / Differential Pressure Gauges etc. are enclosed.

However, this does not absolve the vendor of the responsibility for proper selection with respect to the fluid & its operating conditions. Proper sizing & selection of filter, pressure safety valves etc. and accessories are vendor's responsibility.

Sizing Calculation required for above items shall be submitted for Client/ consultant review.

Following information shall be furnished as a part of the filter design & engineering:

- Make, model and detail specification of each item.
- Fixing pressure drop across various elements
- Sizing of filter, PSV etc..
- Selection of ranges for Pressure Gauges, Differential Pressure Gauges and Transmitters etc.
- All design performance characteristics.
- Individual dimensions of each item.
- Overall dimension of filter.
- Empty & Hydro Test Weight of filter.

1.2 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 filters.

1.5 Vendor to note that all the items of the filter shall be procured from reputed vendors as per the attached Vendor list.

1.6 Vendor's quotations shall include the detailed specifications for all the items of filter. The vendor shall also offer data sheet / specification of any instruments / equipments required for safe and efficient operation of the system.

1.7 All units of measurements in vendor's specification sheets shall be same as those in attached data sheets of filter, pressure safety valves, pressure/differential pressure gauges.

1.8 Vendor shall enclose catalogues giving detailed technical specification and other information for cartridge filters, pressure safety valve, pressure/differential pressure gauges covered in the bid.

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

1.10 All drains/vents should be having provision for putting end cap and shall be complete with wire seal.

2.0 STANDARDS AND CODES

Following principal codes and standards (Latest Edition) and in accordance with the relevant Institute of Gas Engineers (IGE) codes shall be followed for design, manufacture, testing etc. of the equipments.



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ASME Boiler and Pressure Vessel code

Section —V : Non destructive examination
Section —VIII : Pressure Vessel, Division-1
Section —IX : Welding and brazing qualification

American National Standard Code

ANSI/ASME B 16.5 : Flanges and Flange fittings
ANSI/ASME B31.8 : Gas Transmission and Distribution Systems
ANSI/ASME B 16.20 : Metallic gaskets for pipe flanges
ANSI/ASME B 1.20.1 : Pipe threads general purpose (inch)
ANSI/ASME B 16.34 : Valves flanged, threaded & welding ends
ANSI/ASME B 16.1 : Forged Steel Fittings Socket Welded & Threaded
ANSI/ASME B 16.47 : Large Diameter Steel Flanges
ANSI/ASME B 36.10 : Welding & Seamless Wrought Steel Pipe
ANSI/ASME B 16.21 : Design of Non-Metallic Gasket
ASME Sec-II & ASTM : Material Specifications

American Petroleum Institute

API RP 520 : Part -1 & 2, Design. and installation of pressure relieving system in refineries
API RP 521 : Guide for Pressure relief and Depressing Systems.
API RP 550 : Manual on installation of refinery instrument and control system.
API 6 D : Specification for pipeline valves, end closures and swivels.
API 527 : Commercial Seat Tightness of safety relief valves with Metal-to-Metal seats.

British Standard Specifications

BS 449 : Structural steel work
BS 1515 : Materials of filters & scrubbers

Instrumentation

Instrumentation shall generally be in accordance with the applicable sections of the following principal codes of practice (latest editions).

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.
API RP 550 : Manual on Installation of Refinery Instrument Control Systems.
API RP 521 : Guide for Pressure relief & Depressurising Systems.
ISA A 5.1 : Instrument Symbols & Identification
BS 2765 : Thermowell.

For purpose of material selection, national code of the country of origin shall also be acceptable provided the vendor specifically establishes, to the satisfaction of purchaser, the equivalence or superiority of the proposed material with respect to those specified.

3.0 SCOPE OF SUPPLY

3.1 Vendor's scope shall include but not limited to:-

- i) Filter Vessel along with necessary filtering cartridge elements, internal and external supports, lifting lugs, quick opening end closure (QOEC) and flanged connections at inlet, outlet, drain, vent and necessary nozzles with flanges & blind flanges fitted with bolts, nuts and gaskets for other utility services and instrumentations.
- ii) Design, engineering and supply of PSV, Pressure Gauges, differential pressure indicator cum transmitter etc. as per Instrumentation Data Sheets and standards.
- iii) Ladder and Platform Cleats, if required.



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- iv) Anchor/Foundation bolts with nuts & washers and base plates.
- v) Protective coating & painting of equipments.
- vi) Documents as called for in vendor data requirements.
- vii) Spares for two years of normal operation. Bidders shall furnish the itemized price list of the recommended spares with the bid. However, the actual supply shall be as per Purchaser's advice.
- viii) Mandatory spares :
 - Two sets of each installed gaskets.
 - Two sets of element for each filter.
 - Two sets of fasteners for each filter
 - Four nos. of Door Seal for QOEC

Price to be included in the base price.
- ix) Commissioning spares :
 - One set of each installed gaskets. Price to be included in base price.
- x) Interconnecting piping, tubing, fittings, valves, instruments with fittings, necessary nozzles, flanges, blind flanges (fitted with bolts, nuts, gaskets etc.) etc. as required for the installation of Instruments.
- xi) Special installation tools / spare parts as required for two years normal operation and maintenance.
- xii) Any other item required to complete the filter in all respects as per technical specs mentioned in tender document.

- 3.2 The filters shall be completed in all respects, ready for installation and commissioning. There shall be Minimum work to be done at site. All field mounted instruments shall be supplied loose to avoid damages of same during transportation of the filters. The details regarding installation of filters, shall be clearly described in the "Installation Manual" especially made for filter installation .
- 3.3 All items in the filters shall be properly supported to avoid vibration. Special supports, if required, shall also be supplied by vendor.
- 3.4 All piping materials shall be as per piping material specification/codes specified. The piping fabrication work shall confirm to the requirements of ANSI B31.3.
- 3.5 The filters shall be sized considering ease of transportation.
- 3.6 All the instrument enclosures mounted in the field shall be weather proof / ex proof conforming to IP-55/ NEMA 4/ NEMA 7 as a minimum.
- 3.7 The filters shall be installed in accordance with local government rules and regulations applying to such facilities. The vendor shall be responsible for determining all applicable requirements and ensuring compliance.
- 3.8 The vendor shall read the specification in conjunction with following documents enclosed :
 - i) P & IDs.
 - ii) Data sheets.
 - iii) Technical Specifications.
- 3.9 Commissioning spares as required shall be included as part of the offer. A separate list should be attached along with the bid.
- 3.10 Vendor shall quote separately for two years operation and maintenance spares for the filters as per the SOR.

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- 3.11 The pressure safety valves as indicated shall be vented 3 meters above the highest point of working platform with proper support, rain cap, bug screen.
- 3.12 Any soft material used in filters shall be able to retain its functional properties for minimum period of 3 years.
- 3.13 The allowable tolerance in the set pressure for the pressure safety valves shall be as per relevant codes.
- 3.14 The pressure safety valves shall meet the seat tightness requirement as per API 527.
- 3.15 All materials to be used in construction of valves shall be suitable for Natural Gas services.
- 3.16 All the calculations and units of measurement shall be metric standards only.
- 3.17 All the instruments mounted on the filters shall be suitable for installation in tropical hot and humid climate.
- Temp range: 0 - 65 deg. C
Relative Humidity: 95 %
- 3.18 Flow direction shall be clearly marked on the filter body.
- 3.19 Field mounted instruments shall be capable of working under high ambient temperature and environmental condition without any degradation in accuracy and repeatability.
- 3.20 End connection details of filters shall be as per data sheets.
- 3.21 a) Bidder shall take single point responsibility for the design, fabrication, assembly, testing and performance of the filters.
- b) The fabrication, assembly, testing and inspection works have to be carried out at Bidder's works or works designated by the Bidder. In case of Bidder designated works, the facility should have established track record.

4.0 TECHNICAL REQUIREMENTS :

- 1) The filter shall be provided with Quick Opening End Closure (QOEC) for easy removal & replacement of filter elements for maintenance. The QOEC shall be high pressure quick release type, equipped with locking device, which can be opened only when the vessel is completely depressurized. The Quick Opening End Closure shall be of Double Yoke / Band Lock design. The diameter of QOEC shall be same as that of main vessel diameter. Threaded and other designs are not acceptable. A Davit / Hinged arrangement shall be provided for the QOC for convenient handling. The QOEC shall have perfect sealing arrangement to prevent leakage. All calculations for QOEC shall be submitted to consultant for review / information. The Quick Opening Closure shall be of Peco-Facet / Sirtec NIGI Spa / G.D. Engineering make conforming to all applicable ASME code requirements and will carry AMSE U Stamp. Additionally QOEC of the following makes like R&M Energy Services / Piping Technologies-France / Pipeline Engineering, UK / Peerless / Grinell / CYPRIS Technologies / Huber Yale may also be accepted subject to their PTR of same or larger size and same or higher pressure and other acceptance criteria.
- 2) The Filter Elements shall be of single piece construction, with no joint. The filter element shall be of PECO-FACET / FILTAN / PALL / FILTERITE / VELCON / BURGESS MANNING / ACS make. Additionally, filter elements of following makes like M/s Dollinger & M/s Dahlman may also be acceptable subject to their meeting the PTR of same or larger size and same or higher pressure and other acceptance criteria.
- 3) Length of each filter element should be between 1.0 -1.1 mtr maximum.



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- 4) The inlet nozzle should be located in such a way that incoming gas does not impinge the cartridge element directly.
- 5) The diameter of main vessel shall not be less than twice of inlet nozzle diameter.
- 6) The minimum centre distance between two consecutive cartridges shall not be less than outside diameter of cartridge element plus 15.0 mm. Overall annular space between inside surface of main vessel and outside surface of outer filter element shall be maintained as 10.0mm minimum.
- 7) For filter element maintenance & replacement, the inlet & discharge pipe connection should not be disturbed.
- 8) Filter elements must withstand a pressure of 2.0 kg/cm² (g) without breaking or failure.
- 9) Core of filter element shall be of SS material.
- 10) Filter element should be suitable for specified mole % of CO₂ as stated in Process Design Basis.
- 11) Bidder shall submit back-up documents & calculation for sizing of the equipment together with all supportive documents / Catalogues / Monographs etc. along with BID. Back up calculation for selection of no. of filter elements must be submitted from their respective filter element manufacturer/supplier along with BID. This is an essential requirement and bids without this information are likely to be summarily rejected. The type, model and MOC of filter element shall be selected based on allowable pressure drop and supplier's recommendations. No deviation will be allowed.
- 12) The total number of filter elements shall be 20% more (to be rounded off to next whole number) than the number of filter element calculated by the manufacturer/supplier and shall be duly approved by consultant.
- 13) The dirt holding capacity of each set of filter element shall not be less than 216.0 kg (Approx.) before attaining the dirt condition pressure drop (i.e. 1.0 kg/cm²g) within the mentioned cycle (i.e. 30.0 Days) for the flow of 18.0 MMSCMD and for other filter the dirt holding capacity can be calculated similarly. Dirt holding capacity of each element shall be duly certified by the respective element manufacturer/supplier and shall be submitted to Consultant/GAIL for review along with the BID. Bidder shall submit the testing procedure (which will help to verify/confirm the actual dirt holding capacity of each element) along with BID. The same test procedure shall be submitted to consultant for approval after receipt of order. Testing shall be done at same element manufacturer's shop from where the element will be sourced by the bidder. The tests shall be witnessed by consultant/GAIL representative and the test result shall be submitted to consultant for review.
- 14) All nozzles / pipes on the main vessel shall be of seamless construction. All nozzles less than or equal to 50 NB size shall be provided with two nos. 6.0mm thk. stiffeners at 90 degrees apart. All nozzles from 65NB and above shall be provided with reinforcing pads.
- 15) All flanges mounted on the vessel shall be WNRF unless otherwise specified. Dimension of flanges including shell flanges, blind head cover flanges, nozzle flanges and blind flanges shall be as per ANSI B16.5. Larger flanges shall be as per ANSI B16.47.
- 16) Pressure parts joined by butt welds shall be with full penetration welds. Where both side welding is not accessible, root run by tungsten inert gas process or backing strip, shall be used to ensure full penetration. Backing strip, if used, shall be removed after welding.
- 17) Vessels shall be post weld heat treated, whenever it is required due to service requirement or due to code requirements and no welding shall be permitted after post weld heat treatment is completed.
- 18) Filter shall be provided with lifting and earthing lugs. Fire proofing and insulation of support shall be provided if mentioned in data sheet.



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- 19) The piping items shall conform to specification and data sheets included in the Engineering documents.
- 20) The filters shall be supplied in segments of overall dimension and weight, suitable for easy transportation, handling at site during installation. If the filters are supplied in more than one segment, necessary flanges, nuts, bolts and gaskets for installation and assembled at site shall also be supplied by vendor.
- 21) Piping material (pipes, fittings, flanges, etc.) for high point vents shall be supplied loose by vendor to be installed and assembled at site.
- 22) Vendor shall submit general arrangement drawings for filter indicating the elevations of inlet and outlet flanges, overall dimensions and the weights of the individual segments and assembled filter.
- 23) Vendor shall furnish details of filter foundation along with load.
- 24) Vendor shall submit complete dimensional drawings for filters indicating materials of all components for company's approval prior to procurement and commencement of fabrication of filters.
- 25) Vendors shall submit the sizing calculation of Pressure Safety Valve.
- 26) Suitable baffle plates/passage ways shall be provided inside the vessel for evenly distribution of gas across the bundle of filter elements. All internal bolts and nuts shall be of stainless steel irrespective of material of construction of vessel.
- 27) Filter mounting configuration shall be horizontal.
- 28) The filter element shall be designed such that the frequency of replacement of filter element shall be after minimum of 30 days of operation. Bidder to submit the justification calculation for this along with BID.
- 29) Bidder to provide Load Calculation of all nozzles mentioning Allowable Forces, Moments & Thermal Growth.

5.0 EXCLUSIONS

The following are excluded from Vendor's scope of supply :

- Civil & Structural works.
- Equipment foundations. However, the necessary load data and foundation layout required for the design and construction of foundation shall be provided by the vendor.
- Erection and installation of equipments.

6.0 TESTING AND INSPECTION

6.1 Vendor shall submit Quality Assurance (QA) procedures before commencement of fabrication. Approved QA procedures shall form the basis for equipment inspection. All materials and equipments shall be factory tested before shipment in the presence of purchaser / its authorized inspection agency. 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.

6.2 Testing at Vendor's Works shall include but not limited to the following :

- Non destructive tests such as radiography, dye penetration tests.

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- Hydrostatic test at 150% of design pressure for the vessel.
- Any other tests as per data sheet / standards / codes.

6.3 Extent of radiography shall be 100%.

6.4 Vendor shall submit the following documents / certificates for review by the purchaser / its authorized inspection agency 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.

1. Material test certificate, hydrostatic test certificate of pressure safety valves and for all piping / valves of the filters.
2. Calibration certificate for pressure safety valve for set pressure and all field instruments.
3. Seat tightness test certificate for pressure safety valves.
4. Test certificate for all field instruments such as PGs, DPGs, PTs.
5. Certificates from statutory body for field instruments being flame proof and weather proof.
6. Interconnecting piping material testing and NDT of welds as per PMS.
7. The vessel hydrostatic test certificate.
8. Leak test certificate of complete filter with air/N2, if required.
9. Filter functional testing considering pressure regulation, limiting and safety characteristics.

6.5 For this inspection, labour, consumable, equipment and utilities as required shall be in vendor's scope.

7.0 DOCUMENTATION

The Purchaser in vendor data requirement sheets indicates detailed drawings, data and catalogues required from the vendor. The required number of reproducible and prints should be dispatched to the address mentioned, adhering to the time limits attached.

Final drawings from the vendor shall include dimensional details, weight, mounting details and any other special requirements etc. for the filters. All dimensions in general shall be in millimeters. Vendor shall furnish all manuals necessary to test, operate and maintain, the system.

8.0 NAME PLATE

Each filter and all the instruments mounted on the filter body shall have a SS nameplate attached firmly to it at a visible place furnishing the following information:

- Tag number as per Purchaser's data sheets.
- Body sizes in inches and the valve Cv (for Pressure Safety valves).
- Set pressure range (for Pressure Safety valves).
- Flow range in MMSCMD.
- Rating
- Manufacturer's Name & model number

9.0 PROTECTION AND PAINTING

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- 9.1 All exposed carbon steel parts to be painted shall be thoroughly cleaned from inside and outside to remove scale, rust, dirt and other foreign materials by wire brushing and sand blasting as applicable. Minimum acceptable standard in case of power tool cleaning shall be St. 3 and in case of blast cleaning shall be Sa 2-1/2 as per Swedish Standard SIS 0055900.
- 9.2 Non-ferrous materials, austenitic stainless steels, plastic or plastic coated materials, insulated surfaces of equipment and pre-painted items shall not be painted.
- 9.3 Stainless steel surfaces both inside and outside shall be pickled and passivated.
- 9.4 Machined and bearing surfaces shall be protected with varnish or thick coat of grease.
- 9.5 Depending on the environment, following primer and finish coats shall be applied.

<u>Environment</u>	<u>Description</u>		
1) Normal Industrial	Surface Preparation	:	Sa 2-1/2
	Primer	:	2 coats of red oxide zinc chromate each 25 micron thick
	Finish coat	:	2 coats of synthetic enamel, each 25 micron thick.
2) Corrosive Industrial	Surface Preparation	:	Sa 2-1/2
	Primer	:	2 coats of epoxy zinc chromate each 35 micron thick
	Finish coat	:	2 coats of epoxy high build paint, each 100 micron thick.
3) Coastal & Marine	Surface Preparation	:	Sa 2-1/2
	Primer	:	2 coats of high build chlorinated rubber zinc phosphate each 50 micron thick
	Finish coat	:	2 coats of chlorinated rubber paint, each 35 micron thick.
4) All Environment (80-400 ⁰ C)	Surface Preparation	:	Sa 2-1/2
	Finish coat	:	2 coats of heat resistant aluminium paint suitable for specified temp, each 20 micron thick.

(All values refer to dry film thickness).

- 9.5.1 The filters in carbon steel body shall be painted light gray (RAL 7038) and Interconnecting piping shall be canary yellow, unless otherwise specified. However, the colour of finish coat shall be confirmed to vendor after placement of order.
- 9.6 Vendor to ship supply of primer and the paint to permit on-site repair of shipping damage (if any) to the factory coatings.

10.0 SHIPPING

- 10.1 All threaded and flanged opening shall be protected to prevent entry of foreign material.
- 10.2 All the field mounted instruments shall be supplied loose to avoid damages during transportation.
- 10.3 Filters shall bear proper shipping markings.



TECHNICAL SPECIFICATION OF FILTER

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10.4 Shipping details like gross wt., net wt., volume, dispatch point, mode of dispatch, mode of package etc. for each filter shall be provided with the offer.

11.0 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.

12.0 INFORMATION TO BE SUPPLIED WITH TENDER

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

13.0 WARRANTY & DEFECT LIABILITY PERIOD

The Vendor shall as required by the Engineer in charge and without additional cost to Owner (unless it can be shown that defects and deficiencies have occurred through Owner's negligence), amend repair or replace with new materials any defects or deficiencies in terms of performance in the plant and/or work which become apparent at any time or from time to time, within the period of twelve (12) months occurring from the date of commissioning or 18 months from the date of arrival of the material at site, whichever is earlier.

If the Vendor does not make good those defects or deficiencies in the plant and/or work within a reasonable time of having been given prior written notice by the Engineer In charge to do so, the Engineer In -charge may arrange for such defects or deficiencies to be remedied by others at the risk and expenses of the Vendor, but without prejudice to any other rights which Owner has under the Contract in respect of those defects or deficiencies.

Bidder shall note that they shall submit the offer with full details as desired in the tender document. Bidder shall submit the enclosed "CHECK LIST" & "TECHNICAL QUESTIONNAIRE" duly filled in along with sets of offers to avoid further queries and to ensure proper evaluation of offer. If these are not complied with, offer is liable to be rejected.



**TECHNICAL SPECIFICATION OF
FILTER**

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**KHERA COMPRESSOR STATION
UPGRADATION PROJECT**



PROCESS DESIGN BASIS						CLIENT JOB NO.	-
						TOTAL SHEETS	4
DOCUMENT NO.	11	0330E	03	09	04	003	

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0	17.05.11	ISSUED FOR TENDER		AS	ASD	AD
A	29.03.11	ISSUED FOR CLIENT'S COMMENTS		AS	ASD	AD
REV	DATE	DESCRIPTION		PREP	CHK	APPR

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5.	PROCESS DATA.....	4



PROCESS DESIGN BASIS

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1.0**INTRODUCTION**

GAIL is in the process of introducing a separate Natural Gas Filtration System at inlet to Compression Station as a replacement of existing Filtration System at Khera Compressor Station in Ujjain, M.P.

The existing Filtration System has a total flow capacity of 31.5 MMSCMD to remove dust particles of Natural Gas for transportation from & to IP Station via Khera Compressor Station.

2.0**SCOPE**

This specification defines the basic parameters required to be used for design of Filtration System along with associated facilities.

3.0**PROCESS DESIGN DATA**

Operating Fluid	Dry Natural Gas
Total Flow Capacity	36.0 MMSCMD
Operating Pressure	42.0 kg/cm ² g
Operating Temperature	45.0 °C
Specific Gravity	0.6972
Design Pressure	93.0 kg/cm ² g
Design Temperature	65.0 °C
ANSI Pressure Rating/Class	600#

4.0**GAS COMPOSITION**

GAS CONSTITUENT	AT KHERA STATION
Methane v/v %	82.6803
Ethane v/v %	7.1472
Propane v/v %	3.7403
I-Butane v/v %	0.6763
N-Butane v/v %	0.7670
Butane v/v %	1.4433
Iso Pentane v/v %	0.1590
Normal Pentane v/v %	0.1460
Pentane v/v %	0.3050
Hexane (C-6) v/v %	0.0766



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GAS CONSTITUENT	AT KHERA STATION
C-7	0.0373
C-8	0.0187
C-9	0.0000
C-10 v/v %	0.0000
CO ₂ v/v %	4.4534
N ₂ v/v %	0.0979
Specific Gravity	0.6972
NCV kcal/cm ²	9059.5381

5.0 PROCESS DATA

5.1. Horizontal Type Cartridge Filter

Configuration : The system shall have two nos. Dry Natural Gas Filters (Both Working) as per GAD & Schematic Diagram of Filter.

Design Data :

Fluid	Dry Natural Gas
Flow Rate of each Filter (MMSCMD) (Normal)	18.0
Design Pressure (kg/cm ² g)	93.0
Design Temperature (°C)	65.0
Operating Pressure (kg/cm ² g)	42.0
Operating Temperature (°C)	45.0
Inlet Dirt Load (mg/Sm ³ at 42.0 kg.cm ² g)	0.4
Filter Cleaning Frequency (Days Minimum)	30.0
Pressure Drop across Filter at Clean condition (kg/cm ² g)	0.2
Pressure Drop across Filter at Dirty condition (kg/cm ² g)	1.0



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CLIENT :	GAIL India Limited	KHERA COMPRESSOR STATION UPGRADATION PROJECT	
QUANTITY	02 SETS		
TAG NOS. : 56-F-101D & 56-F-101E			
S.No.	UNITS :	Flow Rate : MMSCMD	Pressure : kg/cm ² g Temperature : Deg. C
OPERATING CONDITION			
1	FILTER	Simplex, Horizontal Type	
2	SERVICE	Dry Natural Gas	
3	NORMAL FLOW RATE (MMSCMD) at 42.0 kg/cm ² g Pressure	18.0 (Design Flow Rate shall be 1.1 times the Normal Flow Rate)	
4	SPECIFIC GRAVITY	0.6972	
5	VISCOSITY (Centipoise)	*	
6	INLET SIZE (Inch NB)	30.0	
7	OUTLET SIZE (Inch NB)	30.0	
8	OPERATING PRESSURE (kg/cm ² g)	42.0	
9	OPERATING TEMPERATURE (°C)	45.0	
10	PARTICLE / MESH SIZE (Micron)	< 5.0	
11	FILTRATION EFFICIENCY (%)	98.0	
12	CORROSION ALLOWANCE (mm)	3.0	
13	ALLOWABLE PRESSURE DROP (kg/cm ² g) Clean / Dirty	0.2 / 0.3 (Max.)	
14	DUST CONCENTRATION (@ P & T) (mg / Sm ³)	0.4 with cleaning frequency of 30 days min.	
MATERIAL OF CONSTRUCTION			
15	PLATES (SHELL / DISHED ENDS)	ASTM A516 GR.70 / ASTM A234 GR. WPB / ASTM A106 GR.B	
16	PIPES (NOZZLES)	ASTM A106 GR.B	
17	FLANGES / BODY COVER / QOEC	ASTM A105 / ASTM A516 GR.70	
18	EXTERNAL BOLTING	ASTM A193 GR.B7 & ASTM A194 GR.2H	
19	INTERNAL BOLTING	SS 316L	
20	FITTINGS	ASTM A234 GR.WPB	
21	SKIRT / LEG SUPPORT	ASTM A516 GR.70 / ASTM A283 GR.C / IS 2062 GR.B	
22	INTERNAL GASKET	*	
23	EXTERNAL GASKET / O-RING	SPIRAL WOUND WITH SS 316L METAL WINDING / BUNA-N	
24	FILTER ELEMENT	FIBROUS	
25	PERFORATED SHEET & OTHER INTERNALS	SS 316	
26	QOEC SEALS	NYLON 6	
DESIGN & CONSTRUCTION			
27	DESIGN CODE	ASME -SEC VIII DIV-1 (LATEST EDITION)	
28	DESIGN PRESSURE (kg/cm ² g)	93.0	
29	HYDROSTATIC TEST PRESSURE (kg/cm ² g)	139.5	
30	DESIGN TEMPERATURE (°C)	65.0	
31	MAKE / MODEL OF CARTRIDGE ELEMENT	*	
32	QTY. OF CARTRIDGE ELEMENT	*	
33	CARTRIDGE ELEMENT (OD x LENGTH x THICKNESS) (mm)	*	
34	DUST / DIRT HOLDING CAPACITY OF EACH CARTRIDGE ELEMENT (For specified pr. Drop)	*	
35	CARTRIDGE ELEMENT BURST PRESSURE (kg/cm ² g)	2.0	
36	TOTAL GROSS FILTERING AREA OF CARTRIDGE ELEMENTS	*	
37	NAME OF FILTER MANUFACTURER	*	
38	FIXING DETAILS OF FILTER CARTRIDGE ELEMENT	*	
39	FLANGE RATING	CLASS 600#	
40	FLANGE FACING	125 AARH	
41	FLANGE TYPE	WNRF	
42	VENT SIZE (INCH NB)	2.0	
43	DRAIN SIZE (INCH NB)	2.0	
44	UTILITY CONNECTION SIZE (INCH NB)	2.0	
45	FLUSHING / BLOW DOWN CONNECTION SIZE (INCH NB)	2.0	
46	PSV / DPT CONNECTION SIZE (INCH NB)	3.0	
47	BODY CLOSURE	QUICK OPENING END CLOSURE (NOTE-7)	
48	PAINTING	AS PER SPECIFICATION	
DIMENSION & WEIGHT			
49	INLET FLANGE TO OUTLET FLANGE (mm)	*	
50	OVERALL HEIGHT (mm)	*	
51	SHELL DIA. (mm)	*	
52	EMPTY WEIGHT (kg)	*	
53	OPERATING WEIGHT (kg)	*	
54	HYDROTEST WEIGHT (kg)	*	
		DATA SHEET OF FILTER	DOCUMENT NO. 11-0330E-03-09-03-004
		REV. 0	
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CLIENT :	GAIL India Limited	KHERA COMPRESSOR STATION UPGRADATION PROJECT	
QUANTITY	02 SETS		
TAG NOS. : 56-F-101D & 56-F-101E			
S.No.	UNITS :	Flow Rate : MMSCMD	Pressure : kg/cm ² g Temperature : Deg. C
ACCESSORIES			
55	QOEC DETAIL	YES	
56	INSULATION CLEATS	NO	
57	LIFTING LUGS	YES	
58	ANCHOR/FOUNDATION BOLTS & NUTS	YES	
59	BLIND FLANGES, BOLTS, NUTS & GASKETS FOR DRAIN, VENT AND UTILITY CONNECTIONS	YES	
60	LADDER & PLATFORM	*	
INSPECTION & TESTING			
61	RADIOGRAPHY	FULL (100%)	
62	PWHT	AS PER CODE	
63	HYDROTESTING	REQUIRED	
64	DP / MP TEST	YES	
NOTES :			
<p>1. (*) VENDOR TO SPECIFY.</p> <p>2. THIS DATA SHEET TO BE READ IN CONJUNCTION WITH THE MATERIAL REQUISITION (DOC. NO. 11-0330E-03-09-06-001) AND TECHNICAL SPECIFICATION (DOC. NO. 11-0330E-03-09-02-002) OF FILTER.</p> <p>3. FILTER ELEMENT SHALL BE OF SINGLE PIECE CONSTRUCTION WITH NO JOINT IN THE ELEMENT. STACKING OF FILTER ELEMENT IS NOT PERMITTED.</p> <p>4. ALL CS MATERIALS SHALL BE OF FULLY KILLED QUALITY.</p> <p>5. FLANGES SHALL CONFORM TO ASME B16.5 AND ASME B16.47.</p> <p>6. GASKETS SHALL CONFORM TO ASME B16.20.</p> <p>7. VESSEL BODY END COVER SHALL BE OF QUICK OPENING (QOEC) TYPE WITH SAFETY DEVICE LIKE DOUBLE YOKE OR BAND LOCK TYPE AND SHALL NOT OPEN UNLESS THE FILTER IS DEPRESSURISED. THE DIAMETER OF FILTER VESSEL SHALL NOT BE LESS THAN TWICE THE INLET NOZZLE DIAMETER.</p> <p>8. THE DIAMETER OF QOEC SHALL BE OF FULL VESSEL DIAMETER.</p> <p>9. TAG NOS. SHALL BE PRECEDED BY "56" FOR ALL EQUIPMENTS / INSTRUMENTS I.E. FOR PRESSURE INDICATOR "PI-1007" SHALL BE READ AS "56-PI-1007".</p> <p>10. BIDDER TO PROVIDE LOAD CALCULATIONS OF ALL NOZZLES MENTIONING ALLOWABLE FORCES, MOMENTS AND THERMAL GROWTH.</p>			
		DATA SHEET OF FILTER	
		DOCUMENT NO.	REV.
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CLIENT:		GAIL India Limited		KHERA COMPRESSOR STATION UPGRADATION PROJECT		
QUANTITY: TWO NOS.						
GENERAL	1	Tag Number		PSV-1009, PSV-1012		
	2	Line Number	Schedule	NA	*	
	3	Vessel Nos.		56-F-101D & 56-F-101E		
	4	Safety/Relief		Safety Relief		
VALVE	5	Full nozzle full lift/Mod. Nozzle		Full nozzle full lift		
	6	Bonnet type		Closed		
	7	Conv./Bellows/Pilot Operated		Conventional		
	8	Inlet Conn.	Size & Rating	3" NB, 600#		
	9		Facing & finish	*		
	10	Outlet Conn	Size & Rating	*		
	11		Facing & finish	*		
	12	Cap Over Adj. Bolt		Yes		
	13		Screwed/bolted	Bolted		
	14	Lifting Gear - Type				
15	Test Gag		Yes			
16						
17						
MATERIAL	18	Body & Bonnet		A 351 CF8M		
	19	Nozzle & Disc		SS 316		
	20	Spring		SS 304		
	21	Belows		-		
	22					
	23			*		
	24	Resilient Seat Seal		-		
OPTIONS	25					
	26					
BASIS	27	Code		API		
	28					
	29					
SERVICE CONDITIONS	30	Fluid	State	Dry Natural Gas	Gas	
	31	Corrosive Constituent				
	32	Required Flow Capacity				
	33	Mol. Wt.	S.G at Rel. Temp.			
	34	Oper. Pressure	Normal	42.0 kg/sq.cm g	42.0 kg/sq.cm g	
	35	Oper. Temp.	Rel.Temp.	45.0 °C		
	36	Valve Discharges to		Atmosphere		
	37	Back Press	Const. or Variable	Variable		
	38	Set pressure				
	39	Cold bend test pressure				
	40	% Over Pressure	% Blow Down	20%	*	
	41	Cp/Cv	Compress. factor			
	42	Viscosity @ Rel. temp mPas(cP)				
	43	Vess. Wall Temp	Surf.Area-m2			
	44	Min. & Max. pressure		As per Technical Specification		
45	Max. flow capacity		*			
ORIFICE	46	Calculated Area cm2		*		
	47	Sel. Area cm2	Orifice Design	*	*	
	48	No. of valves reqd. for capacity		*		
	49	Total Area-cm2		*		
	50	Actual flow capacity		*		
	51	Model No.		*		
	52	IBR Certification		No		
	53	Manufacturer		*		
NOTES :-						
		* Vendor to furnish				
1	Process Data shall be as per Design Basis					
2	At the time of approval of DS, supplier shall furnish DS with catalogues.					
		DATA SHEET OF PRESSURE SAFETY VALVE			DOCUMENT NO.	
					11-0330E-03-11-03-005	
					Rev.	
					0	
SHEET 1 OF 1						

CLIENT:		GAIL India Limited					KHERA COMPRESSOR STATION UPGRADATION PROJECT						
QUANTITY: TWO NOS.													
TAG NOS. : PG-1009 & PG-1012													
1	Type	Direct					Wetted Parts Material						
2	Mounting	Local					Other Material						
3	Dial Size	150 mm					Process Connection						
4	Colour	White with black inscription					Size & rating						
5	Case Material	SS 316					Facing & finish						
6	Bezel Ring	Beyonnet type SS 316					Capillary Material						
7	Window Material	Shatterproof glass					Armour Flexible Material						
8	Enclosure	WP to IP 65 as per IEC 60529/IS 2147					Capillary Length						
9	Pressure Element	Bourdon					Flushing/filling connection with						
10	Element Material	SS 316					17	Over range protection				130 % of FSD	
11	Socket Material	SS 316					18	Blow out protection				Yes	
12	Accuracy	"+/-" 1% of FSD					19	Options					
13	Zero Adjustment	Micropointer					a)	Scrubber			b)	Syphon	
14	Connection	3/4" NPT(M)					c)	Gauge Saver			d)	Liquid filled casing	
	Connection location	Bottom					e)	Vaccum protection			f)	Solid front	
15	Movement	SS 316					g)	Two valve manifold			Yes		
16	Diaphragm Seat	Rigid											
	Type												
S.NO.	TAG NO.	RANGE	PRESSURE			TEMPERATURE			SERVICE	OPTIONS			
			OP.	MAX.	DES.	OP.	MAX.	DES.					
									Natural gas	e,f,g			
NOTES:-		* Vendor to furnish											
	1)	Process data shall be as per Design Basis											
	2)	At the time of approval of DS, supplier shall furnish DS with catalogues											
						DATA SHEET OF PRESSURE GAUGE				DOCUMENT NO.		Rev.	
										11-0330E-03-11-03-006		0	
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CLIENT: GAIL India Limited		KHERA COMPRESSOR STATION UPGRADATION PROJECT									
QUANTITY: TWO NOS.											
TAG NOS. : DPT-1004 & DPT-1005											
1	Function	Transmission & Indication				Other Material					
2	Type	2 Wire, Electronic smart transmitter with HART protocol of latest version				Process Connection					
3	Case	Mfr. Std.				Size & Rating					
4	Mounting	Yoke				Facing & finish					
5	Elec. Area Class.	IEC Zone 1, Gr. II A/IIB, Temp. class T3				Capillary Material					
6	Enclosure	WP to IP 65 as per IEC 60529				Armour Flexible					
7	Intrinsically Safe	Yes				Armour flexible material					
8	Power Supply	24 V DC				Capillary Length					
9	Cable Entry	1/2 " NPT(F) with SS plug				20	Fill Fluid	Silicone Oil			
10	Accuracy	"+/-" 0.075% of span (Note 1)				21	Zero Suppression & Elevation	100% of span			
11	Repeatability	40:1 or better				22	Zero & span adjustment	Continuously adjustable externally, non interactive type			
12	Transmitter Output	4-20mA DC				23	Adapter "O" ring	PTFE			
13	Load Driving Capability	600 ohms at 24 V DC				24	Body Rating				
MEASURING UNIT					MISCELLANEOUS						
14	Service	Natural Gas				25	Over Range Protection	Yes			
15	Element	Diaphragm				26	Options				
16	Body Materials	SS 316				a)	Intrinsically safe output meter :- Yes (LCD in Engg. Unit)				
17	Element Materials	SS 316 L				b)	Air Filler Regulator				
18	Process Connection	3/4" NPT (F) thru flange adapter with plug.				c)	Mounting Accessories suitable for 2" NB pipe :- Yes				
	Process Connection Location	Bottom				d)	2 Valve manifold:- Yes				
19	Diaphragm Seat					27	Model				
	Wetted Parts Material										
S.NO.	TAG NO.	DIFF. RANGE		ZERO ELEV.	ZERO SUPP.	PRESSURE		TEMP.		SERVICE	OPTIONS
		SPAN	SET	mm H2O	mm H2O	MAX.	DES.	MAX.	DES.		
										Natural Gas	a),c),d)
NOTES:-		* Vendor to furnish									
	1)	Accuracy includes the combined effect of repeatability, linearity, hysteresis etc.									
	2)	Operating principle of transmitters shall be capacitance / peizo resistance									
	3)	Process data shall be as per Design Basis									
	4)	HP side of DPT shall be connected with process point terminal & LP shall be open to atmosphere.									
	5)	At the time of approval of DS, Supplier shall furnish DS with catalogues									
		DATA SHEET OF DP TYPE PRESSURE TRANSMITTER				DOCUMENT NO.		Rev.			
						11-0330E-03-11-03-007		0			
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KHERA COMPRESSOR STATION
UPGRADATION PROJECT



TECHNICAL SPECIFICATION FOR
PRESSURE SAFETY VALVE

CLIENT JOB NO.

-

TOTAL SHEETS

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DOCUMENT NO

11

0330E

03

11

02

008

REV	DATE	DESCRIPTION	PREP	CHK	APPR
0	17.05.11	ISSUED FOR TENDER	PS	MLS	MLS
A	29.03.11	ISSUED FOR CLIENT'S COMMENTS	PS	MLS	MLS

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2.0 DESIGN AND CONSTRUCTION..... 4

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TECHNICAL SPECIFICATION FOR
PRESSURE SAFETY VALVE

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1.0 GENERAL

1.1 Scope

1.1.1 This specification, together with the data sheets attached herewith covers the requirements for the design, materials, fabrication, nameplate marking, inspection, testing and shipment of pressure relief valves.

1.1.2 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 American National Standards Institute/American Society for Mechanical Engineers.

- B 1.20.1 Pipe Threads General Purpose (Inch).
- B 16.5 Pipe Flanges and Flanged Fittings NPS 1/2" through JSr PS 24
- B 16.20 Ring Joint Gaskets and Grooves for Steel Pipe Flange
- B 16.34 Valves- Flanged, Threaded and Welding End

ASME American Society of Mechanical Engineers.

- Sec-VIII Boiler and Pressure Vessels Code Section VIII 'Pressure Vessels'
- Sec-I Boiler and Pressure Vessels Code. Section-I 'Power Boilers'

API American Petroleum Institute

- API 520 Sizing, Selection and Installation of Pressure Relieving Devices in Refineries.
- Part I Sizing & Selection
- Part II Installation
- API 521 Guide for Pressure Relieving and Depressurizing Systems.
- API 526 Flanged Steel Pressure Relief Valves
- API 527 Seat Tightness of Pressure Relief Valves.
- EN 10204 Inspection Documents For Metallic Products.
- IBR Indian Boiler Regulations

1.1.3 In the event of any conflict between this specification, data sheets, related standards, codes etc., the following order of priority shall govern:

- a) Statutory Regulations
- b) Data Sheets
- c) Standard Specification
- d) Codes and Standards

1.1.4 In addition to compliance to purchaser's specifications in totality, vendor's extent of responsibility shall include the following;



**TECHNICAL SPECIFICATION FOR
PRESSURE SAFETY VALVE**

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- a) Technical data sheets indicate the type, size, relieving area etc. of the selected the valve. However, vendor shall be responsible to size and select the proper valve with orifice relieving area meeting the indicated operating conditions
- b) Technical data sheets specify the minimum acceptable materials for body, bonnet, disc, nozzle, spring, bellows etc.

1.2 Drawing and Data

1.2.1 Detailed drawings, data, catalogues and manuals required from the vendor are indicated by the purchaser in vendor data requirement sheets.

1.2.2 Final documentation consisting of design data, installation manual, operation and maintenance manual etc. submitted by the vendor after placement of purchase order shall include the following as a minimum:

- a) Specification sheet for each pressure relief valve and its accessories
- b) Certified drawing sheets for each pressure relief valve and accessories, which shall provide dimensional details, internal construction details, end connection details, weight and material of construction.
- c) Copy of type test certificates.
- d) Copy of test certificates for all the tests indicated in clause 4.0 of this specification.
- e) Installation procedure for Pressure relief valve and its accessories
- f) Calibration and maintenance procedure including replacement of internals wherever applicable.

2.0 DESIGN AND CONSTRUCTION

2.1 Valve Design

2.1.1 The definitions of various terminologies used in purchaser's data sheets are as per clause 1.2 of API RP 520 part 1.

2.1.2 Unless specified otherwise, all pressure relief valves shall be full nozzle full lift type and all relief valves in thermal safety application shall be modified nozzle type.

2.1.3 For flanged pressure relief valves, the valve inlet and outlet size, the orifice designation and corresponding relieving area shall be as per API 526.

2.2 Valve Sizing

2.2.1 Sizing shall be carried out using the formulae mentioned in the following standards whenever the sizing code mentioned in the purchaser's data sheets refers to these

<u>Sizing Code</u>	<u>Standard</u>
API	API RP 520 Part I API RP 521

2.2.2 Discharge Co-efficient

For all valves in gas, vapour or steam service with design code as ASME Sec VIII or ASME Section I discharge co-efficient of 0.975 as per API 520 shall be used.

2.2.3 For the selected orifice letter designation and inlet and outlet size of the pressure relief valve, relieving area of the valve offered by vendor shall meet those in API-526.

2.3 Valve Construction

2.3.1 Body

2.3.1.1 Unless otherwise mentioned, end connection details shall be as below: -

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- a) Threaded end connections shall not be used.
- b) Flanged end connections shall be as per ANSI/ASME B 16.5.
- c) Flanged face finish shall be as per ANSI/ASME B 16.5. The face finish as specified in the data sheets, shall be as follows;

125AARH	125to200AARH
63 AARH	32 to 63 AARH

2.3.1.2 For flanged valves, inlet and outlet sizes and ratings and centre to flange face dimensions shall be in accordance with API-526. Dimensional tolerance shall be as mentioned therein.

2.3.1.3 Body drain with a plug shall be provided as a standard feature on every pressure relief valve.

2.3.1.4 For the pilot operated pressure relief valves, where vendor's standard model provides only semi nozzle design (i.e. the body is part of the inlet flow path), body material shall be of the same material as that of nozzle specified in purchaser's data sheets, as a minimum.

2.3.2 Trim

2.3.2.1 The term 'trim' covers all the parts of the valves exposed to and in contact with the process fluid except for the body and bonnet assembly i.e. nozzle, disc, disc holder, stem etc.

2.3.2.2 Valves shall be of the full nozzle type of design with the exception as per clause 2.3.1.4 and valves in thermal relief application.

2.3.2.3 Wherever stelling of disc and nozzle has been specified, it stands for stelling of the seat joint and the entire disc contour, unless otherwise mentioned.

2.3.2.4 For high temperature application, the materials for the internals shall be selected to avoid galling.

2.3.2.5 Resilient seat, seals or o-rings wherever used shall be suitable for pressure and temperature conditions specified.

2.3.2.6 Gaskets wherever used shall be metallic type. Gaskets with asbestos filler or with asbestos bearing material shall not be used.

2.3.3 Bonnet and Spring

2.3.3.1 All valves shall be provided with a cap over the adjusting bolt. Cap shall be of either bolted type or screwed type as specified in the purchaser's data sheets.

2.3.3.2 Lifting lever shall be provided whenever the fluid to be relieved is steam and air or water above 65°C.

2.3.3.3 Valve spring shall be selected such that it can permit an adjustment of ±5% of the set pressure, as a minimum.

2.3.3.4 Carbon steel springs shall be made corrosion resistant through plating/coating as per manufacturer's standard design or as specified in the purchaser's data sheets.

2.3.3.5 The allowable tolerance in set pressures are as below:

- a) ±0.14 kg/cm² g for set pressure upto and including 5kg/cm² g.
- b) ±3% for set pressure above 5kg/cm² g.

2.3.3.6 Bonnet shall be of the closed type for all process applications in general. Open type bonnet shall be used only for steam and non-hazardous/non-toxic fluids. For all steam applications under design code 1BR or ASME Section-I with open bonnet design, weather protection cover shall be provided.

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2.3.4 Pilot Design

2.3.4.1 For pilot operated valves, the pilot design shall be of inherently fail safe.

2.3.4.2 Unless specified otherwise, pilot shall be non-flowing type.

2.3.4.3 All accessories like back flow preventer, pilot filter etc. required for proper operation of pilot operated valves as per indicated service conditions shall be included.

2.3.4.4 Material of construction of pilot shall be same as that of main valve nozzle as a minimum.

2.3.4.5 The o-ring and diaphragm material of pilot shall be suitable for the pressure and temperature conditions specified in the data sheet.

NAMEPLATE

2.4 Each pressure relief valve shall have a stainless steel nameplate attached firmly to it at a visible place furnishing the following information: -

- a) Tag number as per purchaser's data sheet.
- b) Manufacturer's serial number and/or model number.
- c) Manufacturer's name/trade mark.
- d) Nominal flange size in inches and rating in pounds for both inlet and outlet.
- e) Orifice letter designation.
- f) Valve set pressure.
- g) Cold bench test set pressure.

2.4.1 For the above, pressures shall be marked in the same units as those followed in purchaser's data sheets.

3.0 INSPECTION AND TESTING

3.1 Vendor shall submit the following test certificates and test reports for purchaser's review:-

- a) Material test certificate as per clause 3.1B of EN10204 for each valve body and bonnet castings/forging, nozzle and as per clause 2.2 for stem, disc etc.
- b) Certificate of radiography/X-ray for valve castings as per following requirements;
 - i) 100% radiography shall be carried out for all valve castings with body rating of 600# and above or wherever specifically indicated for in the material requisition.
 - ii) Radiography procedure shall be as per ANSI B 16.34 and acceptance criteria shall be as per ANSI B 16.34 Annexure-B. Following area of pressure relief valve shall be radiographed unless specified otherwise.
 - Inlet flange neck
 - Outlet flange neck
 - Nozzle (in case of cast construction)
 - Body/bonnet joint neck.
- c) Dimensional, hydrostatic and functional test reports for all valves as per clause 4.3 and 4.4 of this specification.
- d) Type test certificate for blow-off and closing down pressure.

3.2 Hydrostatic Test

3.2.1 Each Pressure relief valve body shall undergo hydrostatic test as per outlet flange ANSI rating. However all the safety valves castings covered under IBR shall be tested as per IBR regulations. There shall not be any visible leakage during this test.



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3.2.2 For full nozzle type of pressure relief valve, nozzle shall undergo hydrostatic test as per inlet flange ANSI rating. For Semi nozzle design, valve Inlet shall be tested after assembly as per Inlet flange ANSI rating.

3.3 **Functional Test**

3.3.1 Cold bench set pressure test:

Pressure relief valve shall be tested for opening at specified set pressure. Testing of pressure relief valves shall be with air or nitrogen, testing of thermal relief valves shall be with water.

3.3.2 Seat Leakage test

a) Whenever the specified set pressure is less than or equal to 420 kg/cm²g, the valve shall meet the seat tightness requirements specified in API RP-527. The maximum permissible leakage rates against various sizes shall be as specified therein. Whenever the specified set pressure exceeds 420 kg/cm²g, the vendor shall submit the leakage rates of valves for approval by the purchaser. Where bubble tightness has been specified, there shall be no leakage or bubbles of air at the specified percentage of set pressure.

b) Seat leakage test pressure shall be as per API RP 527 for all valves except for valves under IBR or ASME Section-I design code and pilot operated pressure relief valves. For these valves seat leakage shall be carried out at the following pressure;

- i) Valves Under IBR or ASME Section-I: 95% of Set Pressure
- ii) Pilot operated Pressure relief valves
 - Upto 3.5 Kg/cm²G : 90% of set Pressure
 - Above 3.5 Kg/cm²G : 95% of Set Pressure

-----X-----X-----





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PROJECT**



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ANNEXURE-1 : MATERIAL OF CONSTRUCTION



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1.0 GENERAL

1.1 Scope

1.1.1 This specification, together with the data sheets attached herewith covers the requirements for the design, materials, nameplate marking, and inspection, testing and shipping of pressure, differential pressure and vacuum gauges.

1.1.2 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 American National Standards Institution/American Society
of Mechanical Engineers.

B 1.20.1 Pipe Threads General Purpose (Inch)

B 16.5 Pipe Flanges and Flanged Fittings NPS'A through
NPS24

B 16.20 Metallic Gaskets for Pipe Flanges, Ring Joint, Spiral
wound and Jacketed.

EN10204 Inspection Documents For Metallic Products

IEC-60529 Degree of Protection Provided by Enclosures (IP Code)

IS-13947 Specification for Low Voltage Switchgears and Control
gears.

IS-3624 Specification for Pressure and Vacuum Gauges.

1.1.3 In the event of any conflict between this standard specification, data sheets, statutory regulations, related standards, codes etc., the following order of priority shall govern:

- a) Statutory Regulations'
- b) Datasheets
- c) Standard Specification
- d) Codes and Standards

In addition to compliance to purchaser's specifications in totality, vendor's extent of responsibility shall include the following:

- a) Purchaser's data sheets specify the type of pressure element. Unless specifically indicated otherwise, alternate type of pressure elements shall also be acceptable provided all the functional and performance requirements specified in the respective data sheets are guaranteed by the vendor.
- b) Purchaser's data sheets indicate the minimum acceptable material of construction for pressure element, movement etc. Alternate superior material of construction shall also be



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acceptable provided vendor assumes complete responsibility for the selected materials for their compatibility with the specified fluid and its operating conditions.

1.2 Drawing and Data

1.2.1 Detailed drawings, data, catalogues and manuals required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducible, prints and soft copies shall be dispatched to the address mentioned, adhering to the time limits indicated.

1.2.2 Final documentation consisting of design data, installation manual, operation and maintenance manual etc., submitted by the vendor after placement of purchase, order shall include the following, as a minimum:

- a) Specification sheet for each gauges, and its accessories.
- b) Certified drawings sheets for each gauges and its accessories, which shall provide dimensional details, internal constructional details, end connection details and materials of construction.
- c) Copy of type test certificates.
- d) Copy of the test certificates for all tests indicated in clause 4.0 of this specification.
- e) Installation procedure for each gauge and its accessories.
- f) Calibration and maintenance procedures including replacement of internal parts wherever applicable

2.0 DESIGN AND CONSTRUCTION

2.1 Pressure Elements, Gauge Movement and Socket

2.1.1 The pressure element shall be an elastic element like bourdon tube, bellow, diaphragm etc with material as specified in the data sheet.

2.1.2 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.

2.1.3 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.

2.1.4 The gauge socket shall be in one piece and shall also serve as element anchorage in case of bourdon tube type element, which shall be directly connected to the socket, without any capillary or tube in between. For other types of elements, the anchorage may be integral with the socket or connected with the socket using capillary tube with minimum bore of 3 millimetres.

2.1.5 Any joint in the process wetted system including joint between the element and the anchorage/socket shall be welded type only.



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- 2.1.6 Unless specified otherwise, the pressure gauges shall have an over-range protection of at least 130% of maximum working pressure, as a minimum.
- 2.1.7 Data sheet indicates the minimum requirement of material of construction. Alternate materials as specified in Annexure 1 to this specification shall also be acceptable subject to meeting process conditions.
- 2.1.8 The gauge movement material shall be of stainless steel unless specified otherwise in the data sheet. It shall be adjustable for calibration without dismantling the sensor unit. The use of 'S' link for calibration of span is not permitted.
- 2.1.9 Vendor shall ensure that the operating pressure falls in the middle 30% of the full working range i.e. operating pressure shall fall between 35% and 65% of the range offered.
- 2.1.10 Pressure gauges with range as 0 to 100kg/cm²g and above shall have safety type solid front case.
All gauges in oxygen and chlorine service shall be thoroughly degreased using reagents like trichloro-ethylene or carbon tetrachloride. All connections shall be plugged after degreasing process in order to avoid entrance of grease or oil particles.

2.2 Cases and Dials

- 2.2.1 Unless specified otherwise, the gauges shall be weather proof to IP 55 as per IEC 60529 / IS 13947, as a minimum.
- 2.2.2 In general, dial markings and dial colour shall be as per IS 3624. Dials of gauges in oxygen service shall additionally have the word 'OXYGEN' or 'CHLORINE' written in black and 'USE NO OIL' written in red.
- 2.2.3 The gauge dial shall be made of a suitable metallic materials so that the finished dial shall be capable of withstanding a dry heat of 85°C for 10 hours and immersion in water-at 85°C for 1 hour without cracking, blistering, warping or discolouration of the dial or paint on the dial.
- 2.2.4 The pointer stops shall be provided at both ends of the scale to restrict the pointer motion beyond 5% above the maximum of scale and less than 5% below the minimum of the scale.
- 2.2.5 The dial cover shall be made out of shatter proof glass sheet of thickness 1.5 to 3mm for gauges with dial size less than 100mm while minimum 3.0mm for gauges with dial size 100mm or greater.
- 2.2.6 All gauges shall be provided with a blow out device i.e. blow out disc of aperture not less than 25mm for gauges with dial size 100mm and above, while 20mm for gauges with dial size less than 100mm.
- 2.2.7 When safety type solid front type of gauges are specified, they shall consist of a solid partition isolating the pressure element from the dial. In such gauges the total solid partition disc area shall not



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be less than 75% of the cross sectional area of the inside of the case surrounding the pressure element.

2.3 Diaphragm Seals

- 2.3.1 Unless otherwise indicated in purchaser's data sheets, gauges specified with diaphragm seals shall have their diaphragms integral with the gauges.
- 2.3.2 Whenever diaphragm seal gauges are specified with capillary, the size of the capillary shall be selected to ensure response time of the gauge better than 5 seconds.
- 2.3.3 The sealing liquid for diaphragm seal gauges shall be an inert liquid, compatible with the process fluid and its temperature. For gauges in oxygen and chlorine service, the sealing liquid shall be fluoro lube or equivalent compatible with the specified service.
- 2.3.4 For diaphragm seal pressure gauges with flanged ends, the diaphragm shall be rated for the maximum allowable pressure of the associated flange.

2.4 End Connection

- 2.4.1 Unless specified otherwise, the following shall govern;
 - a) Threaded end connections shall be NPT as per ANSI / ASME B. 1.20.1.
 - b) Flanged end connection shall be as per ANSI / ASME B. 16.5
 - c) Ring joint flanges shall have octagonal grooves as per ANSI / ASME B16.20.
 - d) Flange face shall be as per clauses 6.4.4.1, 6.4.4.2 and 6.4.4.3 of ANSI / ASME B16.5. The face finish as specified in the data sheet shall be as follows;

125AARH : 125 to 250 AARH
 63 AARH : 32 to 63 AARH

2.5 Performance Requirements

- 2.5.1 Unless otherwise specified, the accuracy which is inclusive of repeatability and hysteresis of pressure gauges / differential pressure gauges shall meet the following performance requirements:
 - a) Direct pressure gauge : ±1% of full scale
 - b) Chemical seal type pressure gauge : ±2% of full scale
 - c) Differential pressure gauges : ±2% of full scale

2.6 Accessories

- 2.6.1 Gauges shall be supplied with all accessories as specified in the data sheets pre-installed.
- 2.6.2 For flanged diaphragm seal gauges, spacer ring, isolation valve and plugs shall be provided whenever specified.
- 2.6.3 Over Range Protector (OPV)
 - a) Whenever the maximum pressure specified in the data sheet exceeds the over range protection pressure, over range protector shall be supplied.



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- b) In case of pressure gauges with diaphragm seal, the over-range protector shall be installed between the seal and the gauge.
- c) The material of construction of over range protector shall be same as socket material, as a material.

2.6.4 Snubber

- a) Whenever the service specified is pulsating type, snubber shall be supplied.
- b) The material of construction of snubber shall be same as socket material, as a minimum.

3.0 NAME PLATE

3.1 Each gauge shall have a stainless steel nameplate attached firmly to it at a visible place either by riveting or screwed to the case, furnishing the following information:

- a) Tag number as per purchaser's data sheets.
- b) Vendor's name
- c) Model number and manufacturer's serial number.
- d) Range of the instrument.
- e) MAWP and maximum vacuum rating of element

4.0 INSPECTION AND TESTING

4.1 Unless otherwise specified, purchaser reserves the right to test and inspect all the items at the vendor's works inline with the inspection test plan for pressure, differential pressure and vacuum gauges.

4.2 Vendor shall submit following test certificates and test reports for purchaser's review:

- a) Material test report as per EN10204 clause 2.2 for wetted parts like gauge socket and sensing element and as per clause 3.IB for flanges and spacer rings of diaphragm seal type pressure gauges.
- b) Type test report for enclosure.
- c) Dimensional test report for all gauges.
- d) Performance test reports for all gauges including accuracy, repeatability, over pressure and vacuum test (as applicable)
- e) Type test reports for shock test and endurance test as per IS-3624 for each type / model.
- f) Type test report for influence of temperature for each type/model.

4.3 Witness Inspection

4.3.1 All pressure, differential pressure and vacuum gauges shall be offered for pre dispatch inspection for following as a minimum:

- a) Physical dimensions verification and workmanship.



- b) Performance test including accuracy and repeatability, on representative samples of each type/model number before and after over-pressure and vacuum test.
- c) Over-pressure and vacuum test (as applicable) shall be carried out on representative samples of each type / model number without loss of their elastic characteristics.
- d) Review of all certificates and test reports as indicated in clause 4.2 of this specification.

4.3.2 In the event when the witness inspection is not carried out by purchaser, vendor shall anyway complete the tests and the test documents for the same shall be submitted to purchaser for scrutiny.



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S.No.	Item	Specified Material of Construction	Alternate Material of Construction
1.	Sensing Element	SS316	SS316L, SS316Ti
2.	Socket	SS316	SS316L, SS316Ti
		SS304	SS304L, SS316
3.	Case	Cast Aluminium	SS316Ti, SS316L,SS
4.	Capillary	SS	SS304, SS316, SS304L, SS316L, SS316Ti
. 5.	Diaphragm	SS316	SS316L, SS316Ti
		SS	SS 302, SS 304, SS 304L, SS316, SS316L, SS316Ti



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1.0 General

1.1 Scope

1.1.2 This specification, together with the data sheets attached herewith forms the requirements for the design, materials, nameplate marking, inspection, testing and shipping of electronic/pneumatic instruments.

1.1.3 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	American National Standards Institute / American Society of Mechanical Engineers
B 1.20.1	Pipe Threads General Purpose (Inch)
B 16.5	Pipe Flanges and Flanged Fittings NPS½ through NPS24
B 16.20	Metallic Gaskets for Pipe Flanges, Ring Joint, Spiral wound and Jacketed.
BS-5760	Reliability of System, Equipments and Components
EN 10204	Inspection Documents For Metallic Products
IEC-60068	Environmental Testing
IEC-60079	Electrical Apparatus for Explosive Gas Atmosphere.
IEC-60529	Classification of Degree of Protection Provided by Enclosures.
IEC-61000-4	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment.
IEC-61158	Fieldbus Standard for use in Industrial Control System
IEC-61158-2	Physical layer specification and Service definition for Field bus
IEC 61508	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems.
IS-13497	Specification for Low Voltage Switch gears and Control gears.
IS-2148	Flame Proof Enclosures of Electrical Apparatus.
ISA	Instrumentation System and Automation Society
S 7.3	Quality Standard for Instrument Air
S 50.1	Compatibility of Analog Signals for Electronic Industrial Process Instruments.
ITK-x.x	Interoperability Test Kit (latest version)

1.1.4 In the event of any conflict between this standard specification, job specification/data sheets, Statutory regulations, related standards, codes etc. the following order of priority shall govern:
a) Statutory Regulations



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- b) Data Sheets
- c) Standard Specification
- d) Codes and standards

1.1.5 In addition to compliance to purchaser’s specifications in totality, vendor’s extent of responsibility shall include the following:

- a) Purchaser’s data sheets specify the minimum acceptable material of construction of body, measuring element and accessories. Alternate superior material of construction shall also be acceptable provided vendor assumes complete responsibility for the selected materials for their compatibility with the process fluid and its operating conditions.
- b) Selection of suitable sealant liquid for diaphragm seal instruments compatible with the process fluid and its operating temperature.

1.2 Drawing and Data

1.2.1 Detailed drawings, data, catalogues and manuals required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducible, prints and soft copies should be despatched to the address mentioned, adhering to the time limits indicated.

1.2.2 Final documentation consisting of design data, installation manual, operation and maintenance manual, etc submitted by the vendor after placement of purchase order shall include the following, as a minimum;

- a) Specification sheet for each electronic/pneumatic instrument and their accessories.
- b) Certified drawing for each instrument, which shall provide dimensional detail, internal construction and part list, material of construction etc.
- c) Calculations for integral orifice
- d) Copy of type test certificates.
- e) Copy of the test certificates of all the tests indicated in clause 4.0 of this specification.
- f) Installation procedure for electronic/pneumatic instrument and its accessories.
- g) Calibration and maintenance procedures including replacement of its internal parts.

2.0 DESIGN AND CONSTRUCTION

2.1 General Requirements

2.1.1 The type and material of construction of electronic/pneumatic instruments shall be as specified in the purchaser’s data sheet.

2.1.2 The range of instruments shall be selected by vendor base on the set range indicated in the purchaser’s data sheet. Where no set range is indicated, vendor may select the same as per the following guidelines;

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- a) The set range shall be 1.1 times the maximum process value or 1.4 times the operating process value whichever is higher rounded to the nearest ten.
 - b) The set range shall preferably be in the middle third of the selected instrument range.
- 2.1.3 Except for instruments covered under clause 2.2.3.10 of this specification or specified otherwise in purchaser's data sheets, each instrument shall have an over-range protection of at least 130% of specified range.
- 2.1.4 Measuring element in vacuum service shall have under range protection down to full vacuum, without undergoing a change in calibration or permanent set.
- 2.1.5 Unless otherwise specified, diaphragm seal instrument shall meet the following requirements;
- a) Instruments shall have its diaphragm seal integral with the instrument and shall be supplied with adaptor flange.
 - b) When purchaser data sheets specify wafer seal type of instrument, vendor shall include supply of studs, nuts and gasket as per the materials specified in the purchaser's data sheet. Refer Annexure – 1 attached with this specification for stud – bolts, nuts and gasket material requirement.
 - c) The sealant shall be an inert liquid, compatible with the process fluid and process temperature indicated in the purchaser's data sheets. In general, sealant shall be;
 - i) DC 704 or equivalent for all diaphragm seal instruments except for oxygen and chlorine.
 - ii) Flouro-lube or equivalent for all diaphragm seal instruments in oxygen and chlorine.
- The requirement of spacer ring shall be as specified in purchaser's data sheet. The material of construction of spacer ring shall be 316 Stainless Steel, as a minimum unless otherwise specified in the purchaser's data sheets.
- 2.1.6 Wherever purchaser data sheet specified integral flow transmitter, vendor shall supply complete assembly consisting of integral orifice, upstream and downstream meter runs with end flanges.
- a) Three nos. of integral orifice plates shall be supplied i.e one is installed and two are spares.
 - b) Unless otherwise specified, material of construction shall be 316 Stainless Steel for integral orifice and meter run with flanges.
- 2.1.7 The instrument enclosure shall be suitable for the area classification indicated in the purchaser's data sheets. Unless otherwise specified, the enclosure shall meet the following standards;

Weatherproof housing IP-65 to IEC-60529/IS-13947.

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Flameproof housing Flameproof/ Ex (d) as per IEC-60079/IS-2148.

Flameproof housing shall also be made weatherproof.

2.1.8 Unless otherwise mentioned, end connection details shall be as below:-

- a) Threaded end connections shall be to NPT as per ANSI/ASME B 1.20.1.
- b) Flanged end connections shall be as per ANSI/ASME B 16.5.
- c) Grooves of ring-type joint flanges shall be octagonal as per ANSI B16.20.
- d) Flanged face finish shall be as per clauses 6.4.4.1, 6.4.4.2, and 6.4.4.3 of ANSI B 16.5. The face finish as specified in the data sheets shall be as follows: -

125 AARH : 125 to 200 AARH

63 AARH : 32 to 63 AARH

2.1.9 All electronic / pneumatic instruments in oxygen and chlorine service shall be thoroughly degreased using reagents like trichloro-ethylene or carbon tetrachloride. End connection shall be blinded / plugged after the degreasing process in order to avoid entrance of grease or oil particles.

2.1.10 Electronic Instruments

2.1.10.1 All instruments shall be of state-of-the-art technology and shall be in compliance with the electromagnetic compatibility requirements specified in IEC-61000-4 standard.

2.1.10.2 Plug-in circuit boards shall be designed and manufactured such that reverse insertion or insertion of the wrong card is prevented.

2.1.10.3 Electronic instruments shall generally operate on nominal voltage of 24 V DC and shall be protected against short circuit and reverse voltage. Transmission and output signal shall generally be 4 to 20 mA DC for analog and smart transmitters. The display of integral output meter shall be in engineering units for pressure, differential pressure and flow and 100% linear for level.

2.1.10.4 Electronic transmitters with two-wire system shall be suitable for delivering rated current to an external loop resistance of at least 600ohm when powered with 24 V DC.

2.1.10.5 Terminals for electrical connections shall be clearly identified, and polarity shall be permanently marked.

2.1.10.6 Peak to peak ripple and total noise level in the analog output signal shall not exceed 0.25% of the maximum signal.

2.1.10.7 Power supply, signal isolation, ripple and noise requirements shall generally be as per ISA-S 50.1.

2.1.10.8 Electrical conduit entries shall have internal NPT 1/2" threads.

2.1.11 Pneumatic Instruments.

2.1.11.1 All pneumatic connections shall be 1/4" NPT, unless otherwise specified.

2.1.11.2 All threaded connections shall be internal, unless otherwise specified.

2.1.11.3 The process input connections and pneumatic output and air supply connections etc. shall be permanently stamped on the body at a suitable place.



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2.1.11.4 Unless otherwise specified, pneumatic instruments shall operate on air supply of 1.4 kg/cm²g and shall have transmission and output signal of 0.2 to 1.0 kg/cm²g.

2.1.11.5 Instrument air quality shall be as per ISA-S7.3 and shall be free from all corrosive, hazardous, flammable and toxic contaminants.

2.2 Transmitters

2.2.1 Pneumatic Transmitters

2.2.1.1 Pneumatic blind transmitters shall be of the force-balance type and pneumatic indicating transmitters of the motion balance type.

2.2.1.2 Transmitters shall have an accuracy of 0.5 % of span.

2.2.1.3 Transmitters shall be supplied with external zero and span adjustments.

2.2.2 Electronic Analog Transmitters

2.2.2.1 Electronic transmitters shall be of the two-wire dc current regulating type. They shall be provided with integral output indicator. When specified, field mounted external output meters shall be provided.

2.2.2.2 Electronic analog transmitters shall have an accuracy of ± 0.075 % of span.

2.2.2.3 Transmitters shall be supplied with external zero and span adjustments, Flameproof transmitters shall also have their calibration adjustment from outside, without any need to remove the cover.

2.2.2.4 Unless otherwise specified, the electronic transmitters shall be certified intrinsically safe.

2.2.3 Smart and Field bus based Transmitters

2.2.3.1 Smart and field bus based transmitters shall be two wire microprocessor based type. These shall have a non-volatile memory, storing, complete sensor characterisation and configuration data of the transmitter. All necessary signal conversions and output generation with the required protocol shall be carried out in the transmitter electronics. Integral output meter with LCD display shall be provided for all transmitters.

2.2.3.2 Transmitter shall also run complete diagnostic subroutines and shall provide diagnostic alarm messages for sensor as well as transmitter healthiness. Field bus based transmitter in addition shall have facility to detect plugged impulse lines, whenever specifically indicated in purchaser's data sheets. In the event of detection failure, the output shall be driven to a predefined value, which shall be field configurable.

2.2.3.3 The transmitters with field bus connectivity shall have built in control algorithm like proportional, proportional-integral and proportional-integral-differential.

2.2.3.4 Whenever specifically indicated in purchaser's data sheets, the meter electronics shall be provided with in-built lightning and power supply surges. The transient protection shall meet the requirements specified in IEC-60587.

2.2.3.5 The configurational data of the instruments shall be stored in a non-volatile memory such that this remains unchanged because of power fluctuations or power off condition. In case vendor standard instrument has battery backed RAM, vendor to ensure that battery drain alarm is provided as diagnostic maintenance message.



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2.2.3.6 Accuracy of transmitters, smart as well as field bus based, shall be as follows:

- a) For transmitter ranges of 760 mm WC and above, the accuracy shall be equal to or better than $\pm 0.075\%$ within a turndown of 1:10 of the offered span.
- b) For transmitters with ranges less than 760 mm WC the accuracy shall be equal to or better than $\pm 0.15\%$ within a turndown of 1:10 of the offered span.
- c) For all diaphragm seal transmitter with ranges 500 mm WC and above, the accuracy shall be equal to or better than $\pm 0.25\%$ within a turndown of 1:10 of the offered span.
- d) For all diaphragm seal transmitter with ranges less than 500 mm WC, the accuracy shall be equal to or better than $\pm 0.5\%$ within a turndown of 1:10 of the offered span.

The accuracy is defined as the combined effect of repeatability, linearity and hysteresis.

2.2.3.7 The stability of the transmitters shall be equal to or better than $\pm 0.1\%$ of span for a period of minimum 6 months, as a minimum.

2.2.3.8 Transmitter shall update the output at least 8 times a second unless otherwise specified.

2.2.3.9 Unless specified otherwise in purchaser's specification, transmitter response time shall be as follows:

- a) For transmitter range of 760 mm WC and above, the response time shall be equal to or 1 second. The response time of the transmitter shall be considered as the sum of dead time and 63.2% step response time of the transmitter.

2.2.3.10 Unless specified otherwise, the over-range/static pressure protection of the transmitter shall be as follows;

- a) For transmitter range between 1 kg/cm²g and 100kg, the over range/static pressure shall be 130 kg cm²g.
- b) For transmitter with ranges of 100 kg/ cm²g and above, the over-range/static pressure shall be 210 kg/cm²g or 130% of maximum range whichever is higher.
- c) For transmitter range between 0.5 kg/cm²g to 1.0 kg/ cm²g, the over pressure/static pressure shall be 70kg/cm²g.
- d) For transmitters with ranges between 1000mm WC to 5000mm WC, the over-range/static pressure shall be 35kg/cm²g.
- e) For transmitter with ranges less than 1000mm WC, over-range/static pressure shall be 1.0kg/cm²g.

2.2.3.11 In the transmitter, the 'WRITE' option shall be protected through password.

2.2.3.12 Temperature transmitters shall meet the following requirements as a minimum:

- a) Temperature transmitter shall be universal type and shall be able to accept input from resistance temperature detector (RTD) or thermocouple (T/C) of any type and range.



- b) Temperature transmitters shall be freely programmable i.e. element type and range shall be programmable without any change in hardware / software.
- c) Temperature transmitter shall be remote mounted type, in general. Head mounted transmitters shall be supplied when specifically indicated in purchaser's data sheets.
- d) The accuracy of the temperature transmitter with RTD element shall be as follows:
 - For temperature range above 350°C, the accuracy shall be equal to or better than $\pm 0.075\%$ of full scale.
 - For temperature range with ranges between 350°C to 150°C, the accuracy shall be equal to or better than $\pm 0.15\%$ of full scale.
 - For temperature range below 150°C, the accuracy shall be equal to or better than $\pm 0.2\%$ of full scale.
- e) The accuracy of temperature transmitter with cold junction compensation for Thermocouple element shall be as follows;
 - For temperature above 350°C, accuracy shall be $\pm 0.25\%$ of range.
 - For temperature between 150°C to 350°C. accuracy shall be $\pm 0.5\%$ of range.

2.2.3.13 When HART protocol is specified, the following features must be ensured;

- a) It shall allow multi masters (two for example, primary and secondary) for configuration, calibration, diagnostics and maintenance. The primary could be the control system or host computer and the secondary could be the hand-held communicator.
- b) It shall be capable of implementing universal commands from either of these locations.

2.2.3.14 In addition to the requirements specified above, field bus based transmitter shall meet the following requirements;

- a) All instruments must satisfy the requirements of the field bus registration laboratory with applicable checkmark like foundation field bus, profibus PA, or as specified in the purchaser's data sheets.
- b) All instruments shall have two analog input blocks, as a minimum. In addition, when specified the transmitter shall also have PID controller block.
- c) All instruments must be interoperable and shall have valid interoperability test clearance like ITK latest version for foundation field bus or equivalent for profibus PA, as applicable.
- d) The field bus instruments shall support peer to peer communication.
- e) Field bus instruments as offered shall not be polarity sensitive.
- f) The field bus instruments in hazardous area shall be certified as per entity concept or shall be FISCO approved as per the requirements specified in the purchaser's specification.



2.4 Receivers

2.4.1 Pneumatic/electrical cables shall be such that they permit the instrument internals to be drawn from its normal mounting position without affecting operation. Pneumatic connection points shall seal automatically upon disconnection.

2.4.2 Electronic receivers shall be suitable for standard voltage inputs of 0.25 to 1.25 V, 1 to 5 V, 0 to 10 V dc. Any voltage receiver shall not alter the voltage drop across the conditioning resistor by more than $\pm 0.1\%$ of input range of maximum input voltage.

2.4.3 Recorder pens shall be easily replaceable.

Each recorder shall be supplied with chart-rolls and ink for six months continuous operation

2.5 Controllers

2.5.1 Automatic control stations including dedicated cascade control stations shall have switches to transfer control from automatic to manual mode and vice-versa. The transfer shall be procedureless and shall not produce any bump in the process under control during such a transfer, the output signal shall not change by more than 1% of span.

2.5.2 Cascade control stations shall have a switch to select local or remote set point.

2.5.3 The control settings of the controller shall be readily adjustable from the front.

2.5.4 Controller action shall be easily reversible.

2.5.5 Pneumatic automatic controller shall be easily removable, without disturbing the manual control mechanism.

2.5.6 Electronic controller shall be easily removable, with the aid of a service station.

2.5.7 Local mounted pneumatic controllers shall be supplied with gauges for air supply pressure and control signal. The gauges shall be integral with the instrument.

2.6 Accessories

2.6.1 Field HART Communicator:

2.6.1.1 It shall be possible to perform routine configuration, calibration, display process variable, diagnostics etc. from a hand held portable communicator, which can be connected at any location in the transmitter loop. It shall be possible to perform all the above functions online. The loop function shall remain unaffected while communication is going on between transmitter and the field communicator.

2.6.1.2 There should be no interruption on the output while communicating with the transmitter.

2.6.1.3 Field communicator shall meet the following requirements:

- a) Hand Held communicator shall be universal type and shall be compatible with all make and models of HART transmitters, Smart positioners, instruments with all engineering capability like calibration, diagnostics, configuration, inhibition of HART signal, etc.



- b) It shall be possible to connect the communicator at any of the following locations for purpose of digital communication;
 - i) Marshalling cabinet serving the transmitter, in safe area.
 - ii) Junction box serving the transmitter, in hazardous area.
 - iii) Directly at the transmitter, in hazardous area. Plug-in type connections shall be provided with field communicator. Necessary interconnection shall be supplied by the vendor.
- c) Offered communicator shall be dust-proof, certified intrinsically safe and suitable for outdoor location. Carrying case shall be supplied with each communicator.
- d) When specified in data sheets, the software shall also be capable of configuring other makes of transmitters.
- e) They shall be battery powered with replaceable and rechargeable batteries.

2.6.2 Field Bus Tester

2.6.2.1 The field bus testers shall be able to determine the ability of the field bus wiring to carry field bus signals. The field bus tester shall be capable of testing both signal and resistance of

2.6.2.2 There shall not be any interruption on the output while communicating with the field bus devices.

2.6.2.3 The field bus tester shall meet all the requirements as specified in clause 2.6.3 (b), (c), (d) and (e)

2.6.3 Field Bus Configurator

The field bus configurator shall be centralised device like personal computer with hardware and software for configuration and maintenance of field bus instrument.

2.6.4 Remote output meter

2.6.4.1 Remote output meter shall be electronic with LCD display. The display shall be in actual engineering units.

2.6.4.2 The indicator electronic shall be able to perform square root extraction for flow measurement.

2.6.4.3 Offered indicators shall be certified Intrinsically safe, when used in hazardous area.

2.6.4.4 Power supply shall be loop powered with smart transmitter, unless otherwise specified.

2.6.4.5 Fieldbus based field indicator shall be able to indicate all signals available in the fieldbus segment, selectively.

2.6.5 Yoke mounted instruments shall be supplied with mounting bracket, U-bolt and nuts suitable for mounting the instruments on a 50 mm (nominal bore) pipe stanchion (horizontal or vertical).

2.6.6 Air set

Air set, where provided, shall be a combination air filter regulator set with 5-micron filter cartridge. It shall have a 50 mm diameter pressure gauge to indicate the regulated pressure. Each air set shall be supplied with mounting bracket and bolts with nuts for surface



mounting.

2.6.7 Battery charger

Battery charger shall be supplied with all necessary accessories and shall operate at 230V $\pm 10\%$, 50Hz ± 3 Hz, unless otherwise specified.

3.0 NAMEPLATE

3.1 Each flush panel mounted instrument shall have the following information identified in the front:-

- a) Tag number as per purchaser's data sheet.
- b) Reading coefficient, if any
- c) Pen colour, tag number-wise in the case of recorders.
- d) Each flush panel mounted instrument shall have a back nameplate permanently fixed to it at a visible place reporting the following information:
 - e) Manufacturer's serial number or model number.
 - f) Manufacturer's name/trade mark.

3.2 Surface mounted instruments need be provided with only one nameplate.

Local mounted instruments shall have a stainless steel nameplate attached firmly to it at a visible place, furnishing the following information:

- a) Tag number as per purchaser's data sheets.
- b) Manufacturer's serial number and /or model number
- c) Manufacturer's name/trade mark.
- d) Body material.
- e) Measuring element material.
- f) Range of measurement.
- g) Area classification in which the equipment can be used, this shall be to the same code as per purchaser's data sheets.

4.0 INSPECTION AND TESTING

4.1 Unless otherwise specified, purchaser reserves the right to test and inspect all the items at the vendor's works in line with the inspection test plan for electronic/pneumatic instruments.

4.2 Vendor shall submit the following test certificates and test reports for purchaser's review: -

- a) Material test report as per clause 3.1B of EN 10204 for body, flanges and spacer rings for all transmitters and diaphragm seal transmitters
- b) Material test report as per clause 2.2 of EN 10204 for sensing element
- c) Hydrostatic test report as per clause 4.3.



- d) Functional and calibration report for each instrument including accuracy, linearity, hysteresis and repeatability.
- e) Performance test report as per clause 4.4.
- f) Response time of smart and fieldbus transmitters
- g) Capability of smart and field bus based transmitters to accept multimasters for configuration, calibration, diagnostics and maintenance.
- h) Configuration, calibration and diagnostics check through hand held configurator / field bus tester for smart and field bus based instruments.
- i) Configuration, calibration and diagnostics check through field bus configurator for field bus based instruments.
- j) Interoperability test certificate as per clause 2.2.3.14c) for fieldbus transmitters
- k) Certificate from statutory body for intrinsic safety/flameproof enclosures.
- l) Functional test report for fieldbus tester

4.3 Hydrostatic Test

4.3.1 All transmitters shall be hydrostatically tested at static pressure as per clause 2.2.3.10 for a period of minimum 1 minute. After this test the transmitter shall not undergo a permanent set from the original calibration.

4.4 Performance Test

4.4.1 All instruments shall meet the Accuracy performance characteristics stated in clause 2.2.3.6 after the instruments have been subjected to the following over-range conditions: -

- a) An air supply pressure of 2kg/cm²g for all pneumatic instruments.
- b) Differential pressure transmitters subjected to a differential pressure in either direction equal to the manufacturer's pressure rating of the body.

4.5 Witness Inspection

4.5.1 Vendor shall offer all items for pre-despatch inspection. Following tests/checks shall be carried out, as a minimum: -

- a) Physical dimensional checks and workmanship.
- b) Hydrostatic testing as per clause 4.3 of this specification on representative sample.
- c) Performance testing as per clause 4.4 of this specification on representative sample.
- d) Functional and calibration check on representative samples.
- e) Effect of power supply/air supply variation and load driving capability check on representative samples.
- f) Response time check on representative samples for smart and fieldbus transmitters



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- g) Capability of smart and field bus based transmitters to accept multimasters for configuration, calibration, diagnostics and maintenance.
- h) Configuration, calibration and diagnostics check through hand held configurator / field bus tester for smart and field bus based instruments.
- i) Configuration, calibration and diagnostics check through field bus configurator for field bus based instruments.
- j) Review of all certificates and test reports as indicated in clause 4.2 of this specification.
- k) Functional checks on fieldbus tester



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**KHERA COMPRESSOR STATION
UPGRADATION PROJECT**



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				TOTAL SHEETS		08
DOCUMENT NO	11	0330E	03	11	02	011

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- 2.0 DESIGN AND CONSTRUCTION
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- 4.0 INSPECTION AND TESTING

ANNEXURE - 1: HYDROSTATIC TEST PRESSURES FOR INSTRUMENT VALVES AND MANIFOLDS.



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1.0 GENERAL

1.1 Scope

1.1.1 This standard specifications, together with the data sheets attached herewith, covers the requirements for the design, materials, inspection, testing and shipping of instrument valves and manifolds which includes the following types:

- a) Miniature instrument valves
- b) Instrument valve manifolds
- c) Instrument air valves

1.1.2 The related standards referred to herein and mentioned below shall be of the latest edition prior to the date of purchaser's enquiry;

ASME/ANSI American Society of Mechanical Engineers/ American National Standards Institute

B 1.20.1 Pipe threads General Purpose (Inch)

B 16.11 Forged steel fittings-socket welding and threaded.

B 16.9 Factory made Wrought Steel Butt welding fittings.

B 16.34 Valves-Flanged. Threaded and welding end.

API-598 Valve Inspection and Testing

EN 10204 Inspection Documents for Metallic Products.

MSS Manufacturers Standardization Society of the Valve and Fittings Industry.

SP99 Instrument Valves

1.1.3. In the event of any conflict between this standard specification, job specification/data sheets, statutory regulations, related standards, codes etc. the following order of priority shall govern:

- a) Statutory Regulations
- b) Data Sheets
- c) Standard Specification
- d) Codes and Standards

1.2 Drawings and Data

1.2.1 Detailed drawings, data, catalogue and manuals etc. required from the vendor is indicated by the purchaser in vendor data requirement sheets attached with material requisition. The required number of reproducible, prints and soft copies shall be dispatched to the address mentioned in the material requisition, adhering to the time limits indicated.

1.2.2 Final documentation consisting of design data, installation and maintenance manual etc. submitted by the vendor after the placement of purchase order shall include the following, as a minimum:



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- a) Specification sheet for type of instrument valve and manifold.
- b) Certified dimensional details showing internal constructional details and material of construction.
- c) Copy of type test certificates.
- d) Copy of test certificates for all the tests indicated in clause 4.0 of this specification.
- e) Installation and maintenance procedures.

2.0 DESIGN AND CONSTRUCTION

- 2.1 The instrument valves shall be of manufacturer proprietary design. However, the minimum requirements specified herein must be complied.
- 2.2 Qualification tests (hydrostatic proof and burst tests) as per MSS SP-99 shall be conducted by vendor for each design and size of valve to establish the cold working pressure (CW.P) rating.
- 2.3 For all valves and manifolds with body material of carbon steel/stainless steel, the valve trim material shall be 316 Stainless Steel, as a minimum. Whenever body material is other than that specified above, trim material should be same as body material as a minimum.
- 2.4 Unless otherwise specified, the valve packing material for all valves and manifolds shall be PTFE only. The o-ring materials wherever used shall also be of PTFE.
- 2.5 The finishing and tolerances of parts like stem, piston, stem threading etc. of the offered valves and manifolds shall be properly machined to avoid problems like galling.
- 2.6 The hand wheel material for all valves and manifolds shall be zinc/nickel plated carbon steel. Any other material, if provided as per standard vendor design, shall also be acceptable.

2.7 Instrument Valves (Miniature)

- 2.7.1 The instrument valves shall be of globe pattern needle valves forged/ bar stock with inside screwed bonnet, with back-seated blow out proof system.
- 2.7.2 Body material shall be 316 Stainless Steel unless otherwise specified.
- 2.7.3 The minimum cold working pressure (CWP) rating of the valve shall be as per Annexure 1 of this specification, unless otherwise specified.
- 2.7.4 The end connection shall be ^"NPTF to ANSI B 1.20.1, unless otherwise specified.
- 2.7.5 Flow direction shall be marked on the body.
- 2.7.6 The valve dimensions shall be as follows:
 - a) End to end dimensions 76mm (approximately).
 - b) Height in fully open condition - 135mm maximum. These dimensions are indicative only.



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2.8 Valve Manifolds

2.8.1 3-Valve and 5-Valve manifolds:

2.8.1.1 3-Valve manifold

- a) 3-Valve manifold shall be designed for direct coupling to differential pressure transmitters having 2 bolt flanges with 54mm (2-1/8") centre-to-centre connections and 41.3mm (1 -5/8") bolt-to-bolt distance.
- b) 3-Valve manifold shall contain two main line block valves and an equalising bypass valve. The valves shall be needle type. They shall use self-aligning 316 Stainless Steel ball seats, unless otherwise specified.

2.8.1.2 5-Valve manifold

- a) 5-Valve manifold shall be designed for direct coupling to differential pressure transmitters having 2 bolt flanges with 54mm (2-1/8") centre-to-centre connections and 41.3mm (1-5/8") bolt-to-bolt distance.
- b) 5-Valve manifold shall contain two main line block valves and a combination double block and bleed for the bypass line. The valve shall of needle type or special ball with bleed hole.

2.8.1.3 The flanges shall be integral part of manifold block.

2.8.1.4 The material of construction shall be 316 Stainless Steel, unless otherwise specified.

2.8.1.5 The minimum cold working pressure (CWP) rating of manifolds shall be as per Annexure 1 of this specification, unless otherwise specified.

2.8.1.6 The process connection shall be 1/2"NPTF to ANSI B 1.20.1.

2.8.1.7 Wherever the manifolds are specified for stanchion mounting, these shall be supplied along with mounting accessories. The bolts and nuts shall be alloy steel as per ASTM A 193 Gr B7 and ASTM A194 Gr. 2H (Hot dip galvanised or zinc plated) respectively. Other accessories shall be zinc plated.

2.8.2 3 way 2 valve manifold for pressure gauges

2.8.2.1 The manifold shall be designed for use with pressure gauges with block and bleed valves. The manifold body shall be either straight or angle type as specified in the data sheet.

2.8.2.2 The valve shall be a needle type.

2.8.2.3 The body material shall be 316 Stainless Steel, unless otherwise'specified.

2.8.2.4 The minimum cold working pressure rating of the manifold shall be as per Annexure 1 of this specification, unless otherwise specified.



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2.8.2.5 The manifold shall have the following connections:

- a) The inlet connection shall be $\frac{3}{4}$ " plain ends with a minimum of 100mm nipple extension suitable for socket weld or butt weld as per B 16.11/ BI 6.9 as specified in the job specifications
- b) The gauge connection shall be with union nut and tail piece threaded to 1/2"NPTF.
- c) The drain connection shall be W'NPTF.

2.9 Instrument Air Valves

2.9.1 Instrument Air Isolation Valves (Miniature)

2.9.1.1 The valves shall be full-bore ball type with forged body.

2.9.1.2 Body material shall be 316 Stainless Steel.

2.9.1.3 The minimum cold working pressure rating of instrument air isolation valves shall be as per Annexure 1 of this specification, unless specified otherwise.

2.9.1.4 The end connection shall be ^"NPTF to ANSI B 1.20.1, unless otherwise specified.

2.9.1.5 End to end dimensions shall be 70mm (approximately).

2.9.2 Instrument Air Needle Valves (Miniature)

2.9.2.1 The instrument valves shall be globe pattern-needle valves forged/bar stock with inside screwed bonnet.

2.9.2.2 Body material shall be 316 Stainless Steel.

2.9.2.3 The minimum cold working pressure of Instrument Air Needle valves shall be as per Annexure 1 of this specification, unless otherwise specified.

2.9.2.4 The end connection shall be %" NPTF to ANSI BI.20.1, unless otherwise specified.

2.9.2.5 Flow direction shall be marked on the body.

2.9.2.6 The valve dimensions shall be as follows:

- a) End to end dimensions - 54 mm (approximately).
- b) Height in fully open condition - 49 mm maximum. These dimensions are tentative only.

2.10 All instrument valves in oxygen and chloride service shall be thoroughly degreased using reagents like trichloroethylene or carbon tetrachloride. End connection shall be plugged after degreasing process in order to avoid entrance of grease or oil particles.

3.0 NAME PLATE

3.1 Following information shall be punched on the body of each of these items;

- a) Material of construction to the same standards as in purchaser's data sheets.
- b) Cold working pressure of each item to the same standards as in purchaser's data sheets.



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- c) Manufacturer's identification and model number.
- d) Flow direction (if applicable)
- e) Material of construction.

4.0 INSPECTION AND TESTING

4.1 Unless otherwise specified, purchaser reserves the right to test and inspect all the items at vendor's works, inline with the inspection test plan for instrument valve and manifolds.

4.2 Vendor shall submit following test certificates and test reports for purchaser's review:

- a) Material test certificates as per clause 3. IB of EN 10204 for body and bonnet and as per clause 2.2 for other parts.
- b) Dimensional test report.
- c) Pressure test report as per clause 4.3 of this specification.
- d) Hydrostatic proof and burst tests as per MSS-SP-99 for each design and size of valve.

4.3 Pressure Test Requirements

4.3.1 Each valve and manifold shall be subjected to hydrostatic pressure test at ambient temperature for both seat and shell leakage at test pressures given in Annexure-1 of this specification. During and after the hydrostatic test there shall not be any visible leakage.

4.3.2 Pneumatic Test

Each valve and manifold shall be subjected to pneumatic test for both shell and seat leakage at 7.0 kg/cm²g with testing medium as air at ambient temperature. There shall not be any visible leakage when immersed in water or coated with a leak detection solution.

4.4 Witness Inspection

4.4.1 All valves and manifolds shall be offered for pre-dispatch inspection for following, as a minimum:

- a) Physical dimensional verification and workmanship.
- b) Pressure test as per clause 4.3 of this specification on representative samples.
- c) Review of all certificates and test reports as indicated in clause 4.2 of this specification.

4.4.2 In the event, when witness inspection is not carried out by purchaser, the tests shall anyway be completed by the vendor and documents for the same shall be submitted to purchaser for scrutiny.

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HYDROSTATIC TEST PRESSURES FOR INSTRUMENT VALVES AND MANIFOLDS

SL.NO.	ITEM	LINE PRESSURE	MIN. COLD WORKING PRESSURE	HYDROSTATIC TEST PRESSURE FOR SEAT LEAKAGE	SHELL LEAKAGE TEST
1.	Instrument Valves (Miniature)				
A)		<600#	102kg/cm ² g	112kg/cm ² g	153kg/cm ² g
B)		>900#to<1500#	253kg/cm ² g	278kg/cm ² g	383kg/cm ² g
2.	Instrument Valve				
A)		<600#	102kg/cm ² g	112kg/cm ² g	153kg/cm ² g
B)		>900#to<1500#	253kg/cm ² g	278kg/cm ² g	383kg/cm ² g
3.	Instrument Air Isolation Valves		27kg/cm ² g	30kg/cm ² g	41kg/cm ² g
4.	Instrument Air Needle Valves		27kg/cm ² g	30kg/cm ² g	41kg/cm ² g



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GAIL (India) Limited
FILTRATION UPGRADE
PROJECT KHERA



TECHNICAL SPECIFICATION FOR TUBES & TUBE-FITTINGS				CLIENT JOB NO.		
				TOTAL SHEETS		06
DOCUMENT NO	11	0330E	03	11	02	012

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A	29/03/11	ISSUED FOR CLIENT'S COMMENTS			PS	MLS	MLS
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- 1.0 GENERAL
- 2.0 DESIGN AND CONSTRUCTION
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- 4.0 INSPECTION AND TESTING

ANNEXURES:

ANNEXURE - 1: HYDROSTATIC TEST PRESSURES FOR INSTRUMENT TUBE FITTINGS



TECHNICAL SPECIFICATION
FOR
TUBES & TUBE-FITTINGS

Document No.

Rev

11-0330E-03-11-02-012

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1.0 GENERAL

1.1 Scope

1.1.1 This standard specification, together with the data sheets attached herewith, covers the requirements for the design, materials, inspection, testing of instrument tube fittings which includes the following types:

- a) Stainless steel compression fittings (for stainless steel tube)
- b) Brass compression fittings (for copper tube)

1.1.2 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 American National Standards Institute/American Society of Mechanical Engineers

B 1.20.1 Pipe Threads General Purpose (Inch).

B 16.11 Forged Steel Fittings - Socket Welding and Threaded.

BS-4368 Carbon and Stainless Steel Compression Couplings for Tubes.

EN 10204 Inspection Documents For Metallic Products.

IS-319 Specification for free cutting Brass Bars, Rods and Sections.

ISA Instrumentation, Systems and Automation Society.

RP 42.1 Nomenclature for Instrument Tube Fittings.

1.1.3 In the event of any conflict between this standard specification, data sheets, statutory regulations, related standards, codes etc., the following order of priority shall govern:

- a) Statutory Regulations
- b) Data Sheets
- c) Standard Specification
- d) Codes and Standards

2.0 DESIGN AND CONSTRUCTION

2.1 Stainless Steel Tube Fittings

2.1.1 Nomenclature of all tube fittings shall be as per ISA RP 42.1.

2.1.2 Fittings shall be of flare less compression type having four-piece (for double compression type) construction consisting of two ferrules, nut and body or three piece (compression type) construction consisting of single ferrule, nut and body suitable for use on tubes of specified material for example stainless steel tubes conforming to ASTM A269 TP 316L with hardness in the range of HRB 70 to 79.



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- 2.1.3 All parts of the tube fittings shall be of 316 Stainless Steel unless specified otherwise.
- 2.1.4 Hardness of the ferrules shall be in the range of HRB 85-90 so as to ensure a hardness difference of the order of 5 to 10 between tube and fittings for better sealing.
- 2.1.5 Nuts and ferrules of a particular size shall be interchangeable for each type.
- 2.1.6 Spanner hold shall be metric.
- 2.1.7 Threaded ends of fittings shall be NPT as per ANSI B 1.20.1.
- 2.1.8 Specific techniques like silver plating shall be used over threading in order to avoid jamming and galling.
- 2.1.9 Ferrule finish and fitting finish shall be such that there is no abrasion/galling when the nut is tightened.
- 2.1.10 All instrument tube fittings in oxygen and chlorine service shall be thoroughly degreased using reagents like trichloro-ethylene or carbon tetrachloride. End connection shall be plugged after degreasing process in order to avoid entrance of grease or oil particles.

2.2 Copper Tube Fittings

- 2.2.1 Nomenclature of all tube fittings shall be as per ISA RP 42.1.
- 2.2.2 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 B68 /B68M, hardness not exceeding HRB 50.
- 2.2.4 All parts shall be manufactured from brass as per IS 319 bar stock and nickel plated.
- 2.2.5 For better grip, vendor shall maintain hardness difference between tube and ferrule and indicate the same along with the offer.
Threaded ends of fittings shall be NPT as per ANSI
Spanner hold shall be metric.

3.0 NAMEPLATE

- 3.1 No separate nameplates are required on the fittings. However, manufacturer's name/trademark should be punched on a visible place on the body of each fitting for easy identification.

4.0 INSPECTION AND TESTING

- 4.1 Unless otherwise specified, purchaser reserves the right to test and inspect all items at vendor's works, inline with the inspection test plan for instrument tube fittings.
- 4.2 Vendor shall submit following test certificates and test reports for purchaser's review:
 - 4.2.1 Type test reports for following tests in accordance with BS-4368 Part IV:
 - a) Hydrostatic proof pressure test.
 - b) Minimum hydrostatic burst pressure test.
 - c) Disassembly and reassembly test.



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- d) Minimum static gas pressure (vacuum) test.
- e) Maximum static gas pressure test.
- f) Hydraulic impulse and vibration test.

4.2.2 Material test certificates as per clause 3.1 B of EN 10204.

4.2.3 Routine test reports for following tests:

- a) Hydrostatic Test

Instrument tube fittings shall be hydrostatically tested at ambient temperature at test pressures given in Annexure 1 of this specification. During and after the hydrostatic test, the tube fittings shall not show any leakage or rupture.

- b) Pneumatic pressure test

The fittings shall be tested at 7 kg/cm²g of dry air. There shall not be any visible leakage when immersed in water or coated with a leak detection solution.

- c) Disassembly and reassembly test.

- d) Hardness verification:

Hardness test shall be carried out on each rod used for machining ferrules. Vendor shall ensure that after machining, the finished ferrules shall meet the required hardness given in the specification.

- e) Dimensional test report

4.3 Witness Inspection

4.3.1 All fittings shall be offered for pre-dispatch inspection for the following as a minimum:

- a) Physical dimensional verification and workmanship on representative samples.
- b) Hydrostatic and pneumatic tests as per clause 4.2.3 of this specification on representative samples.
- c) Hardness verification as per clause 4.2.3 of this specification.
- d) Disassembly and reassembly test on representative samples.
- e) Review of all certificates and test reports as indicated in clause 4.2 of this specification.

4.3.2 In the event when no witness inspection is carried out by purchaser, vendor shall anyway complete the tests and test reports for the same shall be submitted to purchaser for scrutiny.



**HYDROSTATIC TEST PRESSURES
FOR INSTRUMENT TUBE FITTINGS**

Sr. No.	Size of Tube Fittings	Material	Line Pressure Class	Hydrostatic Test Pressure
1	6mm and 1/2"	Stainless Steel	<600#	153 Kg/cm ² g
2	6mm and 1/2"	Stainless Steel	> 900# to <1500#	383 Kg/cm ² g
3	6mm and 1/2"	Brass		80 Kg/cm ² g



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**KHERA COMPRESSOR STATION
UPGRADATION PROJECT**



TECHNICAL SPECIFICATION OF CONTROL PANEL				CLIENT JOB NO.		
				TOTAL SHEETS		09
DOCUMENT NO	11	0330E	03	11	02	013

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0	17/05/11	ISSUED FOR TENDER			PS	MLS	MLS
A	29/03/11	ISSUED FOR CLIENT'S COMMENTS			PS	MLS	MLS
REV	DATE	DESCRIPTION			PREP	CHK	APPR

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1.0 GENERAL

1.1 Pipeline and location of panels(Local control panel, fire alarm panel, gas alarm/monitoring panel, telecom interface panel).

- i. Dispatch station at Chainsa.
- ii. SV-2
- iii. SV-3
- iv. SV-4 & Bamnoui.
- v. PPCL Receipt station.
- vi. Jhajjar Receipt station.

1.2 Owner : M/s GAIL India Ltd

1.3 Consultant : M/s JP KENNY

1.4 Location of control panel and accessories: Indoor

1.5 Floor : Concrete Floor with Trench

1.6 Air conditioning :- YES

1.7 Control Panels Size : - Local control panel (Size 2100mmX1000mmX800mm)
Wall mounted Fire and gas monitoring panels, Telecom interface panel.
(Approx size 600mmX600mmX300mm0

1.8 Contractor shall provide an alarm annunciator for fire and gas alarms, in fire and gas monitoring panels.



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2.0 CONTROL PANEL CONSTRUCTION

- 2.1 Type: Self supported, Free standing, enclosed cubicle.
- 2.2 Lighting: Required inside Panel with door switch
- 2.3 Ventilation: Required with louvers backed by wire fly screen & fan. Fan failure alarm required.
- 2.4 Doors: Rear single/double removable hinged doors with flush pull type handles & with locking arrangement
- 2.5 Cable Entry: Bottom, Cable glands shall be single compression type. All unused entries are plugged.
- 2.6 Receptacles: Required for 230VAC UPS.
- 2.7 Painting: The finish should include sand blasting, grinding, chemical cleaning's finishing by suitable filler and two coats of paint. Panel colour shall be Non-glossy high strain finish. Panel colour shall be informed later.
- 2.8 Channel Base : 100*50*6 MM, MS material
- 2.9 Name Plates: Front of panel instrument name plates shall be blacklaminated plastic white core. Name plate shall be provided on rear of panel also.

3.0 DIMENSION & MATERIAL OF CONSTRUCTION

- 3.1 Panel Dimension : 1000(w) mm*2200(H)mm*800(D)mm including channel base
- 3.2 Control Panels : 3.2 CRCA/5.0 mm thick HRCA steel welded to frame
- 3.3 Side & Top plates : 2mm thick CRCA steel welded to frame.
- 3.4 Door Panel : 1.6 mm thick CRCA steel. Vendor to decide single or double door. Concealed Hinges and Flush pull chromoplated handles.
- 3.5 Cable Gland Plate : 3mm thick CRCA steel
- 3.6 Anchor Bolt Size : By contractor



3.7 Frame: 50 mm * 50 mm * 4mm Formed section

3.8 Lifting Eye Bolt : Required

4.0 WIRING

4.1 Type : General Purpose

4.2 Wiring details (Power)

230 V AC UPS Wiring (Outside cabinet) : Min, 3* 2.5 mm² copper conductor PVC insulated armoured

Low Voltage Inside the Cabinet: (24V DC) : Min 19 strands, 16 AWG copper conductor PVC insulated.

230V AC Non UPS (outside cabinet) : Min, 3* 2.5 mm² copper conductor PVC insulated armoured

4.3 Signal Wiring :
External to cabinet : 1.0 mm² twin twisted, individual shielded/overall Shielded with overall drain PVC insulated, armoured.

Inside the cabinet : Multi strand min 1.0mm² copper conductor PVC Insulated.

Terminal Type : Screw clamp with pressure plate

Terminal Size for signal : Suitable for min. 2.5mm² size conductor.

Terminal size for power dist : Suitable for min 4.0 mm² size conductor and higher as per actual cable sizes.

Terminal Block : Clip on type.

Wiring colour code
Power supply : Hot-Red
Neutral-Black
Earth-green

DC Wiring : Positive-Red Negative Black

Alarm System : White

Control and shutdown : Yellow

Analog Signals(IS) : Light Blue

5.0 POWER SUPPLY DISTRIBUTION BOXES FOR PANELS

5.1 Function : Distribute power to individual instruments



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- 5.2 Mounting : Inside Panel
- 5.3 Door : Front single door
- 5.4 Painting : As per panel painting specification
- 5.5 Box Dimension : By Contractor
- 5.6 Box Plate Thickness : 3mm hot rolled steel
- 5.7 Cable Entry : By Contractor
- 5.8 Accessories : Suitable MCBS
- 5.9 Switch Fuse unit for incoming feeder : Required

6.0 BULK POWER SUPPLY UNIT

- 6.1 Input : 24VDC \pm 10% (at Chainsa,sv-2,sv-3,sv-4/bamnouli,jhajjar) & 230V AC at PPCL power plant.
- 6.2 Output : 24V DC \pm 5 % or as required for instruments.
- 6.3 Rating : By Contractor
- 6.4 Qty : 2 nos. for each Panel (Dual Redundant)

7.0 SPECIFICATIONS FOR ACCESSORIES

7.1 LAMPS

- Type Miniature filament
- Rating By Contractor
- Voltage 24V DC
- Make/Model No. By Contractor
- Lamps shall be provided with series resistor to increase life of lamp.

7.2 Push Buttons

- Type Spring return
- Contacts 2NO + 2NC
- Contact Rating 2A 24V DC
- Make By Contractor
- Color As per standard

7.3 Selector Switch

- Type As per functional switching and logic requirement
- Specification Silver alloy gold plated contacts with SS shaft dust covers with water proof covering and contact shall be made before break type.
- Rating 2A, 24V DC
- Make KAYCEE/Eqv.

7.4 Relays



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- 8.5 Inputs : 4-20 m A DC (2 wires)
- 8.6 Outputs : 4-20 m A DC
- 8.7 Facia : Bar graph display of PV(with digital display)
- 8.8 Scan time : 500 msec. Max
- 8.9 A/D Convertor resolution : 1500 steps min
- 8.10 D/A Convertor resolution : 1500 steps min
- 8.11 Load driving capacity : 750 ohms
- 8.12 Online diogmostics : Required
- 8.13 Power Supply : 24V DC
- 8.14 QTY : AS Required

9.0 SIGNAL DISTRIBUTION CARDS

- 9.1 Type Dual output current isolator
- 9.2 Input 4-20 m A DC
- 9.3 Output Two nos 4-20m A isolated outputs as minimum
- 9.4 Isolation Between input & output, Between power supply and between output and input
- 9.5 Accuracy $\pm 0.1\%$
- 9.6 Power Supply 24V DC
- 9.7 Transmitter Power Supply 24V DC
- 9.8 Output load driving capacity 550ohms min for each output
- 9.9 Qty As Required

10.0 ZENER BARRIERS /ISOLATORS

- 10.1 Type Active
- 10.2 Application Instrument Type
 - a) 4-20 m A Analog I/P from 2 wire transmitter .





**QUALITY ASSURANCE PLAN
FOR FILTER**

PROJECT: KHERA COMPRESSOR STATION UPGRADATION PROJECT

CLIENT: GAS AUTHORITY OF INDIA LTD.

CONSULTANT: J P KENNY

QAP No.: 11-0330E-03-09-10-014

Rev. 0

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SR. NO.	DESCRIPTION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	INSPECTION BY			REMARKS
									M	TPI	CONSULTANT/ OWNER	
1	Review of Quality Plan	Sequence of check points	Major	Review	100%	Contractual Doc/ Drgs.	Contractual Doc/ Drgs.	Internal Reports	P	R	A	
		Marking of Hold/Review/Witness Pts.	Major							Reports		
2	Approval of Drwg & Design Calculations	Code Requirements	Major	Review	100%	Design code	Design code	Internal Reports	P	R	A	
3	Review of WPS/ PQR/ WPQ	Code Requirements/ Coverage to all weld joints	Major	Review	100%	Design code	Design code	Internal Reports	P	R	R	
INCOMING MATERIAL IDENTIFICATION OF BOUGHTOUT ITEMS												
4	Material Identification & Allocation to all Pressure Parts	Verification to TC with material spec.and Drwg.	Major	Review	100%	Material Spec.	Material Spec.	Internal Reports	P	W/R	R	
		Coorelation of TC with Material	Major	Visual	100%	Test Certificate	Test Certificate	Internal Reports				
		Dimensions	Major	Measurement	Sample	Drawing/ TC	Drawing/ TC	Internal Reports				
		Hydrotest/ NDE/ Impact Test of Plates / Pipes at Maker	Major	Review of TC	100%	Code	Code	Internal Reports				
		Identification Stamp Transfer	Major	Visual	100%	Hard Punching	Hard Punching	Internal Reports				
5	Inspection of Machined & formed parts (Dish Ends/ Shell Plates/ End Plates/ Stubs/ Nozzles)	Identification	Major	Visual	100%	Drawing	Drawing	Internal Reports	P	W	R	
		Dimensions/ Profile	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Min. Thickness/ Ovality	Major	Template	100%	Drawing/ Design	Drawing/ Design	Internal Reports				
		PT of knuckle/ Edge	Major	Visual	100%	LPE 01	LPE 01	Internal Reports				
		Heat Treatment	Major	Chart	100%	Design code	Design code	Internal Reports				
INPROCESS INSPECTION												
6	L Seam Set up for shells and Test Plates	Identification	Major	Visual	100%	Drawing/ IR	Drawing/ IR	Internal Reports	P	W	R	
		Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Weld Preparation	Major	Template	100%	Drawing	Drawing	Internal Reports				
		alignment/ Squareness	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Tack Weld Soundness	Major	PT	100%	Drawing	Drawing	Internal Reports				
7	A. Welding of L Seam & Test Plates/ Pipes (above Parts)	Backchip & PT after 1st side Welding	Major	Visual	100%	LPE 01	LPE 01	Internal Reports	P	W	R	
		Weld Size/ finish	Major	Visual	100%	FPAS-001	FPAS-001	Internal Reports				
		Weld joint soundness of L-seam & Test Plates	Major	RT	100%	Design code	Design code	Internal Reports				
		Production Test Coupon	Major	Impact Test	100%			Internal Reports				
	B. Repair: (if any) L Seam	Defect Removal	Major	PT	100%	Design code	Design code	Internal Reports	P	W	R	
		Weld joint soundness	Major	RT	100%	Design code	Design code	Internal Reports				
8	Set-up of Nozzle pipe to Flange	Squareness	Major	Measurement	100%	FPAS-001	FPAS-001	Internal Reports	P	W	R	
		Weld Preparation	Major	Template	100%	Drawing	Drawing	Internal Reports				
9	Welding of Nozzle pipe to Flange	Weld size/ Reinforcement	Major	Template	100%	Drawing	Drawing	Internal Reports	P	W	R	
		Weld joint Soundness	Major	RT	100%	Design code	Design Code	Internal Reports				
10	Inspection of Internals of HP Separator	Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports	P	W	R	
		Pickling Passivation	Major	MTC	100%	Drawing	Drawing	Internal Reports				



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									M	TPI	CONSULTANT/ OWNER	
11	Welding of internals to HP Separator Shell	Weld size/ Reinforcement/ Finish	Major	Template/ Visual	100%	Drawing	Drawing	Internal Reports	P	R	R	
		Weld joint soundness	Major	PT	100%	LPE01	LPE01	Internal Reports				
12	C Seam set up for shells to Dish Ends & Test Plates	Identification	Major	Visual	100%	Drawing/ IR	Drawing/ IR	Internal Reports	P	W	R	Test Plate to be impact Tested & Shall be witnessed by TPIA
		Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Alignment/ Squareness	Major	Measurement	100%	Drg./ FPAS001	Drg./ FPAS001	Internal Reports				
		Tack Weld Soundness	Major	PT	100%	Drawing	Drawing	Internal Reports				
13	A. Welding of C Seam (above parts) & Test plates	Backchip & PT after 1st side welding	Major	Visual	100%	LPE01	LPE01	Internal Reports	P	R	R	Do
		Weld size/ finish	Major	Visual	100%	FPAS-001	FPAS-001	Internal Reports				
		Weld joint soundness of C seam	Major	RT	100%	Design Code	Design Code	Internal Reports				
	B. Repair: (if any) C Seam	Defect Removal	Major	PT	100%	Design Code	Design Code	Internal Reports	P	W	R	Repair RT to be Reviewed
		Weld joint soundness	Major	RT	100%	Design Code	Design Code	Internal Reports				
14	Heat Treatment of Test Plates + EQPT as per code	Time/ Temperature Charts	Major	Visual	100%	Design Code	Design Code	Internal Reports	P	R	R	
15	Testing of all Test Plates	Mech./ Physical Test Reports	Major	Visual	100%	Design Code	Design Code	Internal Reports	P	W	R	N.A.
16	Inspection of Marking for Openings on Dish Ends/ Shelf	Identification	Major	Visual	100%	IR/ Drawing	IR/ Drawing	Internal Reports	P	R	R	
		Layout	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Orientation	Major	Visual	100%	Drawing	Drawing	Internal Reports				
		Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		No. of holes	Major	Count	100%		Drawing	Internal Reports				
17	Inspection after opening on shell/ Dish Ends	A - Earlier Stage clearance review	Major	Review	100%	Acc. Inspn. Rep.	Acc. Inspn. Rep.	Internal Reports	P	R	R	
		B - Opened Holes Orientation Quadrantwise	Major	Visual	100%	Drawing	Drawing	Internal Reports				
		H - hole finish	Major	Visual	100%	FPAS-001	FPAS-001	Internal Reports				
		I - Final Acceptance	Major	Visual	100%	Hard Stamping of Insp.	Hard Stamping of Insp.	Internal Reports				
18	Setup of studs, nozzles, sockets and connections with Shell / Dish End / Flange	Orientation	Major	Visual	100%	Drawing	Drawing	Internal Reports	P	RW	W/R	
		Weld preparation	Major	Template	100%	Drawing/ Code	Drawing/ Code	Internal Reports				
		Alignment	Major	Line thread	100%	Drg / FPAS001	Drg / FPAS001	Internal Reports				
		Squareness	Major	Right angle	100%	Drg / FPAS001	Drg / FPAS001	Internal Reports				
		Distance between connections	Major	Measurement	100%	Drg / FPAS001	Drg / FPAS001	Internal Reports				
		Tack Weld Soundness	Major	PT	100%	LPE01	LPE01	Internal Reports				
19	Welding of Nozzles, & connections to Shell/ DESCRIPTION	Weld size/ finish	Major	Visual	100%	Design Code	Design Code	Internal Reports	P	R	W/R	
		Weld Soundness	Major	RT/PT	100%	Design Code	Design Code	Internal Reports				
20	Setup of Structural Saddles & Attachments	Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports	P	R	W/R	
		Weld preparation	Major	Template	100%	Drawing	Drawing	Internal Reports				
		Alignment/ Squareness	Major	Measurement	100%	Drg./ FPAS001	Drg./ FPAS001	Internal Reports				
21	Welding of Structural Saddles & Attachments	Weld size/ finish	Major	Visual	100%	Design Code	Design Code	Internal Reports	P	R	W/R	
		Weld Soundness	Major	PT	Sample	Design Code	Design Code	Internal Reports				



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									M	TPI	CONSULTANT/OWNER	
22	Full Welding Clearance	Overall Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports	P	W/R	R	
		Squareness of Connections	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Distance Between Connections	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		RT Clearance/ U.T.	Major	Review of RT Rpts.	100%	Drawing	Drawing	Internal Reports				
		Code Punching Details	Major	Rub off	100%	Design Code	Design Code	Internal Reports				
Final Inspection												
23	Hydrostatic Testing	Pressure Gauge (2 Nos.)	Major	Review	100%	Valid Cert.	Valid Cert.	Internal Reports	P	W	W/R	
		Calibration	Major	Visual	100%	No leakage	No leakage	Internal Reports				
		Leakage	Major		100%			Internal Reports				
24	Final Inspection	Document Review	Major	Review	100%	Design Code	Design Code	Internal Reports	P	W	W/R	
		Dimensions	Major	Measurement	100%	Drawing	Drawing	Internal Reports				
		Surface Preparation	Major	Visual	100%	Free from scales etc	Free from scales etc	Internal Reports				
25	Clearance for Assembly/ Dispatch (as applicable)	Painting finish	Major	Visual	100%	Drawing	Drawing	Internal Reports	P	W	W/R	
		Capping/ Blanking of all opening	Major	Visual	100%	All Opening Protected	All Opening Protected	Internal Reports				
		Code Punching Details	Major	Visual	100%	Design Code	Design Code	Internal Reports				

Legend


M Manufacturer
C Client
TPI Third Party Inspection Agency
A For Approval


P Perform
R Review
W Witness
W/R Witness for Test & Review of Certificates & Documents as per QAP
H Hold
RW Random Witness
NA Not Applicable

LIST OF RECOMMENDED VENDORS						
S.NO	ITEM	NAME OF VENDOR	ADDRESS	PHONE NO	FAX NO	QUALIFIED FOR SIZE
1	Station Piping (Seamless Pipes) Trader	Ishwardas Aggarwal & Sons (Trader)	39, Lalit House, 3rd floor, Sant Tukaram Road, Iron Market, Mumbai - 400 009	(+91)22-342 2566	(+91)22-342 3762	
2		M.J. Patel & company (Trader)	116, P.D. Mello Road, Near Camace Bridge, Mumbai - 400 009			
3		Apex Tubes Pvt. Ltd (Manufacturer & Trader)	Apex Tubes Pvt. Ltd. 1/6 B, Asaf Ali Road New Delhi - 110 002	011 - 3236408		
4		Steel Tube (India) (Trader)	526/36, Maulana Azad Road, 2nd floor, Gulawadi Circle, Mumbai - 400 004	(+91)22-389 5908 (+91)22-381 2564	(+91)22-3895906	
5		Nagardas Kanji Shah (Trader)	176, Magazine street, darukhana, Mazagaon, Mumbai 400 010	(022) 3721066/ 3724157	(022) 3781032	
6		Jyoti Industries	P.B. No. 3081, 276/278, Samuel street, 2nd floor, Vadgadi, Mumbai 400 003	(022) 3435091/92	(022) 3421 391	
7		The Bengal Mill stores supply co (Trader)	205, Magnanial Chambers, Baburao Bobde Marg, Iron Market, Mumbai 400 009	(022)3430105, 3430107, 3434918	(022) 3414763	
8		Radiant Engineering Co.	M-2, sundaram, sion college, Mumbai 40 022	(022) 409 2016, 409 6036	(022) 409 4822	
9		Tianjin Pipe corporation	PO box 17537, Jebel Ali Free zone, Dubai, U.A.E	97148833799	97148833899	
10		Milsubihsi				
11		Trub Chomulov				
12		TENARIS				
13		Valcvony				
14		Vallurorec Maneshman Tubes Brazil				
15	BALL VALVES	Virgo Engineers Ltd, Pune	Virgo Engineers, J/517, MIDC, Bhosari, Pune - 411026	020 - 2747 4481	020-2747 0772	Upto 24" class 600
16		Steel Strong Valves (P) Ltd.	Plot No. R-241, TTC Industrial area, MIDC, Rabale, New Bombay - 400 701			Upto 12" class 600 of split body type
17		Flow Chem Industries	10, Navdurga Indl. Estate, Opp Forge Blower, Naroda Road, Ahmedabad - 25	79 - 220 4773	79 - 220 1401	upto 12" class 600
18		Micro Finish Valves	B.D.K. Engineering Ltd. Gokul Road, Hubli 580 030			upto 12" class 600
19		Hawa Valves (India) Pvt Ltd	4, Karmabhumi Industrial estate, opp. Ajit Mill Police chowky, Rakhial Road, Ahmedabad			Upto 8" class 600
20		L&T / Audco valves	Chennai			Upto 24" 600#
21		Cooper Cameron Valves (singapore) Pte. Ltd	No.2, Gul Circle, Jurong Industrial Estate, singapore - 629560	0065 865 2887	0065 861 7109	Upto 48" 600#
22		BOHMER Ball Valves	Gedulderweg, 95 45549 Sprockhovel Germany	(+49) 2324 70010	(-49) 2324 700179	Upto 48" 600#
23		MSA	Hlucinska, 41 747 22 Doinin Benesov Czech Republic	(+420) 553 881111	(+420) 553 651236	Upto 48" 600#
		LIST OF RECOMMENDED VENDORS FOR FILTER		Document No.		Rev.
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LIST OF RECOMMENDED VENDORS						
S.NO	ITEM	NAME OF VENDOR	ADDRESS	PHONE NO	FAX NO	QUALIFIED FOR SIZE
24	BALL VALVES	RMA Maschinen - und Armaturenbau Fulhaber & Truttenbach	Oststrasse, 17 77694 Kehl Germany	(+49) 78 518680	(+49) 78 5186813	upto 30" 600#
25		SCHUCK ARMATUREN (ex BORSIG)	Dailerstrasse 4-7 89555, Steinheim Germany	(+49) 73 29 950 0	(+49) 73 29950161	upto 30" 600#
26		SUD ROBINETTERIE INDSUTRIE (SRI)	279 -305, Bvd D, Casanova 13309 Marseille, France	(+33) 495 055050	(+33) 495 055070	upto 30" 600#
27		TORMENE GAS TECHNOLOGY (VALVITALIA)	Via L. Campolongo, 97 35020 Due Carrare PD ITALY	(+39) 059 919 9511	(+39) 049 9125455	upto 30" 600#
28		VIAR VALVOLE	Via L. Cadorna, 6 21041 Albizzate VA ITALY	(+39) 0331 99 2985	(+39) 0331 992992	upto 30" 600#
29		BREDA ENERGIA SESTO INDUSTRIA	Viale Sarca, 336 20126 Milano ITALY	(+39) 0264 4771	(+39) 02 64477542	upto 30" 600#
30		FLOW CONTROL TECHNOLOGIES (TYCO Flow Control)	23, Deuzieme avenue 13743 Vitrolles FRANCE	(+33) 442 103600 (+91) 11 647 1469	(+33)442103636 G39 (+91) 11 646 1550	upto 30" 600#
31		PETRO VALVES	Viale G Borri, 42 21053 Catellanza VA ITALY	(+39) 0331 334 111	(+39) 0331 675830	upto 48" 600#
32	Contractor shall ensure that each valve manufacturer shall have valid API 6D license and in case of firm order the license shall be valid till complete execution of supplies.					
33	Gas Over Oil Actuators	BIFI	Italy			
34		Rotork Fluid System	Italy			
35		CAMERON	Italy			
36		PC Intertecnik	Germany			
37		Bettis	Belgium			
38		LEDEEN	Texas			
39	Globe Valve	Flow Chem Industries	10, Navdurga Indl. Estate, Opp Forge Blower, Naroda Road, Ahmedabad - 25	79 - 220 4773	79 - 220 1401	upto 12" 600#
40		Shreeraj Industries	101, Samrudhi, Sattar Taluka Society, Opp old high court lane, Ahmedabad	79 - 2204773/ 3623		upto 12" 600#
41		Steel Strong Valves (P) Ltd.	Plot No. R-241, TTC Industrial area, MIDC, Rabale, New Bombay - 400 701			Upto 12" class 600 of split body type
42		Ornate Valves Pvt. Ltd, Mumbai	104, Eric House 16th Road Chembur, Mumbai - 400 071			upto 12" 600#
43		Micro Finish Valves	B.D.K. Engineering Ltd. Gokul Road, Hubli 580 030			upto 12" class 600
44		L&T / Audco Valves	Chennai			Upto 24" 600#
45		Niton Valve Industries Pvt. Ltd	SD -115/116 Ghatkopar Industrial Estate, L.B.S. marg Ghatkopar (West) Mumbai 400 086	022- 500 8315	022 - 5007654	Upto 24" 600#
46	Check/ Non Return Valve	L&T / Audco valves	Chennai			
47		Steel Strong Valves (P) Ltd.	Plot No. R-241, TTC Industrial area, MIDC, Rabale, New Bombay - 400 701	022 - 27699489/90	022 - 27695537	Spring loaded type upto 12" 600# of split body type
48		Micro Finish Valves	B.D.K. Engineering Ltd. Gokul Road, Hubli 580 030			upto 12" 600 #
49		Flow Chem Industries	10, Navdurga Indl. Estate, Opp Forge Blower, Naroda Road, Ahmedabad - 25	79 - 220 4773	79 - 220 1401	upto 12" 600# (lift type, wafer type & Swing type)
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LIST OF RECOMMENDED VENDORS						
S.NO	ITEM	NAME OF VENDOR	ADDRESS	PHONE NO	FAX NO	QUALIFIED FOR SIZE
50	Check/ Non Return Valve	Ornate Valves Pvt. Ltd, Mumbai	104, Eric House 16th Road Chembur, Mumbai - 400 071			upto 12" 600# Lift & Swing type
51		Arpita Enterprise	1201, GIDC Estate, Phase IV Vithal Udyog Nagar Anand 388 112	02692 - 36187		upto 8" 600# (wafer type)
52		Niton valve Industries Pvt. Ltd	SD -115/116 Ghatkopar Industrial Estate, L.B.S. marg Ghatkopar (West) Mumbai 400 086	022- 500 8315	022 - 5007654	Upto 24" 600# (Lift & Swing Type)
53	Pressure Relief Valve	FMC Sanmar Ltd	147, Karapakkam Village, Chennai-600096	044-492-5455	044-492-6114	
54		Protego Equipments Pvt. Ltd.	Navi Mumbai			
55		Larsen & Tubro (Audco)	32, Sivaji Marg, Post Box 6223, Near Moti Nagar, New Delhi	011-25931302	011-25438624	
56		MEKASTER/sebim valves India Pvt. Ltd.	908, Ansal Bhawan, 16 Kasturba Gandhi Marg, New Delhi	011-23312110, 23318360	011-23712155	
57		TYCO SANMAR LTD	Chennai			
58		RMG regal + GmbH, Germany	Germany			
59	Pipe fittings (Elbows, Tees, Reducers)	INTERFORGE	Grobe Strabe 14, 27356 Rotenburg, Germany	+49 4261 4081*	+49 4261 3090*	Upto 30" class 600 fittings & flow tee
60		KURVERS Piping	Mark S Clarkelaan 13 a, Haven No. M 512, 4761 RK Zevenbergen, The Netherlands	+31 168 33 43 44"	+31 168 33 43 49"	Upto 30" class 600 fittings & flow tee
61		MEREK Engineering	Premier estate, Leys road, Brockmoor Brierley Hill, DY5 3UT West midlands, UNITED KINGDOM	+44 121 544 9938"	+44 121 544 9132"	Upto 30" class 600 fittings & flow tee
62		PETROFIT	Unit 3 Rowan Court, Crystal Drive, Smethwick, B66 1RB West Midlands, UNITED KINGDOM	0121 544 9938	0121 544 9132	Upto 30" class 600 fittings & flow tee
63		PHOCEENINE (Groupe Genoyer)	Ten bergstraat 4, 2830 Wildebroek, BELGIUM	+32 3 860 73 70"	+32 3 860 73 71"	Upto 30" class 600 fittings & flow tee
64		VAN LEEUWEN BUIZEN	Schaarbeekelei 189, 1800 Vilvoorde, BELGIUM	+32 2 255 40 00"	+32 2 253 20 92"	Upto 30" class 600 fittings & flow tee
65		MS Fittings Mfg. Co. Pvt. Ltd., Kolkatta	M.S.FITTINGS MFG. CO.(P)LTD., H.O 17 WESTERN STREET, KOLKATTA 13	033-2362902, 2362903	033-2252103	Upto 24" class 600
66		Ferrous Alloy Forgings(P) Ltd.	Ferro tubes & Forging Industries, C 1/129, GIDC Estate, vaghodia, Baroda-391760	02668-62479		Upto 12"
67		Pipe Fit Engineers	496/1 GIDC Industrial Estate, Makarpura, Baroda-390010, pipefit@pipefit.net	0265-2636 547/545	0265-2636 546	Upto 24" class 600
68		Teekay Tube	315/317, Navratan 69, P D Mello Road Near Camac Bridge, Mumbai- 400009	+91 22 342 3382-83, 91 22 343 7716 ,345477, 3446975"	(022)349162	Upto 24" class 600
69		Alliance Fittings & forgings , Navi Mumbai	Alliance fittings & forgings inc., A-468/469, T.T.C Industrial Area	022-2788 1333/1916	022-2788 1134/ 5590 2273	Upto 12" Class 600
70		Swastik Lloyds Engineering Pvt. Ltd., Mumbai	Swastik Lloyds Engineering Pvt. Ltd., 5 B Islam pura Street, Mumbai-400004	022-3860222/23	022-7402779	Upto 12" Class 600
71		Steel Tubes (India)	526/36, Maulana Azad Road, 2nd Floor, (Gulawadi Circle), Mumbai- 400004	022-3895908/ 3822821	022-3895906	Upto 24" class 600
72		Eften Engineering Pvt. Ltd.	D1, Sipcot Industrial Park, Irungaltukottai-602105, Tamil nadu	04111-256284, 256714	04111-256714	Upto 8" class 600
73		Dylan Belgie	Lerenveld 20, 2547 Lint, Belgium	32 3 488 4880	32 3 488 4880	Upto 30" class 600 fittings & flow tee
74		FBF	Dynamicalaan 4-8, 2610 Anwerpen, Belgium	32 3 820 5880	32 3 828 2822	Upto 30" class 600 fittings & flow tee
75		Ferrostaal(Mangroup)	Hohenzollernstrasse 24, 45128 Essen, Germany	49 201 818 01	49 201 818 2822	Upto 30" class 600 fittings & flow tee
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S.NO	ITEM	NAME OF VENDOR	ADDRESS	PHONE NO	FAX NO	QUALIFIED FOR SIZE
76	Pipe fittings (Elbows, Tees, Reducers)	Sawan Engineers	201, Palace Plaza, Lalbaug Road, Near kashivishwanath Temple, Baroda-390001, Email :sawanengg@sify.com	0265-243 3003/553 8303	0265-243 5196	upto 24" class 600
77	Flanges	Ferrous Alloy Forging(P) Ltd.	111, DLF Industrial Estate, 14th Mile stone, Mathura Road Faridaba-121003			upto 24" 600#
78		Sanghvi Forging & Engineering Ltd	Parvati chambers, Opp Apsara cinema-pratap Nagar Road, Baroda-390004	0265-258 0644 /1658	0265 258 1125	upto 12" 600#
79		Sawan Engineers	201, Palace Plaza, Lalbaug Road, Near kashivishwanath Temple, Baroda-390001	0265-2433003/ 3096008	0265-2435196	upto 18" 600#
80		ECHJAY Forgings Ltd.	Kanjur Village Road, Kunjan Marg east Mumbai- 400042	225782461 225782830	225784962	upto 30" 600#
81		Ms Fittings Mfg.Co. Pvt.Ltd.Kolkata	Ms Fittings Mfg.Co. Pvt.Ltd.Kolkata, H.O.17 Western street, Kolkata-13	033-2352902, 2362903	033-2252103	upto 24" 600#
82		Pipe Fit Engineers	496/1, GIDC, Indi.Estate Makarpura, Baroda-390010	0265-2636547 /545	0265-2636546	upto 24" 600#
83		Punjab Steel Works	38B, Mayapuri Indl Area Phase-1 New Delhi-110064	011-5130960	115137432	upto 24" 600#
84		Pressure /Level/Temperature transmitters	Yokogawa			
85	Invensys India					
86	Honeywell Automation					
87	ABB					
88	Emerson Process Management					
89	Instrument Fittings including manifold, needle valve etc	Swagelock				
90		Hamlet				
91		Hoke				
92		Parker				
93	Impulse tubing	Sandvik				
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LIST OF RECOMMENDED VENDORS						
S.NO	ITEM	NAME OF VENDOR	ADDRESS	PHONE NO	FAX NO	QUALIFIED FOR SIZE
94	Instrumentation Panel	Positronics				
95		ICA				
96		Rittal				
97		Pyrotech Controls				
98		Enclotek				
99	Turbine Flow Meter	Daniel				
100		RMG				
101		GE				
102		FMC				
103		Instromet/Elster				
104	Signal Repeater & Isolator	MTL India Pvt. Ltd	A-273 Ansal chambers-1 3,Bhikaji cama place, New Delhi	011-26715408/6180	011-2671681	
105		P & F				
106	Indication Lamp (Cluster LED type)	Concord				
107		L&T				
108	24 V DC Power supply	SITOP				
109		Siemens				
110		PHEONIX				
111	RTD With Thermowell	Pyroelectric Instruments				
112		General Instruments				
113		ALTOP				
114		A.N.Instruments				
115	MCT	Roxtec				
116		NEIMEX				
117		Signet International				
118	Junction Box	Flame Proof Control Gears Pvt. Ltd				
119		Flame Proof Equipments Pvt. Ltd				
120		Flex pro Electricals pvt. Ltd,Navsari				
121		CEAG				
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LIST OF RECOMMENDED VENDORS						
S.NO	ITEM	NAME OF VENDOR	ADDRESS	PHONE NO	FAX NO	QUALIFIED FOR SIZE
122	Alarm Anunclator	IIC				
123		Procon				
124	Selector Switch	KAYCEE				
125		SALZER				
126	Quick Open Closure	PECO				
127		GD ENGG				
128		R&M Energy Systems				
129		TD Williams				
130		Peerless				
131		Huber Yale				
132		Pipeline Technologies UK				
133	Digital Bar graph Indicator	Honeywell				
134		ABB				
135		YOKOGAWA				
136		MASIBUS				
137	Switch Socket & Plugs	B.C.H.				
138		Baliga				
139		CGL				
140		MDS				
141		Delton				
142	Instrumentation Signal Control Cable	CORDS				
143		KEI				
144		Elkay Telelinks.				
145		Polycabs Associate cables				
146	Isolating Barrier	MTL India Pvt. Ltd	A-273 Ansal chambers-1 3,Bhikaji cama place, New Delhi	011-26715408/6180	011-2671681	
147		P & F				
		LIST OF RECOMMENDED VENDORS FOR FILTER		Document No.		Rev.
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LIST OF RECOMMENDED VENDORS

S.NO	ITEM	NAME OF VENDOR	ADDRESS	PHONE NO	FAX NO	QUALIFIED FOR SIZE
148	Cable Glands	Control switch Gear				
149		Electromac				
150		Commet				
151		Baliga				
152		Flameproof Control Gear				
153	Lugs	Dowells				
154	Control Valve	IL Paighat				
155		Fisher				
156		Valtec				
157		Dresser valves(India)				
158		Arca Controls				
159		Masoneilan				
160	Gas Chromatograph	Daniel				
161		ABB				
162		Instromet/Elster				
163		RMG				
164	Terminal Block	Elemex				
165		Phoenix Contact(India) Pvt.Ltd.				
166	Filter Element / Cartridge	PECO-FACET				
167		FILTAN				
168		VELCON				
169		ACS				
170		BURGESS MANNING				
171		PALL				
172		FILTERATE				
173		DOLLINGER				
174		DAHLMANN				



**LIST OF RECOMMENDED VENDORS
FOR FILTER**

Document No.

11-0330E-03-09-05-015

Rev.

0

SHEET 7 of 8



**KHERA COMPRESSOR STATION
UPGRADATION PROJECT**



THIRD PARTY INSPECTION AGENCY FOR FILTER						CLIENT JOB NO.	-
THIRD PARTY INSPECTION AGENCY FOR FILTER						TOTAL SHEETS	04
DOCUMENT NO	11	0330E	03	09	10	016	
0	17.05.11	ISSUED FOR TENDER			AS	ASD	AD
A	29.03.11	ISSUED FOR CLIENT'S COMMENTS			AS	ASD	AD
REV	DATE	DESCRIPTION			PREP	CHK	APPR

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2.0	SCOPE OF WORK.....	3
3.0	CO-ORDINATION FOR INSPECTION	3
4.0	INVOLVEMENT OF TPIA.....	3



**THIRD PART INSPECTION AGENCY
FOR FILTER**

Document No.

Rev

11-0330E-03-09-10-016

0

SHEET 2 of 4

1.0 INTRODUCTION

The objective is to specify the role of Third Party Inspection Agency (TPIA) appointed by Supplier for supply items for carrying out inspection.

The Supplier will appoint an independent approved Third Party Inspection Agency (TPIA) whose role shall be to witness, review and certify all quality related issues for supply of material. The TPIA shall ensure that all quality related requirements during manufacturing are strictly followed as per Owner/Owner's representative specifications and approved documents. Owner shall appoint its TPIA for witness, review and certification of all the construction activities.

2.0 SCOPE OF WORK

2.1 Role of TPIA for supply items

TPIA, as appointed by the Supplier from list to be provided, shall witness, review and certify all quality related activities for supply of material. The extent of TPIA involvement as a minimum is indicated in the various Quality Control Sheets attached with the tender document and shall be as per final approved QA/QC procedures or as per codes and standards, wherever applicable.

2.2 Role of Owner / Owner's representative for supply items

For supply items, Owner / Owner's Representative reserves the right to carryout independent inspection / audit of the plant during manufacturing. The extent of inspection shall be at the discretion of Owner / Owner's Representative. All costs related to the same (excluding travel expenses) shall be borne by Supplier

2.3 The various Hold points involvement as mentioned in various QC sheets are indicative minimum. However, actual involvement shall be decided by Owner/Owner's Representative during review of documents, and Supplier shall be bound by the same. Supplier shall also submit the calibration certificates of all the equipment/instruments, which are part of manufacturing/Inspection & testing for TPIA review TPIA shall also be responsible to check /witness the necessary calibration of such equipment/Instruments during visit to supplier's works.

3.0 CO-ORDINATION FOR INSPECTION

Supplier on award of the Contract/LOI shall submit the detailed procurement schedules within fifteen (15) days to Owner/Owner's representative for their approval. The detail item wise Manufacturing schedule indicating dates and location of manufacturer works shall be submitted by the Supplier within One (1) week from the date of issue of their internal Indent /Purchase order to sub vendor. The Supplier shall inform in writing minimum One (1) week in advance to inform the Owner/Owner's representative for Inspection Notice/Call. All coordination among Owner/Owner's representative/TPIA and Supplier's/ Vendor's works shall be the responsibility of Supplier. In case the Supplier fails to honour its inspection calls/notice, supplier has to reimburse all costs incurred by the Owner/Owner's representative at actual.

4.0 INVOLVEMENT OF TPIA

4.1 The Minimum requirements are indicated in the Quality Control Tables attached in tender document.

4.2 Mechanical

All bought out items required for execution activities for mechanical supply should satisfy the following conditions:

- All materials shall be of standard quality and shall be procured from renowned sources / manufacturers approved by Owner/Owner's representative.

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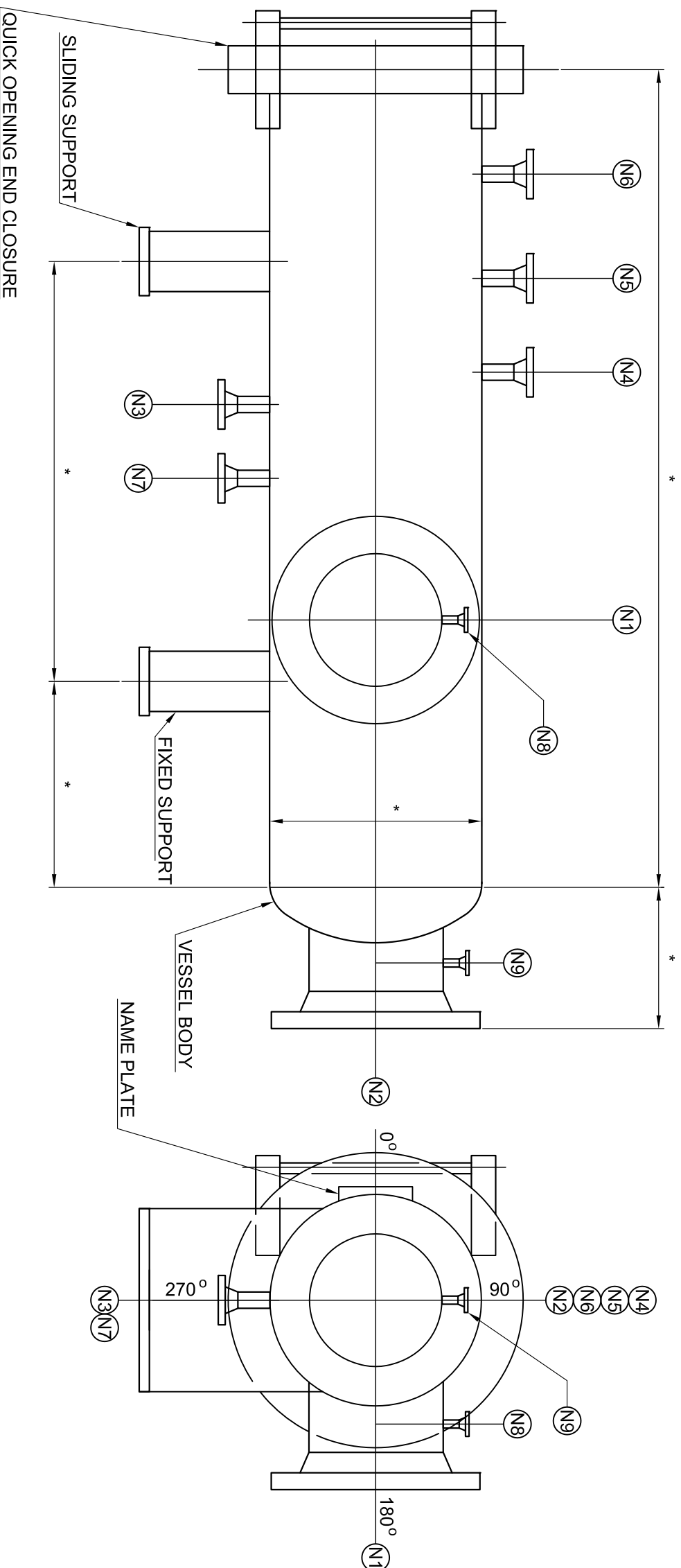
- All tests of the materials as specified by the relevant codes should be carried out by the supplier in an approved laboratory and the test reports should be duly authenticated by the laboratory and should be submitted to TPIA for his approval. If so desired by Owner/Owner's representative, tests shall be conducted in his presence or in presence of his authorized nominee.
- Quality and acceptance of materials not covered under technical specifications shall be governed by relevant codes.
- The Supplier shall submit manufacturer's test reports on quality and suitability of any material procured from them and their recommendations on storages/application/workmanship etc. for the intended use. Submission of manufacturer's test reports does not restrict Owner/Owner's representative from asking fresh test results from an approved laboratory of the actual materials supplied even from an approved manufacturer.
- The Supplier shall furnish the QAP for all supply items for approval.

4.3 Instrumentation

All bought out items for required execution activities for Instrumentation works should satisfy the following conditions:

- Supplier shall furnish the quality assurance procedure for field instruments and cables for review of Owner/Owner's representative.
- QAP will commence at the instigation of the requisition and follows through to equipment acceptance, thereby ensuring total conformity to the specifications.
- Type test certificates of similar equipment shall be provided.
- Owner/Owner's Representative shall carryout the inspection of erection of the equipment and witness the testing and commissioning and approve the certificates.

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NOZZLE SCHEDULE


NOZZLE	SIZE	QTY.	SCHEDULE / WALL THK. (MM)	RATING	TYPE	FLANGES		SERVICE	REMARKS
						FACE			
N1	30"	1	*	600#	WNRF	SMOOTH FINISH (RF 125AARRH)		GAS INLET	
N2	30"	1	*	600#	WNRF	SMOOTH FINISH (RF 125AARRH)		GAS OUT LET	
N3	2"	1	*	600#	WNRF	SMOOTH FINISH (RF 125AARRH)		DRAIN	
N4	2"	1	*	600#	WNRF	SMOOTH FINISH (RF 125AARRH)		VENT	
N5	3"	1	*	600#	WNRF	SMOOTH FINISH (RF 125AARRH)		CONNECTION FOR PSV	
N6	3/4"	1	*	6000#	SOCKET WELDED			CONNECTION FOR PG	
N7	2"	1	*	600#	WNRF	SMOOTH FINISH (RF 125AARRH)		UTILITY CONNECTION	
N8, N9	3/4"	2	*	6000#	SOCKET WELDED			CONNECTION FOR DPT	



REFERENCE DRAWING

S/NO	DRAWING/DOCUMENT NAME	DRAWING/DOCUMENT NO.

- NOTES:-**
1. ALL DIMENSIONS ARE IN MILLIMETER UNLESS OTHERWISE SPECIFIED.
 2. PAINTING SUITABLE TO CORROSIVE INDUSTRIAL CONDITION.
 3. EARTHING BOSS SHALL BE PROVIDED.
 4. VENDOR SHALL SUPPLY RECOMMENDED COMMISSIONING SPARES WITH ATLEAST 200% GASKETS, 100% FASTENERS, TWO NOS. DOOR SEAL FOR OQEC AND ONE SET OF FILTER ELEMENT ALONG WITH EACH FILTER.
 5. THIS DRG. TO BE READ IN CONJUNCTION WITH DATA SHEET NO. 11-0330E-03-09-03-004, MR NO. 11-0330E-03-09-06-001 AND TECHNICAL SPECIFICATION NO. 11-0330E-03-09-02-002.
 6. NOZZLE ORIENTATION ARE TENTATIVE, HOWEVER INLET NOZZLE N1 AND DISCHARGE NOZZLE N2 SHALL BE AT 90 DEGREE APART HORIZONTALLY.
 7. VENDOR TO SPECIFY / CONFIRM DIMENSION / DATA AS MARKED "*".

NO	DATE	REVISION	PREPD	CHKD	APPD
0	17.08.11	ISSUED FOR TENDER	VSJ	ASD	AD
A	29.03.11	ISSUED FOR TENDER	VSJ	ASD	AD

CLIENT

GAIL (India) Limited.
 A GOVT. OF INDIA UNDERTAKING

CONSULTANT

J.P. KENNY
 a trading name of

WOOD GROUP ENGINEERING INDIA PVT. LTD.
 NEW DELHI

PROJECT
NATURAL GAS PIPELINE PROJECT FORM
JHJJAR TO HISSAR

TITLE
GAD OF HORIZONTAL CARTRIDGE FILTER
 TAG NO. 56-F-101D & 56-F-101-E

SCALE	SIZE	JOB NO.	DRAWING NUMBER	SHEET	REV
1:75	A3	110330E	ANNEXURE - 1	1 OF 1	0

HORIZONTAL TYPE CARTRIDGE FILTER

QTY. = 02 NOS.

TAG NOS.: 56-F-101D & 56-F-101E

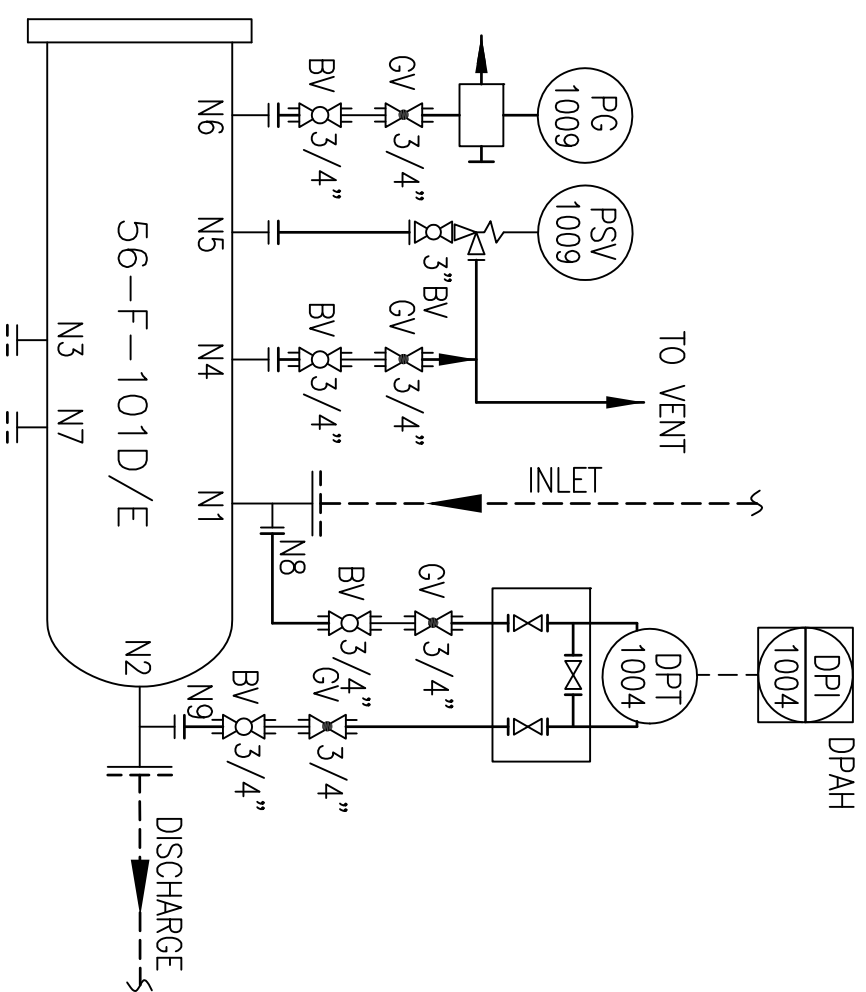
NORMAL FLOW RATE = 18.0 MMSCMD (FOR EACH FILTER)

INLET PRESSURE = 42.0 KG/SQ.CM G

INLET TEMPERATURE = 45.0 DEG.C

DESIGN PRESSURE = 93.0 KG/SQ.CM G

DESIGN TEMPERATURE = 65.0 DEG.C



NOTES:-

1. INLET & OUTLET MATCHING FLANGES WITH STUDS, NUTS & GASKETS ARE NOT IN SCOPE OF FILTER MANUFACTURER.
2. ALL INSTRUMENT / EQUIPMENT TAG NO. SHALL BE PRECEDED BY UNIT NO. 56, I.E. P-1007 SHALL BE READ AS 56-P-1007.
3. 3MM THK. COPPER JUMPER WILL BE PROVIDED AT EACH FLANGE CONNECTION.
4. SAFETY VALVE TO BE LOCALLY VENTED AT SAFE ELEVATION. VENTS FROM DEPRESSURING LINES TO BE IN A SAFE AREA AT AN ELEVATION NOT LESS THAN 3.0 M ABOVE THE HIGHEST OPERATING LEVEL IN THE FILTRATION AREA. ALL VENT LINES TO HAVE RAIN CAP AT TOP AND VENT AT BOTTOM.
5. DRAIN WILL RUN UP TO EDGE OF THE FILTER BODY.
6. DESIGN FLOW RATE SHALL BE 1.1 TIMES THE NORMAL FLOW RATE.

PROCESS CONDITIONS TABLE

OPERATING PARAMETER	MIN.	NORML.	DESIGN	UNITS
FLOW	~	18.0	~	MMSCMD
INLET PRESSURE	~	42.0	93.0	KG/CM ² G
TEMPERATURE	~	45.0	65.0	°C
ANSI PRESSURE CLASS	#600			

LEGENDS:-

- TRUNION MOUNTED FLANGED BALL VALVE (GAS OVER OIL ACTUATOR OPERATED)
- FLANGED GLOBE VALVE
- SOCKET-WELDED GLOBE VALVE
- FLANGED BALL VALVE
- SOCKET-WELDED BALL VALVE
- FLOW CONTROL VALVE
- SOLENOID OPERATED VALVE
- PLUG VALVE
- SPADE & SPACER
- PROPOSED PIPELINE
- EXISTING PIPELINE

NO.	DATE	REVISION	BY	CHKD	APPRD.
0	17/06/11	ISSUED FOR TENDER	PK	ASD	AD
A	29/03/11	REVISION	PK	ASD	AD

CLIENT
GAIL (India) Limited
(A Government of India Undertaking)

ENGINEERING CONSULTANT
 Jpkenny
WOOD GROUP KENNY INDIA PVT. LTD.
NEW DELHI

PROJECT INSTALLATION OF ADDITIONAL FILTRATION SYSTEM AT KHENA COMPRESSION STATION, UJJAIN, MP

TITLE SCHEMATIC DIAGRAM OF HORIZONTAL CARTRIDGE FILTER

SCALE	JOB NO.	DRAWING NUMBER	REV
N.T.S.	110330E	ANNEXURE-II	0