

PROCUREMENT OF ONLINE GAS CHROMATOGRAPH

BID DOCUMENT FOR ONLINE GAS CHROMATOGRAPH

**TENDER NO.: - AGCL/INST/OGC/2024/01
DATED 04.11.2024**

OPEN DOMESTIC COMPETITIVE BIDDING

VOLUME - II OF II

SUBMITTED BY



PIPELINE ENGINEERING CONSULTANTS PVT. LTD.

NOIDA, INDIA

Pipeline Engineering Consultants Pvt. Ltd.

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PROCUREMENT OF ONLINE GAS CHROMATOGRAPH

Material Requisition for Online Gas Chromatograph

Doc No.: P181-MRR-I001

TA	15.10.2024	Issued for Tender	VK	NC	AD
CC	29.08.2024	Re-Issued for Client Review	VK	NC	AD
CB	28.07.2024	Re-Issued for Client Review	VK	NC	AD
CA	04.07.2024	Issued for Client Review	VK	NC	AD
IA	03.07.2024	Issued for Internal Review	VK	NC	AD
REV.	DATE	DESCRIPTION	ORG	REVIEW	APPROVED



MATERIAL REQUISITION FOR ONLINE GAS CHROMATOGRAPH

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P181-MRR-I001
Rev.TA

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1.0 INTRODUCTION

Assam Gas Company Ltd. (AGCL) is a 61 years old Natural Gas transmission and distribution company, wholly owned by the Govt. of Assam with its registered office at Duliajan, Dist. Dibrugarh, Assam 786602.

The company transports Natural Gas through its integrated pipeline infrastructure to several market segments i.e., Power, Fertilizer, Petrochemicals, Industrial, Commercial and Domestic consumers primarily located in upper Assam. The present infrastructure of the company has a transportation capacity of about 6.0 MMSCM of gas per day.

Assam Gas Company Ltd. intends to procure Online Gas Chromatograph at various locations in Assam.

1.1 Purpose of the Document

This document specifies the basic requirements for the Design, Engineering and Procurement of Online Gas Chromatograph for various locations in Assam.

2.0 DEFINITION

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

PROJECT	Procurement of Online Gas Chromatograph
CLIENT / OWNER	Assam Gas Company Ltd.
EPMC	Pipeline Engineering Consultants Pvt. Ltd. (PLECO) the party to act for and on behalf of OWNER for Development of Rupkhelia Pipeline Terminal
CONTRACTOR	Agency appointed by CLIENT/ OWNER for executions of assigned tasks
PURCHASER	Either of CLIENT, OWNER or EPMC
VENDOR/MANUFACTURER	Party, which manufactures and supplies equipment, services to the OWNER or to CONTRACTOR

3.0 DOCUMENT PRECEDENCE

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

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

- Data Sheets;
- Specifications;
- P&ID
- Basic Documents

- Codes and Standards.

3.1 SCOPE OF DESIGN AND ENGINEERING

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

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

4.0 SCOPE OF WORK

Vendor shall be completely responsible to supply, laying, installation, testing and commissioning of below mentioned materials and services for satisfying the functional / operational requirements stated in this Material Requisition and its Attachments:

S. No.	Description	Quantity
1.0	<ul style="list-style-type: none"> • Retractable Sample Probe of 3" Size positioned at 12 'O' clock position, • Sample Tubing of 40 Meter, • Pressure regulators, • Sample Handling System, • Field Mounted Gas Chromatograph Analyzer unit installed in three side analyzer shed, • Panel Mounted Controller. • HMI along with all required hardware and software to be provided in control room • All the signals shall be interfaced with existing RTU installed in the control room. • 3-Stream online gas chromatograph with auto Selection (Presently 2-Sample Streams and 1-Stream without Sample Probe, the vendor shall consider all the components). • Carrier Gas supply for two years • Gas Chromatograph shall have Packed/Capillary Type column. • Gas Chromatograph shall be provided with 2 Nos. Vents - 1 No. for GC outlet and 1 No. for Fast Loop with Flame Arrestor. 	

MATERIAL REQUISITION FOR ONLINE GAS CHROMATOGRAPH

	<ul style="list-style-type: none"> 2 Years of Consumable Items shall be in OEM's Scope. Item to be Supplied for Sample probe Installation for 2 streams- <ol style="list-style-type: none"> 1.5" Weldolet as per Pipe Schedule 1.5" OD CS Pipe 1.5" 300# WNRF Flange weldolet 1.5" X 300# Full Bore Ball Valve SS 316 X 1.5" 300#, Blind Flange with 3/4" NPTF Thread in Center. Gaskets and Studbolts as per the installation requirements SS316 1/8" OD SS Tube-qty:30meters for each stream and total stream will be 2. Sample probe for 2 streams - online retractable type sample probe for under pressure pipe installation and maintenance . Moisture filter. The analytical/analyzer unit shall separate all components sufficiently from each other so all components present in the process gas are detected with sufficient accuracy. Detector type should be Thermal conductivity Detector (TCD). The unit shall control the chromatograph. Program software, interfaces and protocol should be robust with special consideration concerning automatic regeneration of all control and communicational functions after the event of a general power failure. controller unit is an integral part of GC consisting analytical unit. This control unit should be integral part of GC and should be within same housing. Analysis Time- Less than 5 minutes. 	
1.01	Supply, Supervision of Installation, Testing and Commissioning of Online Gas Chromatograph Package at AGCL Industrial Area Duliajan as per the above specification:	1 No.
1.02	Supply, Supervision of Installation, Testing and Commissioning of Online Gas Chromatograph Package at AGCL Lakwa 'O' Point, Maibella as per the above specification:	1 No.

MATERIAL REQUISITION FOR ONLINE GAS CHROMATOGRAPH

1.03	Supply, Supervision of Installation, Testing and Commissioning of Online Gas Chromatograph Package at AGCL Station NRL Golaghat as per the above specification:	1 No.
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Vendor shall have complete responsibility for all the items supplied by him including his sub-Vendors if any. The Vendor's scope of work includes, but not limited to:

- Design & Engineering;
- Procurement, Supply, Inspection, Factory Testing and Acceptance
- Supervision in installation, field calibration / testing, pre-commissioning & commissioning of the system
- Transportation, Transit Insurance, loading and unloading of material at AGCL site/ stores;
- Rectification of any damage (if any) occurred during transportation/ unloading / observed on receipt of material at site;
- Compliance of Checklist points during FAT, SAT, Site, stores (if any);
- If required by Client, Vendor to provide Caesar file of Gas Chromatograph System on the basis of which final load are provided.
- Cable & Cabling from Gas Chromatograph Skid to GC Panel;
- Other General scope of work.

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

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

Notes:

- i. Gas Chromatograph System and its accessories shall be sized as per requirements as mentioned in datasheet and suitable for installation.
- ii. Vendor shall submit datasheets, sizing calculations and drawings for approval. Vendor to proceed further only upon approval of Vendor submitted documents.
- iii. Vendor shall quote separately spares for 2-year normal operation and mandatory spares. List of spares quoted shall be furnished as per OEM standard formats.
- iv. Vendor to include the startup and commissioning spares in the quoted price. In case no startup/commissioning spares are recommended by the Vendor but the same are required at the time of startup/commissioning, Vendor shall supply such spares free of cost.
- v. Vendor shall provide one week of Technical Training on the Operation and maintenance of Gas Chromatograph System to five AGCL/Client personnel by the Vendor's Technical Consultants

at vendor's place. All Travel and lodging expense shall be borne by the Client/ AGCL. Training dates shall be decided by AGCL/Client. Vendor quoted price shall include the above.

- vi. Vendor shall furnish quotation only in case he can supply material strictly as per this MR and specification / data sheets forming part of MR.
- vii. The submission of prices by the Vendor shall be construed to mean that he has confirmed compliance with all technical specifications of the corresponding item(s).
- viii. If the offer contains any technical deviations or clarifications or stipulates any technical specifications (even if in line with MR requirements) and does not include complete scope and technical / performance data required to be submitted with the offer, the offer shall be liable for rejection.
- ix. Vendor must submit all design documents / drawings / calculations as specified in relevant specification along with offer and after award of order.
- x. Purchaser's inspector reserves the right to perform stage wise inspection and witness tests, as indicated in Specification for Gas Chromatograph System at Manufacturer's works prior to shipment. Manufacturer shall give reasonable notice of time and shall provide without charge reasonable access and facilities require for inspection to the Purchaser's inspector. Inspection and tests performed/witnessed by Purchaser's inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and test.
- xi. Vendor shall deliver the Gas Chromatograph System at AGCL Store in Golaghat and the delivery schedule shall be 5 months FOT site basis.
- xii. Vendor shall arrange checking of all material as per item list before handling over to Company. In case materials are packed in boxes, boxes shall be opened for inspection. All transportation, handling, Delivery (Mobilization of Crane, Manpower etc. as required for delivery) shall be in bidder's scope.

5.0 WARRANTY

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

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

6.0 VENDOR DOCUMENTS

6.1 Vendor Data Requirements

This section describes the Vendor Data Requirements applicable to a Vendor's scope. The Vendor data requirements shall be as mentioned in Gas Chromatograph System specification.

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

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

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

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

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

6.2 Vendor Drawing Review

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

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

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

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

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

7.0 PACKAGE AND STORAGE

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

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

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

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

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

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

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

8.0 LIST OF ATTACHMENTS

- a) Datasheet;
- b) Standard Specifications;
- c) P&ID;
- d) Piping Material Specification;
- e) ITP - Instrumentation items;
- f) Plot Plan

9.0 LIST OF DRAWINGS/DOCUMENT REQUIRED ALONG WITH THE BID.

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

1. No deviation Form / certification
2. Drawings / Documents / catalogues of offered model flow meter, flow computer, field instruments etc.;
3. Signed and stamped copy of complete tender
4. Piping GA drawing of Gas Chromatograph, tapping points with root valves, of instruments etc.;
5. MTO of offered Gas Chromatograph System;
6. ISO Certificate of the manufacturer
7. Type approval for major items in the GC System.



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8. List of 2 Years-Vendor recommended O&M Spares;
9. Minimum specification / datasheet of the offered Gas Chromatograph System

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Datasheet for Gas Chromatograph

Doc no.: P181-DSH-I001

Rev.	Date	Description	ORG	REVIEW	APPROVAL
TA	15.10.2024	Issued for Tender	VK	NC	AD
CC	29.08.2024	Re-Issued for Client Review	VK	NC	AD
CB	28.07.2024	Re-Issued for Client Review	VK	NC	AD
CA	10.07.2024	Issued for Client Review	VK	NC	AD
IA	04.07.2024	Issued for Internal Review	VK	NC	AD

DATASHEET FOR GAS CHROMATOGRAPH AT AGCL DULIAJAN				Rev.
GENERAL	1	TAG NO.	P181-GC-001	
	2	Application	Natural Gas	
	3	Quantity	01 Nos.	
	4	Gas Sampling Valve	3-Stream online gas chromatograph with auto Selection (Presently 2-Streams are in use and 1-Stream are for future, the vendor shall consider all the components except sample probe and sample tube).	
	5	Gas Chromatograph Unit	Microprocessor based	
DETECTOR	6	Thermal Conductivity Detector type able to identify following gases in Natural Gas mixture in prescribed ranges:		
	7	Nitrogen (N2)	0-20 Mole %	
	8	Methane (C1)	55-100 Mole%	
	9	Ethane (C2)	0-10 Mole%	
	10	Propane (C3)	0-10 Mole%	
	11	N-Butane (nC4)	0-10 Mole%	
	12	Carbon-di-oxide	0-20 Mole%	
	13	Iso-Butane	0-10 Mole%	
	14	Iso-Pentane	0-0.25 Mole%	
	15	N-Pentane	0-0.25 Mole%	
	16	Hexane+	0-0.1 Mole%	
	17	H2S	2ppmV-1%	
	18	Temperature Rating	Temperature control Range: 3°C~400°C	
	19	Accuracy	Temperature control Accuracy: ±0.1°C	
Column	20	Type	Packed/Capillary	
	21	Tube material	S.S.	
	22	Length	*	
	23	Outer diameter	*	
MISC.	24	Software	User friendly interface to show molecular composition of detected components of Natural Gas (as mentioned above) in Mole % (upto 4 decimal points) & their respective Gross Heating Values in MMBTU Windows based	
	25	Calibration Gas Standard Cylinder	Reference Gas Mixture for Calibration of GC of above mentioned gases of Capacity-35 litre (2 Nos. Each).	
	26	Carrier Gas Cylinder	Two carrier gas bottles shall be permanently connected to the analytical unit through auto change over system so that either bottle be replaced without upsetting the GC operation. 99.995%(Ultra Pure) pure Helium gas will be used as carrier gas. Supplier need to ensure supply of atleast 2 years carrier gas along with main GC system supply. calculations shall be supported by proven datasheet and actual site data.	
	27	Installation Kit/Consumables	Vendor to Provide the list of 2 years consumables. Any special Tools required.	
	28	Shelter Requirement	Pre-Fabricated 3 Side Shelter with Flame Proof Lighting	
	29	Voltage Stabilizer	Required	
Notes: **To be decided				
1	Vendor to specify. *			

DATASHEET FOR GAS CHROMATOGRAPH AT AGCL LAKWA 'O' POINT, MAIBELLA				Rev.
GENERAL	1	TAG NO.	P181-GC-002	
	2	Application	Natural Gas	
	3	Quantity	01 Nos.	
	4	Gas Sampling Valve	3-Stream online gas chromatograph with auto Selection (Presently 2-Streams are in use and 1-Stream are for future, the vendor shall consider all the components except sample probe and sample tube).	
	5	Gas Chromatograph Unit	Microprocessor based	
DETECTOR	6	Thermal Conductivity Detector type able to identify following gases in Natural Gas mixture in prescribed ranges:		
	7	Nitrogen (N2)	0-20 Mole %	
	8	Methane (C1)	55-100 Mole%	
	9	Ethane (C2)	0-10 Mole%	
	10	Propane (C3)	0-10 Mole%	
	11	N-Butane (nC4)	0-10 Mole%	
	12	Carbon-di-oxide	0-20 Mole%	
	13	Iso-Butane	0-10 Mole%	
	14	Iso-Pentane	0-0.25 Mole%	
	15	N-Pentane	0-0.25 Mole%	
	16	Hexane+	0-0.1 Mole%	
	17	H2S	2ppmV-1%	
	18	Temperature Rating	Temperature control Range: 3°C~400°C	
	19	Accuracy	Temperature control Accuracy: ±0.1°C	
Column	20	Type	Packed/Capillary	
	21	Tube material	S.S.	
	22	Length	*	
	23	Outer diameter	*	
MISC.	24	Software	User friendly interface to show molecular composition of detected components of Natural Gas (as mentioned above) in Mole % (upto 4 decimal points) & their respective Gross Heating Values in MMBTU Windows based	
	25	Calibration Gas Standard Cylinder	Reference Gas Mixture for Calibration of GC of above mentioned gases of Capacity-35 litre (2 Nos. Each).	
	26	Carrier Gas Cylinder	Two carrier gas bottles shall be permanently connected to the analytical unit through auto change over system so that either bottle be replaced without upsetting the GC operation. 99.995%(Ultra Pure) pure Helium gas will be used as carrier gas. Supplier need to ensure supply of atleast 2 years carrier gas along with main GC system supply. calculations shall be supported by proven datasheet and actual site data.	
	27	Installation Kit/Consumables	Vendor to Provide the list of 2 years consumables. Any special Tools required.	
	28	Shelter Requirement	Pre-Fabricated 3 Side Shelter with Flame Proof Lighting	
	29	Voltage Stabilizer	Required	
Notes: **To be decided				
1	Vendor to specify. *			

DATASHEET FOR GAS CHROMATOGRAPH AT NRL GOLAGHAT				Rev.
GENERAL	1	TAG NO.	P181-GC-003	
	2	Application	Natural Gas	
	3	Quantity	01 Nos.	
	4	Gas Sampling Valve	3-Stream online gas chromatograph with auto Selection (Presently 2-Streams are in use and 1-Stream are for future, the vendor shall consider all the components except sample probe and sample tube).	
	5	Gas Chromatograph Unit	Microprocessor based	
DETECTOR	6	Thermal Conductivity Detector type able to identify following gases in Natural Gas mixture in prescribed ranges:		
	7	Nitrogen (N2)	0-20 Mole %	
	8	Methane (C1)	55-100 Mole%	
	9	Ethane (C2)	0-10 Mole%	
	10	Propane (C3)	0-10 Mole%	
	11	N-Butane (nC4)	0-10 Mole%	
	12	Carbon-di-oxide	0-20 Mole%	
	13	Iso-Butane	0-10 Mole%	
	14	Iso-Pentane	0-0.25 Mole%	
	15	N-Pentane	0-0.25 Mole%	
	16	Hexane+	0-0.1 Mole%	
	17	H2S	2ppmV-1%	
	18	Temperature Rating	Temperature control Range: 3°C~400°C	
	19	Accuracy	Temperature control Accuracy: ±0.1°C	
Column	20	Type	Packed/Capillary	
	21	Tube material	S.S.	
	22	Length	*	
	23	Outer diameter	*	
MISC.	24	Software	User friendly interface to show molecular composition of detected components of Natural Gas (as mentioned above) in Mole % (upto 4 decimal points) & their respective Gross Heating Values in MMBTU Windows based	
	25	Calibration Gas Standard Cylinder	Reference Gas Mixture for Calibration of GC of above mentioned gases of Capacity-35 litre (2 Nos. Each).	
	26	Carrier Gas Cylinder	Two carrier gas bottles shall be permanently connected to the analytical unit through auto change over system so that either bottle be replaced without upsetting the GC operation. 99.995%(Ultra Pure) pure Helium gas will be used as carrier gas. Supplier need to ensure supply of atleast 2 years carrier gas along with main GC system supply. calculations shall be supported by proven datasheet and actual site data.	
	27	Installation Kit/Consumables	Vendor to Provide the list of 2 years consumables. Any special Tools required.	
	28	Shelter Requirement	Pre-Fabricated 3 Side Shelter with Flame Proof Lighting	
	29	Voltage Stabilizer	Required	
Notes: **To be decided				
1	Vendor to specify. *			



STANDARD SPECIFICATION FOR GAS CHROMATOGRAPH I-SPC-025

0	04.07.24	ISSUED AS STANDARD	SC	NC	AD
Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by

ABBREVIATIONS

ANSI	:	American National Standards Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society of Testing and Materials
API	:	American Petroleum Institute
EDDL	:	Electronic Device Description Language
FDT / DTM	:	Field Device Tool / Device Type Manager
FISCO	:	Fieldbus Intrinsic Safe Concept
FAT	:	Factory acceptance Test
HART	:	Highway Addressable Remote Transducer
IEC	:	International Electro-technical Commission
IS	:	Indian Standards
ISO	:	International Organization for Standardization
IP	:	Ingress Protection
LAS	:	Link Active Scheduler
NACE	:	National Association of Corrosion Engineers
NIST	:	National Institute of Standards and Technology
NPT	:	National Pipe Thread
NPT	:	Nominal / National Pipe Thread
OD	:	Outer Diameter
PID	:	Proportional, Integral and Derivative
SS	:	Stainless Steel
SAT	:	Site Acceptance Test



STANDARD SPECIFICATION FOR GAS CHROMATOGRAPH

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1.0 SCOPE

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

2.0 DEFINITIONS

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

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

3.0 REFERENCE DOCUMENTS

3.1. Codes & Standards

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

AGA Report no. 8	Compressibility factors of Natural gas and other Related Hydrocarbon Gases.
ANSI B 1.20.1	Pipe Threads, General Purpose (Inch)
ANSI B 16.5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ANSI B 16.20	Metallic Gaskets for Pipe Flanges Ring - Joint, Spiral-Wound, and Jacketed
API MPMS	Manual of Petroleum Measurement Standards Chapter 1 - Vocabulary Chapter 4 - Proving Systems Chapter 5 - Metering
IEC-801	Electromagnetic compatibility for industrial-process measurement and control equipment
IEC-529/ IS-2147	Degrees of protection provided by enclosures.
IEC-79/IS-2148	Electrical apparatus for explosive gas atmospheres - Flameproof enclosures
IEC 60079	Electrical apparatus for Explosive atmospheres.
NACE MR-0175 / ISO	Petroleum and natural gas industries - Materials for use in H ₂ S-containing environments in oil and gas production - Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys - Part 3
BS 6121	Selection of Cable Glands.
IP CODE PART 15	Area classification code for petroleum plants.
API 555	Process analysers.
ISO 6974	Natural Gas - Determination of composition with defined uncertainty by Gas Chromatograph
ISO 6976	Natural Gas - Calculation of Calorific Values, Density and Relative Density, and Wobbe Index from Composition.
ASTM D1945	Standard Test Method for Analysis of Natural Gas by Gas Chromatography



3.2. Order of Precedence

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

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

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

4.0 MATERIAL

Materials selected shall be in accordance with the Data Sheets and Company's standard Specifications along with the Instrumentation Design Criteria.

The complete On-line Gas Analyser (Chromatograph) and its sampling system shall be field mounted. All wetted parts material shall be suitable for sour service and shall be certified to NACE-MR-01-75 (Latest Edition). All impulse tubes shall be as a minimum SS316 flareless. All the tube fittings shall be of SS 316 double ferruled compression type. All pipe and pipe fittings shall conform to the piping material specification provided as per project.

5.0 DESIGN

The following design requirement covers the general requirements of Gas Chromatograph and its accessories etc., but for the exact requirements and applications, the relevant, job Specifications, Data Sheets and design basis shall be referred and complied.

5.1. General

I. The following components of the Gas Chromatograph system are defined as below:

a. Chromatograph

A stand alone, unit architecture-based microprocessor-controlled instrument consisting of chromatograph proper, sample conditioning system and programmer which is capable of working and generating hardwired and serial outputs without the aid of any external device.

b. Programmer

A microprocessor-based device which is a part of Chromatograph and controls the overall functioning of the system and also provides hardwired analogy and serial outputs.

c. Communication Interface

A high-level microprocessor-based device that can "talk" to a number of programmers and does the job of data collection, concentration and providing a Page 6 of 17 single serial interface between chromatograph system and purchaser's DCS or SCADA / PLC or host computer system.

II. Analyzer and accessories shall be purchased from a single supplier as a complete package. The supplier shall be from the approved list of Purchaser's Vendor's list. The Gas Chromatograph system shall, in general, consist of the following:

- a. Sample conditioning system including sample probe
- b. Chromatograph Analyser

- c. Programmer / Controller with display unit
 - d. Recording Unit
 - e. Gas cylinders for calibration standards, carrier gas and fuel gas
 - f. Communication Interface
- III. The Chromatograph proper, programmer and the sampling system shall be completely assembled, tested and ready for field installation.
- IV. Process Stream sampling shall be continuous.
- V. The Analyzer performance shall be within the specifications when the supply voltage changes by $\pm 10\%$ of the specified value, and supply frequency changes by ± 3 Hz of specified value.
- VI. Unless otherwise specified, materials for all components wetted by the sample shall be 316-SS, as a minimum.
- VII. All interconnecting wiring shall be colour coded/numbered and terminal blocks clearly identified.
- VIII. The sampling system, Chromatograph etc. shall be supplied pre-mounted on a self-standing panel. The panel shall have grouting holes to anchor bolt it to the ground.
- IX. Base frame and mounting stands with suitable clamps shall be provided for the carrier and calibration gas cylinders.
- X. Components of any sub-assembly that requires removal maintenance shall be removable without having to disassemble any other components. Such components include items like stream selector valves, sample inject valves, filters, pressure regulators, plug-in circuit cards and detector cells.
- XI. Sampling valves shall be of special design to minimize peak tailing and baseline separation problems.
- XII. On-stream Analyzers shall be installed in accordance with process requirements. They shall be housed in enclosures meeting the Electrical Area Classification Class-1 Zone-1, Gas Gr. IIA & IIB Temp T3. All Analyzer components located in hazardous areas must meet the electrical classification of that area. The Job Specifications shall be referred for the exact hazardous area of classification.
- XIII. Analyzer shall be selected for high accuracy and repeatability as the primary criteria. Analysis speed and cycle time is secondary for custody transfer purposes
- XIV. Analyzer and sample system shall be suitable for outdoor installation in the field. It shall be weather proof to minimum of IP66 protection.
- XV. A sunshade and a three-side weather shelter shall be provided to protect the Analyzer and sample system.
- XVI. Power supply for the Gas Chromatograph system shall be 24 V DC / 230 Volts ac from the Purchasers electrical supply system. Vendor shall provide the power requirements of the system.

5.2. Sample System

- I. Vendor shall provide a fabricated assembly of sample conditioning system having facility to measure sample flow to the Chromatograph proper.
- II. Sampling system design should be such that the sample drawn for analysis is truly representative of the process stream. The unit shall be supplied with all equipment necessary to condition each

stream for injection into the Chromatograph. The system must include, but not limited to, all regulators, vaporizers, dryers, filters, Rotameter, solenoid valves required for proper analysis. All Components of sampling system shall be rated for the mechanical design pressure and temperature conditions indicated in Purchaser's Data Sheet.

- III. Transportation time for the sample from the process tapping point upto the sampling system shall not exceed 30% of the cycle time specified for the Chromatograph.
- IV. The sampling system shall contain at least one wire mesh strainer of US standard sieve mesh size 100 or finer. Where Purchaser's Data Sheets indicate greater possibilities of plugging, Vendor shall provide more filters/separators as required.
- V. Where Purchaser's Data Sheets indicate possibilities of polymer formation on presence of excess polymers, Vendor shall offer suitable design features to minimize plugging because of polymer residue.
- VI. Wherever the process stream pressure is low, Vendor shall provide/ advise the purchaser on use of aspirators or sample pumps. Vendor shall also indicate the utility requirements (e.g. water or air) for such devices.
- VII. Sampling system shall include provisions for connection of calibration standard.
- VIII. Sampling system shall include block valves on all process sampling lines.
- IX. The sampling system shall provide a high-pressure retractable probe with 2" flange process connection (to fit a 2", full bore, and ball valve). The size of the probe shall be finalized depends upon the flow requirements to analyzer section from main pipeline. Vendor shall submit the required drawings and calculations.
- X. Multi-stream Analyzer systems shall have a separate sample handling sub-assembly for each stream.
- XI. Stream selecting valves shall be located as close as possible to the Analyzer to minimize connecting tubing length and possibility of cross-contamination of samples.
- XII. Stream selecting valves shall have bubble tight shut off and shall be fail closed so as to block the samples from Analyzer. Multi stream sample system shall consider the use of double block with atmospheric pressure configuration to prevent cross-contamination when Vendor's experience for the particular application involved, demands this precaution.
- XIII. When fast loop is specified, Vendor shall provide flow meters for sample bypass flow. Sample return line to process shall be provided with isolation valve and check valve. In case of multi-stream gas Chromatograph separate fast loop return lines shall be provided for each stream. Vendor shall indicate the fast loop return pressure and flow rates for each stream in his quotation. Return pressure shall be higher than the pressure of the process destination point specified by Purchaser.
- XIV. When liquid samples are to be analyzed, Vendor shall provide vaporizer to be installed close to the process tapping point to convert the liquid phase to vapour and transport the sample in vapour phase to the Analyzer. The sample vaporizer shall consist of heater, regulator, and pressure gauges (upstream and downstream) and safety valves all mounted on a plate ready for installation at site.
- XV. Where sample handling system requires heat to properly condition the sample, it will be enclosed in a thermally insulated enclosure. Temperature shall be controlled by an accurate control system to ensure proper sample conditioning. Heating shall be with steel coils.

- XVI. Where the Chromatograph has to analyze very high temperature samples e.g. furnace effluent, cooling probes shall be provided by Vendor to bring down the temperature of the sample near the tapping point. Cooling media shall be preferably Instrument air. Vendor to indicate the pressure and flow rates of instrument air required for this purpose.
- XVII. The sampling system shall be mounted on a free-standing rack and located as near the chromatograph as possible.
- XVIII. When remote calibration or automatic calibration is specified, solenoid valves shall be used for the purpose to be controlled by the programmer or by a remote-control device like DCS or SCADA / PLC.
- XIX. Electrical components in the sampling system shall be suitable for the electrical area classification indicated in the Purchaser's data sheet.

5.3. Analyser – Gas Chromatograph

- I. The Gas Chromatograph shall distinguish and analyze the following minimum components of natural gas: CO₂, N₂, C₁, C₂, C₃, iC₄, nC₄, iC₅, C₆+. The exact requirements shall be referred against the project specifications, data sheets, etc.
- II. The chromatograph chamber shall be maintained at a constant temperature level. When the detector is of the thermal conductivity type, the temperature shall be maintained within $\pm 1^{\circ}\text{C}$.
- III. Where multiple temperature-controlled zones are involved in a single chromatograph, each zone shall be well insulated so that the temperature of one zone does not affect that of another.
- IV. All the temperature-controlled zones shall be operated at a temperature well above the maximum ambient temperature. Provision shall be made for manual temperature control.
- V. Base line drift per analysis cycle without auto-zero shall be $\pm 1\%$ of auto-zero adjust span or less.
- VI. Vendor shall provide a pressure switch to shut off power supply to the detector during loss of carrier gas flow, so as to prevent any damage to the detector.
- VII. The Gas Chromatograph shall calculate heating value, specific gravity, calorific value, and Wobbe Index per GPA 2145/2172 for gas at standard conditions of 1.0332 kg/cm² abs and 15.56 °C. The calculated Kcal values shall have an accuracy of 0.1 % or better, exclusive of calibration standard accuracy. Repeatability shall be ± 0.5 Kcal per 1000 Kcal (0.05%) or better.
- VIII. Analyzer shall be equipped with an automatic calibration facility. The calibration interval shall be programmable.
- IX. Vendor shall supply one certified calibration gas cylinder prior to commissioning. The certificate shall include the exact mole percent of each of the 10 components, the specific gravity, calorific value, and Wobbe Index. All values to be calculated as per GPA 2145 / 2172 for gas at a pressure of 1.0332 Kg/cm² and a temperature of 15.56°C. Calibration gas composition shall be similar to the expected pipeline gas.
- X. The calibration gas cylinder shall be provided complete with individual regulator, pressure gauges, and valve assembly. Gas cylinder shall have a minimum capacity of 2 standard cubic meters. For the factory testing and the pre- commissioning calibration in the field, the typical gas composition shall be used.
- XI. Analyzer shall be supplied with carrier gas supplies. Carrier gas shall be purified helium. A minimum of two cylinders shall be supplied.

- XII. The carrier gas cylinders shall be provided complete with individual regulators, pressure gauges, and valve assemblies. The valve assembly shall facilitate changing both cylinder and setting of the cylinder regulator without disturbing operation of the gas chromatograph.
- XIII. Analyzer controller shall provide a minimum of six dry contact alarm outputs. These contacts shall be wired for alarm purposes. The alarm for each contact shall be configurable.
- XIV. Analyzer shall provide software configuration of the following parameters as a minimum
 - a. Stream selection and timing;
 - b. Baseline correction;
 - c. Leak detection;
 - d. Alarm programming

5.4. Programmer with Digital Display

- I. Programmer unit shall do the following as a minimum, communicate from Host computer system through the serial interface and locally on the Programmer itself, properly control the analysis cycle, provide chromatogram outputs to communication interface for Chromatograph /bar chart recording, provide hardwired analog outputs for each component of analysis, provide digital output to communication interface device, automatic zero adjustment and calibration of the chromatograph system.
- II. The programmer unit shall be dedicated to each Chromatograph and shall be an integral part of each Chromatograph in the field.
- III. The programmer unit shall be a microprocessor based solid state device.
- IV. The programmer unit or analyzer system shall have LCD digital display in the Analyzer system itself in the housing for the local field check, calibration, etc.
- V. Battery back-up shall be provided for the volatile memory.
- VI. Audio-visual alarms shall be provided for detector temperature deviation and zero off-set.
- VII. Maintenance diagnostics to be included in the software to allow rapid trouble-shooting in the event of system malfunction.
- VIII. On power failure or on communication failure between chromatograph and programmer, the chromatograph shall revert to safe condition (back flush).
- IX. Programmer output to DCS or SCADA / PLC or host computer shall represent the actual concentration of measured component in engineering unit.
- X. It shall be possible to generate either a Chromatogram or a bar-graph on the Printer.
- XI. For obtaining continuous analog outputs, peak-pickers and long-term memory circuit boards shall be provided for each component of interest.
- XII. All program data cables shall be capable of field modifications without knowledge of higher-level programming.
- XIII. Detector balancing and zero adjustment shall be automatic.
- XIV. The programmer will be certified by a statutory body for the electrical area classification specified in purchaser's data sheet.

5.5. Communication Interface

- I. Analyzer controller shall support configuration and maintenance via an RS-232 / RS-485 interface to a PC-based notebook computer. The Vendor shall supply a dedicated notebook computer, complete with appropriate software, for configuration and maintenance of the Analyzer. The software shall be capable of providing reports and graphics printout of the analysis results on demand.
- II. Analyzer controller shall support two additional communication ports. Each port shall be individually configurable for speed (1200 bps to 9600 bps) and protocol (MODBUS ASCII, MODBUS RTU and other Vendor specific protocol).
- III. The ports shall normally operate in the RTU mode as a slave device over an RS-422 / RS-485 interface to a MODBUS master device such as a SCADA RTU; PLC or DCS based station controller.
- IV. Analyzer shall provide all data such as gas composition, specific gravity, calorific value, and Wobbe Index over this interface to the station controller.
- V. Analyzer shall accept configuration parameters over the MODBUS interface from the station controller.

5.6. Carrier Gas, Fuel Gas and Calibration Gas Cylinders

- I. Each Chromatograph shall be furnished with the following compressed gas steel cylinders:
- II. Carrier gas dual cylinder and manifold. The carrier gas system shall be a dedicated one to each chromatograph providing automatic switchover to standby cylinder when the first cylinder is exhausted. All the accessories required for this purpose shall be provided by vendor. Number of cylinders supplied by vendor shall be adequate for 3 months continuous operation.
 - a. Certified calibration gas. In case of dual range of measurement, separate calibration standard for each range shall be provided. Calibration standard supplied by vendor shall be adequate to last six months.
 - b. Fuel gas for FID / FPD detector for three months continuous operation
 - c. Each of the calibration gas and fuel gas cylinders shall be provided with two stage pressure regulators. For carrier gas manifolds, pressure regulator shall be provided on the manifold for each cylinder.
- III. All gas cylinders shall be located near the chromatograph and shall be mounted by vendor on a free-standing support.
- IV. In case the calibration standard deteriorates with time (e.g. hydrogen sulphide, hydrogen in gas mixtures) then instead of supplying calibration gas, Vendor shall provide alternate.

5.7. Name Plate

Each Chromatograph shall have a stainless-steel name plate attached firmly to it at a visible place either by riveting or screwed to case, furnishing the following information: -

- a. Tag number as per owner's data sheet;
- b. Manufacturer's name and trademark;
- c. Manufacturer's serial no. and/or model no.;
- d. Range;

- e. Area classification in which the equipment can be used

6.0 FABRICATION AND PAINTING

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

Painting of Gas Chromatographs shall be in accordance with Company Painting Specifications.

7.0 INSPECTION AND TESTING

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

7.1. Factory Acceptance Testing (FAT)

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

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

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

- a. Visual inspection;
- b. Material tests;
- c. Dimensional check;
- d. Calibration test
- e. Any other tests defined in FAT/SAT Procedures.

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

7.2. Site Acceptance Testing (SAT)

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

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



8.0 MARKING, PACKING AND SHIPMENT

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

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

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

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

All threaded and flanged openings shall be suitably protected to prevent entry of foreign material.

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

8.1. Rejection

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

9.0 SPARES AND ACCESSORIES

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

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

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

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

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

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

10.0 DOCUMENTATION

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

10.1. Documentation Required with Technical Bid

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

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

- e. Any other documents.

10.2. Documentation Required for Approval

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

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Calculations for sample transportation time, zero gas & calibration gas consumption;
- d. JB wiring drawings;
- e. General arrangement drawings for Analyzer housing, sample conditioning system and analyzer.
- f. Detailed sectional drawings showing all parts with reference numbers and material specifications;
- g. Inspection and test plan, calibration procedures;
- h. Catalogues, Manuals and relevant GA / IA drawings and documents;
- i. Dimensional drawings;
- j. Material test certificates;
- k. Procedures for FAT & SAT;
- l. Quality Assurance Plan;
- m. Any other documents (Project Specific)

10.3. Operation and Maintenance Manuals

An Operation and Maintenance manual with all the relevant details to install and operate/maintain the complete package for the mechanical, instrument and electrical parts shall be provided, with detailed parts list, spare parts list, all the applicable drawings and details. The manual shall be split into separate sections, which include:

- a. Operations & Maintenance data and installation instructions;
- b. Technical design data and test results;
- c. Calibration and certification data;
- d. Drawings and schematics;
- e. Spare Parts, tools and test equipment's;
- f. Documents shall be in the English language

10.4. Training

Training on Gas Chromatograph system shall be provided to nominated Company personnel. The training course shall be conducted at the manufacturing facilities from where the Gas Chromatograph is offered. The course shall be designed to train the trainees in all aspects of Gas Chromatograph. Following topics/subject shall be covered as a minimum:

- a. Fundamentals of natural gas and its associated components measurement;



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- b. Different techniques for natural gas analysis in HC gas;
- c. Operating principle of analyser;
- d. Functioning of each component of analyzer, i.e. detector, sample conditioning system, electronics etc.;
- e. Fundamentals and operating of sample conditioning system;
- f. Calibration.

10.5. Guarantee & Warranty

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

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

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



STANDARD SPECIFICATION FOR INSTRUMENT TUBE FITTINGS

I-SPC-014

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Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by	Approved by	



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ABBREVIATIONS

ANSI	:	American National Standards Institute
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society of Testing and Materials
BS	:	British Standards
FAT	:	Factory Acceptance Test
IS	:	Indian Standards
ISA	:	Instrument Society of America
ISO	:	International Organization for Standardization
NACE	:	National Association of Corrosion Engineers
NPT	:	Nominal Pipe Thread
SAT	:	Site Acceptance Test
SS	:	Stainless Steel



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1.0 SCOPE

This Standard Specification, together with the Data Sheets attached herewith, establishes the minimum technical and functional requirements for design, engineering, materials, fabrication, painting, inspection and testing, documentation, marking, packing and shipping of instrument tube fittings which includes the following types :-

- a. SS compression fittings (for SS tube)
- b. Brass compression fittings (for copper tube)

2.0 DEFINITIONS

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

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

3.0 REFERENCE DOCUMENTS

3.1 Codes & Standards

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

American Society of Mechanical Engineers

ASME B1.20.1	Pipe Threads
ASME B 16.5	Steel Pipe Flanges and Flanged Fitting
ASME B 16.20	Ring Joint Gaskets and Grooves for Steel Pipe Flanges
ASME B16.11	Forged Steel Fittings -Socket Welding and Threaded

British Standards

BS-4368	Carbon and Stainless Steel Compression Couplings for Tubes - Part-IV
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Instrument society of America

ISA RP 42.1	Nomenclature for Instrument tubing fittings
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Indian Standards

IS-319	Specification for free cutting Brass Bars, Rods and Sections
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3.2 Order of Precedence

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

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

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

4.0 MATERIALS

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

5.0 DESIGN

5.1 SS Tube Fittings

Nomenclature of all Tube Fittings shall be as per ISA RP 42.1.

Fittings shall be of flare less compression type and four - piece (for double compression type) construction consisting of two ferrules, nut and body suitable for use on SS tubes conforming to ASTM A 269 TP 316 with hardness in the range of RB 70 to 79.

All the parts shall be of SS 316.

Hardness of the ferrules shall be in the range of RB 85-90 so as to ensure a hardness difference of the order of 5 to 10 between Tube and Fittings, for better sealing.

Nuts and ferrules of a particular size shall be interchangeable for each type.

Spanner hold shall be metric.

Threaded ends of Fittings shall be NPT as per ANSI B 1.20.1.

Vendor shall ensure that the ferrules and nuts supplied for fittings shall be suitable for the sample Tube which shall be supplied during manufacture.

Specific techniques like Silver plating shall be used over threading in order to avoid jamming and galling.

5.2 Copper Tube Fittings

Nomenclature of all Tube Fittings shall be as per ISA RP 42.1.

Fittings shall be of flare less compression type and of three- piece construction consisting of ferrule, nut and body suitable for use on copper tubes conforming to ASTM B 68/B 68M hardness not exceeding RB 50.

All parts shall be manufactured from Brass as per IS 319 bar stock and nickel plated.

For better grip, Vendor shall maintain hardness difference between tube and ferrule and indicate the same along with the offer.

Nuts and ferrules of a particular size shall be interchangeable for each type.

Threaded ends of Fittings shall be NPT as per ANSI B 1.20.1.

Spanner hold shall be metric.

Vendor shall ensure that the ferrules and nuts supplied for fittings shall be suitable for sample tube which shall be supplied during manufacture.

5.3 Name Plate

No separate nameplates are required on the Fittings. However, a Manufacturer's name / trademark should be punched on a visible place on the body of each Fittings for easy identification.

6.0 FABRICATION AND PAINTING

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

7.0 INSPECTION AND TESTING

Vendor shall perform all inspection and testing as per Job Specification requirements, and as per relevant codes, prior to shipment. The inspection and testing for Instrument Tube Fittings shall be carried out as per approved Inspection and Test Plan.

Type test for the products shall be according to 8S-4368 Part IV which shall necessarily include the following:-

- a. Hydrostatic proof pressure test
- b. Minimum hydrostatic burst pressure test
- c. Disassembly and reassembly test

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

The type test results shall be made available for scrutiny during inspection.

Vendor shall submit the test certificates to the Company for the tests conducted during the manufacturing process like hydro test, material test, hazardous area certification test, calibration test and any other before Factory Acceptance Testing (FAT).

7.1 Factory Acceptance Testing (FAT)

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

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

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

- a. Hydrostatic Test: SS Tube Fittings shall be subjected to hydrostatic test at the following pressures.
 - For 6 mm Fittings, at 80 kg/cm².
 - For 1/2" Fittings, at 153 kg/cm² or 400 kg/cm² at 38°C, as specified in the Data Sheets. The ratings are based on usage in piping classes with flange ratings up to 600#, 900# and 1500# respectively.
 - Brass compression Fittings shall be subjected to hydrostatic test at the following pressure:
 - For 1/4" Fittings, at 10 kg/cm², 3/8 " at 80 kg/cm², at 38° C.
 - During and after the hydrostatic test, the tubes shall not show any leaks or rupture.
- b. Pneumatic Pressure Test: The Fittings shall be tested at 7 kg/cm² of dry air. During and after the test, tubes shall not show any leaks or rupture.
- c. Disassembly and Reassembly Test.
- d. Hardness verification. Test for hardness shall be done on parent material for the ferrules.
- e. Dimensional test report

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

7.2 Site Acceptance Testing (SAT)

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

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

8.0 MARKING, PACKING AND SHIPMENT

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

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

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

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

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

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

9.0 SPARES AND ACCESSORIES

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

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

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

Vendor shall recommend accessories and special tools required for operation and maintenance of Instrument Tube Fittings, for Company review.

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

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

10.0 DOCUMENTATION

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

10.1 Documentation Required with Technical Bid

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

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

10.2 Documentation Required for Approval



STANDARD SPECIFICATION FOR INSTRUMENT TUBE FITTINGS

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

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Material test certificates;
- d. Procedures for FAT;
- e. Quality Assurance Plan;

10.3 Guarantee & Warranty

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

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



STANDARD SPECIFICATION FOR INSTRUMENTATION CABLES

I-SPC-013

0	08.01.22	ISSUED AS STANDARD	KS	AD	AD	SK
Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by	Approved by



STANDARD SPECIFICATION FOR INSTRUMENTATION CABLES

SPECIFICATION NO.
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ABBREVIATIONS

ASTM	:	American Society of Testing and Materials
AWG	:	American Wire Gauge
BS	:	British Standards
DC	:	Direct Current
DIN	:	Deutsches Institute for numbering
EPR	:	Ethylene Propylene Rubber
F&G	:	Fire and Gas
IEC	:	International Electro-technical Commission
IS	:	Indian Standards
PVC	:	Polyvinyl Chloride



STANDARD SPECIFICATION FOR INSTRUMENTATION CABLES

SPECIFICATION NO.
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1.0 SCOPE

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

2.0 DEFINITIONS

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

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

3.0 REFERENCE DOCUMENTS

3.1. Codes & Standards

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

IEC-332-3 Part 3	Tests on bunched wires and cables
IEC 584-3 Part	Extension and compensating cables – Tolerances identification system

IEC-60332 Part 3	Tests on electric and optical fibre cables under fire conditions - Test for vertical flame spread of vertically mounted bunched wires or cables
IEC-60331	Fire-Resisting Characteristics of Electric Cables
ASTM D 2863	Test method for measuring the minimum oxygen concentration to support candle like combustion of plastics (Oxygen index)
BS-5308 Part 1	Specification for Polyethylene insulated cables
BS-5308 Part 2	Specification for PVC insulated cables
DIN-50049	Document on Material Testing
IS-1554 Part 1	PVC insulated (heavy duty) electric cables-working voltage up to and including 110 V
IS-2633	Method for testing uniformity of coating on zinc coated articles
IS-3975	Mild steel wires, formed wires and tapes for armouring cables
IS-5831	PVC insulation and sheath of electric cables
IS-8784	Thermocouple compensating cables

3.2. Order of Precedence

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

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

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

4.0 MATERIALS

Materials selected shall be in accordance with the Data Sheets and Company's Standard Specifications. Type and material of extension Cable shall be as per IS-5831 and IEC 584-3 where applicable.

Cable cores shall be of annealed electrolytic tinned copper conductor with PVC jackets conform to IS-5831. Insulation shall be Mica-glass / EPR or silicon rubber for F&G. signal/control Cables. Armouring shall be of galvanized steel wire / strip armour conforming to IS-1554. Screening / shielding shall be of black Aluminium backed Mylar / Polyester foil.

5.0 DESIGN

The following design requirement covers the general requirements of Instrument Cables and accessories etc., but for the exact requirements and applications, the relevant, specific job Specifications and design basis shall be referred and complied.

5.1. Signal and Control Cables

5.1.1. Type – I (Single Pair / Triad Shielded Cable)

Each core shall be 1.5 mm², made of 7 stranded annealed electrolytic copper conductor. Each strand shall be 0.53 mm dia.

Primary insulation shall be 85°C polyvinyl chloride (PVC) as per IS-5831 Type-C. Thickness shall be 0.5 mm minimum.

A pair or triad shall have twisted cores and number of twists shall be not less than 10 per meter. Colour of core insulation shall be black-blue in pair and black-blue-brown in a triad.

Individual pair and triad shall be shielded. Shield shall be Aluminium backed by Mylar / polyester tape with the metallic side down helically applied with either side 25 % overlap or 100% coverage. Minimum shield thickness shall be 0.05 mm. Drain wire shall be 0.5 mm² multistrand bare tinned annealed copper conductor. The drain wire shall be in continuous contact with Aluminium side of the shield.

Inner and outer jacket shall be made of extruded flame retardant 90°C PVC to IS 5831 - Type ST2. Oxygen index of PVC shall be over 30 %. Temperature Index shall be over 250°C. The thickness of the jacket shall be as per IS-1554 Part-1.

Inner jacket colour shall be black. Outer jacket colour shall be black, except for cables to be used in intrinsically safe systems it shall be light blue. A rip cord shall be provided for inner jacket.

Armour over inner jacket shall be of galvanized steel wire / flat as per IS-1554 Part-1.

Tolerance in overall diameter of cable shall be within ± 2 mm over offered value.

5.1.2. Type – II (Multipair / Multitriad Cable with Individual Pair Shield and Overall Shield)

a. Generally the Cable shall be same as single pair shielded Cable except conductor sizes shall be 0.5 mm² made of 7 strands of annealed electrolytic copper conductor. Each strand shall be of 0.3 mm dia.

b. Overall shield shall be of Aluminium backed up by Mylar / polyester tape helically applied with the metallic side down with either side 25% overlap or 100% coverage. Minimum shield thickness shall be 0.075 mm. Drain wire shall be similar to individual pair drain wire and shall be of the overall shield.

c. Overall twist of all pair / triads shall be as per Vendor's standard.

d. A pair of communication wire shall be provided for multipair / multitriad cables. Each wire shall be 0.5 mm² of plain annealed single or multistrand copper conductor with 0.4 mm thick 85°C PVC insulation. Insulation shall be green and red colour coded.

e. Pair identification shall be with numbers at interval of not more than 250 mm as per vendor's standards.

5.1.3. Type – III (Multipair / Multitraid Cable with Only Overall Shield)

a. These Cables shall be same as type-II cables except that the individual pair / triad shall not have shielding.

5.1.4. Type - IV (Multipair / Multitriad Cable with Individual Pair Shield and Overall Shield)

a. The Cable shall be same as Type II except conductor size shall be 1.5 mm² made of 7 stranded annealed electrolytic copper conductor. Each strand shall be of 0.53 mm dia.

5.1.5. Type – V (Multipair / Multitriad Cable with Overall Shield only)

a. The Cable shall be same as type IV except that the individual pair / triad shall not have the shielding.

5.2. Fire and Gas Cables shall be fire resistant and shall meet all the Specifications mentioned above and:

- a. Insulation shall be Mica-Glass / EPR or silicon rubber.
- b. The inner sheath shall be applied with a low smoke fire resisting compound.
- c. Suitable filler material (if necessary) shall be filled.
- d. Outer sheath shall be made up of low smoke, heat and oil resistant and flame retardant material.
- e. Circuit integrity of the Cable shall be maintained for a minimum period of 3 hours as per IEC-60331.
- f. The outer jacket colour shall be orange.

5.3. Thermocouple Extension Cables

Type and material of extension cable shall be as per IS-5831 and IEC-584-3 where applicable.

5.3.1. Type – I (Single Pair Shielded Cable)

- a. Each core shall be made of 16 AWG solid conductors.
- b. Primary insulation shall be 85°C polyvinyl chloride (PVC) as per IS 5831 Type C. Thickness shall be 0.5 mm minimum. Colour coding shall be as per IS-8784 Table-5.
- c. The cores of the pair shall be twisted and number of twists shall be not less than 10 per meter. The pair shall be shielded. Shield shall be Aluminium backed by Mylar / polyester tape bonded together helically applied with the metallic side down with either side 25% overlap and 100% coverage. Minimum shield thickness shall be 0.05 mm. Drain wire shall be 0.5 mm² multistrand bare tinned annealed copper conductor. The drain wire shall be continuous contact with Aluminium side of the shield.
- d. Inner and outer jacket shall be made of extruded flame retardant 90°C PVC to IS 5831- Type ST2. Oxygen index of PVC shall be over 30 %. Temperature index shall be over 250°C. The thickness of the jacket shall be as per IS-1554 part-1. Inner jacket and outer jacket colour shall be as per IS-8784. A rip cord shall be provided for inner jacket.
- e. Armour over inner jacket shall be of galvanized steel wire/flat as per IS-1554 Part-I.
- f. Tolerance in overall diameter of cable shall be within ± 2 mm over offered value.

5.3.2. Type – II (Multipair Cable with Individual Shield and Overall Shield)

- a. The Cable shall be same as single pair shielded cable except for following;
 - i. Each core shall be 20 AWG solid conductor.
 - ii. In addition to individual pair shield overall shield shall be provided. Overall shield shall be of Aluminium backed up by Mylar / polyester tape helically applied with metallic side down either side 25% overlap or 100% coverage. Minimum shield thickness shall be 0.075 mm. Drain wire shall be similar to individual pair drain wire and shall be in continuous contact with the aluminium side of the overall shield.
 - iii. Overall twist of all pair shall be as per Vendor's standard.
 - iv. A pair of communication wire shall be provided for multipair cables. Each wire shall be 0.5 mm² of plain annealed single or multistrand copper conductor with 0.4 mm thick 85°C PVC insulation. Insulation shall be green and red colour coded.
 - v. Pair identification shall be with numbers at interval of not more than 250 mm as per Vendor's standard.

5.3.3. Type – III (Multipair Cable with Individual Pair Shield and Overall Shield)

- a. The Cable shall be same as type II except conductor size shall be 16 AWG.

5.4. Electrical Characteristics

5.4.1. Cable parameters L/R ratio, capacitance shall conform to intrinsic safety requirements for IS cables. Limitations for cable parameter shall be as follows:

- a. Maximum DC resistance of the conductor of the completed cable shall not exceed 12.3 Ω /km at 20°C for cables with 1.5 mm² conductors and 39.7 Ω /km at 20°C for cables with 0.5 mm² conductors.
- b. Mutual capacitance between any core and screen shall not exceed 250 pF/m at 1 KHz. Capacitance between any cores or screen shall not exceed 400 pF/m at 1 KHz.
- c. L/R ratio of adjacent core shall not exceed 40 μ H/ Ω for cables with 1.5 mm² conductors and 25 μ H/ Ω for cables with 0.5 mm² conductors.
- d. Electrostatic noise rejection ratio shall be minimum 76 dBA.
- e. Drain wire resistance including screen shall not exceed 30 Ω /km.
- f. Core inductance shall not exceed 4 mH/Km.
- g. Values shall be derived under the fault condition in the cable which produces the worst case parameters for intrinsic safe cables.

All Cables shall have insulation voltage rating of 600 / 1100 V.

5.5. Name Plate

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

- a. Tag number as per Data Sheet;
- b. Manufacturer's name;
- c. Details of the Cable;
- d. Length of the Cable in meters contained in the drum;
- e. Gross weight;
- f. Direction of rotation of drum for unwinding by means of an arrow;
- g. Purchase Order number.

6.0 FABRICATION AND PAINTING

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

7.0 INSPECTION AND TESTING

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

7.1. Factory Acceptance Testing (FAT)

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

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

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

- 7.1.1. Standard Type Test certificate shall be furnished for Cables similar to those being offered,**
- a. Cable shall be flame retardant to IEC-60332 part-III category A.
 - b. Cables required for F&G applications shall be as per IEC-60331.
- 7.1.2. Standard Routing Test (to be carried out by the manufacturer during various stages of manufacturing, test certificates shall be furnished)**
- a. Insulation resistance, voltage test and spark test as per 8S-5308 part-II and sheath test as per IS-5831;
 - b. Armor test as per IS-3975;
 - c. Cable capacitance, L/R ratio and inductance test;
 - d. Conductor resistance test in Ohms/km;
 - e. Thermo emf tests for thermocouple extension cables.
- 7.1.3. Standard Acceptance Test shall be carried out in the presence of Purchaser or his authorized representatives,**
- a. Continuity test;
 - b. Voltage test as per 8S-5308 part-II;
 - c. L/R ratio and capacitance values test;
 - d. Oxygen index test as per ASTM D 2863 latest edition;
 - e. Conductor resistance and drain wire resistance;
 - f. Dimensional check for overall diameter and under armor outer armor diameter;
 - g. Fire resistant test / certificate review (when specified);
 - h. Tests for uniformity of galvanization of armor as per IS-2633;
 - i. Check for drum length and overall length tolerances.
- 7.2. Site Acceptance Testing (SAT)**
- A SAT shall be carried out on completion of the installation of the Cables at site which shall be witnessed by the company / owner's representative. SAT shall be performed as per the approved test procedure. A comprehensive test procedure in compliance with the company specification shall be developed and issued to company / owner for review and approval.
- The Site Acceptance Test (SAT), in general, shall demonstrate that the Cables functions correctly and properly in accordance with the specified requirements. SAT mainly consists of the following inspections:
- a. Continuity test

- b. Conductor resistance and drain wire resistance
- c. Drum length and overall length tolerances
- d. Any other test, if required.

8.0 MARKING, PACKING AND SHIPMENT

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

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

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

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

Cables shall be dispatched in wooden drums, securely battened with take-off end fully protected against damage

The ends of the Cable shall be sealed with suitable PVC / Rubber caps to prevent ingress of moisture.

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

9.0 SPARES AND ACCESSORIES

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

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

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

Vendor shall recommend accessories and special tools required for operation and maintenance of Instrument Cables for Company review.

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

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

10.0 DOCUMENTATION

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

10.1. Documentation Required with Technical Bid

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

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

- d. Quality Assurance Plan;
- e. Any other documents.

10.2. Documentation Required for Approval

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

- a. Specifications, Data Sheets;
- b. Bill of materials including Vendor list, details for third party items;
- c. Catalogues, Manuals and relevant drawings and documents;
- d. Dimensional drawings;
- e. Material test certificates;
- f. Procedures for FAT;
- g. Quality Assurance Plan;
- h. List for spare parts for start-up and for 2 years of operation.

10.3. Guarantee & Warranty

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

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

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



**STANDARD SPECIFICATION
FOR
CONTROL PANEL AND ACCESSORIES

I-SPC-0017**

0	20.02.22	ISSUED AS STANDARD	KS	AD	AD	SK
Rev.	Date	Purpose	Prepared by	Reviewed by	Approved by	Approved by



STANDARD SPECIFICATION FOR CONTROL PANEL AND ACCESSORIES

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ABBREVIATIONS

AC	:	Alternating Current
DC	:	Direct Current
DPDT	:	Double Pole Double Throw
HRC	:	High Rupturing Capacity
LED	:	Light Emitting Diode
NPT	:	National Pipe Thread
PVC	:	Poly Vinyl Chloride



STANDARD SPECIFICATION FOR CONTROL PANEL AND ACCESSORIES

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1.0 SCOPE

1.1 General

1.1.1 This specification, together with the data sheets covers the requirements for the design, materials, fabrication, wiring, painting, nameplate marking, inspection & testing, shipment and site activities including installation of control panels and accessories.

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-

ASME - American Society of Mechanical Engineer

B 1.20.1 : Pipe Threads, General Purpose (Inch)

B 16.5 : Pipe Flanges and Flanged fittings

B 16.20 : Metallic Gaskets for Pipe Flanges

API - American Petroleum Institute.

MPMS : Manual of Petroleum Measurement Standards

RP 552 : Transmission Systems

EN - European Standards

10204 : Inspection Documents For Metallic Products.

IS/IEC - Indian Standards/International Electro-Technical Commission

IS/IEC 60079 : Electrical Apparatus for Explosive Gas Atmosphere.

IS/IEC 60529 : Degree of Protection Provided by Enclosures (IP Code).

IEC-61000-4 : Electromagnetic Compatibility for Industrial : Testing and Measurement Techniques.

IS-5 : Colours for Ready Mixed Paints.

IS-2062 : Hot rolled Medium and High Tensile Structural Steel.

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) Job Specification, Data Sheets
- c) Standard Specification
- d) Codes and Standards

1.1.4 In addition to meeting purchaser's specifications in totality, vendors' extent of responsibility shall also include the following.

Vendor shall be responsible for panel front arrangement including proper location and spacing of instruments and accessories like switches, push buttons, lamps, terminal blocks, supporting steel members, wiring raceways etc., from the point of view of accessibility and ease of maintenance based on the indicative drawings/schemes furnished by the purchaser.

1.2 Bids

- 1.2.1 Vendor's quotation shall be strictly as per the bidding instructions to vendor attached with the Material Requisition.
- 1.2.2 Vendor's quotation, catalogues, drawings, installation, operation and maintenance manual etc. shall be in English language only.

1.3 Drawing and Data

- 1.3.1 Detailed drawings, data, catalogues and manuals required from the vendor are indicated by the purchaser in vendor data requirement sheets attached with the requisition.
- 1.3.2 Final documentation consisting of design data, installation manual, maintenance manual etc. submitted by the vendor after placement of purchase order shall include the following, as a minimum;
- a) Specification sheet for control panels, instruments and accessories.
 - b) Certified drawings for each control panel, which shall provide following details:
 - i) Control panel front arrangement drawing showing all dimensions including bezel/cut out dimensions.
 - ii) Loop wiring drawings showing the terminal numbers of each instrument/ accessory used in the wiring.
 - iii) Ladder drawings and relay wiring drawings showing terminal numbers for interlock/shutdown.
 - iv) Power supply distribution drawings with terminal numbers, incoming/ outgoing feeder size, fuse and isolator rating etc.
 - c) Vendor shall provide test certificates for all the tests indicated in Clause 4.0 of this specification.
 - d) Maintenance procedure including replacement of instruments and accessories in vendor scope.

2.0 DESIGN AND CONSTRUCTION

- 2.1 Control panel and accessories shall be designed and fabricated in accordance with the drawings/data sheets enclosed with the Enquiry. Applicable standards and codes shall include relevant sections of APT-MPMS APT BP 552
- 2.2 The design of the electronic instruments, relays etc. shall be in compliance with electromagnetic compatibility requirements as per IEC 61000-4.

2.3 Construction

- 2.3.1 Control panels shall generally be 2100 mm high and 1000 mm deep and shall be mounted on 100mm high channel base. Width of the panels shall be 1200 mm or 800 mm in general (as indicated in material requisition), however it may vary as per actual requirements.
- 2.3.2 Panels shall be free standing type. Panels with instruments mounted on the front shall be Fabricated from 3 mm thick cold rolled steel sheet. If the same is not available, 4 mm thick Hot rolled steel sheet shall be used. All other panels shall be fabricated from 2mm thick cold Rolled steel sheet. Angle iron framework shall use a minimum section of 50 x 50 x 4 mm Angle. Panel painting procedure shall include blast cleaning, grinding, chemical cleaning, Surface finishing by suitable filler and two coats of high grade lacquer with wet blasting Wherever required. Two coats of paint in the panel colour shall be provided for non-glossy High satin finish. Final coat shall be given after assembly at site.

For local control panel, Steel sheets for panels shall be cut on a squaring shears to ensure tight flush joint when butted together. Adjacent panels are bolted together with cadmium-plated bolts and nuts. Bolts or screw shall not be exposed on the face of the panel. Welded coupling of panel section is not allowed. Adjacent panels shall be assembled with face flush. Gaps or cracks shall not be visible from the front of assembled panels.

- 2.3.3 Where specified vendor to provide one digital clock on the panel front. Clock display shall be seven segments LED with AM/PM or 24-hour mode, which shall be field selectable. Display shall be visible from a distance of 7 metres arc covering an angle of minimum 120°.
- 2.3.4 All exposed surfaces in plain view shall be perfectly level, smooth and free from any protrusions and tool or clamp marks. All edges including cut outs shall be ground smooth.
- 2.3.5 Rear of each panel section shall have a steel framework assembled to it for supporting instruments, raceways and other accessories like power distribution boxes etc. Panel stiffeners shall be welded to the rear of the panel and shall not interfere with instrument installation. All structural shapes of steel members shall be as per IS-2062.
- 2.3.6 Enclosed cubicle panels shall have removable hinged doors (rear) for easy maintenance and Accessibility of the instruments. Doors shall be double leaved type with handle and shall be Provided with lock and key. Adequate illumination shall be provided inside the panel. All Light fittings shall be suitable for 240 V, 50 Hz AC. Power supply greater than 240 V shall Also not enter the control panel..
- 2.3.7 All cable entries to the panel shall be from panel bottom only using cable glands of adequate Size. Cable gland plate thickness shall be a minimum of 3 mm cold rolled cold annealed (CRCA) as a minimum. All unused cable entries must be plugged.
- 2.3.8 One telephone socket, and 110V 50 Hz/ 230V 50 Hz plug in outlets shall be provided for every three panel sections.
- 2.3.9 Semigraphic displays shall be screen printed as per approved drawings, on the front of fibre glass or back of transparent acrylic sheet as specified in material requisition and screwed to a steel backplate of indicated thickness. Semigraphic background colour shall be same as that of control panel.
- 2.3.10 Where specified LEDs shall be provided on the semigraphic section complete with all wiring brought to terminal boxes located on the framework of semigraphic section. A redundant power supply unit with 100% spare capacity for each power supply shall be provided by vendor for LEDs operation.
- 2.3.11 After completing fabrication of panels and semigraphics, semigraphics shall be erected and bolted to the top of the panel sections. Suitable angles and tees shall be provided between top of panel sections and bottom of semigraphic sections and at the top of semigraphics. Any defect/misalignment of the assembly shall be rectified before first coat of painting.
- 2.3.12 Lifting eyebolts shall be provided for each panel.
- 2.3.13 Normal mounting heights on panel of instruments (centre lines of instruments to floor) shall conform to the following, with minor adjustments depending upon instruments selected:

1	Instruments	Bottom Row Middle Row Top Row	1100mm 1350mm 1600mm
2	Annunciators	-	1950mm
3	Electrical push buttons, Selector switches, lamps, etc.	-	700mm

- 2.3.14 The design of panel shall incorporate provision for expansion by installing adequate spare Capacity. Each panel shall be designed to accommodate the following additional equipment, As a minimum:
- a) 20% of panel front/inside mounted instruments including lamps, push buttons, switches, relays etc.
 - b) 20% additional power feeders each provided with switch fuse assembly.
 - c) 20% additional spare windows in alarm annunciators.
 - d) 20% spare cable entry points.

2.4 Local Control panel

Local Control panel and accessories shall be suitable for location in non air-conditioned building. Panel and associated accessories shall be designed to withstand environmental conditions at site. Panel in open areas shall be weatherproof to IP-55 as per IS/ IEC-60529. Gasketed glass doors shall be used for normal visibility wherever required.

2.4.1 Panels Located in Hazardous Area

2.4.1.1 Pressurised Panel

Pressurisation shall be as per NFPA-496 type X (for panels located in Zone-I) or Z (for panels located in Zone-2) in general. However, actual requirements shall be as specified in job specification. Vendor shall provide all the instrumentation and accessories being mounted on/inside the panel, including the pressurisation kit. Make/model of all instrumentation shall be subject to approval by owner. The pressurisation kit shall be complete with filter regulator, differential pressure purge rotameter and differential pressure indicator on front panel, differential pressure switch for alarm or power cut off as per area classification and for remote alarm in case of pressurisation failure. The control unit and other electrical components like pressurisation status, purge medium control solenoids etc. required for purging/ pressurisation of panel shall be flame proof. All incoming/outgoing contacts from panel shall be routed through the flameproof control unit, which will provide isolation of the contacts automatically during pressurisation failure in case of IEC-Zone-1 area, or manually through a switch for maintenance purpose. Pressurisation level adjustment should be possible externally without depressurising the panel. The atmospheric open end of differential pressure gauge/switch shall be provided with bug screen. No hazardous gas shall be piped inside the panel. All cutouts shall be properly gasketed for good pressurisation. An additional glass door opening at the front shall be provided for weather protection of instruments mounted on the front of the panel. All instruments shall be calibrated at shop before despatching the panel. Glass door, if any, shall be of shatterproof glass. Cable glands shall be double compression types. Instruments that are liable to get damaged during shipment shall be removed and despatched loose along with the panel.

2.4.1.2 Flame-proof Panel

These panels shall be duly certified by statutory authority, as mentioned in clause 1.2.2 of this specification, for safe use in specified hazardous area. Glass door if any shall be of shatterproof glass. All special tools shall be supplied for maintaining these panels. Cable glands shall be double compression types.

Weatherproof panel but with all electrical components and accessories flameproof. All electrical components and accessories shall be flame proof and duly certified by statutory authority as mentioned in clause 1.2.2 of this specification. Cable glands shall be double compression type

2.4.1.3 Pneumatic Panel

2.4.1.3.1 Air Supply

- i) Each pneumatic instrument shall be fed through 1/4" isolation valve and air filter regulator.

Air reducing station shall be provided for panels housing more than ten instruments

- ii) Air pressure reducing station shall have two parallel branches each consisting of block valves, filter and regulator. Pressure relief valve and a pressure indicator shall be installed at the common outlet. Each branch of air reducing station shall be designed for full capacity.
- iii) Vendor shall furnish air supply piping from a point on the panel framework to the inlet side of the pressure reducing station or alternatively to the inlet side of individual pressure regulators. A flanged connection shall be provided on the framework to connect the inlet piping.
- iv) Fittings and 1/4" valves downstream of the filters at the air reducing station shall be of brass material. All headers shall be minimum 2" and shall be nickel-plated brass material.
- v) Air supply header shall be extended from downstream side of the main pressure reducing valves across the length of the panel.
- vi) The air header shall be installed with proper slope towards the dead end. A brass gate valve shall be provided at the dead end of the air header for cleaning or draining the header. Air reducing station shall not hinder access to bulk head fittings.
- vii) Where miniature type instruments are used, vertical sub-air headers for each panel shall be provided with 1/4" NPT (F) brass needle valves. In all cases 10% spare take-off points with needle valves shall be provided for future use.

2.4.1.3.2 Tubing

- i) Vendor shall supply and install all tubing between instruments to bulkhead fittings and from auxiliary items such as pressure switch rack mounted within panel.
- ii) All bulkhead union shall be suitable for 1/4" OD copper tube on either side. 10% spare bulkhead fittings shall also be furnished.
- iii) Tube fittings shall be compression, double ring ferrule type.
- iv) 6 mm OD x 1 mm thick bare wall copper tube shall be used for tubing inside the panel and accessories.
- v) PVC ducts shall be used for laying of tubing behind the panel, racks etc. Rubber grommets shall be provided wherever tubings are taken in and out of instruments, racks etc.
- vi) Spare pens/pointers in recording/indicating instruments shall also be tubed and connected to bulk head.

2.5 Painting

2.5.1 The entire surface of panels and accessories, comprising front, rear and sides shall be treated and painted as follows:

- a) All surfaces including structures shall be sand blasted and grinded until they are smooth and free of scale, rust etc.
- b) Chemical treatment shall be done to remove rust, oil, entrapped impurities and other foreign materials.

- c) If necessary, suitable filler shall be applied to all pits and blemishes on the surfaces.
- d) The front surface of the panels shall be painted with three coats of sealing primer and surfacer. The entire surface shall be wet sanded between coats. Two coats of finish paint of high-grade lacquer enamel shall be given at shop.
- e) All other surfaces including those of accessories shall be painted with two coats of sealing primer and surfacer and two coats of lacquer enamel finish paint.
- f) A final coat of finish paint of high grade lacquer enamel shall be given at site after assembly and filling of front panel butt joints with suitable filler, to present a continuous panel surface.
- g) The finish of the final coat shall be of semi-gloss texture to minimise light reflection.

2.5.2 Unless otherwise specified, exterior portion of all panels and closed cabinets shall have a colour of light admiralty grey shade ISC No.697 as per IS-5 (RAL-7035). Panel rear surface, frame works and bulkhead plates/gland plates shall have a finish colour of light admiralty grey shade ISC No.697 as per IS-5 (RAL-7035). Channel base shall be of black colour.

2.6 Electrical System

2.6.1 General Requirements

- 2.6.1.1 All equipment and wiring in control room shall be of general-purpose type unless otherwise specified.
- 2.6.1.2 All wiring shall confirm to API-MPMS, RP 552 and shall be as per approved drawings.
- 2.6.1.3 All wiring shall be housed in covered non flammable plastic raceways which shall be arranged for easy maintenance. Raceways shall have 50% spare capacity. Rubber/plastic gromets shall be used for wire entry into individual instrument cases and for entry/exit of cables through raceways.
- 2.6.1.4 Wires carrying measurement signals associated with thermocouple, resistance temperature detectors (RTD), pH Instruments and other low-level signals shall be routed in separate wire ways and not along with power cables. Power wiring and control wiring should be separated by not less than 150 mm. If they have to cross, the crossing should be as close to right angle as possible. Parallel runs of AC and DC wiring closer than 300mm shall be avoided.
- 2.6.1.5 All intrinsically safe wiring shall be routed in separate wire ways, separate from non- intrinsically safe and power wiring. The minimum separation shall be 150mm. Intrinsic safe raceways shall be light blue in colour.
- 2.6.1.6 Intrinsically safe terminals shall be adequately separated from non-intrinsically safe terminals. The minimum separation shall be 50 mm. Intrinsic safe terminals shall be light blue in colour.
- 2.6.1.7 Panel wiring for signal and controls shall be carried out using 600 V grade, 1.0 mm² stranded copper conductors with flame retardant PVC insulation. Power supply wiring between distribution box and individual instruments shall be done using 600 V grade, 1.5 mm² stranded copper conductors with flame retardant PVC insulation. All internal wiring will be supplied by the panel vendor.
- 2.6.1.8 Alarm wiring shall be through multicore cables between alarm terminal box and annunciator directly without any intermediate terminals. Raceways on panel to have sufficient space to accommodate such wiring. Vendor to install and wire all annunciators including signal lights, bull's eye lamp, push buttons, audible devices etc.
- 2.6.1.9 All wiring, external to main panel/racks (except for alarm annunciators), shall terminate in terminal boxes/terminal strips and their quantity and size shall be determined by vendor. Panel shall be supplied completely wired requiring only field connection at site.

- 2.6.1.10 All terminals shall be of mechanical screw clamp type with pressure plates. Self-insulating crimping wire lugs shall be used for all terminations on terminal blocks, whereas forked tongue type or lug with eyehole type shall be used for termination on screwed terminals such as on relays, push buttons, lamp etc. Terminals shall be suitable to accept 2.5mm² size conductor, as a minimum. Terminal blocks shall be rated for 600 V. Separate set of terminals for accepting higher size of incoming power cables shall be provided. At least 20% spare terminals evenly distributed throughout the panels shall be provided.
- 2.6.1.11 Generally, no more than two wires shall be terminated on a single terminal. Additional terminals shall be used for looping if necessary. Use of shorting links for looping shall be avoided.
- 2.6.1.12 Where panel is located in hazardous area, all electrical components including junction boxes shall be flame proof and suitable for hazardous area specified in material requisition.
- 2.6.1.13 Terminals housings shall be sized with due consideration to accessibility and maintenance. Following guidelines shall be observed:
- 50 mm minimum space shall be provided between terminal strips and sides of the box parallel to the strip for up to 50 terminals and an additional 25 mm for each additional 25 terminals.
 - 100 mm minimum space to be provided between adjacent terminal strips for up to 50 terminals and an additional 25 mm for each additional 25 terminals.
 - 75 mm minimum space shall be provided between terminal strip and top or bottom of the box for up to 50 terminals and an additional 25 mm for each additional 50 terminals.
 - The bottom of any terminal strip shall not be lower than 300 mm from the gland plate unit in any cabinet.
- 2.6.1.14 All terminal strips shall be mounted on suitable anodised metallic or plastic stand off. Terminal strips shall be arranged group wise for incoming and outgoing cables separately.
- 2.6.1.15 Wire colour code for panel and accessory shall be as follows:
- | | |
|----------------------|--------|
| Power supply hot | Red |
| Power supply neutral | Black |
| Ground | Green |
| Alarm System | Yellow |
| Signal: IS | Blue |
| Signal: Non-IS | Grey |
- 2.6.2 Power Supplies
- 2.6.2.1 Main power distribution box shall have copper busbars suitable for required current rating. Bus bars shall be suitably insulated. Provision of reducing type of lugs is not acceptable. Main power supply box shall be provided with two pole circuit breakers of thermo-magnetic type.
- 2.6.2.2 Each section of main panel shall have a separate power supply distribution box with two pole toggle switches and glass cartridge fuses. Power supply to individual instruments shall be through DPDT isolation switch and HRC fuse. Vendor may provide two pole circuit breakers of suitable rating for power distribution.
- 2.6.3 Grounding

- 2.6.3.1 Each panel section and accessory equipment in control room shall be provided with an earthing lug and shall be grounded to an earth bus bar to be provided by purchaser. All panel structure, racks, cabinets etc shall be connected to this power ground bus.
- 2.6.3.2 In addition to above, vendor shall also provide a separate instrument circuit ground bus along the panel length. This shall be electrically isolated from panel structure, equipment, incoming cable armour etc. This ground bus shall be typically 8 mm thick and 37.5 mm wide and of copper. All circuit grounds of electronic instrument, drain wires of alarm signal cables, intrinsic safety barrier insulated bus bar etc shall be connected to this ground bus by insulated copper conductor. Both ends of this bus bar shall have suitable terminals for further connection to ground electrode by purchaser. Creation of multiple grounds in a loop should be avoided.
- 2.6.4 Identification and Marking
- 2.6.4.1 All electrical terminals and equipment on the panel and other accessories shall be identified with appropriate tag, cable marker etc.
- 2.6.4.2 All terminals in a terminal strip shall be identified by their individual numbers located integral with the terminal itself.
- 2.6.4.3 Interconnecting multicables shall be identified by metal tags as indicated in cable schedules.
- 2.6.4.4 Wiring at terminals shall be identified by the terminal number and termination services at the other end of the wire. Wiring at instruments and accessories like alarm relays, push buttons etc shall be identified by the item tag number and terminals number and the termination service at the other end of the wire. Ferrule shall be used for this purpose.
- 2.6.4.5 Identification markers as mentioned above shall be indicated in vendor drawings.
- 2.6.4.6 For pneumatic panel, Air supply tubes and signal tubes etc shall be provided with PVC sleeves with inscription strips fitted on it at either end. Sleeves for air supply shall be in red while other sleeves shall be yellow in colour
- 2.6.5 Internal lighting shall be installed within panel using two fluorescent lighting fixtures to provide adequate lighting for maintenance of equipment. The location of lighting fixtures must not interfere with doors and other equipment and shall be accessible for fluorescent tube replacement. Lighting shall be operable through door switch in a suitable surface mount enclosure.

3.0 NAMEPLATE

- 3.1 Nameplates shall be provided for all front panel instruments and accessories. For sub miniature instruments, nameplate shall be written on the nameplate slip supplied along with the instrument. For other instruments and accessories (push buttons, lamps etc) nameplates with 1.5 mm thick black laminated plastic with white engraved letters shall be provided.
- 3.2 Front panel nameplates shall be fixed by means of chrome or nickel plated counter sunk screws. These nameplates shall be 25 mm high with 5 mm letter height, and provide information like tag number, service, multiplication factor etc. Rack nameplates to be fixed by suitable adhesives and shall generally be 15 mm high with 5mm letter height to indicate item tag number.
- 3.3 Front panel instruments shall also be identified by their tag numbers on nameplates fixed by adhesives on panel back surface.

4.0 INSPECTION AND TESTING



STANDARD SPECIFICATION FOR CONTROL PANEL AND ACCESSORIES

SPECIFICATION NO.
I-SPC-0017

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Purchaser reserves the right to inspect and witness testing at vendor's works as per inspection test plan. All these tests shall be completed by the vendor and test report shall be submitted to purchaser for scrutiny.

5.0 SHIPPING

- 5.1 Each panel and accessory shall be suitably packed and protected from damage due to transportation, loading and unloading.
- 5.2 Each component part requiring identification for proper assembly at site shall be place wise marked.
- 5.3 Shipping breaks shall be provided as applicable to avoid panel damage during transportation.

6.0 SITE ACTIVITIES

- 6.1 Vendor shall furnish a detailed activity schedule covering various activities like installation of panel and accessories, laying of cables, wiring, interconnection, testing etc in consultation with engineer-in-charge.
- 6.2 Vendor shall install all panel and accessories in the control room as per final approved layout drawings.
- 6.3 Control panel and semi graphic shall be checked for proper alignment and defect, if any, shall be rectified.
- 6.4 Vendor shall install all panel-mounted instruments, alarm annunciators and other free issue items as per approved drawings.
- 6.5 Painting, wiring, cabling etc shall be done as per the respective clauses of this specification.
- 6.6 Functional tests for panel and accessories shall be carried out after actual installation, wiring, interconnection to the satisfaction of the engineer-in-charge.
- 6.7 Vendor shall assist field contractor for loop checking.
- 6.8 Vendor shall maintain the control room and workplace neat and clean. Minor civil work, if necessary, shall be carried out by vendor arising due to damage to flooring during panel installation.
- 6.9 Vendor shall arrange to draw and transport free issue material and is responsible for safe custody of the same.
- 6.10 Vendor shall prepare and furnish as built drawing for final record.



Procurement of Gas Chromatograph System

Inspection & Test Plan for Gas Chromatograph

Doc No.: P181-ITP-I001

TA	15.10.2024	Issued for Tender	VK	NC	AD
CB	28.07.2024	Re-Issued for Client Review	VK	NC	AD
CA	10.07.2024	Issued for Client Review	VK	NC	AD
IA	04.07.2024	Issued for Internal review	VK	NC	AD
REV.	DATE	DESCRIPTION	ORG	REVIEW	APPROVED



Inspection & Test Plan for Gas Chromatograph

DOCUMENT NO.
P181-ITP-I001
Rev. TA

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1.0 BACKGROUND

Assam Gas Company Ltd. (AGCL) is a 61 years old Natural Gas transmission and distribution company, wholly owned by the Govt. of Assam with its registered office at Duliajan, Dist. Dibrugarh, Assam 786602.

The company transports Natural Gas through its integrated pipeline infrastructure to several market segments i.e., Power, Fertilizer, Petrochemicals, Industrial, Commercial and Domestic consumers primarily located in upper Assam. The present infrastructure of the company has a transportation capacity of about 6.0 MMSCM of gas per day.

Assam Gas Company Ltd. intends to Procure Gas Chromatograph at various locations in Assam.

Pipeline Engineering Consultants Pvt. Ltd. has been appointed as Engineering Consultant by M/s. Assam Gas Company Ltd. for the Procurement of Gas Chromatograph for various locations in Assam

2.0 DEFINITION

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

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

PROJECT	Procurement of Gas Chromatograph
CLIENT / OWNER	Assam Gas Company Ltd.
EPMC	Pipeline Engineering Consultants Pvt. Ltd. (PLECO) the party to act for and on behalf of OWNER for Development of Rupkhelia Pipeline Terminal
CONTRACTOR	Agency appointed by CLIENT/ OWNER for executions of assigned tasks
PURCHASER	Either of CLIENT, OWNER or EPMC
VENDOR/MANUFACTURER	Party, which manufactures and supplies equipment, services to the OWNER or CONTRACTOR

Inspection & Test Plan for Gas Chromatograph

3.0 QAP FOR GAS CHROMATOGRAPH

INSTRUCTIONS FOR FILLING UP: 1. QAP shall be submitted for each equipment separately with breakup of assembly / sub-assembly & part/component or for group of equipment having same specification. 2. Use numerical codes as indicated for extent of inspection & tests and submission of test certificates & documents. Additional codes & description for extent of inspection & test may be added as applicable for the plant and equipments. 3. Separate identification number with quantity for equipment shall be indicated wherever equipment having same specifications belonging to different facilities are grouped together. 4. Weight in kilogram must be indicated under column 5 for each item. Estimated weights may be indicated wherever actual weights are not available. ABBREVIATION USED: CONTR: Contractor MFR: Manufacturer TPI: Third Party Inspection Agency *: Vendor / Bidder to provide P: Performer, R: Review; W: Witness EN 10204, Type 3.2 certificates shall be provided for bought out items. Those shall be inspected by TPI appointed by Vendor							CODES FOR EXTENT OF INSPECTION, TESTS, TEST CERTIFICATES & DOCUMENTS :											
							CODE DESCRIPTION			CODE DESCRIPTION			CODE DESCRIPTION			CODE DESCRIPTION		
							1. Visual 2. Dimensional 3. Fitment & alignment 4. Physical Test (Sample) 5. Chemical Test (Sample) 6. Ultrasonic Test 7. Magnetic Particle Test (MPT) 8. Radiography Test 9. Dye Penetrant Test 10. Measurement of IR value a) Before HV Test b) After HV Test 11. High voltage Test / Dielectric Test			12. Routine Test as per relevant IS / other standard 13. Type test as per relevant IS / other standard 14. Impulse Test 15. Partial Discharge Test 16. Heat run risk test / temper 17. Enclosure protection test 18. Calibration 19. Noise & Vibration 20. Test certificate of bought out components 21. Tank pressure test 22. Paint shed vibration			23. Short time rating 24. Operational & functional Test 25. Over speed Test 26. Flame proof Test 27. Clearance and creepage distance 28. Acceptance Test 29. Honing Test 30. Hydro test/ Shell leak Test 31. Pneumatic Seat leak Test 32. Impact test			D1. Approved GA Drawing. D2. Approved single Line / schematic diagram D3. Test certificates D4. Approved Bill of materials D5. Un-priced P.O. copy D6. Calibration certificates of all measuring instrument and gauges.		
Equipment Details							Inspection & Test											
Sl. No.	Item	Identification Number	Qty	Weight Kg	Exp Date of Inspection	MFR Name & Address	In-Process Stage			Final Inspection			Test certificate & Document to be submitted to CLIENT	Acceptance Criteria standards/ IS/BS/ASME/ Norms and documents	Remark / Sampling Plan			
							MFR	CONTR & TPI	CLIENT	MFR	CONTR & TPI	CLIENT						



Inspection & Test Plan for Gas Chromatograph

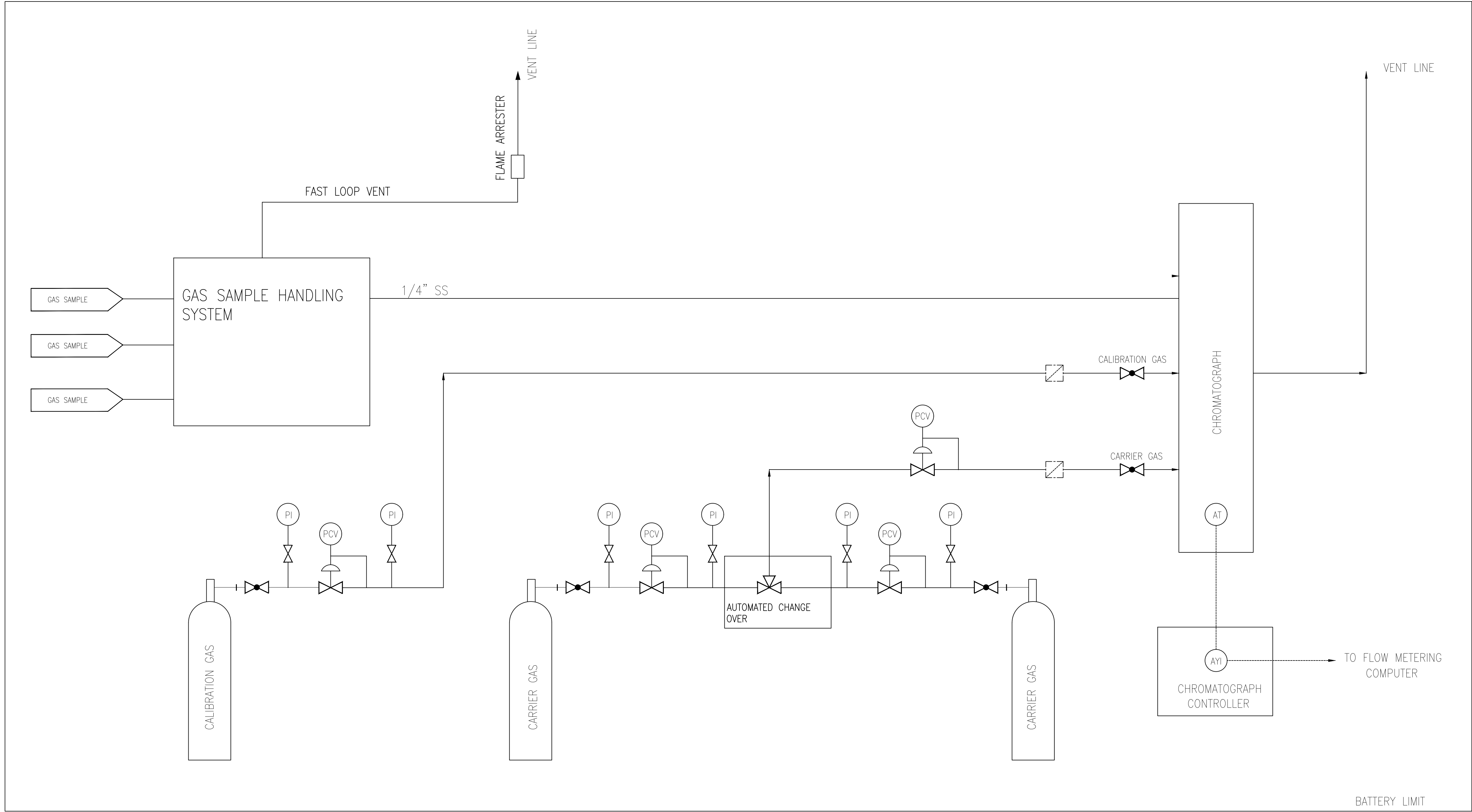
1.	Gas Chromatograph	Refer P&ID	*	*	*	Client Approved	1, 2, 3, 4, 5-P	-	-	1, 2, 3, 18, 20-P	1, 2, 3, 18, 20-R, 24-W	1, 2, 3, 18, 20, 24-R	1, 2, 3, 4, 5, 18, 20, 24, D3, D6	D3, D6, Tech. spec	100%
2.	Cables	Refer P&ID	*	*	*	Client Approved	1, 2, 3, 4, 5-P	-	-	1, 2, 3, 18, 20-P	1, 2, 3, 18, 20-R, 24-W	1, 2, 3, 18, 20, 24-R	1, 2, 3, 4, 5, 18, 20, 24, D3, D6	D3, D6, Tech. Spec	100%
3.	Control Panel	Refer P&ID	*	*	*	Client Approved	1, 2, 3, 4, 5-P	-	-	1, 2, 3, 18, 20-P	1, 2, 3, 18, 20-R, 24-W	1, 2, 3, 18, 20, 24-R	1, 2, 3, 4, 5, 18, 20, 24, D3, D6	D3, D6, Tech. Spec	100%
4.	FAT Procedure	-	-	-	-	Client Approved	-	-	-	P	R	R	FAT Procedure	Test record	100%
5.	SAT Procedure	-	-	-	-	Client Approved	-	-	-	P	R	R	SAT Procedure	Test record	100%
6.	Factory Acceptance Test	As per approved P&ID, GAD, datasheets, FAT	*	*	*	Client Approved				1, 2, 3, 12, 24, Loop check, Power on, Calibr. Verificn.	1,2,3,12,24 Loop check, Power on, Calibr. Verificn.	1, 2, 3,12, 24 Loop check, Power on, Calibr. Verificn.	FAT Test Report	Approved FAT procedure and other relevant doc.	100%



Inspection & Test Plan for Gas Chromatograph

7.	Site Acceptance Test	As per approved P&ID, GAD, datasheets , SAT procedure, FAT Report	*	*	*	Client Approved				1,2,3,12,2 4 Loop check, Power on, Calibr. Verificn.	1,2,3 ,12, 24, Loop check, Power on, Calibr. Verificn.	1, 2, 3, 12, 24 Loop check, Power on, Calibr. Verificn.	SAT Test Report	Approved SAT procedure and other relevant doc.	100%
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TYPICAL SCHEME OF GAS CHROMATOGRAPH
FOR
PROCUREMENT OF ONLINE GAS CHROMATOGRAPH

CB	29.07.24	ISSUED FOR CLIENT APPROVAL	SC	NC	AD
CA	11.07.24	ISSUED FOR CLIENT REVIEW	SC	NC	AD
IA	10.07.24	ISSUED FOR CLIENT REVIEW	SC	NC	AD
REV.	DATE	DESCRIPTION	DR'N	CH'D	AP'D
SCALE: 1:1					
CONSULTANT:					
<div><div></div><div>PIPELINE ENGINEERING CONSULTANTS PVT. LTD.</div></div>					
CLIENT:					
<div><div></div><div>ASSAM GAS COMPANY LTD.</div></div>					
PROJECT: PROCUREMENT OF ONLINE GAS CHROMATOGRAPH					
DRG. TITLE: TYPICAL SCHEME OF GAS CHROMATOGRAPH					
DWG. NO.	P181-00-DWG-I001		Pg.-1 OF 2	REV NO.	CB



CB	29.07.24	ISSUED FOR CLIENT APPROVAL	SC	NC	AD
CA	10.07.24	ISSUED FOR CLIENT REVIEW	SC	NC	AD
IA	08.07.24	ISSUED FOR CLIENT REVIEW	SC	NC	AD
REV.	DATE	DESCRIPTION	DR'N	CH'D	AP'D
SCALE: 1:1					
CONSULTANT:					
 PIPELINE ENGINEERING CONSULTANTS PVT. LTD.					
CLIENT:					
 ASSAM GAS COMPANY LTD.					
PROJECT: PROCUREMENT OF ONLINE GAS CHROMATOGRAPH					
DRG. TITLE: TYPICAL SCHEME FOR GAS CHROMATOGRAPH					
DWG. NO.	P181-00-DWG-I001		Pg.-1 OF 5	REV NO.	CB