

TRACTEBEL**CORRIGENDUM # 1****SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF METERING SKIDS
FOR CGD PROJECT IN NCT OF DELHI & NCR****TENDER NO: IGL/ND/C&P/P14218**

Date: 24.05.2017

Tender doc. No.:
P.009355 R11050 002Project: CGD Expansion Project in NCT
of Delhi & NCR

Owner: Indraprastha Gas Ltd.

Str. No.		Description	Tender Page No.	Clause/ Para/ Section	Amendment/Addition/Modification/Deletion
Volume II of II- Technical					
1	Technical tender document	200050 to 200105	pages	Deletion	Due to oversight, tender pages 200050 to 200105 are attached in tender document two times. Please delete the pages from S.No. 200050 to 200105 attached in tender after page no. 200105.
2	GTS- Filtration Skids- 70000 740 GTS/006	200106 to 200117	Complete GTS	Addition	GTS for Filtration skid is added and forms part of technical Volume II of II
3	GTS- Instrumentation Erection- J/02/3009	200118 to 200141	Complete GTS	Addition	GTS- Instrumentation Erection is added and forms part of technical Volume II of II
4	Name Plates, Tags and Labels for Instrumentation	200142 to 200146	Complete Details	Addition	Name Plates, Tags and Labels for Instrumentation is added and forms part of technical Volume II of II
5	GTS- Pipeline Valves- 70000 740 GTS/402	200147 to 200190	Complete GTS	Addition	GTS- Pipeline Valves is added and forms part of technical Volume II of II

(Signature)
 CHAMAN SINGH
 15

(Signature)
 S.K. Gupta
 TE

TRACTEBEL Engineering GDF SVEZ	GTS – FILTRATION SKID	70000 740 GTS/006
---	-----------------------	-------------------------

FILTRATION SKID
(coalescing type filter)
for
Metering Station

5	14.09.09	Generally Revised	AS	SD	KNC
4	14.08.08	Generally Revised	VS	SD	KNC
3	27.03.08	Logo Changed	AS	NS	KNC
2	30.04.07	Logo Changed	AR	PKS	KNC
1	08/11/01	First issue	GRD	MRY	DKB
Rev.	Date	Subject of revision	Author	Checked	Approved

200106

TABLE OF CONTENTS

1. INTRODUCTION	1
2. GENERALITIES	1
2.1. DEFINITIONS.....	1
2.2. CODES, STANDARDS & LEGAL REQUIREMENTS.....	1
2.3. REVIEW & APPROVAL.....	1
3. DESCRIPTION	2
3.1. INLET CONNECTION.....	2
3.2. OUTLET CONNECTION.....	2
3.3. INLET VALVE.....	2
3.4. OUTLET VALVE.....	2
3.5. FLUSHING CONNECTION.....	2
3.6. COALESCING FILTER.....	2
3.7. INSTRUMENTATION.....	3
3.8. ELECTRICITY.....	3
3.9. SKID ASSEMBLY.....	3
4. SCOPE OF SUPPLY	3
5. EXCLUDED FROM SCOPE OF SUPPLY	4
6. BATTERY LIMIT	4
6.1. PIPING.....	4
6.2. INSTRUMENTATION.....	5
7. LABELLING	5
8. MARKING	5
9. PAINTING	5
9.1. GENERAL.....	5
9.2. GALVANIZING.....	5

10. INSPECTION AND TESTING 5

10.1. FACTORY ACCEPTANCE TESTS.....6

10.2. SITE PERFORMANCE TEST.....6

11. GUARANTEES 6

11.1. MATERIAL GUARANTEE.....6

11.2. PERFORMANCE GUARANTEE.....7

11.3. AVAILABILITY7

12. PACKING 7

13. APPENDICES 7

* * *

200108

1. INTRODUCTION

The present GTS (General Technical Specification) deals with the basic technical requirements for the design, procurement and erection of the filtration skid.

2. GENERALITIES**2.1. DEFINITIONS**

AGREEMENT	Decision concluded between the CLIENT and the CONTRACTOR by which the CONTRACTOR will supply to the CLIENT some GOODS and/or SERVICES according to the stipulations specified in the form of an order.
CLIENT	Purchaser of the GOODS and/or SERVICES which are specified in an AGREEMENT.
CONTRACTOR	Legal entity having concluded an AGREEMENT with the CLIENT. The term "CONTRACTOR" may be used indifferently for a supplier, a manufacturer, an erection contractor, etc.
DAYS WEEKS MONTHS	Number of <u>calendar</u> days, weeks or months.
ENGINEER	TRACTEBEL ENGINEERS & CONSTRUCTORS PVT. LTD. as being involved in this PROJECT.
GOODS SERVICES	All or parts of the drawings, documents, materials, equipments, tools, to be designed, manufactured, supplied, erected, commissioned by the CONTRACTOR according to an AGREEMENT.
PROJECT	All the GOODS and/or SERVICES to be provided by one or several CONTRACTORS.

2.2. CODES, STANDARDS & LEGAL REQUIREMENTS

The materials, design, construction and testing of the filtration skid shall be in accordance with the codes, standards and legal requirements mentioned in the present General Technical Specification (GTS) and in the Particular Technical Specifications (PTS) of this PROJECT.

The PTS will always be prevalent in case of contradiction between GTS and PTS.

2.3. REVIEW & APPROVAL

Whenever CLIENT and/or ENGINEER review and/or approval is requested for a document submitted by the CONTRACTOR or before an action is implemented by the CONTRACTOR, such review and/or approval shall always be requested in writing by the CONTRACTOR to the CLIENT and/or the ENGINEER before any action is taken related to this review and/or approval.

CLIENT and/or ENGINEER approval shall always be given in writing.

3. DESCRIPTION

The skid consists of two identical trains with tie-in connections for a future third train.

The flow sheet annexed in Appendix 1 describes the filtration skid ; the main items are listed hereafter.

FOR THE SKID**3.1. INLET CONNECTION**

- one process inlet connection;
- thermometer, manometer and pressure transmitter.

3.2. OUTLET CONNECTION

- one process outlet connection

FOR EACH TRAIN**3.3. INLET VALVE**

- one manual IDB valve (Internal Double Block & Bleed) bypassed, for pressure balancing, with 2 manual valves in series (one block valve and one throttling valve) ; the IDB valve is provided with open and closed limit switches.

3.4. OUTLET VALVE

- one manual IDB valve (Internal Double Block & Bleed).

3.5. FLUSHING CONNECTION

- two manual valves in series (one block valve and one throttling valve).

3.6. COALESCING FILTER

One coalescing filter, made of carbon steel, designed according to the ASME VIII Div. 1 code, with the following requirements :

- the coalescing filter is designed to remove the liquid and solid particles above 5 microns ;
- an impact test @ -20°C is required for the material of the shell and the heads ;
- all the materials are to be delivered with a 3.1.B certificate (DIN 50049) ;
- a relief valve is fit on the shell side ;
- the mechanical calculation note of the coalescing filter is to be approved by a Third Authority ;

- shell and heads material thickness has to include a 3 mm corrosion allowance ;
- typically, the filter is provided with level gage and transmitter, manometer and pressure drop transmitter, vent valves (2 manual valves in series, one block valve and one throttling valve) and drain valves (2 manual valves in series, one block valve and one throttling valve).

3.7. INSTRUMENTATION

All the instrumentation indicated on the flow sheet attached in Appendix 1 will be provided by the VENDOR.

The instruments will be suitable for an hazardous area classified "zone 2 - II A T3 ; they will be wired up to junction boxes suitable for that classified area.

All the electrical materials will be weatherproof for outdoor installation (minimum IP 55) ; for the safety protection (hazardous area), they will be intrinsically safe EEx(ia) or (ib) or explosion-proof EEx(d).

3.8. ELECTRICITY

The filtration skid will be equipped with :

- all the required electrical materials ;
- the power/control cabinets ;
- the cabling and wiring inside the battery limits ;
- the earthing inside the battery limits ;

The electrical materials will comply with the IEC standards and all the applicable local regulations.

The electrical materials will be suitable for an hazardous area classified "zone 2 - II A T3 ; they will be wired up to junction boxes suitable for that classified area.

All the electrical materials will be weatherproof for outdoor installation (minimum IP 55) ; for the safety protection (hazardous area), they will be intrinsically safe EEx(ia) or (ib) or explosion-proof EEx(d).

The available power supply is 440 V, 3 ph, 50 Hz, 4 wire, neutral solidly earthed.

The power/control panels/cabinets will be equipped with all the required protections and control devices.

The cables will enter the power/control panels, junction boxes, instruments, cabinets from the bottom.

3.9. SKID ASSEMBLY

All the above equipment will be assembled on a common skid equipped with lifting and earthing lugs.

4. SCOPE OF SUPPLY

The CONTRACTOR's scope of supply is :

- detailed drawings and calculations ;
- assistance to Third Authority examination ;
- design, fabrication, assembly and testing of the complete skid including but not limited to :
 - inlet/outlet double block and bleed valves ;
 - coalescing filters ;
 - electronic controllers ;
 - instrumentation, skid and local panel mounted ;
 - connection to venting system ;
- junction boxes for connecting into the local panel (separated junction boxes to be provided for analogue signals, digital input signals and digital output signals) ;
- spare parts for commissioning and two years operation ;
- mechanical tests ;
- material certificates ;
- non destructive tests ;
- shop painting.

5. EXCLUDED FROM SCOPE OF SUPPLY

The next items are excluded from the VENDOR scope of supply :

- civil works (foundations, buildings, etc.) ;
- electrical supply from OWNER substation to skid battery limits ;
- insulation ;
- erection

6. BATTERY LIMIT

6.1. PIPING

- skid gas inlet : see Appendix 1 ;
- skid gas outlet : see Appendix 1 ;
- gas vents : see Appendix 1 (to safe location) ;

- drains : see Appendix 1.

6.2. INSTRUMENTATION

Junction boxes for connections to the local panel ; the signals shall be separated as follows :

- analogue signals ;
- digital inputs ;
- digital outputs.

7. LABELLING

All the process instruments will be clearly identified by fixed labels, showing their tag or loop number.

All the instruments panels and junction boxes will be clearly identified by fixed labels.

Labels and their fixings will be durable regarding the site environmental conditions.

8. MARKING

All the components of the package shall be clearly marked with stainless steel plates (to be submitted for approval) showing the main characteristics and item numbers.

9. PAINTING

9.1. GENERAL

Equipments will be painted in workshop or at site, as appropriate.
Painting will be of approved colours and quality.

9.2. GALVANIZING

Galvanizing will be hot dip according to BS 729 "Hot Dip Galvanised Coatings on Iron and Steel Articles".

Bolts, nuts and washers together with other threaded components used as fasteners will be finished with a centrifuged galvanised coating according to the above standard.

All drilling, punching, stamping, cutting and bending of parts together with welding and removal of burrs shall be completed before articles are galvanised in accordance with BS 729.

10. INSPECTION AND TESTING

Inspection and testing will be performed on all the assemblies and components considering the following list of activities :

- visual inspection ;
- dimensional checking ;
- pressure testing ;
- non destructive testing ;
- functional/performance testing.

Acceptance criteria will comply with the relevant codes and standards ; if not existing, the **VENDOR** shall indicate them in a quality control procedure fully approved by a Third Party inspector.

The **VENDOR** shall indicate a list of inspections and tests with the relevant procedures for being reviewed and approved by the **PURCHASER**.

Some inspections and tests will be witnessed by the **PURCHASER** ; they will be proposed by the **VENDOR** for review and approval by the **PURCHASER**.

10.1. FACTORY ACCEPTANCE TESTS

The following tests will be performed at the **VENDOR** shop.

- Hydrostatic test

All the pressure containing parts (casing, filters, piping and valves) will be hydro-tested at 1.5 times the design pressure.

- Leak test

After having been assembled on skid, all the equipment and lines will be pneumatically tested for leaks detection (soap bubbling).

- Instrumentation and control test

A test of the fully integrated system will be performed at the work shop ; logging data will be issued to demonstrate the performance of the system.

10.2. SITE PERFORMANCE TEST

The **VENDOR** shall assist the **PURCHASER** in performing the site performance test which is, basically, a repeat of the instrumentation and control test performed in the **VENDOR** work shop but with actual signals and not simulated ones.

11. GUARANTEES

11.1. MATERIAL GUARANTEE

The **CONTRACTOR** is responsible for the quality of materials and workmanship included in the manufactured equipment.

All components shall be guaranteed for the specified industrial environment. Their construction shall be such that no damage can occur during normal handling and manipulation by the operators and the maintenance staff.

11.2. PERFORMANCE GUARANTEE

The performance of the system shall be checked on site to verify that it is in conformity with the present specification.

11.3. AVAILABILITY

CONTRACTOR has to confirm an availability factor of 98.5 %

"Level of Availability" of the GOODS is calculated by :

$$\text{Level of availability} = \frac{PH - FOH}{PH} \text{ with } \begin{array}{l} PH = \text{Period Hours} \\ FOH = \text{Forced Outage Hours} \end{array}$$

12. PACKING

After testing, the skid shall be dried, cleaned, prepared and suitably protected for dispatching in such a way to minimize damaging and deterioration during transit and storage.

Openings shall be covered to prevent dirt from entering.

Threaded connections shall have thread protectors.

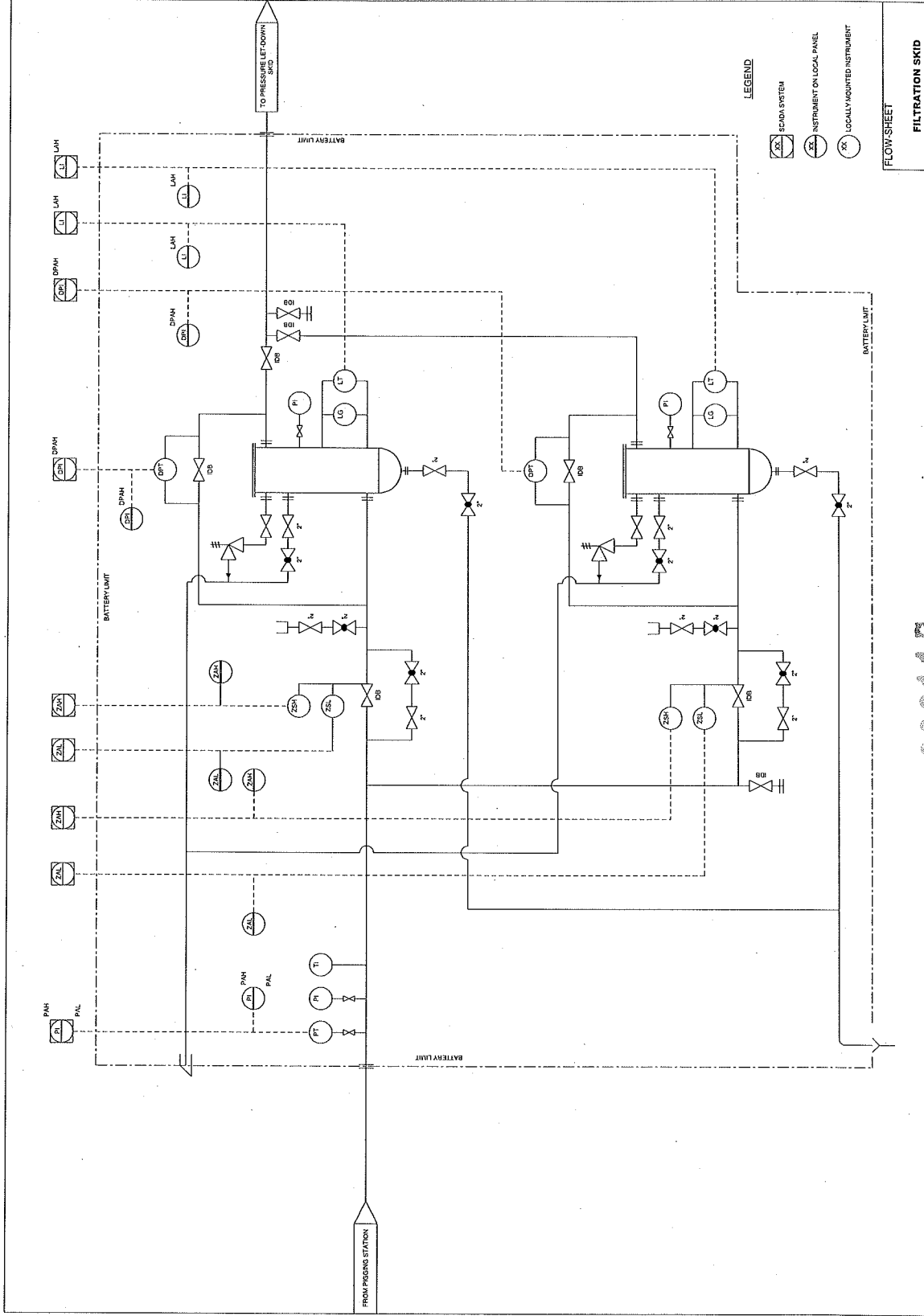
Covers securely fastened to the flanges shall protect flange faces.

13. APPENDICES

APPENDIX 1 : FLOW-SHEET
FILTRATION SKID

APPENDIX 1

FLOW-SHEET : FILTRATION SKID



200117

TRACTEBEL Engineering GDF SUEZ	GTS – INSTRUMENTATION ERECTION	J/02/3009
---	---	------------------

INSTRUMENTATION ERECTION

2	14.09.09	Logo Changed	AS	SD	KNC
1	14.03.08	Logo Changed	AS	NS	KNC
0	30.04.07	Logo Changed	AR	PKS	KNC
B	04.03.05	Logo Changed	SUB	AKJ	VVA
A	15.09.03	First Issue	SUB	AKJ	VVA
Rev.	Date	Subject of revision	Author	Checked	Approved

200118

TABLE OF CONTENTS

1. SCOPE.....1

2. GENERAL.....1

3. BASIC PRESCRIPTIONS.....2

4. SCOPE OF WORKS.....2

5. EXTENT OF SUPPLY.....4

6. GENERAL INSTALLATION PROCEDURES.....5

7. CALIBRATION, CHECKING AND TESTING.....18

8. COMMISSIONING.....21

9. MEASUREMENT AND PAYMENT OF THE WORKS.....21

10. COORDINATION.....21

* * *

200119

1. SCOPE

This specification covers the technical requirements for installation, calibration, checking, testing and commissioning of Instrumentation for Gas pipeline project.

2. GENERAL**2.1. DEFINITIONS**

Subject to the requirements of the context, the terms (hereafter listed in alphabetical order) used in this document are given the following meaning :

AGREEMENT	Designates the agreement concluded between the OWNER and the CONTRACTOR, under which the latter undertakes to the former the GOODS and/or SERVICES according to the stipulations which are agreed and specified in the form of an order.
OWNER	Designates the purchaser of the GOODS and/or SERVICES which are the subject of the AGREEMENT.
CONTRACTOR	Designates the individual or legal entity with whom the order has been concluded by the OWNER. The term "CONTRACTOR" may be used indifferently for a supplier, a manufacturer, an erection contractor, etc.
DAYS - WEEKS - MONTHS	Specify the number of calendar days, weeks or months and not of working days, weeks or months.
OWNER's REPRESENTATIVE	Designates the individual or legal entity to which the OWNER has entrusted various tasks in relation with the carrying out of his PROJECT.
GOODS and/or SERVICES	Designate, depending on the case, all or part of the drawings or documents, substances, materials, materiel, equipment, structures, plant, tools, machinery,... to be studied, designed, manufactured, supplied, erected, built, assembled, adapted, arranged or put into service by the CONTRACTOR under the AGREEMENT, including all the studies, tasks, works and services specified by the order. The terms GOODS or SERVICES may be indifferently used one for the other as required by the context.
PROJECT	Designates the aggregate of GOODS and/or SERVICES to be provided by one or more CONTRACTORS.

2.2. CODES, STANDARDS AND LEGAL REQUIREMENTS

The Instrumentation erection shall be in accordance with the codes and standards mentioned in the present specification and with the codes, standards and legal requirements listed in various documents for the PROJECT.

2.3. REVIEW AND/OR APPROVAL

Whenever OWNER and/or OWNER'S REPRESENTATIVE review and/or approval is requested on a document to be submitted by the CONTRACTOR or before an action is implemented by the CONTRACTOR, such review and/or approval shall always be requested in writing by the CONTRACTOR to the OWNER and/or the OWNER'S REPRESENTATIVE before any action subject of this review and/or approval is taken.

OWNER and/or OWNER'S REPRESENTATIVE approval shall always be given in writing.

3. BASIC PRESCRIPTIONS

- 1) The technical requirements laid down in this specification do not relieve the CONTRACTOR from any responsibility resulting from the awarded works.
- 2) The layout drawings attached to the tender document for the PROJECT and the models regarded as part thereof, show approximate locations of instruments, analysers, single and multicore cable routings, junction box locations, and shall be used as a guide by the CONTRACTOR.

They need not to be strictly adhered to, unless so specified, provided that accessibility, accuracy and lag requirements are taken into consideration.

Any drawing showing connection details and dimensions, or containing any specific information, shall be adhered to and any deviation from the drawings shall be approved by the OWNER'S REPRESENTATIVE before starting installation.

- 3) Any discrepancy between this specification and other documents shall be immediately notified to the OWNER'S REPRESENTATIVE, in writing, for resolution.
- 4) Protection of equipment and personnel against damage through malfunctioning or mishandling the instrument or instrument system shall be provided by the CONTRACTOR as an integral part of contract. Adequate protection shall be included for ensuring safety of personnel from any possible hazards.

4. SCOPE OF WORKS

The CONTRACTOR shall perform the following works (unless explicitly excluded in the tender for the PROJECT):

- 1) Verification of all instruments, when receiving them, to ensure that all components have been delivered and to ascertain any damage suffered.

Failure by the CONTRACTOR to give notice of visible damages or omissions to the OWNER'S REPRESENTATIVE when receiving a consignment of materials and instruments shall be considered as an implicit confirmation that the CONTRACTOR takes upon himself all responsibilities for their soundness until final testing and acceptance.
- 2) Installation of all instruments and ancillary equipment.
- 3) Installation and connection to lines and equipment of instrument process piping including, where specified, seal welding of threaded connections.
- 4) Tracing of instruments, instrument impulse lines, wherever required.
- 5) Installation of protection boxes for instruments, wherever required.
- 6) Installation of junction boxes, wherever required.

- 7) Installation of ladders, trays, trunking and conduits for cables and tubes.
- 8) Installation of consoles, desks, panels and cabinets for instruments.
- 9) Installation of electrical power supply cabinets for the Instrumentation.
- 10) Installation of all the necessary supports for the instruments, cable ladders, trays, trunking and conduits, impulse lines, pneumatic transmission lines, steam tracing lines, cabinets, panels, consoles, desks, junction boxes, connection boxes, cross boards, synoptic panels, etc.
- 11) Painting of the supports, frameworks and locally manufactured panels.
- 12) Installation and connection at both ends of instrumentation cables and conductors.
- 13) Installation of nameplates and/or labels for identification and numbering of instruments, cables, wires, junction boxes, connection boxes, cross boards, terminals, cabinets, panels, desks, pneumatic transmission lines, lines or cables for tracing, etc.
- 14) Carrying out any auxiliary work necessary for installation of the instrumentation as per technical specifications (e.g. removing and replacing doors to facilitate work, drilling small holes in walls and floors, filling back the holes, reparation of damages made during installation and repainting all damaged paint work).
- 15) Handling and properly protecting instruments, cabinets, boxes, panels, desks, consoles after receipt and after installation (especially capillary tubes, proximity switches etc.).
- 16) Removal of oxidation and, if necessary, greasing of parts oxidized during transportation or storage.
- 17) Performing additional works upon request of the OWNER'S REPRESENTATIVE.
- 18) Performing all changes and repairs, as required, resulting from CONTRACTOR'S failure to comply with specifications, standards and/or drawings or from incorrect installation.
- 19) Checking and testing of all instruments.
- 20) Calibration and precommissioning of all instruments.
- 21) Installation and removal as per site regulations of temporary stores, workshops and buildings, for performance of the WORKS and in order to properly protect and store all instruments.
- 22) Cleaning of the site.
- 23) Fabrication of pipe nipples as necessary including threading as per installation standard.
- 24) Drilling of holes in blind flanges including cutting threads as per installation standards.
- 25) Back/seal welding of screwed fittings as required by standards or as per the instruction of Owner/Owner's Representative. This may involve welding of dissimilar materials using appropriate electrodes.
- 26) Civil works including the casting of foundation as required for instrument support.
- 27) Minor civil works like chipping of pavement, grouting of instrument panels, laying of conduits below pavement after chipping and refinishing of pavement as necessary.
- 28) Sealing of cables/ tube entries into the control room after laying and testing of all cable/ tubes by installing Multi-Cable Transit block (MCT) including fixing of MCT frame, routing of cables through cable blocks, tightening of cable blocks.
- 29) Degreasing of impulse lines, valves, instruments and other instrument items in oxygen and chlorine service as per manufacturer's instructions.
- 30) Minor modification/repairs required to be carried out on the instruments namely replacement of dial, glass for pressure gauges or any other similar instrument, replacement of damaged signal tubes on

valves, tapping of damaged threads on couplings, tees and other fittings; cleaning of nozzles and relays in pneumatic instruments.

- 31) Painting of all structural supports for trays, pipes, junction boxes, instruments.
- 32) Punching of tag numbers on items or tag plates.
- 33) Fabrication and installation of pipe stanchion as per Instrument support standards including casting of concrete pedestal, grouting, welding etc. as necessary.
- 34) Drilling holes for providing glands/grommets on panels, shut down cabinets, power supply cabinets, local control panels, pneumatic enclosures, junction boxes etc. wherever required for cables/ multitube entry.
- 35) Grounding of shields cables to respective instrument earth bus provided in the control room/local panel/RTD head etc. as required.
- 36) Laying and termination of earth cable at both ends between instrument earth bus provided in control room/local panel to instrument earth pits provided by other contractors.
- 37) Supply of all types of consumables required for the execution of the job without any exception.
- 38) Sealing of safety valves with standard lead seals after final setting in the presence of Owner/Owner's representative.
- 39) Supply and installation of base frames along with necessary civil works for all the panels / cabinets / consoles including the RTU base frame (RTU size shall be provided during execution) envisaged inside the control room are included in the scope of CONTRACTOR.
- 40) Co-ordination during installation, pre-commissioning and commissioning with mechanical and other sub-contractors for proper installation of line mounted instruments like control valve, ultrasonic flow meters etc. which involve removal of instruments disconnection of tubes/ cables, reconnection of same for alignment and proper installation.
- 41) Incorporation of all information in drawings/document as per the actual execution of work at site including preparation and submission of as-built drawings.
- 42) Any other work not specifically mentioned above, but required for the proper execution of the erection work.

5. EXTENT OF SUPPLY

The CONTRACTOR shall supply the following materials and documents (unless explicitly excluded in the tender for the PROJECT) in accordance with the requirements for the PROJECT:

- 1) All the supports for the installation of instruments, cable ladders, trays, ducts, conduits, instrument process lines, pneumatic transmission lines, cabinets, panels, desks, consoles, junction boxes, connection boxes, cross boards, etc.
- 2) Material for the instrument process piping (except the first isolating valve).
- 3) Material for the tracing of instruments, instrument process piping.
- 4) Material for the pneumatic transmission lines.
- 5) Junction boxes, the connection boxes, the cross boards including terminals and accessories.
- 6) Protection boxes for the instruments and ancillary equipments, including all required accessories.
- 7) Cable ladders, trays, trunking, conduits.
- 8) Cable glands.

- 9) Accessories for fixing the cables on cable ladders, trays and trunking.
- 10) Nameplates and labels for identification and numbering of instruments, analyzers, ancillary equipment, cables, wires, junction boxes, connection boxes, cross boards, terminals, cabinets, panels, desks, consoles, pneumatic transmission lines, air supply lines, lines or cables for the tracing, etc.

Numbers to be used shall be given by the OWNER'S REPRESENTATIVE.

- 11) All the required accessories for an installation in accordance with the prescriptions, drawings and technical specifications and for the verifications, checks and tests of the Instrumentation.
- 12) All equipment and material asked for by the OWNER'S REPRESENTATIVE on site.
- 13) Required equipment for the calibration, testing and the precommissioning of the Instrumentation, when applicable.
- 14) Consumables (electrodes and welding rods, primer, lubricants, sealants, soldering flux, paint, screws, bolts, expansion bolts, nuts, washers, etc.).
- 15) Necessary tools, equipment and temporary stores, workshops and buildings, in order to perform the works (including lifting engines, scaffolding, etc.).
- 16) Required test documents and certificates.
- 17) As-built drawings (marked up copies).
- 18) Welding procedures and welders qualification certificates, when applicable.
- 19) Weekly reports with progress status.
- 20) Planning and organisation documents such as:
 - work preparation sheets,
 - activity bar chart schedule
 - cable cut program for cables delivered by the OWNER.
- 21) The precommissioning sheets filled in and signed off "ready for commissioning". Those sheets could be an OWNER'S REPRESENTATIVE standard, an OWNER standard or a CONTRACTOR standard approved by the OWNER'S REPRESENTATIVE.

6. GENERAL INSTALLATION PROCEDURES

6.1. GENERAL

6.1.1. Site regulations

The CONTRACTOR shall strictly adhere to the site regulations.

6.1.2. Materials

All materials supplied by the CONTRACTOR shall be in accordance with (but not limited to) the requirements laid down in the Technical Specification for the PROJECT and attached documents and drawings.

The CONTRACTOR shall ensure that all materials and equipment are adequately protected and stored until they are installed / erected.

6.1.3. Local fabrication

All equipment necessary for proper installation of instruments (like supports, frameworks, local panels, etc.) and not supplied in prefabricated form shall be fabricated locally by the CONTRACTOR.

6.1.4. Storing and handling of instruments

Immediately after receipt, instruments and installation materials shall be stored by the CONTRACTOR (unless stated otherwise in the Particular Technical Specification for the PROJECT).

When instrumentation is taken from stock temporarily (e.g. for testing), it shall be returned to the CONTRACTOR's store in the original packing.

For preventing damage, the CONTRACTOR shall transport and handle instruments with the utmost care. All covers and plugs on instrument connections and flange facings shall be left in place as long as possible.

Instruments shall be protected against general construction site hazards, and in particular against adverse weather conditions during the construction period, (e.g. extensive use of large size commercial quality polyethylene bags to cover control valves and local instrumentation). All openings shall be properly sealed if the connections are not made immediately after the installation of the instrument, junction box etc.

6.1.5. Cable storage

All cables shall be stored in a locked compound. Partly used drums shall have their ends sealed and an indication of the quantity remaining marked on the drum.

The fenced off area shall be of sufficient size to allow entry of vehicles, and allow the storage of cables by type and size in a neat and orderly manner. The surface of the compound shall be such that it does not get water logged.

6.2. INSTRUMENT INSTALLATION IN THE PLANT

6.2.1. General

- 1) The CONTRACTOR shall make a preliminary study of instrument, junction boxes location and instrument cable run.

Locations and runs proposed by the CONTRACTOR shall be in accordance with sound installation practices and submitted to OWNER'S REPRESENTATIVE for approval. The approval of the OWNER'S REPRESENTATIVE cannot be used as an argument for an extra-cost in case of relocation afterwards.

- 2) All instruments, their measuring elements and their process manifolds and valves shall be safely and permanently accessible from grade, platforms or walkways (2 m above or 1 m either side of).

Where permanent accessibility is impossible, the process connections and measuring elements for instruments may be located so that they are accessible by temporary facilities (ladders or mobile platform, maximum length : 4 m).

In such cases additional block valves shall be provided close to the instrument. This requires approval of the OWNER'S REPRESENTATIVE.

All instruments, their process connections shall have such orientation and location as to allow easy reading.

Control instruments and transmitters shall also be located in such a way that they are easily accessible for operation and maintenance.

- 3) The connections to the process lines and equipment shall be made in accordance with the pipe class up to and inclusive of the first block valves. Their orientation shall be selected so that instruments or instrument process piping will not obstruct walkways or platforms.

Seal welding may be requested on threaded connections for special services. That welding shall be performed in conformity with the welding procedure for threaded connections.

The CONTRACTOR shall check the type, size, material and orientation of the instrument process connections.

- 4) The run of instrument impulse lines shall be such as to avoid liquid pockets in lines containing gas, even if this is not specified on the typical drawings.

Slopes of instrument impulse lines shall be as specified on the engineering drawings. If not specified, they shall be at least 10 cm/meter to the tapping point when the instrument is mounted above the tapping point and to the instrument when the instrument is mounted below the tapping point.

Vertical instrument impulse lines for differential pressure transmitters shall run as close as possible to each other.

Instrument impulse lines shall be properly supported (maximum distance between supports: 1.50 m).

- 5) When the pipe class calls for welded connections, welding procedure shall be approved by the OWNER'S REPRESENTATIVE.
- 6) When seal welds on threaded connections are required, such connections shall be installed with the threads perfectly free of any trace of lubricant or sealing tape.
- 7) Instruments, associated process piping shall be securely fastened in order to avoid vibrations. When applicable, displacement of process pipes or equipment shall be taken into consideration.
- 8) In general the instrument supports shall either be fixed to concrete or be welded to structural steel.

It is prohibited to weld supports to platforms, handrails, process piping or process equipment.

If supporting from structural steel or concrete is not feasible, supporting of instruments by means of clamping around piping may be considered but approval of the OWNER'S REPRESENTATIVE is required for each individual case.

All surfaces of structural steel which could not be painted afterwards shall be made free of rust, cleaned and painted with a layer of primer before supports, trays, cables, etc. are installed.

All brackets and supports shall be finished smoothly, free from sharp and dangerous edges. Pedestal for yoke mounted instruments shall be closed at top to prevent water accumulation.

In order to avoid electrolytic corrosion, insulating barriers shall be provided when instrument and analyser support are clamped on process piping of a different material.

- 9) Even when no cathodic protection is installed, all instrument connections to underground metallic lines shall be electrically insulated.
- 10) Instrument and supports, which must be fixed to fireproofed structures, shall be welded to the steel structure before the fireproofing is applied taking into account the thickness of the applied fireproofing.

When it is not possible, the supports shall be clamped around the fireproofing, if allowed by the OWNER's REPRESENTATIVE.

As a general rule, the support installation method has to be approved by the OWNER's REPRESENTATIVE.

- 11) All outdoor instruments shall be absolutely weatherproof. If required, weatherproof housings shall be supplied and installed by the CONTRACTOR.

In sunny areas, the field mounted instruments and analysers shall be protected from solar radiation.

- 12) Local pressure and differential pressure instruments shall be mounted so as to avoid vibrations.
13) Individual instrument tracing shall be installed as specified on engineering drawings.

The requirements for heavy or light tracing shall be strictly adhered to.

Isolation valves on steam manifolds and steam trap stations for instrument and steam tracing and local isolating switches for electrical tracing shall be clearly tagged with the instrument loop number even if they are not installed by the CONTRACTOR.

- 14) Instrument impulse lines shall be installed in such a way that enough space is kept all around the lines to install the required insulation.
- 15) Stainless steel impulse and sample transport lines will be additionally protected against the climatic conditions by the use of PTFE spray after the hydrostatic test. The spray type and method of application are to be agreed by the OWNER's REPRESENTATIVE.
- 16) Instrument equipment shall be located such that it is protected against direct drainage of condensate, water and process fluids from adjacent plant equipment that can make the instruments, instrument components, junction boxes, etc. dirty, wet or inoperable.
- 17) Care shall be taken that no passage ways are obstructed or access to other plant equipment, electrical lighting panels, other instruments, etc. is impossible. All equipment shall remain easily operable. Ample space shall be available for the removal of covers, protection box doors, etc.
- 18) When API threadings are made by a thread cutting machine dies shall be properly oiled and threads produced shall be agreed by the OWNER's REPRESENTATIVE. PTFE tape shall be used for the installation of threaded fittings, except where temperatures in excess of 200 °C occur, as indicated on the process piping details; for these cases a suitable dope shall be used.
- 19) When installing steel or stainless steel tubing with compression type fittings, all the fitting manufacturer's instructions shall be exactly followed which shall include, but are not limited to :
- proper cutting of tube and deburring,
 - proper installation of the ferrules,
 - taking care that all tubes have the required roundness.

When storing tubes, care shall be taken that no mechanical damage can occur, which makes the tubes unround.

In order to avoid unroundness of the tubes at the places where ferrules are to be applied, it is absolutely necessary to cut the tube at least 5 cm from the end of a bend. Mounting closer to the bend shall not be accepted.

To avoid galling of stainless steel ferrules into the tapered end of the stainless steel fittings, the stainless steel ferrules shall be greased slightly at the outside before installation.

6.2.2. Temperature instruments

All temperature sensing elements shall be firmly bottomed in the thermowells.

6.2.3. Pressure instruments

Refer Standard Drawings enclosed in the tender.

6.3. INSTALLATION OF INSTRUMENTATION CABLES AND SIGNAL LINES

6.3.1. Trenches

Cable trenches shall be excavated as per requirement and site suitability taking into account the following requirements:

- 1) The CONTRACTOR shall do all excavation of whatever substances encountered to depth shown on drawings.

Excavated materials not required for backfill shall be removed and disposed of as directed by the OWNER's REPRESENTATIVE.

- 2) Unstable soil shall be reported to the OWNER's REPRESENTATIVE who shall give instructions to the CONTRACTOR for its removal and replacement with suitable material. The CONTRACTOR shall be responsible for the excavation and disposal of this unsuitable material as directed by the OWNER's REPRESENTATIVE.

- 3) Unstable materials shall be replaced with approved fill material by the CONTRACTOR as directed by the OWNER's REPRESENTATIVE who shall approve the replacement fill. All replaced fill shall be compacted as directed by the OWNER's REPRESENTATIVE.

- 4) When approved by the OWNER's REPRESENTATIVE excavated material suitable for backfill may be deposited alongside the trench excavation but at a distance not less than 1 meter from the edge of the trench excavation or as otherwise instructed by the OWNER's REPRESENTATIVE. When instructed by the OWNER's REPRESENTATIVE, the CONTRACTOR shall remove all excavated material to a designated dump area.

- 5) Ground adjacent to all excavations shall be graded to prevent water running in.

- 6) The CONTRACTOR shall remove by pumping or other means approved by the OWNER's REPRESENTATIVE, any water accumulated in excavations, and shall keep trenches dewatered until cable bedding is completed to the satisfaction of the OWNER's REPRESENTATIVE.

The CONTRACTOR shall note that to be effective, dewatering operations may have to be on a 24 hour, round the clock basis to ensure dry working conditions.

- 7) The CONTRACTOR shall at his own cost supply and install all necessary bracing, sheathing, shoring to perform and protect all excavations as required for conformity with safety regulations and as approved by the OWNER's REPRESENTATIVE.

- 8) Temporary crossings shall be built by the CONTRACTOR as directed by the OWNER's REPRESENTATIVE to maintain traffic on the site. After use, and when instructed by the OWNER's REPRESENTATIVE such temporary crossings shall be removed by the CONTRACTOR.

- 9) All open excavations shall be protected at CONTRACTOR'S cost by means of safety barriers, lamps, etc. as required or directed by the OWNER's REPRESENTATIVE.

- 10) The depth of the trenches shall be locally increased at crossing or branch-off of large quantities of cables.

- 11) The curvature of the trenches shall be compatible with the bending radius of cables.
- 12) The maximum slope of trench bottoms shall be 10 degrees. The transition to horizontal surfaces shall have a smooth curvature.
- 13) At crossing, signal cables shall be at least 0.3 m lower or higher than electric power cables.
- 14) In order to allow future laying of cables, sleeves (200 mm diameter) shall be provided at road and railway crossing and where trenches for signal cables pass under trenches for electric power cables as required on engineering drawings. The sleeves shall be provided with a steel wire in order to allow pulling of cables.
- 15) Trenches shall be kept (at least 0.5 m) away from buried pipes containing hot fluids and from pipes liable to temperature rise owing to steaming-out.
- 16) All stones and/or rocks shall be removed from the trench prior to laying of the cables.
- 17) The CONTRACTOR shall lay a 15 cm thick sandbed to receive the cables.
- 18) The laying of cables in the trenches shall be approved by the OWNER's REPRESENTATIVE.
- 19) The backfill of trenches may only start after approval from the OWNER's REPRESENTATIVE.

The cables shall be covered with a layer of 15 cm of sand on which red or yellow concrete tiles (300 x 300 x 40 mm) shall be installed, after which the trenches shall be backfilled and covered.

- 20) The backfill of the trenches shall be carried out using approved excavated materials, compacted in lifts of 30 cm max. When instructed by the OWNER's REPRESENTATIVE, the CONTRACTOR shall use fill from approved stock pile areas.

The work shall be carried out ensuring that the backfill is firm and compacted, using suitable equipment, and to specification requirements.

- 21) Backfill material shall be deposited by the CONTRACTOR to specification and as instructed by the OWNER's REPRESENTATIVE.
- 22) Puddling or water flooding for consolidating the backfill is not allowed.
- 23) After backfill of trenches, no surface load shall be placed on the backfill until a period of 48 hours has elapsed.
- 24) The location of the trenches shall be clearly marked and reported on "as built" drawings.

Markers shall be placed at 15 m intervals (or at intervals agreed by the OWNER's REPRESENTATIVE) and where the trench changes direction.

For trenches 500 mm or more in width, markers shall be provided on both edges of the trench. For trenches less than 500 mm in width, markers shall be placed at one edge of the trench only.

Markers shall have identification plates of corrosion resistant metal. The plate shall indicate the direction of the cable run and give the voltages of the cables in the trench at the point where the marker is located.

- 25) Excavation of trenches after cables have been laid requires approval of the OWNER's REPRESENTATIVE.

6.3.2. Cable ladders, trays and trunking

Cable ladders, trays and/or trunking shall be installed as indicated on layout drawings or on models and sectional drawings, taking into account the following requirements.