	TECHNICAL TENDER	

CENTRAL U.P. GAS LIMITED
(CITY GAS PROJECT IN KANPUR & BAREILLY)

TENDER FOR

PROCUREMENT OF 250 SCMH MOTOR DRIVEN CNG COMPOSITE DISPENSING UNIT PACKAGE FOR CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, BAREILLY & JHANSI GA

TENDER No. : 55508

TENDER NO. CUGL/C&P/TEN2324/42

VOLUME II OF II
TECHNICAL VOLUME

OPEN DOMESTIC BIDDING
(THROUGH E-TENDERING MODE)

INDEX

SECTION-A
COMPRESSOR

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1.0 INTRODUCTION

M/s Central U.P. Gas Limited (CUGL) a Joint Venture of India's two Maharatna Companies, GAIL (India) Limited and Bharat Petroleum Corporation Limited incorporated on 25th February 2005. CUGL is authorized by the Petroleum and Natural Gas Regulatory Board (PNGRB) to operate in the Geographical Areas (GAs) of Kanpur (including some part of Unnao), Bareilly and Jhansi.

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	:	CITY GAS DISTRIBUTION IN THE GEOGRAPHICAL AREA OF KANPUR, UNNAO, BAREILLY AND JHANSI
OWNER/ COMPANY	:	M/s. Central U.P. Gas Limited (CUGL)

3.0 PROJECT BRIEF

CUGL intends to extend the CNG facility by increasing the number of CNG stations & upgrading existing CNG stations to ensure uninterrupted supply of natural gas to automobile consumers in Kanpur, Unnao, Bareilly & Jhansi cities in the State of UP. CUGL is also developing CGD network in these cities to cater the requirement of Domestic, Commercial and Industrial consumers.

CUGL invites bids through single stage two envelopes system from eligible bidders for Supply, Installation, Testing, Commissioning and Comprehensive Maintenance for Motor Driven Reciprocating 250 SCMH motor driven CNG composite dispensing unit package (that includes compressor, cascade & dispenser attached with each other and installed inside an enclosure box in a single unit on a single skid) as per details furnished in bid document.

4.0 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:

a) Material Requisition
b) Data Sheets
c) Project Specifications
d) Basic Documents
e) Codes and Standards

Generally, 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.)

5.0 SCOPE OF SUPPLY & SERVICES

Design, engineering, manufacture, inspection, testing, Supply, Erection, testing at manufacturer's works and site, packing (if any), delivery and Commissioning, operation & comprehensive Maintenance of motor driven CNG composite dispensing unit package (that includes compressor, cascade & dispenser attached with each other and installed inside an enclosure box in a single unit on a single skid). Supply of all Pre- commissioning, Commissioning spares & documentation as per the enclosed engineering standard, specifications and data sheets etc. attached or referred. Motor driven CNG composite dispensing unit package shall be required at Geographical areas of Kanpur, Unnao, Bareilly and Jhansi.

Any minor addition work/equipment or technical requirement not mentioned in the specification but required to make the offered system complete in accordance with the specifications or required for safe operation or as per applicable statutory/technical guidelines, shall be deemed to be included in the offer.

Description of 250 SCMH motor driven CNG composite dispensing unit package:

SOR Item No.	Group B- Description of item	Unit	Quantity
1.	Design, Engineering, Manufacturing, Inspection, Testing, Supply, erection, Transportation, loading & unloading at Geographical area of Kanpur, Unnao,Bareilly and Jhansi site/store, Installation, commissioning with commissioning spares & Field performance test, Operation and comprehensive maintenance at M/s CUGL site of **motor driven CNG composite dispensing unit package with discharge flowcapacity of 250 SCMH** with 03 banks,6 line priority panel along with all accessories and auxiliaries as per Technical volume of Tender document complete in all respects including special tools and tackles with the list. Suction Pressure Range: 14 - 19 Kg/cm2 (g) Discharge Pressure: 255 kg/cm2 (g)	Nos	08
2.	Operations of motor driven CNG composite dispensing unit package with discharge flow capacity of 250 SCMH		
2.1	Operation charges for during warranty	No. of shifts	5840
2.2	Operation charges for 01st year after warranty	No. of shifts	5840
2.3	Operation charges for 02nd year after warranty	No. of shifts	5840
2.4	Operation charges for 03rd year after warranty	No. of shifts	5840
2.5	Operation charges for 04th year after warranty	No. of shifts	5840
2.6	Operation charges for 05th year after warranty	No. of shifts	5840
3.	Comprehensive Annual Maintenance Contract (CAMC) charges per motor driven CNG composite dispensing unit package with discharge flow capacity of 250 SCMH inclusive of manpower, spares, consumables etc. CAMC will consist of two parts: Preventive maintenance at regular interval by OEM /authorized contractor as per recommendation ofOEM Break down maintenance as and when required within CAMC by OEM. (Included during warrantee and post warranty period). 1st year CAMC shall be inclusive in the warranty period		
3.1	**For 1st Year During Warrantee Period**	Machine Months	Included in warranty period
3.2	**For 1st year** After Warrantee Period	Machine Months	96
3.3	**For 2nd Year** After Warrantee Period	Machine Months	96

3.4	**For 3rd year** After Warrantee Period	Machine Months	96
3.5	**For 4th year** After Warrantee Period	Machine Months	96
3.6	**For 5th year** After Warrantee Period	Machine Months	96

6.0 INSPECTION

Bidder shall appoint anyone of the TPIA furnished in **Doc no- C211036-CGD- ME-TPIA-3001**, for inspection purpose. Apart from inspection by TPIA, inspection shall also be performed by Client representative, as set out and specified in the codes and particular documents forming this MR. TPIA charges shall be paid by the Manufacturer/Supplier for all procured items as required.

7.0 SPECIAL INSTRUCTIONS TO BIDDERS

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

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

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

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

7.5 The bidder must submit all documents as listed in checklist along with his offer.

7.6 The Supplier shall deliver a Certificate conformity or Compliance to BS EN 10204 3.2 stating the quality, the mechanical properties, the chemical analysis, the process of manufacture and the making of the compressor.

7.7 All materials shall be delivered to CUGL stores /sites. Detailed addresses are furnished in the technical bid document.

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

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

a) Inspection & test reports for all mandatory tests as per the applicable code as well as test reports for any supplementary tests, in nicely bound volumes.

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

c) Filled in Quality Assurance Plan (QAP) for Purchaser's/ Consultant's approval. These QAPs shall be submitted in four copies within 15 days from LOI/PO.

d) Other Drawing & document as specified in vendor data & drawing requirements as with Tender.

e) Detailed completion schedule activity wise (Bar Chart), within one week of placement of order.

f) Weekly & fortnightly progress reports for all activities including procurement.

g) Purchase orders of bought out items soon after placement of order.

h) Manufacturer's drawings/documents for bought out items, in 4 copies, for Purchaser's / Consultant's approval within 4 weeks.

i) Manufacturer related information for design of civil foundation & other matching items within 6 weeks of LOI/PO.

j) All approved drawings / design calculation / maintenance & operating manual documents as well as inspection and test reports for Owner's / Consultants reference / record in nicely category-wise bound volumes (in Hard Copy) and in Soft Copy separately.

9.0 LIST OF ATTACHMENTS

Sr. No	Name of Document	Doc. No.	No. of Pages
A.	**COMPRESSOR UNIT**		
1.	SCOPE OF WORK- MOTOR DRIVEN CNG COMPOSITE DISPENSING UNIT PACKAGE	C211036-CGD-ME-SOW-3001A	25
2.	TECHNICAL SPECIFICATION - MOTOR DRIVEN CNG COMPOSITE DISPENSING UNIT PACKAGE	C211036-CGD-ME-TS-3001A	37
3.	STANDARD SPECIFICATION FOR MEDIUM VOLTAGE INDUCTION MOTOR	VPC–SS–EL-4006	16
4.	DATA SHEET MOTOR DRIVEN CNG COMPOSITE DISPENSING UNIT PACKAGE	C211036-CGD-ME-DS-3001A	06
5.	DATA SHEET OF INTERCOOLER & AFTERCOOLER	C211036-CGD-ME-DS-3001B	03
6.	LIST OF INSTRUMENTATION & CONTROLS	C211036-CGD-ME-PRO-3001C	06
7.	DATA SHEET OF LV MOTOR	VPC–DS–EL-009	05
8.	FIRE & GAS DEVICES DATASHEETS	C211036-CGD-IC-DS-3001D	04
9.	DATASHEET FOR CORIOLIS FLOW METER	C211036-CGD-IC-DS-3001E	04
10.	DATASHEET FOR FLAME ARRESTER	C211036-CGD-ME-DS-3001F	04
11.	DATASHEET FOR AIR COMPRESSOR	C211036-CGD-ME-DS-3001G	03
12.	DATASHEET FOR TEMP. GAUGE	C211036-CGD-ME-DS-3001H	03
13.	DATASHEET FOR THERMAL MASS FLOW METER	C211036-CGD-ME-DS-3001I	03
14.	THIRD-PARTY INSPECTION AGENCY LIST	C211036-CGD-ME-TPIA-3001	02
15.	INSPECTION AND TEST PLAN (QAP) FOR MOTOR DRIVEN CNG COMPOSITE DISPENSING UNIT PACKAGE	C211036-CGD-ME-QAP-3001	15
16.	VENDOR DRAWING & DATA REQUIREMENTS	C211036-CGD-ME-VDDR-3001A	05

B.	**CNG CASCADE**		
12.	SCOPE OF WORK-CNG CASCADE	C211036-CGD-ME-SOW- 3001B	09
13.	DATA SHEET CNG CASCADE	C211036-CGD-ME-DS-3001D	03
14.	TECHNICAL SPECIFICATION – CNG CASCADE	C211036-CGD-ME-TS-3001B	14
15.	INSPECTION AND TEST PLAN (QAP) FOR CNG CASCADE	C211036-CGD-ME-QAP-3001B	07
16.	VENDOR DRAWING & DATA REQUIREMENTS	C211036-CGD-ME-VDDR-3001B	03
C.	**CNG DISPENSER UNIT**		
17.	SCOPE OF WORK-CNG DISPENSER	C211036-CGD-ME-SOW-3001C	14
18.	DATA SHEET CNG DISPENSER	C211036-CGD-ME-DS-3001E	04
19.	TECHNICAL SPECIFICATION – CNG DISPENSER	C211036-CGD-ME-TS-3001C	20
20.	QUALITY ASSURANCE PLAN – CNG CAR DISPENSER	C211036-CGD-ME-QAP-3001C	06
21.	VENDOR DRAWING AND DATA REQUIREMENT– CNG DISPENSER	C211036-CGD-ME-VDDR-3001C	08
22.	VENDOR LIST FOR BOUGHTOUT ITEMS FOR CAR DISPENSER	C211036-CGD-ME-VL-3001	05
COMMON			
23.	LIST OF RECOMMENDED TPIA	C211036-CGD-ME-TPIA- 3001	02
24.	CHECK LIST - TECHNICAL	VCS-SD-CK-001	01
25.	COMPLIANCE STATEMENT	VCS-SD-CS-001	01
26.	DEVIATION SHEET	VCS-SD-DS-001	01
27.	DRAWINGS & DOCUMENTS	VCS-SD-DD-001	01
28.	INSTRUCTION TO BIDDER	VCS-SD-ITB-001	01
29.	LIST OF SPARES	VCS-SD-LS-001	01
30.	REFERENCE LIST	VCS-SD-RL-001	01

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1.0 SCOPE OF WORK

The scope of work/services to be provided by the bidder shall be inclusive of but not limited to:

- The intent of this tender is to outline minimum requirement for Design, Engineering, Manufacturing, Inspection, Testing, Packaging, Supply, Erection & Commissioning including Performance Acceptance Test at site along with, Operation during six years and CAMC during One year warranty period and subsequent Five year post one year warrantee period including supply of all spares and consumable items for **"250 SCMH MOTOR DRIVEN CNG COMPOSITE DISPENSING UNIT PACKAGE"** as required for dispensing CNG to vehicles at various locations as per this technical specification and applicable codes as referred. Various parts of this specification shall be read in conjunction with each other and in case where the different parts of this specification differ, the more stringent requirement shall govern.

- Motor driven CNG composite dispensing unit package is to be installed at the CNG outlets of CLIENT and Oil and Marketing Company (OMC) retail Outlets located at various locations as per the instructions of Engineer in charge to increase the pressure of natural gas for dispensing in vehicles.

- Motor driven CNG composite dispensing unit package may be installed in any of the GA of M/s. CUGL.

- Erection, testing, commissioning and field performance test by the Bidder shall include unloading of composite unit onto the foundation, leveling, alignment, grouting etc. Foundation shall be prepared by CUGL/OMC. The bidder shall arrange for crane, lifting arrangement, manpower required for lifting of package at site, and unloading on the foundation. In case the composite unit requires any grouting, then grouting (supply and pouring) using shrinkcom grout etc. shall be in the scope of the bidder

- Bidder shall be responsible for supply, erection, commissioning and field trial run. Bidder shall conduct a field trial run of each composite unit for minimum 72 hours continuous at guaranteed points in which satisfactory operation of complete package together with all accessories / auxiliaries controls shall be established for specified operating conditions prior to the start of CAMC as defined in the contract. During the field trial run the bidder will be allowed a maximum of THREE attempts to complete the above specified test. The Equipment shall be considered commissioned after the successful completion of Field Trial Run

- Bidder shall furnish pre-commissioning and installation checklist.

- During the field performance test, all the parameters such as flow rate, power consumption, vibration level, cabin temperature (temperature within the enclosure) etc. will be checked. Functioning of all the safety and protection devices, instruments, gauges, measuring devices such as mass flow meters, PLC, priority panel, ESD etc. will be checked at the site. Bidder has to demonstrate the functioning of composite unit at site.

- During field trial run, noise level test shall be carried out and bidder shall demonstrate / achieve the guaranteed noise levels for the complete package including auxiliary

motors if installed externally to the enclosure.

- All necessary instruments / accessories required for measurement purpose at site shall be pre-calibrated and shall be arranged by the bidder. In case any defect / deficiency is noticed under specified site conditions, bidder shall first rectify the same and repeat the test. It will be the endeavor of all the parties to get the performance acceptance test (PAT) at site conducted within a period of 20 days from the start of commercial CAMC of a particular package. The power required to run the motor driven CNG Composite Dispensing Unit will be provided by CLIENT/ OMC. The vendor shall maintain the motor driven CNG composite dispensing unit packagein sound mechanical condition at all times. The vendor shall rectify the defects notified by CLIENT immediately and should submit all the history log sheets and spares availability status along with the report in the format mutually agreed betweenCLIENT and the bidder.

- The bidder shall depute adequate numbers of qualified, experienced and competent persons and supervisors for smooth maintenance of the Composite/Integrated CNG Compressor packages.

- Periodic inspections of Safety Valves, Transmitters, Pressure vessel gauge and any other equipment as per statutory norms of UP Factory Rules 1950. SMPV and Gas Cylinder Rules shall have to be carried out by the bidder at his own cost during the period of maintenance by the bidder. The inspections have to be carried out by competent persons as per advice of Engineer-in-Charge and certificates have to be submitted to CLIENT.

- The bidder has to keep his services personnel ready to attend problems any time of the day. Name and mobile phone number of in-charge of the services team has to be provided to Engineer-in-Charge / his representatives.

- The bidder has to ensure to deploy operators round the clock at site or as per instructions of CUGL.

- The bidder shall allow weekly rest and restrict daily working hours of his workmen as per relevant Act/Law/and Rule made there under. However, no work shall be left incomplete/ in dismantled condition on any holiday/weekly rest. Technician provided shall have minimum qualification of ITI. The bidder in person or his authorized representative shall be available on regular basis to interact with Engineer –in charge.

- The work force deployed by the bidder for the operation & maintenance services at the CNG installation shall be of sound relevant technical professional expertise which is otherwise also essential from the safety point of view of the personnel of the vendoras well as for the installation.

- All personnel of the bidder entering on work premises shall be properly and neatly dressed while working on premises of the company including work sites.

- Bidder shall maintain proper record of his working employee's attendance and payment made to them.

- The bidder's representative/supervisor shall report on regular basis to the Shift-in-charge at CLIENT control rooms for day to day working.

- All the safety rules and regulations prevailing and applicable from time to time at the installations as directed by CLIENT will be strictly adhered to by the Vendor and his workforce.

- The bidder shall plan schedule maintenance in consultation and prior permission of Engineer in-charge or his representatives.

- The bidder shall be responsible for the discipline and good behavior of all his personnel deployed to carry out the services. In case of any complaint received against any of his employee, he shall arrange to replace such persons within 24 Hrs. of notice issued by the Engineer-in-charge. The decision of the Engineer-in charge in this matter shall be final and binding on the Vendor.

- The bidder shall arrange to supply/renew identity cards to his workforce at his own cost. The vendor's personnel shall be required to carry their respective identity cards while on duty and produce on demand. Without valid identity cards, they will not be allowed to enter into the CNG station.

- Engineer-in-charge shall have authority to issue instructions to the Vendor from time to time during the contract period necessary for the purpose of proper and safe execution of the contract and the Vendor shall carry out and bound by the same. In case of non-fulfilment of any obligations under the contract and /or non- execution of any instruction issued by Engineer-in-charge as per terms and conditions of the contract, Engineer-in-charge shall have power to withhold Payment for an amount equivalent to the amount to be spent for execution the obligations/instructions issued by him. The decision of engineer-in-charge in this regard will be final and binding to the Vendor.

- Receipt at site, storage in warehouse as per manufacturer's recommendation and safety and security from theft and breakage during transportation, handling including security guard at site.

- Submission of drawings & documents.

- Erection, CAMC and all others relevant manuals for motor driven CNG composite Dispensing unit package & its accessories, priority panel, electrical motor & all instrumentation.

2.0 SCOPE OF SUPPLY

2.1 Bidder's scope of supply shall in include but not limited to design, engineering, manufacturing, inspection, erection, testing, supply including packaging, forwarding, insurance, Custom clearance, handling and unloading as well as at PURCHASER stores, package performance test (FAT) at Bidder's shop and Site Acceptance Test (SAT) of "250 SCMH MOTOR DRIVEN CNG COMPOSITE DISPENSING UNIT PACKAGE" as required for dispensing CNG to vehicles at the location described in this tender.

2.2 Online 250 SCMH motor driven CNG composite dispensing unit package.

2.3 Three banks 450 Water Liter (minimum) capacity Cascade along with 250 SCMH compressor package (However, adequate capacity need to checked and verified by bidder). (Detail scope of supply, specification refer Section-B).

2.4 The storage cylinders to be kept completely inside the single enclosure of the machine.

2.5 Twin arm CNG Car Dispenser (1 no.) and Interconnected SS tubes & fittings. (Detail scope of supply, **specification refer Section-C**).

2.6 Dispenser shall be supplied with standard enclosure.

2.7 Air compressor of capacity 1.5 KW with air receiver with PRV, desiccant/Refrigerated air dryer along with all accessories and auxiliaries shall be supplied for each CNG compressor package. (If required) and shall be installed out side the package in safe zone.

2.8 Bidder shall provide By-pass provision arrangements for air dryer with isolation valve provision during maintenance of air dryer unit.

2.9 Inlet pressure regulator at suction of compressor with upstream pressure 14 to 19 Kg/cm2g and downstream pressure 14 to 19 Kg/cm2g.

2.10 Suction line pressure may vary from 14 kg/cm2G to 19 kg/cm2G with discharge pressure remaining constant at 255 kg/cm2G. Compressor shall be designed for complete range of suction pressure from 14 to 19 Kg/cm2g and driver shall meet max. Power requirement. Bidder to provide PRV with slam shut off valve of 300# rating at gas inlet of compressor to protect the downstream distribution piping and fixtures from experiencing excess unsafe pressures in the event that outlet pressure of the high flow PRV rises above an acceptable level. Outlet pressure of PRV should be in the range of 14 to 19 Kg/cm2(g) and it may have multiple springs sizing of the compressor for 250 SCMH capacity at discharge pressure of 255 kg/cm2 (g) shall be carried out at 14 kg/cm2(g) suction pressure. Suction pr. transmitters shall be provided to protect the compressor from very high and low pressure.

2.11 Bidder shall provide sizing calculation of pilot operated PRV type which shall maintain Maximum & minimum inlet, Maximum & minimum outlet line pressure & Maximum line temperature whereas when gas line demand pressure increases the downstream pressure decreases below setting of pilot springs so vendor shall keep in mind during use of PRV at main lines.

2.12 Bidder also provide a Bypass provisions for PRV with ball valve to compressor inlet.

2.13 One SOV operated auto shut off valve bypassing PRV shall be provided. If pressure at

package inlet is more than 22 kg/cm2, the auto shut off valve shall close to prevent the compressor from overloading and gas shall pass through PRV to compressor (Ist stage). However, if gas pressure is less than 22 kg/cm2 shut off valve shall remain in open condition to prevent pressure loss through PRV so that the compressor can be operated at maximum capacity corresponding to suction pressure. Inlet gas piping to CNG compressor shall be designed for min 49 kg/cm2 pressure.

2.0 Bidder also alternatively use gas actuated valves in compressor for actuation of valves but same shall also be gas actuated or Electro valves use in CNG dispensers in place of Air compressors. Bidder shall also submit CCOE/Equivalent approval certificates for Gas actuated or Electro valves.

2.1 All interconnections between compressor, cascade and dispenser up to the battery limit shall be in the scope of bidder.

2.2 Bidder need to submit copy of valid type approval for offered motor driven CNG composite dispensing unit package from PESO along with the bid. Bidder must submit duly peso approved mechanical drawings/ mechanical design of the motor driven CNG composite dispensing unit package along with the Bid.

2.3 Enclosure wall and doors shall be of SS-304 or fire resistant and insulated from inside with Rockwool. The side wall of the enclosure/doors shall not have any louvers (To prevent accidental escape of debris/fire). Doors shall have heavy duty double security locks tocurtail sudden high pressure inside the enclosure.

2.4 Since motor driven CNG composite dispensing unit package is planned to be placed inside the forecourt in the CNG station hence design of the enclosure should be impactresistant of slow moving vehicle.

2.5 4 nos. mass flow meters to measure the Natural Gas consumption at packages inlet –1 no. & package discharge – 2 no. (Part of dispenser section), both Coriolis type. The flow meters should be enabled with MODBUS/RS 485 communications. 1 No Mass flow meter to measure Vent Loss. However, if compressor is designed in such a way that there is no venting loss, then no mass flow meter required at vent otherwise 01 no mass flow meter to be supplied at vent. Inlet mass flow meter could be installed out side the package after filtration skid. Inlet mass flow meter to be supplied and installed by bidder.

2.6 NRV also provided at before gas vent mass flow meter to measure corrected gas loss.

2.7 Safety relief valve discharges connected to common manifold suitable to allow dispersion of gas via a vent stack and In-line flame arrestor / trap. The suitable selection & sizing calculation of flame arrester shall be done by bidder and flame arrester sizing calculation to be reviewed during detail engineering.

2.8 Thermal type mass flow meter shall be used for gas vent loss.

2.9 During Package performance Test at bidder testing facilities Bidder shall arrange Coriolis mass flow meter at discharge and proper future assembly provision of mass flow meter for Continuous 4hrs. Routine test during FAT & Site acceptance test whenever required.

2.10 All Mass flow meter shall be provided with a Liquid Crystal Display (LCD) for ongoing flow monitoring, Temperature and totalizers.

2.11 PLC based control panel with HMI. PLC based control system with 7" touch screen HMI display or higher size. PLC shall be provided with mounting rack, CPU, Input output cards, Power supply card, and communication card.

. Failure alarm of CPU shall be provided in HMI. Dedicated Modbus (RS 485) slave

communication port shall be provided for Remote terminal unit (RTU) interface. Additionally, separate communication ports shall be provided for GPRS modem for communication with SCADA system.

2.12 For automation purpose, communication protocol to be provided in the form of as required in the RTU of purchaser.

2.13 PLC shall be mounted in EXD proof enclosure. Cabinet specification with statutory certificate shall be submitted during engineering stage for approval.

2.14 Instrumentation and control system as specified on data sheets including Local panel, Console/Local gauge boards, PLC. All the transmitters shall be Ex proof or intrinsically safe. PESO certificates shall be submitted.

2.15 Pressure Transmitter and Temperature Transmitters shall be used for CNG Gas application with 4-20 mA output signals to PLC. The units of measurement for flow shall be Kg/hr, for pressure shall be Kg/cm2 (g) or and for temperature shall be degree C. Pressure and temperature switches are not acceptable.

2.16 Common structural steel skid for the compressor- Motor combination and for all auxiliary systems including cascade, dispenser, priority panel, control panel etc. with one number IR type point gas detectors, one number Flame detector UV type inside the enclosure.

2.17 Vendor shall submit documents during engineering stage for review & approval to client/consultant. Document are specification /data sheet with statutory approval certificate, W&M certificate, PESO certificate of all the instruments as per P&ID, instrument index, input output list, power consumption calculation, cause & effect cables specification, cable schedule with termination details, operation & control philosophy, and PLC specification & architecture.

2.18 Air-cooled heat exchanger for inter stage and discharge gas.

2.19 6 line (3 bank) Priority Panel at Compressor Discharge.

2.20 2 way/ 3 way valves with full flow ball valve for priority line.

2.21 All interconnecting oil, gas, water, air piping within the compressor package, including priority panel, cascade & dispenser & interconnecting tubing.

2.22 Impulse and pneumatic piping/Tubing for all valves, fittings as specified & required for mounting the instruments.

2.23 Junction boxes as required for interfacing to compressor package mounted control panel.

2.24 NRV at final discharge & suction.

2.25 NRV to be provided at final discharge & suction of the compressor.

2.26 NRV to be provided at Low, Medium & high bank of cascade to main header line of priority panel.

2.27 NRV to be provided at High bank dispenser line from downstream of High bank cascade for priority fill of dispenser over CNG cascade.

2.28 Structural supports within the motor driven CNG composite dispensing unit package for all piping, instruments etc.

2.29 One no. relief valve at each stage discharge, first (1st) stage suction and if 1st stage of Suction through Blow down vessel and installed with safety relief valve then no additional Safety relief is not required for 1st stage suction.

2.30 Bidder shall provide Load Torque and Speed torque graph to be provided for Electrical Motor.

2.31 Power Consumption graph vs suction pressure graph to be submitted by bidder duly with technical bid.

2.32 CCOW/BIS approvals of cylinders used in Co2 flooding system to be submitted.

2.33 Bidder shall design the compressor in such a way that there additional safety when suction pressure reaches its above set point.

2.34 Y- Type strainers, valves, sight flow indicators, check valves, auto & manual drain traps etc. as required for various auxiliary systems i.e. frame lube oil, cylinder lubrication system, cooling water systems etc. according to manufacturer safe design.

2.35 Coupling/V-belts/pulleys.

2.36 Common CO2 extinguishing system consisting of two cylinders, piping, valves and control systems as per details given in this specification.

2.37 The bidder shall design, assembly & procure the CO2 flooding system from reputed and authorized suppliers (Make: Tube fit Engineers) with valid PESO /MTC/Hydro test certificates for approval during detail engineering.

2.38 Compressor Inlet and outlet manual and automatic isolating valves for maintenance & emergency.

2.39 Complete Erection, Testing & Commissioning of motor driven CNG composite dispensing unit package.

2.40 Field Performance test at site

2.41 Supply of all essential spares as specified, erection & commissioning spares.

2.42 One set of priced spare parts catalogue along with the priced bid (Part-II), as built drawings and Maintenance catalogue with each motor driven CNG composite dispensing unit package.

2.43 An oil drain pot outside of the package shall be provided to collect all drains from packing, distance pieces, processes etc. The OEM shall design and sizing the oil recovery pot as per OEM standard specifications.

2.44 Only air cooled and lubricated compressor with suction/discharge volume bottles (dampers) for each stage (separators) with manual drains and automatic drain system, lube oil system, closed circuit cooling water system (console type)/Air cooled according to manufacturer safe design.

2.45 Priority refueling system inside of the package.

2.46 Drive belt, if used shall be anti-static fire retardant type.

2.47 Duplex suction filters with filtration level up to 5 Micron to be provided outside battery limits of the package at the inlet of package with DP gauge after Y- type strainer and

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before PRV.

2.48 Coalescent type filter at discharge so as to limit oil carryover is to be provided.

2.49 Three no. Emergency stop button (push type) along with one hooter in office/customerinterface room.

2.50 Wires mesh type guard for heat exchanger fan.

2.51 Erection, Maintenance and all others relevant manuals for motor driven CNG composite dispensing unit package & its accessories, priority panel, electrical motor & all field instruments, dispenser, storage cascade etc. for easy operation & trouble shooting.

2.52 Annual comprehensive maintenance services for a period during the warranty and after warranty period, including supply of all spares and consumable items.

2.53 Training to Owner's Employees on the operation of unit for daily working including regular checks, troubleshooting etc. (at site or works as per owner's permission)

2.54 Master Maintenance technician needs to be available at one location of Client's choice along with mandatory tools and spares. Master technician shall also provide necessary training to Client staff for successful operation as and when required.

2.55 For added safety, manufacturer shall isolate Dispenser from compressor and cascade in separate sections, using heavy gauge steel sheet wall of minimum 15 mm thickness.

2.56 Cables

a) Main incoming Power cable from owners Power Distribution Board (PDB) to maincontrol panel of the compressor through heavy duty GI conduit or trenches, all inter connecting cables in compressor package, including complete erection accessories like double compression cable gland, ex proof gland in hazardous area, cable tags, lugs etc. as required.

b) Cable from owners UPS system/DB to main control Panel of the compressor & Dispenser through heavy duty GI conduit or trenches.

c) Electrical/Control Cables required for providing connectivity to Co2 system and emergency switch.

d) Supply, laying, glanding, lugging, ferruling, clamping, terminal of Instrumentation cable (signal, control, communication, Ethernet & Power) frominstrument to junction box/PLC inside enclosure, PGD, flame detectors to PLC, PLC to HMI. Emergency push button outside compressor enclosure to PLC.

e) Supply of signals and power cable from Emergency push button (field and controlroom) to Compressor PLC and RS 485/Ethernet/Modbus port cable of Compressor PLC to Client's RTU. Vendor shall provide all the RS 485/Ethernet/Modbus configuration details to RTU vendors/client/consultant required for configuration. Vendor shall also provide their support during configuration.

Note -FRLS (Fire resistant low smoke) cables shall be used for gas detectors,flame & multisensory detectors and emergency push buttons.

2.57 Supply of Communication Cables, cable glands, termination of cable and cable laying from dispenser & Compressor PLC (in Composite package) to junction box is in Vendor's scope. Supply of standard make, **WP IP 65** or higher degree of IP junction boxes,

terminal blocks and installation of junction box shall be in Vendor's scope. Side & bottom cable entry will be as per manufacturer standards. All the spare entry shall be plugged properly by means of FLP type Dead Plug. Vendor shall be responsible to provide all the signals at the junction box which will be connected to RTU in future. During installation & commissioning of dispenser same will be checked by CLIENT's Engineer.

2.58 All FLP-WP junction Category shall be Exd. IIC-T6 With suitable to gas group IIA/IIB & zone-1 & 2 with valid Enclosure testing lab certificates & CCOE approvals.

2.59 Communication cable is single pair (1Px 1.5mm2), multi strand, armored cable with HR PVC insulation and PVC st2 inner and outer sheath. Tentative cable length from each dispenser to junction box is max. 50 meters. Bidder to provide the same.

2.60 Vendor must share junction box termination details with CLIENT.

2.61 All Instruments & electrical equipment shall be supplied with double compression type of cable glands tested & certified to be used in hazardous area classified as Zone-I.

2.62 Appropriately plugged drain valves of the filter outside the dispenser housing with suitable arrangement to collect the drained oil to facilitate the operator to drain the oil on regular basis without requiring to open the lock of the dispenser cabinet. The layout of tubing and other component should be such that it gives unhindered access to all parts and maintenance becomes easy.

2.63 CUGL & CNG logo and name shall be printed on stainless steel panel to cover completely both the sides of the doors. Color code and logo design shall be obtained from client. Additional set of stickers (2 Nos per dispenser) is required to be supplied along with the dispenser.

2.64 On-Site Training to CLIENT personnel (Three days each for three separate groups).

2.65 Training to CLIENT personnel at vendor's shop (10 personnel for three working days). The travelling, boarding & lodging of CLIENT's Engineers shall be borne by CLIENT. The training module shall cover the equipment construction features, maintenance procedures, practical hands-on experience on assembling, dismantling. etc.

2.66 Motor driven CNG composite dispensing unit package shall be suitable for outdoor installation without roof / shed.

2.67 From safety point of view, manufacturer to provide Compressor, Cascade & Dispenser in separate sections, isolated from each other using heavy acoustic wall.

2.68 The composite unit are intended to be installed at existing petrol pump outlets/retail outlets dispensing bays which have limited space. Bidder shall optimize the compressor package for minimum possible space requirement considering space constraint. The maximum size of the package shall not exceed more than **4.0 meters (length) x 2.0 meters (width) x 4.0 meters (height).** The package offered over & above of this size shall be rejected.

3.0 OPERATIONS & COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT OF COMPRESSOR PACKAGES

The date of start of commercial sale as intimated by client be considered as the date of commencement of operations & AMC. Also refer the cl. No. 7 for CAMC of dispenser given in the Scope of work for supply of dispenser. **(Doc no. C211036- CGD-ME-SOW-3001C).**

3.1 Accommodation / transportation / medical

The bidder shall make his own arrangement for the accommodation of his personnel at respective locations and subsequent transportation arrangement for them from their place of residence to work place or any other place as required and company shall have no obligation in this respect. The company shall not be responsible for providing any medical assistance to the bidder personnel.

3.2 Discipline:

The bidder shall be responsible for the discipline and good behavior of all his personnel deployed in the services contracted out and should any complaint be received against any of his employee, he shall arrange to replace such persons within 24 hours of notice issued by the Engineer-in-Charge. The decision of the Engineer -in-Charge in this matter shall be final and binding on the Bidder.

3.3 Gate pass / identity card

The contract shall arrange to supply / renew identity card to his workforce at his own cost, if so required by the Purchaser for security or for any other reasons. Those Bidder's personnel shall be required to carry their respective identity cards while on duty and produce on demand. Right to get services carried out through other agencies.

Nothing contained herein shall restrict Purchaser from accepting similar service from other agencies, at its discretion and at the risk and cost of the Bidder, if the bidder fails to provide the said services any time.

3.4 General

The operations & maintenance services shall be provided on the round the clock basis as mentionedin the tender document.

a) The bidder shall deploy adequate number of operators and technicians / supervisors /Engineers / helpers as well as tools & equipment for smooth and proper maintenance of the compressors supplied in terms of the contract. In case required to meet operational requirements, the bidder shall augment the same as per direction of Engineer -in-Charge.

b) The bidder is required to carry out all services as mentioned in the Scope of Services and Schedule of Rates on all the 365 days including Sunday and all Holiday & around the clock.

c) The bidder shall allow weekly rest and daily working hours to his workmen as per the relevant Act/Law/and Rule made thereunder. However, no work shall be left incomplete/unattended on any holiday/weekly rest. Technician/operators provided shall have minimum qualification of ITI. Contract in person or his

authorized representative shall provide the services on daily basis to interact with Engineer-in-charge and deployed workman.

d) The work force deployed by the bidder for CAMC services at CNG installation shall be of sound relevant technical professional expertise which is otherwise also essential from the safety point of view of the personnel of the bidder as well as for the installation.

e) Bidder has to ensure the safety of man and machine all the times. Damages of equipment due to negligence will be recovered as per the decision of Engineer in-Charge, which will be final.

f) Regarding work completion, the decision of the Engineer-in-Charge will be final and binding.

g) The bidder shall make his own arrangements to provide all facilities like boardingand transport etc. to his workmen.

h) All personnel of the bidder entering on work premises shall be properly and neatly dressed and shall wear uniform, badges while working on premises of the company including work sites.

i) Bidder shall maintain proper record of his working employee's attendance and payment made to them.

j) The Bidder's representative/supervisor shall report daily to the Shift-in-Charge for day to day working.

k) All the safety rules and regulations prevailing and applicable from time to time at the installations as directed by PURCHASER will be strictly adhered to by the Bidder.

l) The rates quoted by the Bidder must be inclusive of all the taxes, duties, services tax, work contract tax and any other levies, Bidder's share of P.F. and insurance charges, Bidder's profit and any other expenditure etc.

m) It will be the responsibility of the bidder to pay as per the minimum wages of the appropriate government applicable under the Minimum Wage Act.

n) The services shall be provided on the round the clock basis. The bidder is responsible to provide effective and efficient services in all shifts and assure that there is no disruption in the services for want of any resources.

o) The bidder shall establish a central control room to operate 24 hours, seven days a week where complaint regarding non-performance of the compressors in terms of the contract can be lodged. Further, the bidder shall deploy adequate number of technicians/ supervisors / engineers at various site offices in consultation with Engineer-in-Charge to provide trouble free maintenance of the compressors.

p) All arrangements for communication from control room to the contract person working on job under the services shall be the responsibility of the Bidder, i.e pagers / walky-talky/mobile phone.

q) All the jobs mentioned under scope of services shall be carried out as per

sound engineering practices, work procedure documentation, recommendation of the manufacturer and as per the guidelines/direction of engineer-in-charge of authorized representative.

3.5 Maintenance of compressor packages for five years post warranty period (1st year during warranty period & five years post warranty period)

3.5.1 SCOPE OF SUPPLY DURING 1st YEAR OF WARRANTY PERIOD

All spares, consumables, lubricants, lubricating oil, coolant, sealant etc. required for carrying out the maintenance of the complete compressor package during the warranty period, including periodic, breakdown maintenance for continuous and uninterrupted operation of the compressor packages shall be in scope of the Bidder and shall be kept in stock. Bidder to quote unit rate of consumables & spares required during maintenance in warranty period separately. Rates of consumables and spares shall be freezed during warranty period. Payment shall be made based on actual consumption of consumables and spares consumed exclusively during the warranty period. If any equipment got fire or broken due to accident the same shall be replaced or rectified by the bidder. Electricity shall be supplied free of cost to the Bidder. If any breakdown occurs during warranty period in compressor that shall be rectified/replacedby the bidder without any charges.

3.5.2 SCOPE OF SUPPLY DURING FIVE YEARS POST WARRANTY PERIOD:

All spares required for carrying out the maintenance of the complete compressor package including major overhauling of compressor & Electric motor during the post warranty period of further 5 years, including periodic, breakdown maintenance for

Continuous and uninterrupted operation of the compressor packages shall be in scope of the Bidder and shall be kept in stock. If any equipment got fire or broken due to

Accident the same shall be replaced or rectified by the bidder. Electricity shall be supplied free of cost to the Bidder.

3.5.3 SCOPE OF SERVICES:

- The Bidder shall have to keep all the spares, consumables, lubricants, coolant, etc. required for carrying out periodic, breakdown, emergency maintenance etc. of the package so as to minimize the down time of the compressor. Non-availability of compressor package on account of non-availability of spares shall be liable for compensation.

- All tools, tackles and fixtures required for carrying out the above maintenance of the compressor shall be in scope of the Bidder. The scope will also include handling equipment like crane, forklift, chain pulley block, etc. required during the any maintenance activity.

- Any expert services required from principal company or OEM shall be arranged by the bidder or his agent at his own cost. All arrangements like phone, fax, computer, Internet etc. required for correspondence with above personnel shall be arranged by the Bidder.

- The periodic maintenance required to be done as per OEM recommendation shall be taken up promptly. The Bidder shall provide the detailed preventative maintenance schedule along with

a) Estimated down time required for each type of maintenance schedule.

b) List of spares and their quantities required for each type of maintenance schedule per compressor.

c) Type and number of man days required for each type of maintenance schedule per compressor.

- The bidder shall plan such maintenance during non-peak hours and in consultation with the Engineer in Charge (EIC) of CUGL. Any maintenance that needs to be taken up shall be well planned in advance with due approval of the EIC.

- The Bidder shall use only OEM's certified spares during maintenance. In case, the schedule maintenance of the OEM manual recommends checking and replacing parts like valve spring, valve plates, piston rings etc. after certain time interval, same shall be replaced or used further only on approval from the CUGL representative. However, any untoward consequences for non-replacement of such parts shall be the responsibility of the Bidder.

- All routine and periodic checks / inspections required to be done as per OEM recommendation shall be done by the Bidder. Instruments required for above inspection like Vernier caliper, micrometer screw gauge, fill gauges, bore gauge etc. shall be in scope of the Bidder and these instruments shall be calibrated every year.

- All parts replaced by the Bidder during the above contract period shall be properly packed and handed over to CUGL, on replacement.

- The bidder shall submit a copy of the daily / weekly / fortnightly / monthly / bimonthly / quarterly and yearly performance report to the EIC in both soft and hard form. All stationery including the printed material shall be in scope of the Bidder.

- The entire maintenance / inspection job carried out by the Bidder and shall be recorded. The report of the same shall be jointly signed by CUGL representative.

- The EIC will be final authority to take decision with regards to maintenance or replacement of parts or any disagreement between the Bidder and CUGL, during the execution of the contract.

- The Bidder shall carry out calibration of gas detectors and flame detectors every six months or earlier as per requirement or instruction of EIC of CUGL. Also yearly calibration of all instruments such as pressure gauges, transmitters, switches, mass flow meters etc. shall be in the scope of the Bidder. In addition to the above all safety relief valves shall also be tested and calibrated every year.

- Calibration shall be done from government-approved laboratories and shall be carried out at least 15 days prior to the calibration due date.

- The Bidder shall keep 1 set of safety relief valves in spare for the purpose of calibration for total MR quantity of compressor packages.

- The Bidder shall carry out retesting of pressure vessels periodically as per Gas Cylinder rules 2016 or Static & Mobile Pressure Vessels Rules. The periodic

maintenance required to be done as per OEM recommendation shall be taken up promptly. The Bidder shall plan such maintenances during non-peak hours and in consultancy with the Engineer in Charge (EIC) of CUGL. Any maintenance that needs to be taken up shall be well planned in advance with due approval of the EIC. The scope shall include preparation of maintenance schedule for carrying out the maintenance during the contract period.

- In case, the schedule maintenance of the OEM manual recommends checking and replacing parts like valve spring, valve plates, piston rings etc. after certain time interval, same shall replace in the presence of PURCHASER representative. If top overhauling and major overhauling of the compressor and prime mover is required as per compressor and prime mover manufacturer's O&M manual recommendation, the same shall be in supplier's scope.

- Insurance of free issue items up to 15 days beyond commercial operation or two months from the date of supply of equipment at site whichever comes earlier will be in the scope of supplier. The risks that are to be covered under the insurance shall include, but not be limited to the loss or damage in handling, transit, theft, pilferage, riot, civil commotion, weather conditions, Accidents of all kinds, fire, war risk etc. After that the purchaser will arrange insurance for fire, war, earthquake, civil commotion, riots and flood. Any other risk over and above will be in the scope of supplier.

4.0 EXCLUSIONS

The following are excluded from the scope of the bidder:

- All civil works and foundation design. However, the Bidder shall furnish all the relevant data for design of pedestal/ foundation. Grouting of equipment on the foundation including supply of material with foundation bolts (if required for bidder ′ s design) is a part of erection and is included in the scope of bidder's work.

- All piping beyond battery limits except from air compressor & air piping for air and piping from CO2 cylinders up to the enclosure.

5.0 UTILITIES & BATTERY LIMITS

5.1.1 UTILITIES

Two Number Tapping from air receiver supplied along with the air compressor package and dryer shall be provided as follows:

a) For dispenser: One tapping with isolation valve from air receiver.

b) For compressor: One tapping with isolation valve from air receivers along with all tubing for the instrument.

Cooling water is not available as utility and the package shall be provided with self-sufficient cooling water system for Compressor, as required, with makeup tank. However, cooling water for makeup tank is available. All the electrical equipment in this system shall be suitable for area classification of Hazardous area CLASS-1,DIVISION-1, GROUP-D as per NEC.

Any auxiliary motor above 10 HP shall be provided with star delta/ soft starter (three phase controlled) type starter. Single phase motor will be not acceptable above 1 HP rating.

All electrical and instrumentation terminals shall be as specified.

Electric power shall be made available by Client.

For running the compressor and illumination 415 Volt (±10 %) 3-phases 3 Wire, 50 Hz (±5%) shall be provided to starter panel to feed the compressor motor. Bidder shall indicate power/ Feeder (KW/Amp) requirement in the offer.

Bidder shall provide UPS (240 ±1 % V, 50 ±1 % Hz) for LCP. Bidder shall indicate power/ feeder (KW/Amp) requirement in the offer. Bidder to make arrangement for conditioning of power supply beyond above limit.

5.1.2 BATTERY LIMITS

All customer interface connections, gas Inlet shall be brought out to the package edge and terminated with ¾ "OD SS-Tube OR Main gas inlet nozzle size at package battery limit shall be 2"-300# WNRF, and piping between PRS skid and package will be in customer scope.

As and where specified on the data sheets all vents (i.e. Relief valve, distance piece and packing) shall be Mani folded and terminated at skid edge outside the enclosure and vented to safe height of 2.5 m at package roof with proper support.

All drains from different process equipment, distance piece and packing shall be Mani folded and terminated as single point for customer interface with isolation valve.

UPS and Non-UPS power shall be made available from power distribution board (PDB) in the electrical room. Supply, Erection and termination of all cables and accessories from feeder in electrical room (50 mtrs distance to be considered) shall be in the bidder's scope.

Electrical earth pit shall be made available at a distance of about 5 Mtr. from compressor package. Electrical earthing Cable from this earth pit shall be in the bidder's scope shall be terminated to dedicated earth provided in the panel through proper size of glands. Owner's earthing main ring shall be made available at compressor foundation for equipment earthing. Electrical earthing for motor shall be done through Cable and the body earthing to be done through GI strip of 25 x 3 inside the compressor package shall be in the bidder's scope.

6.0 AS-BUILT DOCUMENTS

On successful completion of hydrostatic testing, the Bidder shall prepare As Built drawings & reports of entire motor driven CNG composite dispensing unit package as specified in scope of work. All "As Built" drawings / reports shall be submitted as below.

Four sets of hard copies / soft copy in pdf documents of following shall be submitted by Bidder. All documents shall be bounder together:

(i) As-built drawing of Compressor package GAD / Fabrication Drawing / P&ID etc.

(ii) Test Reports/Results/Records

In addition, the above documents shall also be submitted in either hard copy or soft copy (pdf) formats. Software used for the presentation of these documents shall be as follows:

Type of document Software

a) Test Reports/Results/Records MS Word/Excel (MS Office 2000).

b) Drawings AutoCAD / 3-D Solid works.

For the purpose of preparation of as-built drawings, Bidder shall update the "Issued for Construction" (IFC) drawings approved by the Company.

7.0 BIDDER'S RESPONSIBILITIES

Bidder's responsibilities, besides the scope of work for supply to be performed by him defined earlier, shall also include the following:

A) Interpretation and verification of data/information furnished by company. Any additional information/data/surveys etc. Required by bidder for detailed engineering shall be obtained by him. Company may assist him in obtaining such information/ data by issuing recommendatory letters etc.

B) Entire engineering for procurement & fabrication, including drawings, qa/qc procedures, etc. Performed by the bidder for the compressor package system shall be reviewed and approved by company. All works shall be executed based on approved documents only.

C) Review and approval of bidder's documents by company shall in no way relieve the bidder from his sole responsibility for safe and efficient design, engineering, supply and subsequent smooth operation of the system.

D) Bidder shall depute independent third-party inspector from list of recommended TPIA (attached with this tender) for carrying out all necessary inspections and review of test results/reports etc.

E) Pre-commissioning/ commissioning assistance of entire compressor package.

F) Bidder shall carry out all testing and inspection of materials, equipment etc. Through independent testing institutions, laboratories, if so desired by company.

G) Any other work not specifically listed above but is required for successful completion of entire system.

8.0 CHECKLIST: SCOPE OF SUPPLY

Bidder shall furnish all equipment, drivers, auxiliary systems, instruments, and controls and safety devices as per the enquiry document. Anything required over and above what is specified, for safe and satisfactory operations of the equipment package shall be included by the Bidder in his scope.

Bidder to write 'YES' or 'NO' against each item. Bidder is required to include complete scope, as such 'NO' is not warranted. However, in case for any of the items if Vendor's reply is 'NO', Vendor should give reason for the same.

Bidder's scope of supply shall include but not be limited to the following:

S.NO	Description	Specified by Purchaser (YES/NO)	Included by Bidder (as annexure/ page)	Remarks
1	Each compressor package shall be complete with:			
1.1	Suction / discharge pulsation dampers/Volume bottles	Yes		
1.2	Process equipment such as separator complete with supports, drain system for separators	Yes		
1.3	Air cooled, lube oil, cooling water, inter-stage and discharge gas coolers with necessary air cooling arrangement	Yes		
1.4	Combined or separate closed circuit cooling water system for compressor (As required)	Yes		
1.5	Lubricating oil system for compressor	Yes		
1.6	Safety relief valves on each stage of the compressor	Yes		
1.7	All interconnecting oil, gas, water, air piping within the compressor package	Yes		
1.8	All valves, tubing, fittings as specified and required within the compressor package	Yes		
1.9	Common skid for compressor and other auxiliary systems	Yes		
1.10	Acoustic enclosures for compressor for noise attenuation up to 75 dBA @ 1 m distance fitted with fire detection and extinguishing system as specified	Yes		
1.11	Instrumentation and control system complete with PLC based control panel configured as RTU of supervisory computer and data acquisition, instrumentation as Specified.	Yes		
1.12	Cabling with cable trays for all the electrical devices within the package.	Yes		
1.13	Mass flow meter with integral display	Yes		
1.14	Inlet Pressure Regulators (Compressor Suction)	Yes		
1.15	Priority Panel(as specified) at Package Discharge	Yes		

1.16	Compressor gas inlet strainer, permanent twin inlet filter.	Yes		
1.17	Y-type strainers/paper filter, valves, sight flow indicators, check valves, auto drain traps as required for various compressor auxiliary systems, i.e. frame lubrication system, cylinder lubrication, cooling water systems etc.	Yes		
1.18	Manual package isolating valves and auto inlet isolation valve	Yes		
1.19	All couplings and guards	Yes		
1.20	Flywheels, barring device	Yes		
1.21	CO2 Cylinders, fire and gas detection System including CO2 flooding system.	Yes		
1.22	1.5 KW Air Compressor and dryer including air receiver. (If required)	Yes		
2.0	Erection and commissioning spares as recommended by Bidder including lube oil consumables etc. as required For erection & commissioning of each compressor package.	Yes		
2.1	Comprehensive maintenance Contract of each package during warrantee period by the Bidder	Yes		
2.2	Comprehensive maintenance Contract of each package for 1st year (post warrantee) by the Bidder	Yes		
2.3	Comprehensive maintenance Contract of each package for 2nd year (post warrantee) by the Bidder	Yes		
2.4	Comprehensive maintenance Contract of each package for 3rd year (post warrantee) by the Bidder	Yes		
2.5	Comprehensive maintenance Contract of each package for 4th year (post warrantee) by the Bidder	Yes		
2.6	Comprehensive maintenance Contract of each package for 5th year (post warrantee) by the Bidder	Yes		
2.7	Special tools and tackles required for normal operation & maintenance of each equipment of compressor package as required and recommended by the Bidder	Yes		
2.8	Inspection and Testing	Yes		
2.9	As specified on the datasheets and tech. Spec.	Yes		
3.0	Vendor data and drawings	Yes		

	All data & drawings as required per VDR format	Yes		
4.0	Erection, commissioning of the complete package	Yes		
4.1	Miscellaneous			
5	Foundation and anchor bolts	Yes		
6	Acoustical and mechanical analysis report & pulsation study **(approach-3)**	NO		
6.1	Additional items not specified by Purchaser but recommended by Bidder for safe smooth and normal operation. (Bidder shall indicate separate list of such items in his proposal)	Yes		
6.2	Data sheet of compressor, Electric motor, electric motor LEL and UV Detection system duly filled.	Yes		
6.3	Combined Speed-Torque Characteristic curve of Electric motor and Compressor at rated inlet Pressure.	yes		
6.5	Electrical Load summary	Yes		
6.6	Catalogues of electric motor, flame proof equipment and Instrumentation	Yes		
6.7	Power required from UPS Supply (230 V AC Single Phase	Yes		
6.8	Power required from Non UPS Supply (415V TPN)	Yes		
7.0	operations of each package	Yes		
7.1	operations of each package for 01st year during warrantee period by the Bidder	Yes		
7.2	operations of each package for 02nd year after warrantee period by the Bidder	Yes		
7.3	operations of each package for 03rd year after warrantee period by the Bidder	Yes		
7.4	operations of each package for 04th year after warrantee period by the Bidder	Yes		
7.5	operations of each package for 05th year after warrantee period by the Bidder	Yes		
7.6	operations of each package for 06th year after warrantee period by the Bidder	Yes		

8.0	List containing unit prices of consumables & spares required during warranty period.	Yes		

9.0 GUARANTEED PARAMETERS

a). <u>For basis of loading and penalty:</u>

SUCTION PR 14 KG/CM2 (g); COMPRESSOR CAP. REQUIRED = 250 SCMH

SL NO	DESCRIPTION	By bidder	Unit
1.	Compressor capacity in SCMH at suction pr.14 kg/cm2 (g) disch. Pressure 255 kg/cm2(g) and gas inlet temp 30°C (No -ve tolerance):	250	SCMH
2.	Compressor BKW excluding (motor coolingfan , after cooler and inter cooler fan, lube oil pump, water pump etc. if applicable) at guaranteed condition in Kw (No +ve tolerance)		KWH
3.	Auxiliaries load (motor cooling fan , after cooler and inter cooler fan, lube oil pump, water pump etc. if applicable) in Kw (No +ve tolerance)		KW
4.	Total electric power consumed by compressor package including power absorbed by following auxiliaries along with transmission losses and at guaranteed flow at specified conditions. Lube oil pump motor, Air exchanger fan motor, Cooling water pump motor if required.		KW
5.	Gas loss as % of production, including loss from SRV, due to oil top ups and idling (basis for loading & penalty)		%
6.	Electric power consumed by following auxiliaries shall not be included in the above Electric power consumption figure.		KW
a)	Control panel		KW
b)	Air compressor motor		KW
c)	Exhaust fan motor		KW
d)	Enclosure lighting		KW
7.	Noise level at 1 meter from enclosure (required 75 dBA max)		dBA
8.	Dimensions of compressor package quoted		Length x Width x Height

SUCTION PR 19 KG/CM2 (g): COMPRESSOR CAP. By BIDDER

SL NO	DESCRIPTION	By bidder	Unit
1.	Compressor capacity in SCMH at suction pr.19 kg/cm2(g) disch. Pressure 255 kg/cm2(g) and gas inlet temp 30 °C (No -ve tolerance):	250	SCMH
2.	Compressor BKW excluding (motor coolingfan , after cooler and inter cooler fan, lube oil pump, water pump etc. if applicable) at guaranteed condition in Kw (No +ve tolerance)		KWH
3.	Auxiliaries load (motor cooling fan , after cooler and inter cooler fan, lube oil pump, water pump etc. if applicable) in Kw (No +ve tolerance)		KW
4.	Total electric power consumed by compressor package including power absorbed by following auxiliaries along with transmission losses and at guaranteed flow at specified conditions. Lube oil pump motor, Air exchanger fan motor, Cooling water pump motor if required.		KW
5.	Gas loss as % of production, includingloss from SRV, due to oil top ups and idling (basis for loading & penalty)		%
6.	Electric power consumed by following auxiliaries shall not be included in the above electric power consumption figure.		KW
a)	Control panel		KW
b)	Air compressor motor		KW
c)	Exhaust fan motor		KW
d)	Enclosure lighting		KW
7.	Noise level at 1 meter from enclosure (required 75 dBA max)		dBA

Notes:

- Bidder to quote in the Unit as asked for in the above table.
- Bidder has to fill all the rows in above table. If any row is not filled by bidder or above tables are modified in any manner, bid will be rejected summarily.
- Conversion factor for Kg to SCM is 1 kg = 1.44 SCM
- Bidder has to guarantee that offered compressor package will deliver minimum 250 SCMH under the condition described above. Deliver less than 250 SCMH is not acceptable and will be summarily rejected.

TECHNICAL SPECIFICATION – 400 & 250 SCMHMOTOR DRIVEN CNG COMPOSITE DISPENSING UNIT PACKAGE		
	Total Sheets	37

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

TABLE OF CONTENTS

1.0 SCOPE

This specification along with applicable codes as referred describe the minimum requirements for Design, engineering, manufacturing, inspection, testing, packaging, supply, erection & commissioning including Field Performance Test at site along with operations (six years) and CAMC in warrantee period andFive year Comprehensive Annual Maintenance Contract (CAMC) psot 01 year warrantee period of **"250 SCMH MOTOR DRIVEN CNG COMPOSITE DISPENSING UNIT PACKAGE "** as required for dispensing CNG to vehicles at geographical area of Kanpur, Unnao, Bareilly and Jhansi.

The packages ordered on one packager shall be identical in all technical aspects. Various parts of this specification shall be read in conjunction with each other and in case where the different parts of this specification differ the more stringent requirement shall govern.

Any additional work/equipment or technical requirement not mentioned in the specification but required to make the offered system complete in accordance with the specification or required for safe operation, shall be deemed to be included in the offer and provided by the bidder, without any additional payment.

Bidder shall be responsible for supply, erection, commissioning, and field trial run. Noise level test and performance test of all packages at sites.

2.0 CODES & STANDARDS

The design, construction, manufacture, supply, testing and other general requirements of the compressor package equipment shall be strictly in accordance with the data sheets, applicable API Codes, and shall comply fully with relevant National/ International standards.

Any modification suggested by the statutory bodies either during drawing approval or during inspection, if any shall be carried out by the bidder without any additional cost and delivery implications.

The following codes and standards (Latest versions/revisions valid on the date of order) are referenced to & made part of specification:

API-11P (Second edition), ISO 13631-2002, TRUNK PISTON

API -618

Gas Cylinder Rule 2016

CCOE (PESO)

IS- 3224

IS 7285 (Part 2)

Indian Explosive rules

NZS-5425

ATEX

OIML R-139

IAS NGV 4.2.CSA12.52, NGV 4.1, NGV 4.4, NGV 4.6 AND AGA

Indian electricity rules, Indian Explosive act, IS 2825 code. ASME code section IX

ASME B 31.3-Process Piping

NFPA-37, OISD 179:2016, NFPA-52: 2016

NFPA-12:2015, IS: 6382, Gas Cylinder Rule: 2016

IS: 5571, IS: 5572, IS: 5580, IS-325/IEC or EQV for electric motor.

ANSI, ASTM, NEC, NEMA

Indian Electricity Rules, Indian Explosives Act,

ASME Section VIII DIV. -1 – Design code for unfired pressure

vessel. PNGRB regulations

API 661:-Design code for Air cooled Heat Exchanger

(Latest applicable codes and standards shall be referred)

2.1 Precedence

In case of any conflict among the various documents of this requisition the following preferential order shall govern:

1. Data sheets/Approved drawings
2. Technical Specification
3. International standards/codes as applicable
4. Indian Standards / codes applicable

Compliance with these specifications shall not relieve the bidder of the responsibility of furnishing equipment and accessories of proper design, material and workmanship to meet the specified operating conditions.

No deviations to the technical requirements and to the scope of supply specified in this enquiry document shall be accepted and offers not in compliance to the same shall be rejected. In case a deviation is required due to inherent design of the equipment offered, the bidder shall list all such deviations at one place giving reasons thereon.

2.2 Safety

- All controls shall operate in a fail-safe mode i.e. failure of any control shall not lead to running of equipment in unsafe mode. Fail safe control shall be available through both software and hardware for all trips.

- **Area Classification:** The hazardous area classification Class-I, Division I, Group D as per NEC or Zone I, Group II A/ II B as per IS/ IEC. Certificate from recognized agency to the effect that equipment supplied and/or installed conform to above area classification. All Devices shall meet the requirement for the specified area classification in which they are installed, including instrumentation leads.

- All exposed rotating parts shall be provided with adequate guards of non-sparking type.

- Driver belt if used shall be of anti-static and fire-resistant type.

- Piping shall be arranged in a manner so as to provide clear headroom and accessibility within the package. Adequate clearances shall be provided for all the engineered components.

- Each package ENCLOSURE shall have at least 01 no. L.E.L detectors (IR Type) and at least 01 no. Ultra Violet (UV) fire detectors to cover the enclosure effectively as already spelt in the scope of supply.

- All material used in the package shall be flame retardant.

- The Compressor Package shall trip if any of the enclosures is opened while the machine is running.

- Relief Valves shall be provided at suction and discharge and in between inter stages of compressor with setting as per cl. 11.18.5 of ISO 13631:2002 with R.V. venting as per cl. 11.18.6 of ISO 13631:2002. All vented lines to be connected to common relief valve

header.

2.2.1 CO2 Flooding System:

The package shall be protected with fire by automatically operated CO2 flooding system designed as per NFPA-12 which should have minimum following features: -

1. Gas Detection by installation of hydrocarbon gas detector (IR type) with self-check function and transmitter with adjustable alarm levels (0-100%) with preset of 10%, 20%and 50%. Each enclosure should have at least 2 nos. gas detectors.

2. Installation of flame detector (UV-IR type) with self-check function and transmitter, alarm on detection of flame. Each enclosure should have at least 01 nos. flame detectors.

3. CO_2 flooding system will consist of 2 nos. of adequately sized CO_2 cylinders. One cylinder will act as main cylinder & other as stand by, which shall have identical arrangement and connected to the system. The cylinders shall be placed in a shed to protect from weather and direct sunrays as per Gas Cylinder Rules, 2016. Cylinders shall be fitted with automatic actuated Valves, Solenoid valves etc. No extra utility as air, inert Gas shall be made available by client/used by the supplier to operate the system other than the UPS.

4. The System shall be designed to operate on 24 V DC supply. FRLS (Fire resistant low smoke) cables shall be used for the wiring of the system.

5. Interlock of CO_2 Flooding system with compressor as per following sequence: -

   i. Compressor shall trip on detection of gas at preset level.

   ii. Compressor shall trip on detection of flame at preset level and automatic discharge of CO2 gas shall take place from the main cylinder simultaneously.

   iii. Compressor shall not start if the CO_2 Flooding System is faulty, not working, Switched OFF etc. The compressor shall be able to start only when the CO2 Flooding System is in healthy working condition.

   iv. On detection of flame by any of the flame detector, the solenoid valve of selected cylinder will open and CO2 will be flooded into the package.

   v. At that time, pressure switch will open (NO) because of pressure in CO2 header. If the selected cylinder is empty, then pressure switch will operate (NC) and PLC will give signal to open solenoid valve of other cylinder, if flame is detected by flame detector.

   vi. Even after discharge of selected cylinder, if flame remains detected by flame detector, other cylinder can also be operated after 20 sec (Settable from display) from the time of selected cylinder valve energized irrespective of pressure switch signal.

   vii. The limit switch provided on the weighing machine will be connected to PLC to indicate that the CO2 cylinders are full. Both are start permissive for compressor, i.e. if any of the cylinders is empty as sensed by limit switch, compressor will not start. If the operator wants to run the package even if one of the cylinders is empty, the compressor can be run by putting Limit Switch in By-Pass mode for obtaining start permissive.

   viii. When maintenance override switch put in By-Pass mode to keep the system off during maintenance, CO2 Solenoid valve shouldn't operate, even on detection of flame by any of the flame detector.

   ix. Selector switch shall be provided to put Main/Stand by Cylinder in line at the turn of a switch as per requirement.

6. Alarm panel for CO2 Flooding System shall be integral with the main compressor panel. Necessary displays as system ON, OFF, FAULT, RESET, Gas/ Flame indication, Remote actuation of solenoid valve, distinguished hooter etc., shall be provided for CO2 flooding system.

7. CO2 Cylinders shall be provided outside the package at a safe place, minimum 4.5 meters away (aerial distance), where it is not exposed to fire in case of fire in the compressor. Facility shall be made to operate the system both manually from remote with the help of a switch/ call point and with help of pull down lever on cylinders.

8. Vendor shall provide suitable weighing arrangement to facilitate weighing of the cylinders without requiring the cylinders to be detached from the installation. For this lever operated lifting arrangements shall be made.

9. All installation shall be compatible for hazardous area Class 1, Division 1, Group-D for Methane Gas.

10. The system designed by the supplier shall be duly approved by Client/PMC.

11. Technical specifications, Operation and Maintenance Manual, CCOE Certificate, Approval/ Manufacturing certificates for cylinders and cylinder valves, gas detectors, flame detectors, solenoid valves etc. shall be furnished by the supplier along with system. Software and hardware, calibration procedure shall be provided by the supplier along With the supply sufficient enough to handle the system independently. Necessary tools (1 set per package) shall be provided with the system.

12. System shall be offered for testing to Client. By the supplier after commissioning at site by creating actual Gas leak and Gas fire situations and actual discharge of CO2 Gas from the Cylinders. This shall form a part of performance test and thereby acceptance of the package. The cylinders have to be refilled by the vendor at no extra cost to Client after performance test. If the system fails during testing, subsequent testing and refilling would be at vendor's cost.

13. Warning and Operating instructions to be displayed at equipment as per the statutory/ safety regulations.

14. The CO2 system shall be designed to operate on UPS in the event of power failure to handle emergency situations.

System components:

a. CO_2 cylinder (with Protection Cap):

(i) Make : EKC / RAMA/ MARUTI / EUROTECH
(ii) Type : High Pressure Seamless Brand New Rechargeable type CO_2 Cylinder.
(iii) Water Capacity : 68 Liters/each.
(iv) CO2 Capacity : 45 Kg.
(v) Standard : IS-7285.
(vi) Test Pressure : 250 Kg/cm2.
(vii) Working Pressure : 150 Kg/cm2 at 45 deg C
(viii) Inlet Threads : compatible with cylinder thread-IS 3224:2002, Type 4, Size 2, 25.4mm
(ix) Approval : BIS & PESO (CCEO).
(x) Quantity : 02 No./ CO_2 flooding system

b. CO_2 Master valve (Electro-Pneumatic + Manual operated):

(i) Make :VTI Make Master Valve for CO2 application
(ii) Model No :K85-41.1
(iii) Valve Body :High Tensile Brass Forging
(iv) Sealing Tip :PTFE/VITON

(v) Test Pressure :155 kg/cm^2
(vi) Working Pressure:105 kg/cm^2
(vii) Outlet Threads :7/8" UNF thread male & with suitable adapter for hose connect.
(viii) Inlet Threads :Compatible with cylinder thread-IS 3224:2002, Type 4, Size 2, 25.4mm (no adapter fitting between cylinder and valve)
(ix) Safety Device : Fitted with safety disc. With burst pressure 200-220 kg/cm^2
(x) Quantity :01 No./ Cylinder

c. Solenoid valve with coil:

(i) Make : VTI make SOV for CO2 Master Valve
(ii) Model No : K85-41.2
(iii) Operating Pressure : 0-100 bar
(iv) Coil Enclosure : Flameproof, Gr.IIA & IIB, Zone- 1
(v) Coil voltage : 24VDC
(vi) Double compression gland ½" NPT male3. Solenoid valve with coil
(vii) Quantity :01 No./ Cylinder

d. Flexible Hose

(i) Make : Parker/Swagelok/Eaton
(ii) Internal dia. : ½" ID
(iii) Length : 1 mtr.
(iv) End connection : Swivel type at both ends.
(v) End connection material : CS (coated to prevent rusting)
(vi) Working pressure : 77bar
(vii) Medium : CO2 gas
(viii) Hose material : Hydraulic, EN 853 1SN/ SAE 100R1AT
(ix) Temperature range : -40 to 85 deg. C
(x) Test Pressure :1.5 times working pressure
(xi) Quantity : 01 No./ Cylinder

e. SS 316 Tubing & Isolation Valve:

(i) ½" OD SS 316L tube (Sandvik or FAE make only) for CO_2 flooding
(ii) Operating Pressure: 70 bar (CO_2 Gas)

f. CO_2 Nozzle:

(i) Type : Cone
(ii) Material : Brass Nickel Coating - Inside
(iii) Casting : LM 6- Aluminum
(iv) Minimum 2 nos. of Nozzles.

g. Isolation Valve:

(i) Size : ½" OD –SS 316 L
(ii) Quantity : 1 no./ compressor (Make: Parker/ Swagelok)

h. CO2 Weighting System:

I. Weighing Gauge:
a. Dial Size : 6" Circular (Round) dial with zero adjustment provision
b. Material of construction: Mild steel or Die-cast Aluminum with red or black colour powder painted
c. Range /Capacity : 0 - 200 Kg
d. Resolution : 1 Kg
e. Accuracy : +/- 0.5 % of FSD
f. Hooks (Sling): Dual "S" hooks provided on top and bottom.

II. Canopy : Rugged canopy in MS with Epoxy Painting

2.3 Ambient Conditions

Complete compressor package shall be suitable to work under the following climatic conditions:

Wind velocity km/hr. (max.)	160
Amb. Temperature (Min./Max.)	2°C / 50°C
Design Wet Bulb Temp.	27°C
Design Relative Humidity	90%
Altitude, M above MSL	267 meters
Air Cooler design °C	**(42°C+10˚C) DBT**, **27˚C WBT & 90% RH**

3.0 UTILITIES & BATTERY LIMITS

3.1 Utilities

- Bidder shall make his own provision for Instrument air with an electric motor driven 1.5 KW air compressor /air dryer receiver system if required. Air dryer suitable for automatic operation shall be supplied along with all accessories including 500-liter capacity air receiver. The air compressor motor will be kept off the package in safe area. Piping, electrical & instrumentation cabling shall be in bidder's scope.

- Tapping in the air receiver vessel shall be provided with NRV, PRV (set at 7 to 10 kg/cm2 (g)) and isolation valve for CNG dispenser instrumentation line. Air receiver shall be provided with SRV (safety relief valve), pressure gauge and drains. Manual drains and automatic moisture traps/moisture separator cum regulator shall be provided in the system.

- All Airline instrumentation like pressure safety valve, Pressure gauge, drains are provided with isolation valve.

- Cooling water is not available as utility and the package shall be provided with self-sufficient cooling water system for electric motor & Compressor, as required, withmakeup tank.

- All electrical and instrumentation terminals shall be as specified.

3.2 Electric power shall be made available by Client

- For running the compressor and illumination 415 Volt (±10 %) 3-phases 4 Wire, 50 Hz (±5%) shall be provided by Owner at a single point (feeder in PDB) inside the electrical room. Bidder shall indicate power / Feeder (KW/Amp) requirement in the offer.

- Bidder shall provide UPS (230 ±1 % V, 50 ±1 % Hz) for control supply requirements at a single point (feeder in UPS ACDB) inside the electrical room. Bidder shall indicate power/ feeder (KW/Amp) requirement in the offer. Surge protection devices shall be provided for all incoming supply to Bidder's end.

- Purchaser shall provide station overall Earthing system along with Earthing network.

3.3 Battery limits

3.3.1 Online Operation

- As and where specified on the data sheets all vents (i.e. Relief valve, distance piece,

packing and starting air) shall be manifold and terminated at skid edge outside the enclosure and vented to safe height at package roof.

- All drains from different process equipment, distance piece and packing shall be manifold and terminated as single point for customer interface with isolation valve. Drains should be through a common header and discharge to be allowed in a pit to avoid spillage around compressor package.

- UPS and Non UPS power shall be made available from power distribution board (PDB) in the electrical room. Supply, Erection and termination of all cables and accessories from feeder in electrical room shall be in the bidder's scope.

- Electronics earth pit shall be made available at a distance of about 5 Mtr. from compressor package. Cable from this earth pit shall be in the bidder's scope. Owner's Earthing main ring shall be made available at compressor foundation. Cable to control panel body earth inside the compressor package shall be in the bidder's scope.

4.0 BASIC DESIGN

4.1 General

- The Compressor shall meet all the technical requirements as specified in:

i. Data Sheets

ii. Technical Specification

iii. Code and specification API-11P, TRUNK PISTON, ISO 13631-2002, OISD 179, NFPA 37, NFPA 52, ANSI, ASTM, NEC, NEMA, Indian Electricity Rules and Indian Explosives Act are referenced to & made part of specification.

- Compressor and auxiliaries design shall be in conformity with API 11P, second edition/ ISO 13631-2002, TRUNK PISTON.

- All the other applicable codes shall be as per the list mentioned before at Point 2.0- Codes and Standards

- Minimum Three Stage Compressor configuration is envisaged. Gas composition given under Design Case shall be used for Compressor selection, sizing and performance guarantee estimates. However, compressor shall be suitable for continuous operation with the indicated gas composition range and operating parameters given in the data sheet.

- Suction line pressure may vary from 14 kg/cm2G to 19 kg/cm2G with discharge pressure remaining constant at 255 kg/cm2G. A suction pressure regulator shall be installed by purchaser to limit the suction pressure to 19 kg/cm2G. The suction pressure of 16 kg/cm2G shall be used for compressor sizing/selection.

- Bidder's offer shall be based on firm and final compressor models/ electric motor model on which basis the offer shall be evaluated. All bidders shall take full cognizance of this matter before submitting the bid.

- Note that the pressures given on the data sheet are at the compressor package battery limits, bidder shall consider all pressure losses at suction, inter stage and discharge at the specified capacity (with no -ve tolerance) for compressor and indicate the same on the data sheets. No venting of the gas is allowed at any point during operation.

- The compressor Driver shall be capable of running the compressor under loaded condition with each stage pressurized to its respective specified pressure and finalpressure up to PSV set pressure.

4.2 Design Basis

The supplier should design compressor to meet the requirement with respect to technical specification and below gas composition and liaise with PMC/Client to obtain necessary confirmation and approval.

GAS COMPOSITION

Component	Normal Gas Composition %	Design Gas Composition %
C1	82.43 – 99.10	89.45
C2	7.27 – 0.90	4.58
C3	3.47 – 0.00	0.83
I C4	0.65 – 0.00	0.07
N C4	0.78 – 0.00	0.06
I C5	0.17 – 0.00	0.09
N C5	0.13 – 0.00	0.28
C6	0.10 – 0.00	0.17
C7	0.00 – 0.00	0.00
CO2	4.93 – 0.00	4.38
N2	0.06 – 0.00	0.10
H20	0.01 – 0.00	0.00
Sum	**100**	**100**
Average CV (Kcal/SCM)	8950 - 8150	8302.3

NOTE: motor driven CNG composite dispensing unit package guaranteed performance shall be estimated for the design gas composition and performance shall be reported for the two extreme gas compositions above.

Both average over life cycle shaft power consumption & gas loss certificate from compressor block manufacturer to be provided.

4.3 Allowable speeds, temperature and vibration levels

- The rotational speed of both compressor & electric motor (driver) shall be limited to maximum of 1500 rpm.
- The linear piston speed shall be limited to 4 m/sec for non-lubricated compressors and 4.5 m/sec for lubricated compressor.
- The maximum discharge gas temperature for each stage shall be limited to 150°C.
- Compressor maximum vibrations of cylinders shall not exceed 10 mm/sec. unfiltered peak velocity. Maximum Vibration level of installed compressor frame shall not exceed an unfiltered peak velocity of 5 mm/sec. or 200-micron unfiltered peak to peak vibration whichever is less. The Bidder shall provide for all structural support within the package so that these levels can be achieved.

4.4 Piston Rod, Bearings and Cross Heads

- The surface hardness of Rockwell C 50 minimum is required on piston rods in the areas that pass through the packing.
- Crosshead shall be as per manufacturer's standard material and designs. Adequate openings for removal of the crossheads shall be provided.
- Piston rod and cross head pin loading at any specified operating condition including the

relief valve set condition shall not exceed 80% of the maximum design rod load of the offered compressor. Rod loads shall have sufficient reversals in direction for all specified operating conditions including PSV Settings and part load operation.

4.5 Packing Cases and Pressure Packing

- All oil wiper intermediate gas cylinder pressure packing shall be segmental rings with stainless steel garter springs. The pressure packing case shall be provided with a commonvent and drain routed outside the package enclosure.
- Seamless steel tubing conforming series 300 SS tubing conforming to ASTM A-269 to minimum thickness as specified in Cl. 7.11 of API-11P shall be used for vent piping.
- Packing vent piping inside of the distance piece shall be designed for the maximum allowable working pressure of the cylinder.

4.6 Compressor Frame Lubrication

- Compressor frame lubrication shall be pressurized system, with main oil pump driven directly by the compressor shaft.
- All lube oil piping after oil filter shall be 300 series stainless steel conforming to ASTM A 269.
- Heating shall be provided for reservoir when the minimum ambient temperature is less than the Bidder's required minimum start up temperature.

4.7 Distance Pieces

- Compressor manufacturer’s standard Type–1 or Type-2 of API 11 P shall be provided as a minimum.

4.8 Cylinder and Packing Lubrication

- Single plunger per point force feed mechanical lubricator or divider block system shall provide lubrication to compressor cylinders.
- Lubricators shall be driven by crankshaft and bidder shall highlight any pre lubrication requirements of the cylinders and the method of achieving the same.
- Lubricators shall have a pin flow indicator for each lubricator point and a stainless steel double ball check valve shall be provided at each lubrication point.
- Digital no flow switch shall be provided to stop the compressor in case of loss of cylinder lubrication in all stages.
- Lubricator reservoir capacity shall be adequate for 50 Hrs. of normal operation, and shall be equipped with low-level alarm.
- Bidder shall furnish along with their bids the details of the recommended Lubricating oil type, International Grades & Specifications along with their quantity and changing frequency/ schedule. The recommended oil shall be compatible with gaskets, ‘O’ rings, seals, packing, lubricating parts and other parts coming into contact.

4.9 Cooling System

- **Compressor Cylinder**
- Compressor cylinders may be air cooled, in case water-cooled cylinders are offered the

bidder shall conceive and design Compressor cylinder cooling water (CW) system. The Cooling Water shall be cooled by an air-cooled heat exchanger.

- **Inter / After Gas Coolers**

- Air-cooled inter-stage and final stage discharge coolers shall be provided which shall limit the gas temperature after the after cooler limited to **52 °C**. For Design calculating the surface area of the air cooler, the Max. Ambient air temperature shall be consider ($42^{\circ}C+10^{\circ}C=52^{\circ}C$) and 80% RH shall be considered. Cooler design shall be on the basis of 20% excess capacity than required corresponding to suction pr. of 19 kg/cm2 (g).

- Gas sections of coolers shall be designed as per API-661 or ASME section VIII requirements or Equivalent Design code requirements. Vibration switch shall be provided on the heat exchanger to trip the compressor on high vibration limit. Bidder shall indicate vibration level in the offer. For cooling of the Heat Exchangers a cooling fan to be provided inside the enclosure(s). Cooling system shall be preferably installed on the same skid as the compressor due to space constraints. Bidder shall submit cooler sizing calculation for review / records.

4.10 Separators & Oil Removal System

- Carbon Steel separators / KOD/volume bottles with auto drain system shall be provided for the capacity as required.

- All pressure vessels shall be designed as per ASME VIII Div. 1 or Equivalent standard practice.

- The offered scrubber and mist removal shall restrict the oil level to < 5 ppm in the final discharge gas of compressor and the equipment shall be designed accordingly.

- All Separator/KOD/Volume bottle during design stage vendor shall taking consideration of fluid volumetric capacity, flow rate, Max. & Min. Operating temperature, Design Temperature, Max. & Min. Design pressure of process fluid as per Codes & standard practice.

- Gas Recovery System: Bidder shall provide blow-down tank to act as a buffer tank during start-up.

  i. Gas flow dampener during compressor operation

  ii. Surge tank for depressurization of each of the compressor stage piston cylinders during shutdown.

  iii. Blow-down tank size should be to manufacturer's design standards. The gas recovery vessel shall be provided with pressure relief valve and necessary instrumentation to avoid cold flaring of gas.

  iv. Capacity shall be suitable to prevent any venting.

  v. Suction damper and gas recovery vessel shall preferably not be combined and one pressure regulator with isolation valve shall be provided to connect gas recovery vessel with compressor suction.

  vi. If suction damper and gas recovery vessel are combined, pressure regulator after gas recovery vessel will not be allowed due to high pressure drop during compressor operation.

  vii. One vent line from gas recovery vessel with double isolation valves shall be provided

- All separators / KOD's shall be provided with 3 mm corrosion allowance.

- Oil from all drains shall be collected into the oil recovery pot. Oil recovery pot shall be provided with manual drain arrangement. The OEM shall design & sized the Oil recovery pot accordingly.

- Coalescent super fine filters (preferably two stage) with CE mark/ Third party certification for removal of liquid (e.g. water & oil) and solid particles down to 0.1 microns out of compressed natural gas shall be provided. Residual Oil Contents shall be less than 1 PPM. Automatic drains with On-off valve connected to Gas recovery vessel shall be provided. The filter should be sized to flow min. 200% of the flow at suction pressure of 19 kg/cm2g. However mechanical design shall be based on safety set pressure.

4.11 Pulsation, Vibration Control and Analog Study

- The design of pulsation suppressing devices shall be based on the acoustic and mechanical evaluation carried out as per API 618 & API 11P design approach 3.

- These devices must reduce pressure pulsation in piping within ± 3%. These pulsation dampers shall be designed to limit pressure drop to 1%. The minimum acceptable volume of pulsation suppression device shall be 10 times the cylinder swept volume.

- Suitable arrangement for inter stage pulsation damping shall be provided in confirmation to API 618 and API 11P.The bidder has to give compliance report that they have already conducted such type of Pulsation, Vibration Control and Analog Study and offered compressor is safe.

4.12 Coupling

The first preference is for directly coupled driver-compressor arrangement and Power transmission should be preferably thro' flexible coupling. However, a V-Belt driven compressor is also acceptable. In case of belt drive idler pulley must be provided for adjustment of belts.

4.13 Enclosure of CNG Compressor Package

- The maximum allowed temperature within the enclosure shall be 5°C above ambient temperature. Adequate ventilation fans/suitable arrangement shall be provided to meet the above and also to account for heat dissipation of the coolers.

- For handling of all heavy parts inside the package for maintenance purpose suitable lifting provision inside compressor enclosure for use of chain pulley block & hoist arrangements for hoisting & lifting of heavy components to be provided which bidder shall design the system accordingly.

- 1no. each shall be provided for tendered quantity of compressors. Eye bolt arrangement shall be provided on heavier components like electric motor, cylinder crankcase, and wherever felt necessary for lifting during maintenance.

- The bidder shall also provide 1 nos. monkey ladder if required with hand Railing type ladder or slidingtype ladder for safe climbing on the top of the canopy along with hand railing on the top for ease of maintenance and operation. Jack arrangement required for alignment of the motor.

- The compressor package shall consist of single enclosure for Compressor and Electric Motor. The equipment shall be mounted on one common skid. The Enclosure to restrict maximum noise level to 75 dB (A) at 1 meter from the enclosure.

- Enclosures shall be weather proof with manufacturer's compliance to degree of protection equivalent to IP 54 as defined in AS 1939, provided with ventilation system.

- The enclosures shall have doors for normal access and removable wall panels for ease of maintenance. The acoustic material should be fire resistant with fire retardant rating of 30

min. the material used should be UL approved or IS 8183. Necessary documents to be submitted for the material selected.

- The enclosures shall have doors for normal access for ease of maintenance of all the components.

- All the pressure, temperature, lube oil pressure, coolant temperature shall be visible from outside of enclosures though gauge panel.

- All the pressure, temperature, gas flow meter, oil level, lube oil pressure, coolant temperature, coolant level indicators shall be visible from outside of enclosures.

- Enclosure shall have internal flame proof lighting arrangement.

- The Compressor shall be located inside an acoustic enclosure. All Coolers, knock out Drums/Scrubbers/volume bottles, Cooling System, lubrication system along with interconnecting piping shall be inside an enclosure. Enough headroom shall be made available for easy access and maintenance of all equipment.

- Components such as pressure gauges, temperature and pressure switches etc., which require in-situ adjustment and reading, shall be easily accessible.

- Conduits and tubing shall be arranged in orderly and systematic manner and shall be routed neatly to enter the back of display or monitoring panels.

- Routine service item such as, but not limited to, crank case oil filters, inter stage gas filters, inlet and outlets gas filters and drive belt shall be located to facilitate easy one-man servicing.

- One person should be able to access crank case oil inlet and drains to allow addition or drainage of oil without removing panels or adjacent components and without the need of the pump.

- Items which must be operated & monitored during operation shall be readily accessible without opening the door.

- Suitable gradients shall be provided on the enclosure roof for rain drainage and to avoid water pockets

- Communication/Control cables shall be routed through Cable Trays/conduits.

4.14 Piping

- All gas piping shall be designed, fabricated & tested in accordance with ANSI B 31.3.

- All process piping as per ASME B31.3.

- Low pressure Gas piping shall be seamless carbon steel manufacturing in accordance with ASTM A 106 Grade B or ASTM A 312. All Gas piping shall be flanged connections. Pipe wall minimum thickness shall be in accordance with **Table 4 of BS EN ISO 13631:2002.**

- All rigid piping, tubing & other components of compressor package shall be designed for full range of pressure & temp and loading to which they may be subjected with a factor of safety of at least 4 based on minimum specified tensile strength at specified ambient temperature.

- All rigid piping shall be continuous between their respective components & free of connections except welded joints. All high pressure joints shall be welded unless otherwise not feasible.

- The instrument air tubing material shall be Stainless Steel series –316 conforming to ASTM-A269.
- All high-pressure double ferrule fitting & 2/3 way valves shall be from SWAGELOK/ PARKER makes & shall be SS 316 material only.
- Bidder shall furnish a temporary start up conical strainer fitted with adequate size mesh at the gas inlet before the filter.
- All lube oil piping downstream of filter shall be series 300 Stainless Steel.
- Heat exchanger tube material shall be SS 304 / SA 179.
- External drain & vent piping shall be Carbon Steel and not less than 1" nominal size.
- Mercaptan /TBM dosing is envisaged hence all materials coming in contact with gas shall be compatible to such gas with Mercaptan/TBM dosing and be of compressor manufacturer's standard. The use of SA 515 material is prohibited.
- All gas piping after coalescent filter at compressor discharge shall be of SS 316 of Parker/Sandvik /Tubacex and FAE make and hardness less than Rb 80.
- External drain & vent piping shall be Carbon Steel and not less than 1" nominal size. However, all the internal drains shall be SS 316 tube as per ASTM A269. However all the internal drains shall be SS 300 series Material.
- The instrument air header up to compressor enclosure and CO2 piping shall be seamless CS.
- All low pressure and high pressure gas piping joints fabricated at site / shop shall be 100% radiographed after welding.
- All Gas piping 3rd stage final discharge Tubing & fittings shall be SS316 & Low pressure gas piping / tubing shall be Combination of Flanged & screwed connections with seamless CS material (pipes, Fittings & Flanges) as per application requirement & standard design.
- All lube oil piping downstream of filter shall be series 300 Stainless Steel. Pressurized lubricating oil lines downstream of the filter (with the exception of cast-in-frame lines or passages) shall be made of austenitic stainless steel. For either tubing or piping, bends shall be used to minimize the number of fittings wherever possible. Steel fittings shall be furnished with stainless steel tubing. Pressure piping downstream of oil filters shall be free of internal obstructions or pockets (such as those created by socket weld fittings) that could accumulate dirt at pipe joints. Non-consumable back-up rings and sleeve-type joints shall not be used. Other piping fittings shall be of the socket-weld or butt-weld type. When butt welds are necessary, such precautions as internal grinding of joints and use of gas tungsten-arc welding for the first weld pass shall be taken to prevent weld splatter inside the lines. After fabrication, oil lines shall be thoroughly cleaned and preserved. In addition, carbon steel piping shall be pickled and passivated.

- **Design of piping systems shall achieve the following:**
  - Proper support and protection to prevent damage from vibration or from shipment, operation and maintenance;
  - Minimize loads on the nozzles of cylinders and pulsation suppression devices;
  - Avoidance of pipe work bending forces and/or introduction of adequate flexibility to minimize stress;
  - Good accessibility for operation, maintenance and cleaning;
  - Installation in a neat and orderly arrangement adapted to the contour of the machine and not obstructing access openings;
  - Elimination of air pockets;
  - Complete drainage through low points without piping disassembly;
  - Elimination of low points in the inlet process piping including recycle/by-pass piping that could trap liquid;
  - Use of pipe clamps on all gas piping and on all piping DN 50 (2 in) and larger;
  - Supports shall not be welded directly to gas piping.
  - Following certificates have to be submitted for piping fabricated at Site & shop

5.0 CONTROL PHILOSOPHY

5.1 ELECTRICALS & INSTRUMENTATION CONTROL:

5.1.1 Starter/Control Panel/ Control philosophy

5.1.1.1 The compressor package control system shall be designed for unattended operation in automatic mode and in case of any fault it will go in a safe mode.

5.1.1.2 LCP Panel shall be complete with all LCP equipment's like start and stop push buttons, power on and fault indication lamps, fault reset button. All necessary timers and intrinsically safe relays to control the system on an automatic starting and stopping basis shall be provided. The compressor package control system shall be designed for unattended operation in automatic mode and in case of any fault it will go in a safe mode. LCP Shall be suitable for hazardous area classification.

5.1.1.3 PLC shall be suitable for recording of compressor parameters as indicated in instrumentation and all other parameters that are recommended by the compressor manufacturer for recording on hourly basis for the last 24 hours.
The units of measurement for flow shall be Kg/hr, for pressure shall be Kg/cm2 (g) or and for temperature shall be degree C.

5.0.1.1 Compressor Package shall be provided with a PLC based LCP, which shall be mounted on the package enclosure. PLC shall be housed inside flameproof IIA/IIB (Ex'd') enclosure. Local operator panel shall also be provided on the flameproof enclosure. All the interlock, monitoring and controlling of the CNG compressor package shall be done through PLC based control system which will be of proven type and make. PLC hardware shall be in accordance with IEC-61131-2 and PLC programming shall be made only in ladder diagram, however PLC shall be capable to convert programmed in flow chart, functional block diagram, structural text etc in accordance with IEC-61131-3. PLC shall be provided with display & scrolling facilities to view

process & machine parameters. All source & object codes including logic flow chart, ladder diagram etc. is to be furnished by the Packager during detailed engineering. Provision shall be made that the same can be viewed on client's Laptop/ additional laptop to be supplied by the bidder.

5.0.1.2 The PLC System offered shall be supplied with monitor and shall be capable of:

i. Compressor Control & Emergency Shut down
ii. Fire and gas detection and monitoring
iii. Graphics, Data acquisition, monitoring & logging, viewing, modifying set point and range fall process parameters for which transmitters are provided.
iv. Record the last 20 Alarms of abnormal operations on separate page.
v. Viewing process diagram with on line data on line.
vi. Viewing trend of min. 10 critical parameters.
vii. Shall have historical as well as event recording system for at least last 200 events
viii. PLC shall be capable for display of flow meter data for flow rate and flow totalizer (i.e. Gas Suction, Gas Discharge, power consumed by the electric motor), compressor running hour etc. in following manner:
a) Round the clock -shall be available for at least last 96 hours with date stamping
b) Daily basis- shall be available for at least last 31 days with date stamping

The above data will be viewed / analyzed offline (during shut down of compressor) or online through dedicated SCADA port (Ethernet / RS 485) on client's Laptop/ Local PC. Laptop to be supplied by bidder. Necessary software for downloading data and processing as define above shall be provided. 10 Meter cable with suitable adaptor (if required) shall be provided by the Bidder.

5.0.1.3 PLC shall be of modular in construction with single or redundant CPU with EEPROM, redundant interface module, redundant power supply for CPU and HMI, redundant power supply for load, non- redundant I/Os, communication cards for connecting mass flow meter, communication card card/port for future SCADA connectivity. Diagnosis feature shall be available in CPU and I/O used in PLC. Mounting of PLC components such as CPU, HMI, I/Os in one JB and power supply relay barriers/isolators, fuses, MCB, electrical earthling bus bar in other JB. PLC components/ system shall be tropicalized, adopted with complete wiring and necessary terminals. Wiring to be color-coded with cross printed ferruling in position. Mass to volume calculation is not required; however, bidder shall provide a soft tag for entering standard density up to 2 decimal point with the help of external push button in PLC for converting mass flow rate to volume flow rate. PLC shall be configured as a remote terminal unit of supervisory computer and data acquisition system complete with Ethernet Port / RS 485 (MODBUS TCP/IP) shall be readily configurable for communication over MODBUS TCP protocol. All the parameters on the PLC shall be configured to be available for SCADA. Providing necessary support and assistance during integration of the compressor with the SCADA is in Bidder's scope.

PLC shall be capable of carrying out on line routines for at least ten separate loops without affecting the scan, cycle & up dating time etc. PLC programming shall be made only in Ladder Diagram, with comments in English for each Rung.

5.0.1.4 Calibration certificates required for all instruments such as Mass Flow Meter, Pressure transmitters, Pressure gauges, Temperature gauges, Temperature transmitters, Gas detectors, Flame detectors etc. Vendor has to calibrate Pressure & Temperature instruments within 1 month of compressor commissioning or before Performance Guarantee testing.

5.0.1.5 Training to Purchaser team at site - functional & operational with PLC & instrumentation system. Training program and the procedure shall be provided for training at site.

5.0.1.6 The points to be monitored for downstream of priority panel shall be:

i. Pressures in each bank of stationary storage cascades.

ii. Pressure at outlet for dispenser.

iii. Pressure at outlet for mobile cascades.

iv. Control Air Pressure

v. Indicators, Alarms and Trips as per Equipment Data Sheets

vi. Pre alarm to be incorporated in the software before machine trips in predefined values of Pressure & temperatures

5.0.1.7 The compressor package control system shall be so designed that the first item to go into alarm condition shall lock out to indicate the cause of the trip though the cause of the trip may have disappeared. The lock out condition shall be manually reset.

Where three bank cascade has been envisaged; in auto mode, compressor shall start automatically in case high bank storage pressure falls below 220 kg/cm2(g) and stop as soon as pressure in all three banks of stationery cascade and mobile cascade reaches 255 kg/cm2(g). Where only one bank cascade has been envisaged; in auto mode, compressor shall start automatically in case storage pressure falls below 220 kg/cm2(g) and stop as soon as pressure in cascade and mobile cascade reaches 255 kg/cm2(g). In manual mode the compressor shall also stop at 255 kg/cm2 (g) pressure. The priority fill system (In Bidder's scope) shall ensure the filling of vehicle, storage cascade and mobile cascade in correct sequence. Control system shall be designed such that in case of any fault, discrepancy or abnormality, it will go in safe mode.

All controls shall be made in fail-safe mode & failure of any control shall not lead to operation of equipment/ system in unsafe condition. In case of fault, a warning hooter shall operate, the sound of which should be audible at distance of at least 15 meters. Further the fault alarm and emergency stop PB shall be duplicated in the CNG station control room. Acknowledgement/resetting of fault shall be possible only from compressor panel. There shall be red and green indication at top of enclosure to indicate code no of alarm/trip in red color. List of alarm with code no shall be indicated on SS plate and to be fixed atcompressor enclosure. Emergency stop PBs shall be mushroom head turn lockable type. Once the fault is acknowledged or compressor is under normal maintenance, the valves of priority panel shall take the position so that gas available in the stationary CNG storage cascade can be dispensed.

5.0.1.8 **The priority fill systems:** The priority panel shall ensure the filing of vehicle, storage cascades & LCV in correct sequence. The priority fill system shall ensure 200-kg/cm2g pressure in CNG dispenser outlet port. Design of priority fill system shall be aimed to achieve maximum flow rate through combined flow from compressor and cascade arrangement.
All priorities shall be with full bore ball valves having high Cv. Bidder shall indicate flow rate achievable through proposed priority fill system design. All tubing and valves shall be ¾" or ½'' size for 250 SM3/h compressor subject to OEM standard design. One isolation valve at outlet of each line shall be provided. Sheeting work of priority panel shall be SS construction. All the pneumatic tubing for solenoid of priority shall be of SS 316 only.

Nos. of priority panel required shall be as per SOR/MR.

The details for various configuration of priority panel for different type of CNG stations including priority fill panel design to deliver the CNG shall be as follows:

5.1.1.12.1 TYPE –1 FOR MOTHER STATION: 9 LINE:

A: When compressor is running

Priority no. one	:	Car dispenser Low bank
Priority no. two	:	Car dispenser Medium bank
Priority no. three	:	Car dispenser High bank
Priority no. four	:	Bus dispenser (Single bank filling)
Priority no. five	:	High bank of storage cascade
Priority no. six	:	Medium bank of storage cascade

Priority no. seven	:	Low bank of storage cascade
Priority no. eight	:	Bus cascade (Single bank filling)
Priority no. Nine	:	Mobile cascade mounted on Light commercial vehicle (single Bank filling).

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One	:	Low bank of storage cascade
Priority no Two	:	Medium bank of storage cascade
Priority no Three	:	High bank of storage cascade
Priority no Four	:	Bus cascade (Single bank filling)

5.1.1.12.2 TYPE –2 FOR ON LINE STATION: 8 LINE:

A: When compressor is running

Priority no one	:	Car dispenser Low bank
Priority no two	:	Car dispenser Medium bank
Priority no three	:	Car dispenser High bank
Priority no four	:	Bus dispenser (Single bank filling)
Priority no five	:	High bank of storage cascade
Priority no six	:	Medium bank of storage cascade
Priority no seven	:	Low bank of storage cascade
Priority no eight	:	Bus cascade (Single bank filling)

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One	:	Low bank of storage cascade
Priority no Two	:	Medium bank of storage cascade
Priority no Three	:	High bank of storage cascade
Priority no Four	:	Bus cascade (Single bank filling)

5.1.1.12.3 TYPE –3 FOR ON LINE STATION: 6 LINE:

A: When compressor is running

Priority no one	:	Car dispenser Low bank
Priority no two	:	Car dispenser Medium bank
Priority no three	:	Car dispenser High bank
Priority no four	:	High bank of storage cascade
Priority no five	:	Medium bank of storage cascade
Priority no six	:	Low bank of storage cascade

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One	:	Low bank of storage cascade
Priority no Two	:	Medium bank of storage cascade
Priority no Three	:	High bank of storage cascade

5.1.1.12.4 TYPE –4 FOR ON LINE STATION: 7 LINE:

A: When compressor is running

Priority no one	:	Car dispenser Low bank
Priority no two	:	Car dispenser Medium bank
Priority no three	:	Car dispenser High bank
Priority no four	:	Bus dispenser (Single bank filling)
Priority no five	:	High bank of storage cascade
Priority no six	:	Medium bank of storage cascade
Priority no seven	:	Low bank of storage cascade

B: When compressor is not running:

When the compressor is not running, the valves of priority panel shall take the position so that gas available in the stationary car cascade and bus cascade can be dispensed. The priority of dispensing from car cascade shall be as follows;

Priority no One	:	Low bank of storage cascade
Priority no Two	:	Medium bank of storage cascade
Priority no Three	:	High bank of storage cascade

5.1 Human machine interface (HMI)

HMI shall be provided with touch screen and operating system software (**with minimum all the features of operator panel of model MP277B/TP1200 COMFORT min.7" graphic display of Siemens/Schneider)**, software's for interlocking, monitoring and control. All operational buttons shall be on touch screen except the Emergency stop button. Touch screen display system shall be weatherproof to IP65. This should be provided in the flame proof panel with HMI mounted on the door of the panel. The HMI screen shall be backside of the toughened glass. During running of the compressor, the HMI should be assessable through the external push button provided on the panel. The PLC shall be interfaced with SCADA in future. All the parameters on the PLC shall be available on the HMI. Bidder shall provide Application program for PLC, HMI on LCP (licensed one set) along with all interfacing adaptors and cables. Bidder shall also provide one set of source & object codes for PLC, HMI on LCP (in both forms, hard & soft).

5.2 Emergency Shut Down (ESD)

ESD button (3 Nos.) shall be provided (Customer Interface room, locally mounted on package and Panel). A separate hooter for customer interface room shall be provided with annunciation window alarm of individual protection device. Fail-safe system shall be designed and incorporated to isolate cascade storage from dispenser, stop compressor, and isolate the compressor suction and discharge lines. ESD switch shall have to be manually reset to restart the compressor package again. ESD shall activate either on pressing emergency push button (red button) or on fire detection.

In addition to the above, separate ESD push button shall be provided in LCP other than the packaged emergency push button. This push button shall be directly wired with power shut off valve and engine ignition grounding system by passing PLC /engine governing system. On pressing the button, it shall immediately cut off the power supply and ground the ignition system for immediate stop of the machine. A spare contact from the emergency push button shall be connected in PLC to initiate other auxiliaries shut down and indicate alarm as **"hardware emergency push button press".**

5.3 Electric and control panel:

5.4.1 There shall be LCP push button panel available at the compressor skid suitable for hazardous area classification. The switchgear shall have one incomer and adequate number of outgoing feeders.

The incomers shall be provided with suitably rated MCCB/MPCB, indication lamps etc. Adequate number of MCB feeders for control and lighting shall be provided. Bidder shall furnish single line diagram of the panel with the bid.

5.4.2 Push button for fault accept, fault reset, ESD, comp start, comp stop, scroll up, scroll down, enter, increment, decrement, back, hooter test, 3 nos spares shall be provided.

Switch for auto manual selection, CO2 cylinder main /CO2 cylinder standby, 415V AC supply on/off , 230 VAC supply on/off, tube light on/off and 2 nos spares shall be provided. Lamp for 230 VAC on, 24 VDC PLC supply on, ready to start, running & trip and 5 nos spares shall be provided

5.4.3 Electrical Power supply for electrical control panel:

All electrical equipment shall be suitable for the following supply conditions.

i. **Power supply for electrical control panel:** Electrical operating voltage: AC, 3 phases, 415 ± 10%V, 50 ± 5%Hz. Bidder to note that all control electronic / electrics shall be capable of withstanding voltage fluctuation specified.

ii. Power supply for PLC based Control Panel: Electrical control voltage: 230±5 % V, 50 ± % Hz. Control supply through UPS shall be provided by the Bidder.

All auxiliaries and, power contactors in electrical panel etc. shall have operating voltage of 230-volt AC.

5.4.4 List of Documents: (To be provided with each package).

i. **Priority Panel & Air compressors OEM Tests Certificates.**

ii. Instrument Calibration certificates: GD, FD, TG, TT, PT, PG, PS, VS, MFM, PCV+SSV.

iii. SRV, Pressure vessel Test certificates

iv. PLC Program, PLC Display Program (Password Free)

v. Software for communication.

vi. Communication Cable & Adaptor.

vii. Logic Diagram/ Ladder Diagram (Comments in English).

viii. Alarm / Shut Down List with set points.

ix. Operating / Control write up

5.4 ELECTRIC MOTOR AND DRIVE ARRANGEMENT

5.5.1 Selection of Electric motors

The site rating of electric motor shall be of the following condition:

110% of greatest BKW required by compressor including cooling fan, other auxiliaries and the losses at any of the compressor operating conditions corresponding to suction pressure of 19 kg/cm2 with suction valve fully opened and discharge pressure 255 kg/cm2.

5.5.2 Codes & Standards

The squirrel cage induction motors and their components shall comply with the latest applicable Indian standards listed below. Where Indian standards do not exist, the relevant IEC or British standards (as specified elsewhere in this document) shall apply.

IS – 325 Three phase induction motors.

IS - 4029	Guide for testing 3-phase induction motors.
IS - 46	Degree of protection provided by enclosures for rotating electric machines.
IS - 6362	Designation of methods of cooling for rotating electrical equipment.
IS - 2148	flameproof enclosures for electrical apparatus.
IS - 5571	Guide for selection of electrical equipment for hazardous area.
IS - 12075	Measurement & evaluation of vibration of rotating electrical machinery.

5.5.3 Certification:

Certificates from statutory authorities like CMRI / DGMS shall be submitted indicating suitability of motors, control panels and emergency push button etc. in hazardous area.

5.5.4 Motor Accessories:

a) Compressor grooved flywheel

b) Motor grooved drive pulley

c) Drive V belts

d) Flexible coupling for direct drive

e) Drive guard

f) Adjustable motor slide rails for V belt tensioning

5.5.5 Other Requirement of Motor:

1. Motors shall be provided with 230 V anti-condensation heaters, sized and located so as to prevent condensation of moisture during shutdown periods. The heaters shall permanently remain 'ON' when the motor is not in service and as such shall not cause damage to the windings.

2. Motor shall be TEFV squirrel cage type in standard frame size as per IS/IEC rated for continuous duty with high efficiency and designed for soft starter starting. Motors shall be suitable for starting under specified load conditions with 75% of rated voltage at the terminals. Motor torque shall be compatible with speed torque curve of compressor. Motor windings shall be class 'F' insulated with temperature rise limited to class 'B'. Minimum degree of protection of motor enclosure shall be IP55 as per IS. Motors for use in hazardous areas shall have protection Ex (d) as per area classification. Soft starter for electric motor > 55 Kw shall be provided, unless otherwise mentioned elsewhere, by the bidder.

3. The motor name plate rating (exclusive of service factor) shall be minimum 110% of the greatest KW required under any of the specification operating conditions. All motors shall be tested in accordance with IS/IEC.

4. Each motor shall compulsorily be protected with thermal-magnetic over current relay.

5. Pre-lubricated sealed bearings for all motors may be considered provided a full guarantee is given for 4 to 5 years of trouble – free service without necessity of re-

lubrication.

6. Vibrations: Motor vibration shall be within the limit of IS-12075.

7. Noise level: Permissible noise level shall not exceed the stipulations laid down in IS-12065.

5.5.6 Soft Starter Panel:

Floor mounted soft starter panel of 2.0 mm thick CRCA sheet steel enclosure (IP-52) shall consist of following & complete in all respect including bus bar chamber, cable alley, incomer and outgoing feeder with contactors (AC-23), switch fuse unit (AC – 23) and overload relay of suitable rating, Push Buttons, Indicating Lamps (LED cluster type) etc.

5.5.6.1 Controller:

Specification describes the requirements for a solid-state torque-controlled starter used to provide linear ramp starting and stopping of three-phase flame proof AC induction motor for CNG compressor. The requirement is for a stand-alone unit that negates the need for further equipment in terms of protection, viewing and controlling.

A. Electrical ratings

a) 415 +10% Volts AC mains

b) 50- Hz + 5%

B. The Controller shall provide following "starting" modes:

a) Linear Torque control for Start

b) Starting with CNG compressor

c) Current Limit Start

d) Voltage ramp Start

C. The Controller shall provide following "stopping" modes:

a) Linear Torque control for Stop

b) Stopping of CNG compressor

c) Voltage ramp Stop

D. The Controller shall provide following "Protection" features:

a) Motor Thermal Overload

b) Soft Start thermal overload

c) Phase imbalance

d) Phase reversal

e) Over voltage

f) Under voltage

g) Locked Rotor

h) Electronic over load

E. The Controller shall provide following "displays in seven segment functions:

a) Three Phase Current

b) Three Phase Voltage

c) Current in L1, L2, L3

d) Voltage between L1-L2, L1-L3, L2-L3

e) Shaft Power in kW / HP (selectable)

f) Motor thermal capacity

g) Motor Energy consumption (kWh)

h) Power factor

i) Run time in hours

j) Heat sink over temperature

F. The Controller shall provide as standard, the following "Fault Indication" functions:

a) Line failure

b) Phase imbalance

c) Over temperature – motor

d) Over temperature – Soft Starter

e) Locked Rotor

f) Overload - Shaft Torque

g) Underload – Shaft Torque

h) Phase imbalance

i) Over voltage

j) Under voltage

k) Excessive Starts

l) Phase reversal

5.5.6.2 CABLING (all suitable for hazardous area applications)

a) Control Cable inside the compressor package shall be of 1.5 Sq. mm and for outside compressor package shall be 2.5 mm.

b) Cables shall be 1100-volt grade, stranded copper conductor, XLPE insulated, PVC sheathed, round wire/flat armored, FRLS cables.

c) Cables shall be terminated using double compression type metallic frame proof glands and copper lugs.

d) Spare cores to be kept in each control cable.

e) All JB's shall have flame proof metallic enclosure.

f) All the signal cables shall be screened armored cables.

g) All the control and power cables shall be armored cables.

h) All the communication cables shall be screened and shall be terminated to JB through threaded GI conduits only.

i) Communication/Control cables shall be routed through Cable Trays/conduits.

j) Following cables shall be supplied, laid and terminated by bidder:

i. Cables inside the compressor package

ii. Termination of cables in compressor control panel including cable lugs and double compression glands etc. is in the bidder's scope.

k) Electrical cables: Following power cables shall be supplied and laid by purchaser for non-flame proof as well as flame proof control panel:

i. From PDB to compressor control panel

ii. From compressor Package to hooter and up to ESD push button in control room.

iii. Form PDB to air compressor.

iv. From PDB to soft starter panel.

v. From soft starter panel (in electrical room) to motor terminals (inside the package).

l) Following cables shall be supplied, laid and terminated by bidder:

i. Power and signal communication cables from compressor to trailer panel, if trailer panel is indicated in SOR (distance 20 m Approx.).

ii. Cables inside the compressor package

iii. Control and signal communication cables from soft starter panel to compressor package (main motor, distance 40 m Approx.).

m) Termination of cables in compressor control panel, soft starter panel including cable lugs and double compression cable glands etc. is in bidder's scope.

n) Bidder shall furnish following electrical data along with bid:

S.NO.	DESCRIPTION	TO BE FILLED BY BIDDER	REMARKS
	CABLES FOR PROCUREMENT AND ERECTION BY CLIENT		Note: If bidder revises the

1	a) From PDB to compressor control panel	---- SQMM AYFY	cables size being procured by client, it shall be supplied, erected and Terminated by him free of cost.
	b) From compressor to hooter and up to ESD push button in control room.	----SQMM AYFY	
	c) From compressor to ESD push button near dispenser.	----SQMM AYFY	
	d) From PDB to air Compressor.	----SQMM AYFY	
	e)From PDB to soft starter	----SQMM AYFY	
	f) From soft starter panel (in electrical room) to motor terminals (inside the package)	----SQMM AYFY	
2	FEEDER RATING IN PDB PANEL a)FOR SOFT STARTER	---- AMP	For providing feeder in PDB by client
	b)FOR AUXILIARY LOAD	---- AMP	
	c)FOR AIR COMPRESSOR	---- AMP	
3	UPS LOAD	----- KW	
4	NON UPS LOAD	----- KW	

6.0 INSTRUMENTATION

a) All Instruments shall be suitable for an area classification of "Class 1, Division 1, Group D as per NEC **"OR "**ZONE 1, Group IIA/IIB as per IS/IEC".

b) All package mounted transmitters/transducers & temperature element shall be intrinsically safe " ia" as per IEC 79-11 and solenoid valves, switches and related junctionboxes shall be certified flame proof (Eexd) as per IEC 79-1 by a statutory body viz. FM, BASEEFA etc. for the specified hazardous area classification. Other special equipment's/instruments, where intrinsic safety is not feasible or available the same shall be flame proof (Eexd) certified suitable for the specified hazardous area by a statutory body as per IEC 70-1. All analog as well as digital input to PLC shall be connected through barriers. All analog barrier shall be isolator type.

c) Temperature element shall insertion type & all Thermowell design shall wake frequency calculation must be passed according to fluid application used.

d) The compressor package instrumentation & control is to be configured for manual as well fully automatic control system including starting, shutdown as applicable for unattended operation. Control system shall be PLC based with make and proven type.

e) Instrumentation electronics shall be certified by a recognized authority such as BASEEFA, PTB, LCIE, CESI, INIEX, and SMRS or any agency approved by Indian Government.

f) All the instrumentation shall be capable of operating for full range of operation. For detailed instrument specification refer attached Section: General Specification for Instrumentation.

g) Junction boxes shall be provided for each type of signal i.e., analog, digital, solenoids, RTD thermocouple and power supply. Instrument junction boxes should not have any high voltage connection.

h) All pressure gauges and pressure transmitters shall be provided with Needle & bleed /Two valve SS316 manifold and have accuracy of + or - 1% of Full Scale Deflection (FSD).

i) The temperature gauge shall be generally mercury in steel filled type, weatherproof & with capillary extension. Capillary tubing shall be min Carbon Steel with CS flexible armoring. The gauge shall have accuracy of + or - 1% Full Scale Deflection (FSD). Therange shall be 1.5 times of operating temperature.

j) All field instruments power shall be limited to 24 VDC. Power conversion unit if required shall be in the scope of the vendor. All instruments and enclosures shall be dust proof and weather proof to IP 65 as per IEC-529/ IS 2147.

k) Units of measurement shall be:

GAS FLOW	-Kg/hr & SM3/hr
PRESSURE	-Kg/cm2 (g)
TEMPERATURE	-Deg. C

l) Following points to be noted regarding Mass Flow meter – Coriolis type:

Each Mass Flow meter shall include a digital display and a sensor with integral transmitter i.e. meter electronics certified intrinsically safe/explosion proof by statutory authority suitable for the required hazardous area as per IS-2148 /IEC-79. Also the offered sensor and the transmitter shall be weather proof to IP 65 as per IS-2147/IEC-529. Statutory

authority for local installation is CCOE.

Allowable pressure drop for the flow meter at the inlet of the engine is 0.2 kg/cm2 and allowable pressure drop for the flowmeter at the inlet and outlet of the compressor shall be 1.0 kg/ cm2. Offered mass flowmeter shall be necessary for Custody Transferapplication but not exceeding 0.5% of span.

m) Calibration for the offered mass flow meter shall be in Kg/hr and SM3/hr. Pressure, Temperature compensation shall be provided by the meter.

n) Flying lead type electrical termination is not acceptable. All electrical connections shall be ½" NPTF. Cable glands shall be provided for electrical power, signal and control connections. Cable glands shall be double compression type and certified weatherproof and explosion proof for the required area classification as per IS-2147 and IS-2148.

o) Offered Mass flow meter shall be completely free from corrosion of measuring tube due to alternating stresses continuously occurring in the tube. Also measuring tube shall be completely free from erosion, which may result due to fluid velocity.

p) The design of meter electronics shall be in compliance with the electromagnetic compatibility requirements as per IEC-801. Meter Electronics shall include all the associated pre-amplifiers converters linearizer etc.

q) Installation details like straight run requirements, recommendation for horizontal /vertical installation, minimum distance between upstream and downstream pipe bends from Mass flow meter to be provided.

r) Vendor shall calibrate each Mass Flow meter at his shop or any recognized test house with the fluid (Use design process conditions) for which it is to be used as per Clause no.9 of MPMS (Draft standard Nov. 2000). In case it is not possible to calibrate the Mass Flow meter with actual fluid. Vendor must indicate:

   i. Fluid used for calibration

   ii. Correction factor/Adjustment required for actual process fluid. In any case, inaccuracy when extended to actual process shall not exceed the specified limits (as per manufacturer's standard)

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

   i. Material test certificate with detailed chemical analysis from foundry (MIL Certificate).

   ii. Certificate of radiography / x-ray for any welded joint.

   iii. Hydrostatic test report with pressure of 1.5 times the design pressure.

   iv. Calibration report including calibration factors for each Mass flow meter certificate from statutory body for offered sensor and transmitter for required area classification.

t) Vendor shall provide analog type vibration switch to monitors its values on MMI.

u) Vendor shall provide special tools such as (compression gauge, manometer, oxygen analyzer, Timing light, Flywheel turning tool.).

v) Gauges (pressure/Temperature) for oil, coolant, power for electric motor shall be installed outside the acoustic enclosure for effective monitoring.

w) Vendor shall provide running hours display on PLC HMI which will be calculated electronically based on start signal.

6.1 CERTIFICATION:

The requirement of statutory approvals for usage of equipment/instruments/system in electrically hazardous areas shall be as follows:

a) The vendor shall be responsible for obtaining all statutory approvals, as applicable for all instruments and control systems.

b) Equipment/instruments/systems located in electrically hazardous areas shall be certified for use by statutory authorities for their use in the area of their installation. In general, the following verification shall be provided by the vendor.

- Bidder shall provide certificates (from BASEEFA FM, UL, PTB, LCIE etc.) from country of origin for all intrinsically safe/flameproof protected by other methods equipment/instrument/systems, which are manufactured outside India. If required, bidder shall provide necessary certification/approvals/authentication, for all such intrinsically safe/flameproof equipment/instrument/systems, by the Indian authority– Chief Controller of Explosive (CCOE), Nagpur, India.

- For all flame proof equipment manufactured within India, the testing shall be carried out by any of the approved testing houses- Central Mining Research Institute (CMRI)/ERTL etc. The item shall in addition bear the valid certification from CCoE and also the manufacturer shall hold a valid Bureau of Indian Standards (BIS) license.

- For all intrinsically safe equipment manufactured within India the testing shall be carried out by any of the approved testing houses – Central Mining Research Institute (CMRI)/ERTL etc. The item shall in addition bear the valid certification from CCoE.

7.0 EARTHING OF EQUIPMENT

Bidders shall make provisions for Earthing of the complete package as required as per IS (Earth pits are not in Bidder's scope). All electrics shall comply with latest IS/IEC. Epoxy based paints shall be applied on all electrical equipment. Bidder's scope shall includeobtaining statutory approvals for the complete package, wherever necessary.

Metallic part of all equipment not intended to be alive shall be connected to earth as per provisions of IS: 3043/IEC recommendation. Grounding of all electronics shall be separately connected to earth using insulated copper wire. Grounding of electronic equipment shall not be connected to Earthing for electrics or Equi-potential bonding

8.0 INSPECTION AND TESTING

8.1 General

a) Inspection and Test Requirements have been spelled out in respective Equipment Data Sheets and the Technical Specification.

b) Bidder shall confirm compliance to all inspection and testing requirements stipulated therein and include the inspection charges in the lump sum cost.

c) Owner/consultant shall witness tests as per data sheet and this specification. The Bidder shall notify the timing of such inspection and testing at least 15 days in advance to PURCHASER/CONSULTANT. PURCHASER/ CONSULTANT shall depute their representative for witnessing the tests.

d) Bidder shall submit detailed Test Procedure for Approval of the Purchaser two months in advance of the actual date of conducting each test.

e) Inspection testing for foreign bidder: Cost of third party inspection including fees payable and arranging the same shall be borne by bidder. Approved 3rd party inspection agencies are CEIL, BVQI, DNV, and Lloyd's register /TUV/ /SGS/American bureau services/ International certification services limited/BV/EIL.

f) Inspection testing for Indian bidder: Owner/Consultant shall carry out Inspection and testing as per QAP, inspection charges shall be considered @1.0% of the ex-works price excluding duty and taxes of the equipment for price evaluation purpose only. Domestic bidder shall also arrange 3rd party for inspection as indicated in QAP and expenses on third party inspection including fees payable and arranging the same shall be borne by bidder.

8.2 Mechanical running test (MRT)

8.2.1 The MRT for each compressor shall be carried out with job or shop driver including complete job driving system i.e., job driven V-belt, job pulleys etc., for 4 hours continuously at shop of compressor manufacturer. The compressor need not be pressure loaded for MRT test. During this test following shall be recorded at agreed intervals.

- Vibration levels measured on cylinders and frame
- Bearing temperature
- Oil cooler inlet and outlet temp

Subsequent to satisfactory run the compressor shall be examined as per standard procedure & following shall be examined as minimum:

- Bore & other parts by opening a valve
- Piston & cylinder clearance
- Visual examination of position rod, controlled guide bore without dismantling

If any of part found damaged, all similar components shall be stripped for inspection. The MRT test shall be repeated after replacement of such parts.

8.3 Mechanical String Test

Mechanical String Test for 4 Hrs. shall be performed at packager's shop before dispatch in presence of Purchaser/Consultant. This test can be clubbed up with the Mechanical Run Test of compressor as specified above, provided the job driver, lube Oil system is used for the test. Only natural gas is use for testing in the shop. All parameters including discharge pressure shall be demonstrated. All the interlocking and performance of the instrumentation system will be verified during the MST. String test at unload condition is not acceptable.

8.4 Package Performance Test

Bidder shall send fully assembled package including auxiliary systems, instrumentation, safety devices within the enclosure to the site and carry out the performance test at site before the commencement of 72 Hours Field Trial Run.

Complete package shall be performance tested as a module whereby along with electric motor & compressor performance bidder shall demonstrate all controls, shutdown, trips/alarms etc.

The test shall be the basis of assigning penalties on the bidder, acceptance/rejection of the package thereon. Bidder shall submit the detail test procedure for the same, which shall be

approved by Client. The test for the package shall be witnessed by Client representatives.

9.0 PERFORMANCE GUARANTEES, LOADING AND PENALTIES

9.1 This section describes the guaranteed parameter, which the CNG compressor package must fulfill, the penalty for shortfall in guaranteed parameters and rejection of compressor package by the Purchaser.

9.2 The guaranteed parameter shall be adjusted to account for variation in gas composition and prevailing ambient condition during testing.

9.3 Necessary calculations correction curves shall have to be furnished by Bidder along with bid, which shall be final & no deviation shall be permitted afterwards.

9.4 In case of any inconsistency in manufacture and/or operation of supplied compressor package, Bidder shall at his own risk and cost, eliminate the defects to the satisfaction of Owner.

9.5 Bidder shall furnish guaranteed value as per enclosed with this specification

9.6 Compressor Capacity

9.6.1 Bidder shall guarantee 250 SCMH average capacity average capacity with suction pressure of 14 kg/cm2(g) on continuous basis and suction temperatureof 35 C, discharge pressure of 255 kg/cm2(g) continuously with the no negative tolerance for errors in instruments and measurements.

For calculation purpose 1kg of CNG =1.3748 SCM

(Based on Avg. Relative density of Gas @ 0.593557)

Density of Gas = Relative Density of Gas (0.593557) X Density of Air (1.22541

Kg/m3)= 0.7273 kg/SCM

NOTE:-

-The same shall be used to establish the capacity during package performance test.

The same shall be used to establish the capacity at test bed during package performance test.

To calculate above mentioned penalties, following formula shall be applicable for Conversion of units from SCM to Kg:
G (in Kg) = 250 X RD X AD (for 250 SCMH compressor)
Relative Density (RD) = Average Relative Density for the month using Average GC Data (GA wise)
Air Density (AD) = 1.22541

9.7 Loading & Penalty Criteria

9.7.1 Loading

<u>Loading against package Gas loss</u>

The bidder shall design the motor driven CNG composite dispensing unit package so that no venting and leakage of gas takes place. Bidder shall indicate actual vent & leakage losses through the compressor package. If package loss is quoted more than 1% of suction capacity gas consumption than bid shall be rejected. This quoted figure will be used for evaluation and

total quoted price for all packages towards supply, special tools and tackles, erection and commissioning will be loaded as per following formulas:

LA = (G-0) x H x I x N x W

Where,

LA = Loading amount in Rs.

G = Vent/ Leakage rate quoted in percentage

(G-0) = Bidder's vent /leakage rate above 0%

H = Cost of Natural Gas per Kg – Rs. 48/- Kg

I = Factor towards lifecycle in hours @ 58400 hours (Considering daily running of 16 Hrs.)

N = Number of machines

W = 181 kg/hour for 250 SCMH

Note: Guaranteed parameters shall be confirmed during PAT at site and CAMC period. If any deviation is observed from values declared at Bid Stage, CLIENT holds the right to Cancel the Contract / stop Vendor from participation in future tenders.

Loading against Energy Consumption:

The motor driven CNG composite dispensing unit package shall be designed in such a way that Energy Consumption of Motor(KWH/Kg) should be minimum for production of CNG.

Bidder shall indicate actual power consumption for their motor driven CNG composite dispensing unit package. This quoted figure will be used for evaluation and total quoted price for all packages towards supply, special tools & tackles, erection and commissioning will be loaded as per following formulas:

F = (G-Q) x H x I x N

Where,

F = Loading amount in Rs.

G= Bidder's Energy consumption rate quoted in KWH for every Average 250 SCMH (181 Kg/hour) of CNG produced

Q = Lowest Energy consumption rate quoted in KWH for every Average 250 SCMH (181 Kg/hour) of CNG produced

H = Cost of Energy INR 12/Kwh

I = Factor towards lifecycle in hours @ 58400 hours (Considering daily running of 16

Hrs.)

N = Number of machines

Note:

1. **Guaranteed parameters shall be confirmed during PAT at site and CAMC period. If any deviation is observed from values declared at Bid Stage, CLIENT holds the right to Cancel the Contract / stop Vendor from participation in future tenders.**

9.7.2 Penalty

During package performance test, in case the motor driven CNG composite dispensing unit package fails to mee tthe guaranteed values, the following penalties shall be imposed.

Penalty towards Excess Gas Loss:

At the start of CAMC period or even at any point of time during the CAMC / warranty period, costtowards excess gas loss beyond the quoted figure shall be deducted from CAMC bills.

Following calculations shall be used for deduction towards excess gas loss:

F = [G-(Q*D)] * H

Where,

F = Penalty in Rupees to be deducted from CAMC bill

G = Monthly Vent/Leakage loss observed during CAMC period

Q = Vent / Leakage loss quoted by the bidder in percentage

H = Cost of Natural Gas/Kg – Rs. 48/- per Kg

D = Production during the month (Discharge meter) considering above shall be taken as (Suction – Discharge) OR Reading from Vent Mass Flow Meter, whichever is higher.

Penalty towards Excess Energy Consumption:

At the start of CAMC period or even at any point of time during the CAMC / warranty period, cost towards excess power consumption beyond quoted figure shall be deducted from CAMC bills.

Following calculations shall be used for deduction towards excess power consumption.

F = (G-Q) x H

Where,

F = Monthly Penalty in Rs.

G = Monthly Actual Power consumption

Q = (Guaranteed consumption rate quoted by supplier for every 181 Kg/hour for 250 SCMH of CNG) x (CNG produced during the month

H = Cost of power Rs 12/kwh

Penalty towards Package Efficiency Loss

This penalty shall be imposed on compressor blocks not capable of delivering rated capacity of 250 SCMH. Following calculations shall be used for penalty towards package efficiency loss:

F = 5 x {(250 x H x RD x AD) – M} (For 250 SCMH)

Where,

F = Penalty Amount in Rupees

H = Hours clocked in a month

RD = Average RD for the month using GC Data

AD = Air Density = 1.22541
M = Discharge mass flow during the month in Kgs

Note:

- Gauge Pressure at Station Inlet shall be used as benchmark for imposition of penalties and not suction pressure being displayed at the PLC.
- Pressure regulator shall not be used to reduce the pressure at the compressor block inlet below 14 Kg/Cm2.
- In case pipeline pressure at the station itself is less than 14 Kg/Cm2, then the penalty shall be imposed if the package delivery falls below discharge values corresponding to the station pressure.

9.7.3 Penalty for Non-Performance during one year warranty period and further 5 years CAMC period

9.7.3.1 Details of Penalty for non-performance of equipment

(a) On normal day & in case of breakdown (i.e. the day other than the schedule maintenance day):

(i) The party has to ensure that the equipment's are available for operation for minimum 20 hours per day and on an average the equipment availability has to be 98% in a month.

(ii) If the equipment is down for more than 4 hours on any day or availability is less than 98% in a month. Penalty would be applicable as follows:

- Up to 4 hours: Nil
- 4 hours to 12 hours: Rs. 5,000/- per day.
- Beyond 12 hours: Rs. 8,000/- per day.

(iii) In case of daily availability is 20 hrs. But monthly average availability is below 98%. Then penalty @ of Rs. 10,000 per % or part thereof shall be applicable.

(b) On schedule maintenance day:

(i) The party would be required to carry out the recommended schedule/preventive maintenance of the equipment for which the party has to indicate the time required for each type of schedule maintenance.

(ii) If the equipment is down for more than 4 hours & up to 12 hours beyond the time indicated for the agreed schedule maintenance, the party would be penalized R.s. 5,000/- and for more than 12 hours R.s- 10,000/- per day.

NOTE: - In any case the maximum penalty imposed in a month for non-performance of the equipment would be limited to 50% of the amount of basic maintenance

charges only to be paid for the particular month

10.0 PAINTING AND PROTECTION

10.1 SURFACE PREPARATION

a. Rust, rust scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained. The minimum acceptable standard for blast cleaning shall be Sa 2-1/2 or equivalent as per Swedish Standard SIS-055900-1967 or equivalent.

b. Blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceeding 85%.

c. The first coat of primer must be applied by brush on dry surface. This should be done immediately after cleaning.

d. Surface shall be inspected by Purchaser/ third party before application of primer.

10.2 PAINTING (PRIMER & FINISH COAT)

Following primer and finish coats to be applied on the canopy and all structural parts as a minimum: -

a) Primer — Two component epoxy zinc phosphate primer with minimum volume solids of 59%, an initial cure of 75 minutes at 25 deg. C and a weight of around 2.52 kg/liter.

No. of Coats: 1

DFT 75 (micron) µ each

b) Primer — Two component intermediate coat with epoxy high build MIO (micaceous iron oxide) of minimum volume solids of 80%, an initial cure of 60 minutes at 25 deg. C and a weight of around 2.1 kg/ liter.

No. of Coats 1

DFT 100 micron

c) Finish Coat : Acrylic Polyurethane paint

No. of Coats: 2

DFT 50 (micron) each coat

Total DFT 100 µ

Total DFT after application of primer and paint shall be 275 µ (micron) minimum.

The vendor to ensure that exterior steel surface of equipment and piping painted shall have a fade free life without oxidation of paint surface for at least 5 years in an environment of bright sunlight with an intense UV content.

The headers of air-cooled exchanger shall be zinc sprayed/painted.

Packing shall be sufficiently robust to withstand rough handling during ocean shipment & in-land journey. Sling points shall be clearly indicated on crates.

11.0 ERECTION, TESTING AND COMMISSIONING AT SITE

a) Bidder shall be responsible for erection commissioning; performance test, field noise level test and field trial run of all compressor packages at site.

b) Bidder shall be liable to pay all local taxes, levies applicable and comply with rules, laws prevailing in India.

12.0 FIELD TRIAL RUN / SITE PERFORMANCE TEST

Bidder shall conduct a field trial run of each compressor package for minimum 72-hour continuous duration at guaranteed points in which satisfactory operation of complete package together with all accessories/auxiliaries controls shall be established for specified operating conditions prior to the start of CAMC period as defined in the contract. During the field trial run the bidder will be allowed a maximum of THREE attempts to complete the above specified test. The Equipment shall be considered commissioned after the successful completion of Field Trial Run.

13.0 SPARE PARTS, SPECIAL TOOLS AND TACKLES

a) All spare parts, special tools & tackles for erection and commissioning and spare parts required for CAMC of compressor package shall be arranged by the Packager and shall form his scope of supply. The bidder has to provide the list of spares, tools & tackles for erection and commissioning and spare parts required for operation & maintenance along with the bid. These tools and tackles and any spare parts left after work completion shall be the property of client.

b) Vendor shall maintain sufficient spares to fulfil the warranty period requirements. In case of additional requirement during the warranty period, if any spare part is taken from Client, the same shall be replaced to client with new part supported by necessary document for its authenticity of being new & original spare part

14.0 DATA AND DRAWING

a) Drawings and Data shall be furnished in conformity with the Bidder Data Requirements Forms attached with Enquiry Specifications.

b) Bidder shall furnish all the information at the time of bidding as specified in the relevant Bidder Data Requirement (BDR) forms.

c) The data requirement after placement of Fax of Intent (FOI) is indicated in the Bidder Data Requirement Forms for the respective equipment, including the number of weeks within which this data is to be provided. Bidder shall confirm that all data as required shall be furnished by him and shall indicate the Bidder's promised data in the columns provided.

d) After the placement of FOI, a conference (kick off meeting) will be held at such place, as may be mutually agreed upon between the Bidder and the purchaser within 15 days from the date of placement of FOI. The intent of this conference shall be to discuss / clarify various requirements and finalize the modus operandi for execution of the contract within the scheduled delivery period.

e) Bidder shall furnish the Drawings/Documents for Purchaser's Review / approval as per the Bidder Data Requirement (as specified in the Specifications/Bidder Data Requirement forms). The review comments for major and critical drawings (such as system P&ID's, General Arrangement Drawings, Foundation Drawings, Performance characteristics, Pulsation and Vibration Study Reports, Torsional Analysis etc.) shall be discussed across thetable at such date and place as may be mutually agreed between the Purchaser and the Bidder.

f) Along with the supply of each compressor package, the supplier shall provide software for PLC

& HMI, ladder logic and software authorization password/license in two set

STANDARD SPECIFICATION

FOR

MEDIUM VOLTAGE INDUCTION MOTOR

REVISION RECORD

Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description

ABBREVIATION

BIS/IS	Bureau of Indian standards
IEC	International Electro-Technical Commission
BS	British Standards
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
DGMS	Director General Mines Safety
IE Rules	Indian Electricity Rules
CPRI	Central Power Research Institute

CONTENTS

1.0 SCOPE

This specification covers the design, manufacture, testing, packing and supply of three phase medium voltage squirrel cage induction motors.

2.0 REFERENCE DOCUMENTS

2.1 The squirrel cage induction motors and their components shall comply with the latest editions of following standards issued by BIS (Bureau of Indian Standards) unless otherwise specified:

IS – 5:	Colours for ready mixed paints and enamels.
IS – 325:	Three phase induction motors.
IS – 1076:	Preferred numbers.
IS – 1231:	Dimensions of three phase foot mounted induction motors.
IS – 1271:	Thermal evaluation and classification of electrical insulation.
IS – 2148:	Flame proof enclosures of electrical apparatus
IS – 2223:	Dimensions of flange mounted AC Induction motors.
IS – 2253:	Designation for type of construction and mounting arrangement of rotating electrical machines
IS – 2254:	Dimensions of vertical shaft motors or pumps
IS – 2968:	Dimensions of slide rails for electric motors.
IS – 2968:	Guide for testing three phase induction motors.
IS – 4691:	Degrees of protection provided by enclosure for rotating electrical machinery.
IS – 4722:	Rotating electrical machines.
IS – 4728:	Terminal marking and direction of rotation for rotating electrical machinery.
IS – 4889:	Method of determination of efficiency of rotating electrical machines.
IS – 6362:	Designation of methods of cooling of rotating electrical machines.
IS – 7816:	Guide for testing insulation resistance of rotating machines
IS – 6381:	Construction and testing of electrical apparatus with type of protection “e”
IS – 7389:	Pressurized enclosure of electrical equipment for use in hazardous area
IS – 8223:	Dimensions and output series for rotating electrical machines.
IS – 8289:	Electrical equipment with type of protection 'n'.

IS – 8789:	Values of performance characteristics for three phase induction motors.
IS – 9283:	Motors for submersible pump sets.
IS – 9628:	Three phase induction motors with type of protection 'n'
IS – 12065:	Permissible limits of noise level for rotating electrical machines
IS – 12075:	Mechanical vibration of rotating Electrical Machines with shaft heights 56 mm and higher - measurement, evaluation and limits of vibration severity.
IS – 12802:	Temperature rise measurement of rotating electrical machines
IS – 12824:	Type of-duty and classes of rating assigned to rotating electrical machines
IS – 13529:	Guide on effects of unbalanced voltages on the performance of three phase cage induction motors.
IS – 13555:	Guide for selection and application of three phase induction motors for different types of driven equipment
IS – 14568:	Dimensions and output series for rotating electrical machines, frame numbers 355 to 1000 and flange numbers 1180 to 2360

2.2 In case of imported motors, standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian Standards.

2.3 The motors shall also conform to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country. .

2.4 In case Indian Standards are not available, standards issued by IEC/ BS/ VDE/ IEEE/ NEMA or equivalent agency shall be applicable

2.5 In case of any contradiction between various referred Standards/ Specifications/Data Sheets and statutory regulations, the following order of priority shall govern:

a. Statutory regulations
b. Data Sheets
c. Job Specifications
d. Standard Specification
e. Codes and Standards

3.0 DEFINITIONS

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

OWNER / COMPANY	OWNER of the particular Project (Project Specific).

CONSULTANT	The party which is doing engineering, procurement, Construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 MATERIALS

4.1 Unless otherwise specified in the motor Data Sheet, motors shall be provided with class 'B' insulation as a minimum. In case of motors with class `F' insulation, the permissible temperature rise above the specified ambient temperature shall be limited to those specified in the applicable Indian standards for class 'B' insulation.

4.2 Anti-loosening, anti-vibration, type of terminals shall be provided in case of increased safety (type Ex e) and non-sparking (type Ex n) motors.

5.0 DESIGN

5.1 GENERAL REQUIREMENTS

5.1.1. The offered equipment shall be brand new with state of the art technology and proven field track record. No prototype equipment shall be offered.

5.1.2. Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply.

5.1.3. Vendor shall give a notice of at least one year to the end user of equipment and Consultant before phasing out the product/spares and to ensure timely replacement of such product/spares at its own cost without affecting services during the entire contract period.

5.2 OPERATING CONDITIONS

5.2.1 AMBIENT CONDITIONS

5.2.2 Motors shall be suitable for operating satisfactorily in humid and corrosive atmosphere found in refineries, petrochemical, fertilizer and metallurgical plants. Service conditions shallbe. as specified in the motor Data Sheet. If not specifically mentioned therein, a design ambient temperature of 40°C and an altitude not exceeding 1000 meters above mean sea level shall be taken into consideration.

5.2.3 FREQUENCY AND VOLTAGE VARIATIONS

5.2.4 Unless otherwise agreed, motors shall be designed for continuous operation at rated output under the following conditions:

5.2.5 The terminal voltage differing from its rated value by not more than ± 6 % or

5.2.6 The frequency differing from its rated value by not more the ± 3 % or any combination of 5.2.4 and 5.2.5.

5.3 STARTING

5.3.1 Unless otherwise specified, motors shall be designed for direct-on-line starting.

5.3.2 Motors shall be designed for re-acceleration under full load after a momentary loss of voltage with the residual voltage being 100% and is in phase opposition to the applied voltage.

5.3.3 Minimum locked rotor thermal withstand time at rated voltage shall be 10 seconds under cold conditions and 8 seconds under hot conditions. The starting time of the motor shall be less than the hot thermal withstand time (time t_E in case of increased safety i.e. Ex-e motors) to permit application of conventional bimetal relays or thermal released against locked rotor and overload conditions.

5.3.4 Unless otherwise specified, all motors shall be suitable for starting under specified load conditions with 75 % of the rated voltage at the motor terminals.

5.3.5 Motors shall be designed to allow the minimum number of consecutive starts indicated-in table below:

Starts	Minimum no. of consecutive starts
No. of consecutive start-ups with initial temp. of the motor at ambient level (cold)	3
No. of consecutive start-ups with initial temp. of the motor at full load operating level (hot).	2

5.4 DIRECTION OF ROTATION

5.4.1 Motors shall he suitable for either direction of rotation. `In case unidirectional fan is provided for motors, direction of rotation for which ' the motor is designed shall be permanently indicated by means of an arrow. Directional arrow should be manufactured from corrosion resistant material. When a motor is provided with bi-directional fans, a double-headed arrow should be provided.

5.4.2 Normally, clockwise rotation 'is desired as observed from the driving (coupling) end, when the terminals ABC are connected to a power supply giving a terminal phase sequence in the order ABC. Counter-clockwise rotation of the motor shall be obtained by connecting the power supply to terminals so that the phase sequence corresponds to the reversed alphabetical sequence of the terminal letters. Ample space shall be provided at the terminal box for interchanging any two external leads for obtaining the reverse phase sequence.

5.5 PERFORMANCE

5.5.1 Motors shall be rated for continuous duty (S1), unless otherwise specified.

5.5.2 Unless otherwise specified, the starting current (as % rated current) shall not exceed 600% subject to tolerance.

5.5.3 Starting torque and minimum torque of the motor shall be compatible with the speed torque curve of the driven equipment under specified starting and operating conditions.

5.5.4 For heavy duty drives such as blowers, crushers etc. high starting torque motors shall be provided.

5.5.5 In case where characteristics of driven equipment are not available while selecting the motor, minimum starting torque shall be 110% of rated value for motors upto 75 kW and shall be 90% of rated value for motors above 75 kW.

5.5.6 The pull out torque at the rated voltage shall be not less than 175 percent of the rated load torque with no negative tolerance. Unless otherwise agreed, the pull out torque shall not exceed 300 percent of the rated load torque.

5.5.7 In case of motors driving equipment with pulsating loads (e.g. reciprocating compressors) theminimum value of pull out torque at 75 percent of the rated voltage shall be more than thepeak value of pulsating torque and the current pulsation shall be limited to 40%.

5.5.8 The minimum values for performance characteristics of motors rated up to and including 37 kW shall be as per IS-8789 TABLE-1 to TABLE-8.

5.5.9 The minimum value for product of efficiency and power factors of 2 pole, 4-pole, and 6-pole motors rated above 37 kW shall be as given in Table below.

Rated output	**Product of efficiency & power factor at rated load (minimum)**		
	2-Pole	**4- Pole**	**6-Pole**
45 kW	0.82	0.80	0.79
55 kW	0.82	0.80	0:79
75 kW	0.82	0.80	0.80
90 kW	0.82.	0.80	0.80
110 kW	0.86	0.80	0.80
125 kW	0.86	0.80	0.80
160 kW	0.86	0.81	0.80
180 kW	. 0.86	0.83	0.80
200 kW	0.86	0.83	0.80

5.5.10 Efficiency and power-factor figures for motors having synchronous speeds of 750 RPM and below shall be as agreed between the Purchaser and the Manufacturer.

6.0 FABRICATION

6.1 WINDINGS

6.1.1 Unless otherwise specified in the motor Data Sheet, motors shall be provided with class 'B' insulation as a minimum. In case of motors with class `F' insulation, the permissible temperature rise above the specified ambient temperature shall be limited to those specified in the applicable Indian standards for class 'B' insulation.

6.1.2 The winding shall be tropicalised. The windings shall preferably be vacuum impregnated. Alternately the windings shall be suitably varnished, baked and treated with epoxy gel for operating satisfactorily in humid and corrosive atmospheres.

6.1.3 Windings shall be adequately braced to prevent any relative movement during operation. In this respect, particular care shall be taken for the stator windings for direct on line starting squirrel cage motors. Insulation shall be provided between coils of different phases that lie together. Core laminations must be capable of withstanding burnout for rewind at 400 °C without damage or loosening.

6.1.4 In case of motors driving equipment with pulsating loads, special care shall be taken for the joints of rotor bars and end rings to avoid premature failures due to induced fatigue stresses.

6.1.5 The windings shall be connected in delta. However, for motors rated 2.2 kW and below, star connection may be accepted.

6.1.6 In case of motors with star delta starting, the motor windings shall be fully insulated for delta connection.

6.1.7 The ends of the windings shall be brought out into a terminal box. These shall be terminated by means of terminals mounted on an insulating base made of non-hygroscopic and non-flammable material.

6.1.8 All motors shall be with six terminals and suitable links to connect them in star or in delta except for motors rated up to and including 2.2 kW which may be accepted with three terminals.

6.1.9 All terminals shall be thoroughly insulated from the frame with material resistant to tracking.

6.1.10 Anti-loosening, anti-vibration, type of terminals shall be provided in case of increased safety (Type Ex e) and non-sparking (Type Ex n) motors.

6.2 TERMINAL BOX AND CABLE ENTRIES

6.2.1 Unless otherwise agreed, the terminal box shall be located on the right hand side as viewed from the driving (coupling) end. However, as a special case, terminal box- located on top may also be accepted, particularly for hazardous area motors, in case manufacturer has only TOP mounted terminal box design which is duly tested/certified by CIMFR and approved by PESO/CCE for installation in hazardous area. The terminal box design shall allow rotation in steps of 90° to facilitate cable entry from any direction.

6.2.2 The terminal box shall be of robust construction and large enough to facilitate easy connection of the cables. The terminal box shall be with necessary clearances, creepage distances between live parts and between live parts to earth considering air insulation and without any compound filling. Terminal box cover shall be provided with handles to facilitate easy removal. However for terminal box covers weighing less than 5 kg., terminal box covers without handles can be accepted.

6.2.3 An adequately sized earth terminal shall be provided in the motor terminal box for termination of the fourth core' of specified cables.

6.2.4 The terminal box shall be provided entries for suitable cable glands corresponding to the size of the specified cable. Crimp type tinned Cu lugs and nickel-plated brass (or aluminum if specifically required) double compression type cable glands shall be supplied along with the motors for the specified cable sizes for power and space heater cables.

6.2.5 Equipment and accessories provided shall conform to the hazardous area classification and the environmental conditions as specified in the motor Data Sheet.

6.2.6 Unless otherwise specified, the terminals, cable lugs, terminal box, cable entries and cable glands shall be suitable for the cables sizes is specified below in Table for 2 pole, 4 pole or 6 , pole motors:

Motor rating up to and including	**Size of phase conductor (mm^2)**
22 kW and below	4 Al / 2.5 cu

3.7 kW	6 Al / 4 cu
5.5 kW	10 Al / 6 cu
7.5 kW	16 Al / 6 cu
9.3 kW	25 Al / 10 cu
11.0 kW	25 Al / 16 cu
15.0 kW	35 Al
18.5 kW	50 Al
22.0 kW	50Al
30.0kW	70Al
37.0Kw	95Al
45.0kw	95Al
55.0kW	120Al
75.0kW	185Al
90.0kW	2x95Al
110.0kW	2x120Al
125.0 kW / 132.0 kW	2x150Al
150.0kW	2x185Al
160.0kW	2x185Al
180.0kW	2x240Al
200.0kW	2x300Al

6.2.7 Cable sizes for motors having synchronous speeds 750 RPM and below shall be as agreed between the Purchaser and Manufacturer.

6.2.8 Cables used are of 650/1100 V grade aluminum conductor, PVC insulated, PVC extruded inner sheath, armored with overall PVC sheath. However, for cables up to & including 16-mm2 cross-section, cables used may be with copper or aluminum conductor as indicated in the motor Data Sheet.

6.2.9 The terminal box shall be capable of withstanding internal short circuit conditions without danger to personnel or plant from the emission of hot gases or flame or due to excessive distortion or damage to the terminal enclosure.

6.2.10 Appropriate phase markings as per IS shall be provided inside the terminal box. The marking shall be non-removable and indelible.

6.3 MOTOR CASING AND TYPE OF ENCLOSURE

6.3.1 Motors for use in safe areas shall be industrial type meeting the specified ambient conditions, starting and operating requirements.

6.3.2 Motors for use in hazardous areas (Zone-I or Zone-2) shall have type of protection Ex d or Ex e or Ex n as specified in the motor Data Sheet and shall meet the requirements of applicable Indian Standards.

6.3.3 The minimum degree of motor enclosures including terminal boxes and bearing housing shall be IP-55 as per IS.

6.3.4 Motors for outdoor use shall be suitable for installation and satisfactory operation without any protective shelter or canopy. Motor casing shall be provided with a suitable drain for removal of condensed moisture except in case of flameproof motors (Type Ex d).

6.3.5 Vertical motors with downward shaft shall be provided with suitable canopies covering the motor fully. Vertical motors with upward shaft e.g. on fin-fan coolers, shall be adequately protected, (such as cowls/canopies) against ingress of water into the enclosure or the

Bearing housing even when standing still for long periods of time. Motors designed to handle external thrust from the driven equipment shall be supplied with a thrust bearing at the non-driving end.

6.3.6 All internal and external metallic parts, which may come into contact with cooling air, shall be of corrosion resistant material or appropriately treated to resist the corrosive agents, which may be present in the atmosphere. Screws and bolts shall be of rust proof material or protected against corrosion.

6.3.7 Unless otherwise agreed, motors shall have standard frame sizes for various output ratings as stipulated in IS.

6.4 BEARING AND LUBRICATION

6.4.1 Motors shall have grease lubricated ball or roller bearings. In all cases, the bearings shall be chosen to provide a minimum L-10 rating life of 5 years, (40, 000 hours) at rated operating conditions. (The L-10 rating life is the number of hours at constant speed that 90% of a group of identical bearings will complete or exceed before the first evidence of failure).

6.4.2 Unless otherwise specified, the bearings shall be adequate to absorb axial thrust produced by the motor itself or due to shaft expansion.

6.4.3 Vertical motors shall be provided with thrust bearings suitable for the load imposed by the driven equipment.

6.4.4 In cases such as pumps for hot liquids where the driven equipment operates at high temperatures, bearings shall be cooled by a shaft mounted fan. This shall ensure efficient ventilation of the bearing and disperse the heat transmitted from the driven equipment by conduction or convection.

6.4.5 Bearings shall be capable of grease injection from outside without removal of covers with motors in the running conditions. The bearing boxes shall be provided with necessary features to prevent loss of grease or entry of dust / moisture e.g. labyrinth seal. Where grease nipples are provided, these shall be associated, where necessary, with appropriately located relief devices, which ensure passage of grease through the bearings

6.4.6 Pre-lubricated sealed bearings may be considered provided a full guarantee is given for 4 to 5 years of trouble-free service without the necessity of re-lubrication.

6.5 COOLING SYSTEM

6.5.1 All motors shall be self-ventilated, fan cooled. Fans shall be corrosion- resistant or appropriately protected. They shall be suitable for motor rotation in either direction without affecting the performance of the motor. If this is not possible for large outputs, it shall be possible to reverse the fan without affecting the balancing of the motor.

6.5.2 For motors operating in hazardous area, the fans shall be of an anti-static non sparking material.

6.6 ROTOR

6.6.1 The rotor shall be of squirrel cage type, dynamically balanced to provide a low vibration level and long service life for the bearings. The accepted values of peak to peak-vibration amplitudes for a motor at rated voltage and speed on a machined surface bedplate with the

Motor level and with half-key or coupling fitted shall not exceed those given in IS. Die cast aluminum rotors for motors in hazardous areas may be accepted provided the same are type tested and approved by competent authorities.

6.2 SHAFT EXTENSION

Motors shall be provided with a single shaft extension with key way and full key. Motor shaft shall be sized to withstand 10 times the rated design torque.

6.3 LIFTING HOOKS

All motors weighing more than 30 kg shall be provided with lifting hooks of adequate capacity.

6.4 EARTH TERMINALS

6.4.1 Two earth terminals located preferably on diametrically opposite sides shall be provided for each motor. The size of each earth stud shall be as given below in Table:

Motor Rating	Stud size
Up to and including 7.5 kW	6 mm
11 kW to 30 kW	10 mm
Above 37 kW	12 mm

Necessary nuts and spring washers shall be provided for earth connection.

6.5 MISCELLANEOUS ACCESSORIES

6.5.1 ANTI-CONDENSATION HEATERS

a. Unless otherwise stated, all motors rated above 22 kW shall be provided with 240V anti condensation heaters, sized and located so as to prevent condensation of moisture during shut down periods. The heaters shall permanently remain 'ON' when the motor is not in service and as-such shall not cause damage to the windings.

b. For motors installed in hazardous atmospheres (Zone - 1 or Zone - 2), such heaters shall conform to the provisions of applicable Indian Standards and temperature classification specified in the motor Data Sheet.

c. A warning label with indelible red inscription shall be provided on the motor to indicate that the heater supply shall be isolated before carrying out any work on the motor.

6.5.2 NAME PLATES

a. A stainless steel name plate manufactured from series 300 stainless steel and having information as per IS shall be provided on each motor.

b. In addition to the motor rating plate, a separate number plate for motor tag number shall be fixed in a readily visible position. This number shall be as per the motor Data Sheets.

c. Additional information as stipulated in applicable Standards shall be included in the nameplate for motors meant for use in hazardous atmospheres.

6.5.3 NOISE LEVEL

The permissible noise level shall not exceed the stipulations laid down in IS, unless otherwise specified in the motor Data Sheet.

6.5.4 MOTOR VIBRATIONS

Motor vibrations shall be with-in the limits of IS, unless otherwise: specified for the driven equipment.

6.5.5 CRITICAL SPEEDS

The first actual critical speed of stiff rotors shall not be lower than 125% of the synchronous speed. For flexible rotors this shall be between 60% and 80 % of the synchronous speed; the second actual critical' speed shall be above 125 % of the synchronous speed.

6.5.6 PAINTING

Internal and external parts of the casing and all metal parts including the canopy likely to come in contact with the surrounding air shall be protected with anti-acid paint that will resist the specified environment conditions.

All external surfaces of the motor and its canopy shall be given a coat of epoxy based paint. Paint shade shall be 632 as per Indian Standard-IS-5.

7.0 INSPECTION AND TESTING

7.1 During manufacturing of motors, the motors shall be subject to inspection by Consultant / Owner's Inspector or, by an agency authorized by the Owner. The manufacturer; shall, provide all Necessary information concerning the supply to Consultant's / Owner's inspector.

7.2 The manufacturer shall give prior notice of minimum 4 weeks to the Inspector forwitnessing the tests Witness of acceptance test shall he applicable for motors rated above 1:1 kW. In case of motors rated up to 11 kW, routine test records shall be provided as partof final documentation.

7.3 All tests shall be carried out at manufacturer's shop under his care and-expense.

7.4 Tests certificates duly signed by the Consultant / Owner's Inspector shall be a part of final documentation.

7.5 The manufacturer shall submit all internal test records of the tests carried out by him on the bought-out items, motor sub-assembly and complete motor assembly to the Inspector before offering the motors for final inspection and-testing. The manufacturer shall periodically carry out the following type tests as per applicable Indian Standards for all the frame -sizes and ratings of motors.

a. Full load test and measurement of voltage, current, power & slip.
b. Measurement of starting torque,: starting current, full load torque and pull out torque.
c. Measurement of efficiency and P.F.at 100%, 75% and 50% load.
d. Temperature rise test.
e. Momentary overload test.
f. Measurement of vibration.
g. Measurement of noise level.
h. Over speed test.

7.6 The above tests must be witnessed and approved by reputed inspection agencies. The manufacturer shall maintain test records and submit to the Consultant / Owners Inspector at the time of final inspection & testing. In no case, the test records shall be more than 5 year old.

7.7 In special cases where the type tests are asked to be carried out, VCS/ Owner's Inspector shall witness these.

7.8 The manufacturer shall carry out routine tests as per applicable Indian Standards on all the motors. Routine tests not limited to the following shall form part of acceptance testing:

a. General visual checks, nameplate details, mounting, terminal box location and cable gland sizes
b. Measurement of shaft center height dimensions
c. Measurement of clearances in the terminal box
d. Verification type of terminals (for Ex-e & Ex-n motors)
e. Verification of direction of rotation
f. Measurement of winding resistance
g. Insulation resistance test (before & after high voltage Test)
h. High voltage test
i. No load test and measurement of voltage; speed; current & power input
j. locked rotor test at reduced voltage and measurement of voltage, current & power input
k. Reduced voltage starting & running
l. Tests on the Ex d enclosures as per IS

7.9 The manufacturer shall submit the following certificates for verification by the Consultant / Owner's Inspector:

a. Test certificate for degree of protection of enclosure
b. Test certificates issued by the recognized independent test house for hazardous area motors
c. Approval certificates issued by Statutory Authorities for hazardous area motors
d. BIS license and marking as required by Statutory Authorities for Ex d motors

7.10 Though the motors shall be accepted on the basis of the satisfactory result of the testing at the shop, it shall not absolve the Vendor from liability regarding the proper functioning of the motors coupled to the driven equipment at site.

8.0 CERTIFICATION

8.1 The hazardous area motors and associated equipment shall have test certificates issued: by recognized independent test house (CIMFR/Bassefa/LCIEIUL/FM or equivalent). All indigenous motors shall conform to Indian standards and shall be certified by Indian testing agencies. All motors (indigenous & imported) shall also have valid statutory approvals as applicable for the specified location. All indigenous flameproof motors shall have valid bis license & marking as required by statutory authorities.

8.2 Ex n motors shall be supplied with manufacturer's certificate of conformity to IS 9628 or equivalent International Standard and Indian statutory approval.

9.0 MARKING, PACKING AND DISPATCH

9.1 All the equipment shall be divided into several sections for protection and ease of handling during transportation. The equipment shall be properly packed or transportation by ship/rail or trailer. The equipment shall be wrapped in polythene sheets before being placed in crates/cases to prevent damage to the finish. Crates/cases shall have skid bottom for handling. Special notations such as `Fragile , This side up, Center of gravity, Weight, Owner's particulars, `PO Nos.' etc. shall be clearly marked on the package together with other details as per Purchaser order.

9.2 The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains/high ambient temperature, unless otherwise agreed

DATA SHEET OF ELECTRIC MOTOR DRIVEN CNG COMPRESSOR	CLIENT JOB NO.	
	TOTAL SHEETS	6

DOCUMENT NO	C211036	CGD	ME	DS	3001A

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

DATA SHEET
OF
ELECTRIC MOTOR DRIVEN CNG COMPRESSOR

REV	DATE	DESCRIPTION	PREP	CHK	APPR

				CUGL Central U.P. Gas Limited
CLIENT	CENTRAL U.P GAS LIMITED (CUGL)			
PMC				
MECHANICAL DATA SHEET - ELECTRIC MOTOR DRIVEN CNG COMPRESSOR				
`	NO. OF UNITS	:	-	**DRIVE: ELECTRIC MOTOR**
	DUTY	:	**Continuous**	**LOCATION: KANPUR, UNNAO, JHANSI & BAREILLY GA**
1.0	**OPERATING CONDITIONS**			
1.1	Service / stage	:	Motor driven CNG Compressor package for CNG stations/ #	
1.2	Gas handled	:	Natural Gas	
1.3	Composition	:	Natural Gas (Refer gas composition as per given in technical specification)	
1.4	Corrosive due to:		NA	
1.5	Molecular Weight at Intake (Avg)		Refer Gas composition	
1.6	Cp/Cv at intake / compressibility Factor		Refer Gas composition	
1.7	Relative Humidity			
1.8	Suction Temperature ($^{\circ}$C)	:	30°C (35 °C max)	
1.9	Suction Pressure (Kg/cm², Gauge)	:	14 - 19	
1.10	Discharge Temperature (°C)	:	Maximum 52°C After Cooler	
1.11	Discharge Pressure (Kg/cm², G)	:	255 Kg/cm²g	
1.12	Required Capacity (SM³/hr.)	:	250 SCMH	Driver Motor rating: # KW
1.13	Drive arrangement Direct Coupling/V-belt		#	#
1.14	standard Conditions referred to	:	Standard Atmospheric pressure (1.033 Kg/cm² abs) and Temperature of 15.6°C	
2.0	**SITE CONDITIONS**			
2.1	Place			Installation: Outdoor
2.2	Site Ambient Temp. (°C)		Min : 2 °C Max :52 °C	Max. Relative Humidity (%) : 90%
2.3	MSL – 267 m			
2.4	Area Classification	:	Class1 Div1 Group D or Zone 1 Group IIA/IIB	
3.0	**APPLICABLE CODES & SPECIFICATIONS**			
3.1	Compressor	:	API 11P, 2nd edition. ; ISO 13631/ Trunk Piston	Piping: ASME B 31.3
3.2	Driver	:	Refer Electric Motor data sheet	
3.3	Air Cooled Exchangers		API 661	Water cooled exchangers : TEMA 'C' - NA
3.4	Pressure Vessel	:	ASME Sec. VIII Div.1	Control Panel : Refer Tech Specs
4.0	**MANUFACTURER'S SPECIFICATION**			
4.1	Name	:		Model:
4.2	No. Off	:		Compressor RPM/Stroke (mm):
4.3	Type	:		Drive Arrangement:
4.4	Service/Stage			
4.5	Mol. Wt. At Intake (Avg.) (Gas Composition)	:		C_P /C_V Value/ Compressibility Factorat Intake
4.6	Adiabatic Power (KW)	:		Shaft Power @ RV set pressure (KW)
4.7	Driver Rating & Speed (KW/RPM)	:		Noise level:
4.8	Suction Line (Size/ Rating)	:		Discharge Nozzle (Size/Rating)
4.9	Direction of Rotation from Driving End:			
4.1	Compressor Weight :	Max. Erection Weight:		Max. Maintenance Weight::
4.11	Diff. Pr. In Suc. Strainer, Piping, puls Dampener:		Diff. Pr. In after Cooler	

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4.1	**PERFORMANCE DATA PACKAGE #**			
	Gas Suction Pressure	**Suction Pressure 14 kg/cm2g**		
		1st Stage	2nd Stage	3rd stage
	Mol. Wt. at intake	Refer CNG gas composition as per given in Technical Specification		
	Specific Gravity			
	Cp/Cv Value / compressibility Factor at intake			
	Cp/Cv Value / compressibility Factor at discharge			
	Suction Temp. °C	35	52° C MAX	52° C MAX
	Suction capacity, SM3 / Hr	400 / 250		
	Discharge pressure, kg/cm2 g			
	Discharge Temp. Adiabatic °C			
	Discharge Temp. Actual, °C			
	shaft power, Kw			
	V-belt / coupling losses, kW			
	Shaft power at RV set pressure including			
	Volumetric Efficiency, %			
	Valve lift			
	Valve lift area			
	Valve velocity (Average) M/sec			
	Design data			
4.1	Suction Pressure, kg/cm2 g	**Suction Pressure 19 Kg/ Cm2g**		
		1st Stage	2nd Stage	3rd stage
	Mol. Wt at intake	Refer CNG gas composition as per given in Technical Specification		
	Specific Gravity			
	Cp/Cv Value / compressibility Factor at intake			
	Cp/Cv Value / compressibility Factor at discharge			
	Suction Temp. °C	35	52° C MAX	52° C MAX
	Suction capacity, SM3 / Hr.	400 / 250		
	Discharge pressure, kg/cm2 g			
	Discharge Temp. Adiabatic °C			
	Discharge Temp. Actual, °C			
	shaft power, Kw			
	V-belt / coupling losses, kW			
	Shaft power at RV set pressure including			
	V-belt / coupling losses, kW			
	Volumetric Efficiency, %			
	Valve lift			
	Valve lift area			
	Valve velocity (Average) M/sec.			
5.0	**CYLINDER & PACKAGING DATA #**			
5.1	Service / stage	1st Stage	2nd Stage	3rd stage
5.2	Cylinder bore (mm/No. off)			
5.3	Single / Double Acting			
5.4	Liner (yes/ No.)			
5.5	Type of Valves			
5.6	Piston Displacement (M3/Hr.)			
5.7	Volumetric Efficiency (%) Min/ Nor/max			
5.8	Mean Piston Speed(m/sec) [<3.5 m/sec]			
5.9	Suction / discharge valve gas velocity (m/sec)			
5.1	Relief valve setting (kg/cm2 g)			
5.1	Max. allowable cylinder pressure (kg/cm2 g)			
5..12	Max. allowable cylinder temperature (°C)			
5.1	Pneumatic Test By (kg/cm2 g)			
5.1	Hydrostatic test (kg/cm2 g)			
5.2	Suction / discharge nozzle orientation			
5.2	No. of suction / discharge valves			
5.2	Piston Rod Dia. (mm)			

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5.18	Piston Load				
	- Max. Rod load gas compression, Kg				
	- Max. Rod load gas tension, Kg				
	- Rod load (Inertia alone) compression, Kg				
	- Rod load (Inertia alone) tension, Kg				
	- Rod load rated Pr. (gas + inertia) compression, Kg				
	- Rod load rated Pr. (gas + inertia) tension, Kg				
	- Rod load at R.V set Pr. (gas + inertia) compression, Kg				
	- Rod load at R.V. set Pr. (gas + inertia) tension, Kg				
5.19	Max. Permissible Piston Rod loads (kg)				
5.2	Rod packing cooling by liquid (yes/No.)				
5.21	Rod packing lubrication (Yes/No)				
5.22	Rod packing vent to				
5.23	distance piece type				
5.24	Cylinder jacket cooling by				
6.0	**LUBRICATION SYSTEM #**				
	□ Splash	□ Force feed Lubricated			
	□ Pressure lubrication including piping, valves	□ Mini Lubricated			
	□ Oil filter : single	□ Non-Lubricated			
	Degree of filtration	□ Lubricator Driven by			
	□ Oil cooler	□ Compressor shaft			
	□ Oil pump driven by compressor shaft	□ Electric Motor (kW)			
	□ Auxiliary oil pumps, if Required	□ Lubricator equipped with pin flow indicator for each point storage tank with level gauge			
	□ Pre-lube Motor driven pump, in case of splash system				
	Grade / viscosity of lube oil	Grade / viscosity of lube oil			
	Oil sump capacity	Oil sump capacity (For 500 Hrs.)			
	Lube oil consumption (Lt/100 Hr.)	Lube oil Consumption (Lt. /100 Hrs.)			
	Change lube oil after	Hours			
	Type of bearing : Main Big End:	Small End:			
7.0	**COMPRESSOR CONTROLS**				
7.1	□ Automatic start / stop on storage pressure level and manual start stop	□ Actuators (To be included in supply)			
7.2	□ Automatic drain of separators	□ Manual on machine			
7.3	□ Compressor to start automatically after power interruption with 10 seconds delay.	□ Intermediate devices (to be included in supply)			
7.4	□ Automatic recovery of gas form gas recovery vessel	□ Solenoid valves			
7.5	□ Automatic closing of suction isolating valve on compressor trip	□ Manual mounted in a local panel			
7.6		□ Controller (For auto control)			
7.7		□ Pressure switches (For auto control)			
7.8	Compressor shall unload on Power failure/ stoppage through (Vendor to indicate) " Automatically " Manually	□ Any other instrument required.			
7.9	Compressor shall load on start through (Vendor to indicate)	□ Automatically □ Manually			
7.10	Recommended time duration for compressor operation @ 0% capacity (minutes)				
7.11	Recommended number of starts/ stops for the Motor : Per Hours				
8.0	**AUXILIARIES**				
8.1	**COOLERS**				
8.1.1		Oil Cooler (Required)	After cooler	Inter coolers	
8.1.2	Cooler Type	Water cooled	Air cooled	Air cooled	
8.1.3	Tube/Fin Material				
8.1.4	Tube sheet material shell Material				
8.1.5	Shell Material				
8.1.5	ASME /Third Party Inspection	yes	yes	yes	
8.2	**Suction Strainer**	Temporary	Mesh Size		
8.2.1	**Volume Bottles / Pulsation Dampers**		1st stage	2nd stage	3rd stage
8.2.2	Type at Suction /Discharge				
8.2.3	Residual Pulse Amplitude (peak to peak)		3% / 3%	3% / 3%	3% / 3%
8.2.4	Maximum Allowable Working Pressure (kg/cm2g)				
8.2.5	Capacity (M3)				
8.2.6	ASME/Third Party Inspection			yes	yes
8.3	**Separator**	**1st suction**	**1st discharge**	**2nd Discharge**	**Final discharge**
8.3.1	Type				
8.3.2	Max allowable Pr (kg/ cm2g)				
8.3.3	Capacity (M3)				
8.3.4	Design Code - ASME SEC VIII DIV 1 Latest	yes	yes	yes	yes

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8.4	**Oil Mist separator at final discharge to limit oil carry over to 5 PPM**	
8.4.1	Type	capacity :
8.4.2	Max allowable Pr (kg/ cm2g)	Third Party Inspection: Yes
8.5	**Gas Recovery vessel**	capacity :
8.5.1	Max allowable Pr (kg/cm2g)	
8.5.2	Third Party Inspection	yes
9.0	**INSTRUMENTATION**	
9.1	PRESSURE INDICATION	PRESSURE TRANSDUCER
9.2	Gas At inlet	Frame oil header (1 no. For trip on low pressure.)
9.3	Gas at discharge (each stage)	Jacket water system failure
9.4	Frame oil Header	Compressor discharge Pr high (Each stage)
9.5	Frame oil filter (Differential local)	Compressor discharge Pr Low (Final stage)
9.6	Gas at after cooler exit (local)	Compressor suction' pressure low
9.7	Hydraulic Oil Pr. (each stage)	Compressor suction' pressure high
		FRAME HIGH VIBRATION
9.8	**TEMPERATURE INDICATION**	TEMPERATURE TRANSDUCER
	Gas at suction to compressor	Temperature at compressor suction
	Gas at Discharge of Comp (Each stage before & after cooler)	Temperature after compressor discharge before cooler & after cool (each stage)
	Gas at after cooler	
	Oil cooler oil outlet	
9.9	**OTHER INSTRUMENTS**	LEVEL SWITCHES
9.10	Junction Box with interconnecting wiring/ PLC connection	Suction K.O.D (for automatic drain)
9.11		Discharge K.O.D (for automatic drain)
9.12	Pressure Relief Valve at discharge each stage	BAFFLE FLOW SWITCHES OR ORIFICE DIFF. PRESS SWITCHES
9.13	Pressure Relief Valve at suction to compressor	Low cooling water flow
9.14		Water outlet -after cooler/Air cooler
9.15	Instruments for closed circuit cooling water system	PRESSURE TRANSDUCER
9.16	Hour meter	As reqd. in close ckt. cooling system
9.17	Gas detection system	Pin flow indicators, cylinder and packing lubrication oil lines
9.18	Flame detection system	LEVEL GAUGE AND' INDICATORS
9.19	Forced feed lubrication failure to stop comp.	Frame oil (Bull's eye type)
9.20	Priority fill panel	Packing / cylinder 'lubrication oil
9.21	Emergency shut down system	Make up water tank
9.22	Other instrument for safe running of compressor	
9.23	Note: 1. Each pressure gauges and pressure switch with an isolating valve and a drain valve.Switch contacts to open under fault conditions Switch / junction box enclosure (As per the electrical area classification)	

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MECHANICAL DATA SHEET - ELECTRIC MOTOR DRIVEN CNG COMPRESSOR

10.0	**INSTRUMENT PANEL**				
10.1	PNEUMATIC CONTROLS FOR			TRIP CIRCUIT TO BE CONNECTED TO MAIN DRIVER CONTROL SWITCH	
10.2	Capacity Indication			Cause of shut down	
10.3	Pressure Regulator			Frame Oil Pressure-Low	
10.4				Low Cooling Water Flow	
10.5	PUSH BUTTONS AND SIGNAL LIGHTS FOR				
10.6	Main Motor & Aux. Motors			Compressor discharge PR.(Each stage)	
10.7	Ammeters for main and Aux. Motors			Compressor suction Pr. Low	
10.8	ESD			Compressor suction Pr.	
10.9	Common machine trip-alarm				
11.0	**MATERIAL OF CONSTRUCTION & GRADES**			#	
11.1	Stage	1st	2nd	3rd	Remarks
11.2	Cylinder & Head				
11.3	Liner				
11.4	Piston				
11.5	Piston ring				
11.6	Piston Shoe (Wear Band)				
11.1	Valve spring				
11.1	Cylinder Packing Ring				
11.1	Crank shaft F.S	Connecting Road (CR) (Forged		Connecting Rod cap. Bolts (Forged Steel)	
11.1	Main Bearing	Big End Bearing	Small end bush:		
11.1	Piston Rod	Yield strength		Hardness(RC)	Surface Finish
11.2	Pulsation Dampers / Volume Bottles			Suction/Discharge KOD	
11.6	Non Return Valve-shall be compressor Discharge valve type				
12.0	**INSPECTION AND TESTING**				
12.1	X-ray examination for welded joints for heat	NO only TC			
12.2	Ultrasonic testing for piston rod, connecting	YES			
12.3	Magnaflux testing for crankshaft, piston rod	YES			
12.4	Dye penetrant testing for cylinder liners ,	YES			
12.5	Shop inspection by purchaser during	YES			
12.6	Barring over to check clearance	YES			
12.7	Mechanical running test with shop job driver	YES			
12.8	Stripping check and internal inspection	For one comp			
12.9	Hydrostatic test of Cylinders, Pressure Vessels	YES			
12.10	Leak proof test of crank case	YES			
12.1	Fit up test at compressor packager's	YES			
12.1	Performance Acceptance Test	YES			
12.1	Field noise level test	YES			
12.1	Field trial run at site for 12 hours	YES			
12.2	Functional / continuity tests - control panel (	YES			
12.2	Inspection and tests of compressor vessels				
	Piston	Piston Rod			
	Cylinder and liner	Connecting Rod		Crank case	
	Crank shaft	Heat Exchangers		Valve components	
	Pressure vessels				
	Test Certificate required for				
	Auxiliary Motor &	Safety Relief Valves		Capacity control devices	
	Safety switches	Solenoid valves		All instruments	
	Note : 1. For electrical / instrument items, vendor shall provide certificates issued by statutory inspection authority confirming suitability of design / construction for specified Hazardous area classification				

		CUGL Central U.P. Gas Limited
Datasheet for Intercooler / After cooler	**Client Job Number**	
	Total Sheets	03

Document No					

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR

Datasheet for
Intercooler / After cooler

1	**GENERAL**				
2	PROJECT: **CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA**				
3	OWNER: **CENTRAL U.P GAS LIMITED (CUGL)** SITE:				
4	Item No. : Service : **Intercooler / After cooler for Compressor Package**				
5	NOTE: ■ SCOPE OPTION / INFORMATION SPECIFIED BY PURCHASER □ INFORMATION REQUIRED FROM VENDOR.				
6	□ Manufacturer:	Type: □ Forced Draft □Induced Draft			
7	□Bundle Size: m x m x m	Bundles/Section		Number of Units:	
8	Bundles/Unit:	In Parallel / Series		Section Size:	
9	Surface/Bundle: m^2	Bare Tube: m^2		Section/Unit:	
10	Surface/Unit: m^2	Bare Tube: m^2		Plot Area/Unit:	
11	**PERFORMANCE (Of One Unit)**				
12	Heat Exchanged: kcal/hr			MTD (Corrected): ^0C	
13	Transfer Rate: kcal/hr m^2 ^0C	(Finned Surface)		(Bare Surface)	
14	**TUBE SIDE**				
15	Fluid Circulated	**GAS**	Specific Gravity: refer gas composition		
16	Total Entering Gas kg/hr kcal/kg			Enthalpy / Latent Heat	
17	Operating Temperature ^0C/kcal	In:	Out:	Fouling Resistance hr m^2	
18	Operating Pressure Passes / Bundle kg/cm^2				
19	AIR SIDE				
20	Temperature	In: **50**	Out:	Altitude m	
21	Total Flow/Unit kg/hr			Static Pressure kg/cm^2	
22	Quantity/Fan kg/hr			Power/Fan kW	
23	Face Velocity m/sec			Power/Unit kW	
24	**CONSTRUCTION (Each Bundle)**				
25	Design Pressure: kg/cm^2g	Test Pressure: kg/cm^2g		Design Temperature: ^0C	
26	Code Requirements:				
27	Type of Tubing:	Tube Material:	Fin Material: **Al**		
28	**Tube** Bare Tubes (no's):	No. of rows: O.D. Length		BWG/Thk	
29	Fins: Spacing /inch. O.D.	Root Dia		Thickness:	
30	**Header** Type: Plug / Cover		No. of Splits:	Material :	
31	Plugs/Gaskets	Side Frame : **C.S. Inside Zinc Protected**			
32	**Nozzles**		In :	Out :	
33	**Couplings**	**Vent:**		Drain :	
34	**CONSTRUCTION (Each section)**				
35	Structure kgf/m		**CS** Sec. /Gr. No.	Design Wind Load :	
36	Plenum Chamber	**CS inside Zinc Protected**		Type :	
37	Fans No.	Dia.	RPM	Mfr.	
38	Blades Material :		No./Fan	Pitch Angle(Design) :	

39	Hubs	Material:	Pitch: Auto variable / Adjustable (No.)	
40	Louvers	Material :	Type :	Mfr.
41	Weights kg Each Section(Dry) :		Full of Water:	
42	Each Bundle (Dry) :		Full of Water:	
43	**APPLICABLE SPECIFICATIONS API Standard 661**			
44	REMARKS 1. Air coolers shall be designed for 20% excess capacity than required normally.			
45	Exchanger shall be designed with air side temperature of 47 ^{0}C and max. Ambient temperature 52°C.			
46	Separate data sheet shall be filled by the bidder for each service i.e. Inter cooler and After cooler.			

		CUGL Central U.P. Gas Limited

LIST OF INSTRUMENTATION & CONTROLS			**Client Job Number**		
			Total Sheets		
Document No					

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR

LIST OF
INSTRUMENTATION & CONTROLS

1. LIST OF INSTRUMENTATION & CONTROLS

1.1 LIST OF MINIMUM INSTRUMENTATION & CONTROLS TO BE PROVIDED FOR COMPRESSOR:

S.NO	DESCRIPTION	INDICATION		ANNUNCIATION & PRE ALARM		TRIP & A/V ALARM ANNUN.	
		GUAGE –LOCAL GUAGE BOARD	INDICATOR LOCAL PANEL (PLC) DISPLAY	LOW LOCAL PANEL DISPLAY	HIGH LOCAL PANEL DISPLAY (PLC)	LOW –LOCAL PANEL - PLC-DISPLAY	HIGH LOCAL PANEL PLC- DISPLAY
1	Frame Oil Sump/Reservoir Level	■ yes					
2	Main L/O Pump Disch. Pr (supply header).	■ yes	■ yes	■ yes		■ yes	
3	Oil Flow						
4	Oil Pressure at Main Bearing						
5	Supply Header Temp.						
6	Oil cooler Oil Inlet Temp.						
7	Stand by Pump Start						
8	Compressor Main Bearing metal Temp.						
9	Cylinder & Packing Oil						
10	Lubricator Oil Level	■ yes					
11	Lubricator Oil Flow						
12	Lubricator Failure					■ yes	
13	Aux. Oil						
14	Lube Oil Supply Pr. to Electric Motor Driver						
15	Lube Oil return from Electric Motor Driver						
16	Elec. Motor bearing Metal temp.						
17	Coolant System						

LIST OF
INSTRUMENTATION & CONTROLS

S.NO	DESCRIPTION	INDICATION		ANNUNCIATION & PRE ALARM		TRIP & A/V ALARM ANNUN.	
		GUAGE –LOCAL GUAGE BOARD	INDICATOR LOCAL PANEL (PLC) DISPLAY	LOW LOCAL PANEL DISPLAY	HIGH LOCAL PANEL DISPLAY (PLC)	LOW –LOCAL PANEL - PLC-DISPLAY	HIGH LOCAL PANEL PLC- DISPLAY
18	Each cylinder CW outlet Temp.						
19	Inter/After/Oil Cooler CW outlet temp.						
20	CW Supply header flow						
21	Sight Flow CW return each cylinder, Cooler & Header	■ yes					
22	For Closed Circuit Cooling						
23	Coolant main pump disch. Pr.		■ yes	■ yes			
24	Coolant standby pump disch. Pr.						
25	Coolant stand by pump start						
26	Coolant supply header Pr.						
27	Coolant supply header temp						
28	Coolant cooler Outlet Temp.	■ yes					
29	Coolant reservoir Level	■ yes				■ yes	
30	Cylinder Coolant Outlet Temp.						
31	For Static/Thermosiphon System						
32	Cylinder Coolant Outlet Temp.						
33	Diff. Pr. Across packing coolant filter						

LIST OF
INSTRUMENTATION & CONTROLS

S.NO	DESCRIPTION	INDICATION		ANNUNCIATION & PRE ALARM		TRIP & A/V ALARM ANNUN.	
		GUAGE –LOCAL GUAGE BOARD	INDICATOR LOCAL PANEL (PLC) DISPLAY	LOW LOCAL PANEL DISPLAY	HIGH LOCAL PANEL DISPLAY (PLC)	LOW –LOCAL PANEL - PLC-DISPLAY	HIGH LOCAL PANEL PLC- DISPLAY
34	Process Gas System						
35	Each stage inlet Pressure						
36	Each stage inlet temp.						
37	Each stage Outlet Pressure	■ yes	■ yes		■ yes		■ yes
38	Each stage Outlet temp.	■ yes	■ yes		■ yes		■ yes
39	After Cooler Gas Outlet Temp.	■ yes	■ yes		■ yes		■ yes
40	1st stage pressure low / high	■ yes	■ yes	■ yes	■ yes	■ yes	■ yes
41	Cylinder Packing Vent Pressure						
42	Suction Pressure, low	■ yes	■ yes				■ yes
43	Blow Down vessel level	■ yes					
44	Piston Rod Drop Indicator						
45	Distance piece diff. Purge pressure						
46	Common process parameters						
47	Common machine parameters						
48	Blow Down vessel Pressure	■ yes	■ yes				■ yes
49	Vibration Measurement						■ yes

Such as Amperes, voltage, flow rate, total quantity of gas compressed, inlet – outlet pressure, inlet –outlet temperature, Kilo Watt Hour (KWH), electric power (electric driven compressor), fuel gas for gas engine.

1.2 LIST OF INSTRUMENTATION & CONTROLS FOR GAS ENGINE: -

S. NO	DESCRIPTION	INDICATION		ANNUNCIATION & PRE ALARM		TRIP & A/V ALARM ANNUN.	
		GUAGE –LOCAL GUAGE BOARD	INDICATOR LOCAL PANEL (PLC) DISPLAY	LOW LOCAL PANEL DISPLAY	HIGH LOCAL PANEL DISPLAY (PLC)	LOW –LOCAL PANEL -PLC-DISPLAY	HIGH LOCAL PANEL PLC- DISPLAY
1	RESERVOIR OIL LEVEL	■ yes				■ yes, switch	
2	RESERVOIR TEMP.		■ yes		■ yes		■ yes
3	MAIN L/O PUMP DISCH. PR.		■ yes	■ yes		■ yes	
4	LUBE OIL FILTER DIFF. PR.						
5	L/O SUPPLY HEADER TEMP.						
6	OIL COOLER OIL OUTLET TEMP.						
7	STAND BY PUMP START						
8	**COOLING SYSTEM**						
9	OIL COOLER CW OUTLET TEMP.						
10	CW SUPPLY HEADER FLOW						
11	SIGHT FLOW CW RETURN EACH COOLER & HEADER						
12	LOCAL MOUNT TSV ON EACH ISOLATABLE CIRCUIT						
13	WATER LEVEL IN MAKE UP WATER TANK / RADIATOR	■ yes		■ yes		■ yes	
14	ENGINE JACKET C.W SUPPLY TEMP.				■ yes	■ yes	
15	ENGINE JACKET C.W RETURN TEMP. (INLET OF RADIATOR)		■ yes		■ yes		■ yes
16	COOLANT MAIN PUMP DISCH. PR.	■ yes					
17	COOLANT SUPPLY HEADER PR.	■ yes					

LIST OF
INSTRUMENTATION & CONTROLS

S. NO	DESCRIPTION	INDICATION		ANNUNCIATION & PRE ALARM		TRIP & A/V ALARM ANNUN.	
		GUAGE –LOCAL GUAGE BOARD	INDICATOR LOCAL PANEL (PLC) DISPLAY	LOW LOCAL PANEL DISPLAY	HIGH LOCAL PANEL DISPLAY (PLC)	LOW –LOCAL PANEL -PLC-DISPLAY	HIGH LOCAL PANEL PLC- DISPLAY
18	COOLANT SUPPLY HEADER TEMP						
19	COOLANT COOLER OUTLET TEMP.	■ yes					
20	COOLANT RESERVOIR LEVEL SWITCH	■ yes		■ yes		■ yes	
21	**STARTING SYSTEM**						
22	AIR RECEIVER PRESSURE	■ yes	■ yes				
23	**INLET AIR SYSTEM**						
24	INLET AIR FILTER DIFFERENTIAL PRESSURE	■ yes					
25	BOOST AIR (TURBO CHARGER) DISCHARGE PRESSURE (IF REQUIRED						
26	CHARGE AIR COOLER OUTLET AIR TEMP. (IF REQUIRED)						
27	**MISCELLANEOUS**						
28	ENGINE/MAIN ELECTRIC MOTOR VIBRATIONS						■ yes
29	ENGINE/ MAIN MOTOR SPEED	■ yes	■ yes				
30	START STOP BUTTON						
31	ENGINE OVERSPEED						■ yes
32	ENGINE /MAIN MOTOR FAILS TO START		■ yes				
33	FEUL GAS / ELECTRIC POWER CONSUMPTION INDICATION AND CUMULATIVE		■ yes				
34	TACHO-HOUR METER	■ yes	■ yes				

VCS PROJECT CONSULTANTS PVT. LTD.

DATA SHEET
FOR
LV INDUCTION MOTOR

Rev. No	Date	Purpose	Prepared By	Checked By	Approved By	Approved By

DATA SHEET
FOR
LV INDUCTION MOTOR

GENERAL INFORMATION	
Applicable To: ☐ Proposal ☐ Purchase ☐ As Built ☐ Vendor shall complete Data Sheet with information not otherwise provided by Buyer.	
Client: _____	
Facility: _____	Tag Number: _____
Location: _____	Manufacturer/Model No.: _____
Service: _____	

[TECHNICAL DATA SHEET]		
1.00	**GENERAL**	
1.01	Vendor	* / # #
1.02	Manufacturer	* / # #
1.03	Country of Origin	* / # #
1.04	Mechanical data validity (IFI/IFP)	* / # #
1.05	Maximum delivery date	* / # #
1.06	Type	
1.07	Standards, Codes	
1.08	General specification	
1.09	Tag No.	
2.00	**ENVIRONMENTAL/CONDITION**	
2.01	Place of installations	☐ Indoor ☐ Outdoor
2.02	Altitude if>1000m	
2.03	Maximum ambient temperature	
2.04	Design ambient temperature	
2.05	Relative Humidity	
2.06	Special conditions (Tropicalisation, etc..)	
2.07	Hazardous area (zone)	
2.08	Gas group	
2.09	Auto ignition temperature	
3.00	**DRIVEN EQUIPMENT CHARACTERISTICS**	
3.01	Driven Machine	* ☐ compressor ☐ Fan ☐ Pump
3.02	Service conditions	☐ S1 ☐ S2
3.03	Maxi shaft power	*
3.04	Shaft power at operating point	*
3.05	Brake torque curve (kn2...)	*
3.06	Required starting brake torque (Nm)	*
3.07	Moment of Inertia MR2 (kgm2)	*
3.08	Driver Machine Speed RPM	*
3.09	Drive (Direct / Belt)	*
3.10	Coupling	*
3.11	Toward Motor Thrust	* ☐ Transient ☐ Continuous
3.12	Toward Coupling Thrust	* ☐ Transient ☐ Continuous
3.13	Radial Thrust	* ☐ Transient ☐ Continuous

3.14	Number of Belts	*
4.00	**FOR AIR COOLERS EXCHANGER ONLY**	
4.01	Motor in/outside air flow	*
4.02	Motor Ventilation Against Air Flow	* ☐ Yes ☐ N
4.03	Max. Temp. of air (°C)	* Air Speed: * m/s
4.04	Weight Supported by the Shaft End kg	*
5.00	**MOTOR GENERAL CHARACTERISTICS**	
5.01	Rated power kW	# #
5.02	Synchronous Speed RPM	# #
5.03	Voltage (+/- 10%)	
5.04	Phase	
5.05	Frequency (+/- 5%)	
5.06	Mounting Symbol	* / # #
5.07	Height of Shaft	* / # #
5.04	Degree of Protection (IP)	
5.05	Number of Consecutive Start ups Cold	
5.06	Number of Consecutive Start ups Warm	
5.07	Insulation Class	
5.08	Temperature Rise at (55°C)	
5.09	Type of Starting	
5.10	Cooling Type	
5.11	Impregnation	# #
5.12	Direction of Rotation Facing Motor Shaft	* ☐ CW ☐ CCW/2
5.13	Protection for Hazardous Area (Ex'd'...)	
5.14	Gas Group (IIA & IIB...)	
5.15	Temperature Class / Maxi. Surface Temperature	
6.00	**MOTOR ELECTRICAL CHARACTERISTICS**	
6.01	Rated Current (or Full Load Current)	# #
6.02	No Load Current	# #
6.03	No Load Power	# #
6.04	Locked Rotor Current (LRC) (%)	
6.05	Efficiency at	# #
6.06	Power Factor at	# #
6.07	Locked Rotor Power Factor Cos 0	# #
6.09	Thermal Time Constant	# #
6.10	Permissible Locked Rotor Time (Cold, Warm)	# #
6.11	Running Up Time Under Full Voltage	# #
6.12	Running Up Time Under 80% Voltage	# #
6.13	Permissible Voltage Drop at Starting (%Un)	
6.14	Full Load Speed (at 4/4 Load)	# #
6.15	Locked rotor torque at Un/0.8 Un (% FLT)	# #
6.16	Pull up torque at Un/0.8 Un (% FLT)	# #
6.17	Breakdown torque at Un/0.8Un (% FLT)	# #

6.18	Vibration at no load (% mm/s RMS)	# #
6.19	Critical Speed (% r/min)	# #
6.20	Maximum transient air gap torque when - 2 phase circuit at motor terminal Nm - 3 phase circuit at motor terminal Nm	 # # # #
7.00	**MOTOR MECHANICAL CHARACTERISTICS**	
7.01	Frame material	# #
7.02	Moment of inertia MR2 kgm2	# #
7.03	Total weight kg	# #
7.04	Bearing	# # ☐ Antifriction ☐ sleeve
7.05	Bearing at coupling side/Opposite to coupling side	# #
7.06	Axial Thrust bearing	# # ☐ C.A ☐ C.O.A ☐ Without
7.07	Lubrication (Grease/oil)	☐ Grease ☐ Oil
7.08	Painting	# #
7.09	Noise Level (Lp.Lw) dBA	
7.10	Service Factor	
8.00	**MOTOR CERTIFICATIONS**	
8.01	Nr. Of certification (for motors located in Hazardous area)	
8.02	Certifying Authority	
9.00	**MOTOR AUXILIARY EQUIPMENTS**	
9.01	Anti-condensation Heater Protection for Hazardous area	
9.02	Anti-condensation Heaters (power, Voltage)	
9.03	Thermistor protection for motors	
10.00	**MOTOR CONNECTIONS**	
10.01	NR. Of terminals Brought out	
10.02	Earthing Terminal (In / Outdoor, Section)	
10.03	Start or winding connection symbol (star/delta)	
11.00	**MAIN TERMINAL BOX**	
11.01	Short Circuit rating kA	
11.02	Protection (Gas Group, Temp. Class)	
11.03	Orientation	#
11.04	Cable Gland Opening Type	
11.05	Cable Size mm2	#
11.06	Overall Diameter mm	#
11.07	Diameter Over Armor mm	#
11.08	Diameter Under Armor mm	#
12.00	**AUXILIARY TERMINAL BOXES**	

12.01	Heater Terminal Box KA	
12.02	Protection (Gas Group, Temp. Class)	
12.03	Orientation	#
12.04	Cable Gland Opening Type	
12.05	Cable Size mm2	#
12.06	Overall Diameter mm	#
12.07	Diameter Over Armor (mm)	#
12.08	Diameter Under Armor (mm)	#
13.00	**INSPECTION & TESTS**	
13.01	Inspection and Tests	
NOTES:		
	* Data to be filled by supplier with its bid in the supplier data column, those data shall be in accordance with standard specification.	
	# Data to be defined during detailed engineering.	
	# # Data by motor manufacturer.	

		CUGL Central U.P. Gas Limited
FIRE & GAS DEVICES DATA SHEETS	CLIENT JOB No.	
	TOTAL SHEETS	4
DOCUMENT No.		

CENTRAL U.P GAS LIMITED (CUGL)

FIRE & GAS DEVICES DATASHEETS

REV	DATE	DESCRIPTION	PREP	CHK	APPR

INDEX

Rev.

S.NO	ITEM DESCRIPTION	SHEET NUMBER	LOCATION	
1	Point Gas Detector	Sheet 3 of 4	CNG Compressor	
2	Flame Detector	Sheet 4 of 4	CNG Compressor	

POINT GAS DETECTOR

Rev.

GENERAL	1	Tag Number	Refer to Table Below
	2	Quantity	
	3	Ambient Temperature (min / max) deg c	2 to 50
	4	Service	Natural Gas
	5	% of Governing Component in Gas	
	6	Monitoring system	Gas Detection System
	7	Area Classification	Zone-1, IIA/IIB,T3
	8	Certification	ATEX or IECx with PESO
	9		
	10		
TRANSMITTER	11	Sensor Type	IR Absorption sensing
	12	Output	4~20 mA , 3 Wire
	13	Power Supply	24 VDC Loop Powered
	14	Range	0 - 100% LEL
	15	Enclosure Material	SS316 with Epoxy coating (finish)
	16	Response time	T90 < 5 Seconds
	17	Accuracy	± 2%
	18	Electrical Connection size	3/4" NPT*
	19	Wattage	*
	20	Mounting Accessories	Swivel Mounting bracket to suit 2" Pole
	21		
	22		
OTHERS	23	IR lamp source	Replaceable
	24	Immunity	Natural Light radiation, Dust focussing
	25	Splash guard	Required
	26	Enclosure Protection	Eex'd', IP65
	27	Dimensions	*
	28	Weight	*
	29	Calibration Kit	1 No. (configured to CNG sensing)
	30		
	31		

TABLE

S.NO	TAG NUMBER	LOCATION	QTY	MAKE / MODEL
1		CNG Compressor		*
				*
				*
				*
				*
				*
				*

Notes:

1 Vendor to specifiy.*

2 All the detectors shall be provided with dust guard and splashguard.

3 Tag plate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).

4 Calibration and hazardous area certificates shall be provided by the Vendor.

5 Gas Detector are IR type.

FLAME DETECTOR				Rev.
GENERAL	1	Tag Number	Refer to Table Below	
	2	Quantity		
	3	Ambient Temperature		
	4	Service	Natural gas - Flame Detection	
	5	Relative Humidity (RH)		
	6	Monitoring system	F&G System	
	7	Area Classification	Zone-1, IIA/IIB,T3	
	8	Certification	ATEX or IECx with PESO	
	9	Operating Temperature		
	10			
TRANSMITTER	11	Sensor Type	UV/IR Type	
	12	Output	4~20 mA , HART, 3 Wire	
	13	Power Supply	24 VDC*	
	14	Detection Range	30 Mtrs*	
	16	Field of View	90° Conical *	
	15	Enclosure Material	SS316 with Epoxy coating (finish)	
	16	Response time	T90 < 5 Seconds	
	17	Accuracy	0.1 sq.m *	
	18	Electrical Connection size	3/4" NPT*	
	19	Power Consumption	*	
	20	Enclosure Protection	Ex 'd', IP 65	
	21			
	22			
OTHERS	23	Weather Cover		
	24	Mounting Accessories		
	25	Make / Model No.		
	26			
	27			
	28			
	29			
	30			
	31			

TABLE	S.NO	TAG NUMBER	LOCATION	QTY	MAKE / MODEL
	1		CNG Compressor		*
					*
					*
					*
					*
					*
					*

Notes:

1 Vendor to specifiy.*

2 All the detectors shall be provided with dust guard and splashguard.

3 Tag plate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).

4 Calibration and hazardous area certificates shall be provided by the Vendor.

5 Flame detector are both UV & IR type.

		CUGL Central U.P. Gas Limited

DATA SHEET OF CNG MASS FLOW METER

DOCUMENT NO					

CENTRAL U.P. GAS LIMITED

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHK	APPR

MASS FLOW METER (CORIOLIS TYPE) DATA SHEET

	Sl.No.	Description	Client Specifications	Vendor to Provide
General	01.	Tag No.	#	#
	02.	Service	#	#
	03.	Model No.	#	#
	04.	Make	#	#
	05.	Measuring principle	Coriolis type	-
	06.	Fluid	Natural Gas	-
	07.	Design Pressure	345 bar(g)	-
	08.	Working pressure	250 bar(g)	-
	09.	Nominal Line size (inches)	½'' to ¾''(DN15 to DN20)	-
Haz. Area classification & location	10.	Electrical Area classifications	IEC Zone 1 Gr IIA, IIB	-
	11.	Ingress Protection Rating	IP 66/67	-
	12.	Approval & Certification type	ATEX/PESO/IECEx	-
	13.	Hazardous area classifications	Class I, Div. 1, Groups C and D	-
Sensor unit	14.	Sensor unit series	CNG Mass	-
	15.	Type	Coriolis	-
	16.	Function	Mass flow	-
	17.	End Connection size / ratings	# / As per process requirements	#
	18.	Facings & finish	RF 125AARH	-
	19.	Custody transfer	#	#
	20.	Flow tube Design pressure ratings	#	#
	21.	Combined sensor and process fitting ratings	#	#
	22.	Union to NPT adapter piece ratings	#	#
	23.	Body Material	SS316	-
	24.	Sensor Housing Material leads	SS Hermetically Sealed	-
	25.	Sensor/Wetted Parts Material	SS316	-
	26.	Enclosure	WP to IP 66/67	-
Sensor unit	**Sl. No.**	**Description**	**Client Specifications**	**Vendor to Provide**
	27.	Non-Wetted Parts Material	#	#
	28.	Intrinsically safe	Required	-
	29.	Flow range Max./Min.(kg/min)	#	#
	30.	Batch Accuracy	+/-0.5 %	-
	31.	Repeatability	+/-0.25 %	-

	32.	Stand Uncertainty	#	#
	33.	At 100 % flow (flow rate to be)	#	#
	34.	Jacketing	Required	-
	35.	Zero stability	0.009 kg/min.	-
	36.	Sensor weight (kg)	#	#
	37.	Turn down	10:1	#
	38.	Pressure Relief path	Required	#
Transmitter unit	39.	Enclosure	FLP+WP	-
	40.	Mass & Vol. Flow display	Required	-
	41.	Density	N/a	-
	42.	Display configuration	Local integrated display with sensor module	-
	43.	Power	Both AC & DC supply applicable	-
	44.	Transmitter Output	4-20 mA	-
	45.	10KHz pulse	Required	-
	46.	Modbus communication	Required	-
	47.	HART wireless communication	Required	-
	48.	Transmitter Design Temperature	-40° to 120°C	-
	49.	Transmitter Housing	NEMA 4X(IP66/67)	-
	50.	Electronics interface	#	#
	51.	Load Driving Capability in ohms	600 Ω	-
	52.	Conduit connection	1/2-inch NPTF (Applicable for Brass gland FLP Type)	-
	53.	Diagnosis application software	Pro-link latest version	-
	54.	Power consumption in watt	#	#
	55.	RS485 Baud Rate	#	#
	56.	Meter ID	#	#
	57.	Flow rate Measured	Kg/Hr.	-
Transmitter unit	**Sl.No.**	**Description**	**Client Specifications**	**Vendor to Provide**
	58.	Low flow cutoff @	#	-
	59.	High flow cutoff @	#	#
	60.	Transmitter Earthing point	Required	-
	61.	Mass flow cutoff	#	#
	62.	Volume flow cutoff	#	#
	63.	Equipment Ground	Required	-
	64.	Totalizer	shall be non-volatile and non-resettable	-
Fluid data	65.	Fluid / State	CNG / GAS	-
	66.	Pressure: Operating / Max.	250 Bar(g)	-
	67.	Temperature: Operating / Max.	Refer Technical specifications	-
	68.	Operating density (kg/m3)	170 to 219 kg/m3 @ 15°C	-

	69.	Relative Molecular mass	16.80 kg/k mol.	-
	70.	Operating viscosity	Cp	-
	71.	Maximum allowable pressure drops	Bar(g)	-
Parameter Display	72.	Mass flow rate(kg/Min.)	#	#
	73.	Gas Temperature (°C)	#	#
	74.	Volume flow rate (L/min.)	#	#
	75.	Volume total (Liter)	#	#
	76.	Mass total (kg)	#	#
Certification	77.	AGA11 conformance	Required	#
	78.	Hazardous Area PESO	#	#
	79.	Hazardous Area ATEX	#	#
	80.	Custody Transfer-W&M India	#	#
	81.	Calibration Certificates as per ISO 17025	Required	-
Inspection & Testing	82.	Material Inspection certificates	Required	-
	83.	Radiographic Test certificates	Required	-
	84.	Pressure Testing	Required	-
	85.	Weld examination	Required	-

NOTE: -

I. VENDOR TO PROVIDE THE DATA AS MARKED "#".

II. VENDOR TO PROVIDE INDIVIDUAL DATA SHEET ALONG WITH OPERATING MANUAL & OTHER COMPLIANCE CERTIFICATES DURING DETAIL ENGINEERING.

III. VENDOR TO PROVIDE PESO CERTIFIATES FOR BOTH TRANSMITTER & SENSOR UNIT ALOG WITH OTHER SUPPLIMENT CERTIFICTAES DURING APPROVAL PROCESS.

IV. VENDOR TO PROVIDE W&M CERTIFICATES FOR MASS FLOW METER DURING DETAIL ENGINEERING.

V. VENDOR TO PROVIDE TRANSMIITER & SENSOR BODY EARTHING WITH COMPRESSOR MOUNTINGS.

VI. VENDOR TO PROVIDE LATEST PRO-LIK SOFTWARE TO ONLINE DIAGONISIS OF METER.

VII. VENDOR TO PROVIDE CONVERTER CABLES, SOFTWARE & O&M MANUAL FOR FUTURE REQUIREMENTS DURING OPERATION PERIOD.

		CUGL Central U.P. Gas Limited

DATA SHEET FOR FLAME ARRESTER

DOCUMENT NO					

CENTRAL U.P. GAS LIMITED

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHK	APPR

GENERAL DESIGN SPECIFICATIONS

SR. NO.	DESCRIPTION	UNITS	DATA
01	FLAME ARRESTER - TYPE	~	In-line Flame Arresters with Vent tube rain protective type
02	TAG NO.	~	#
03	SERVICE FLUID	~	Natural Gas (Dry)
04	LINE EQUIPED WITH	~	Flared Vent line
05	LINE SIZE & QTY.	Inch	#
06	MAKE / MODEL OF FLAME ARRESTER	~	#
07	MOLECULAR WEIGHT OF GAS	Kg/K-mol.	17.96 ~ 19
08	GAS DENSITY @ P,T…	Kg/m3	219
09	LINE PRESSURE (MIN. / MAX / DESIGN)	kg/cm2	200 / 250 / 280
10	DESIGN GAS FLOW RATE	SCMH	250 / 400
11	OPERATING TEMPERATURE (MIN. / MAX.)	°C	1 ~ 52 °C
12	DESIGN TEMPERATURE (MIN. / MAX.)	°C	-29 ~ 65 °C
13	FLAME ARRESTER - CATEGORY	~	Detonation proof I-line Flame arrester Type (#)
14	MIN. VENT HEIGHT FROM UNPROTECTED SIDE	Mtr.	Min. Height of 3 Meter above
15	RATED INLET PRESSURE	kg/cm2	255
16	FLAME ARRESTER INSTALLATION ORIENTATION	~	VERTICAL

MATERIAL OF CONSTRUCTION

SR. NO.	DESCRIPTION		MATERIAL GRADE
17	MAIN BODY	~	High Temperature carbon Steel (HTCS) #
18	STUD & NUT	~	Hot dip Galvanized
19	DISC	~	#
20	GASKET	~	#
21	ELEMENTS	~	SS316 (CRIMPED-RIBBON ELEMENTS)
22	BANK ASSEMBLY	~	#
22	CORE	~	#

DIMENSION & WEIGHT

SR. NO.	DESCRIPTION		DATA
23	OVERALL LENGTH OF FLAME ARRESTER	mm	#
24	WIDTH OF FLAME ARRESTER	mm	#
25	HEIGHT OF FLAME ARRESTER	mm	#

26	SHIPPING WEIGHT	Kg	#
	SPARE & ACCESSORIES		
SR. NO.	**DESCRIPTION**		**DATA**
27	GASKETS	~	Spare required
28	LIFTING TYPE	~	Handle Required
29	ARRESTER ELEMENTS BANK	~	Spare required
30	DESIGN CODE	~	ISO16852 (As per Latest Edition)
31	FLANGE RATING	Pounds	#
32	FLANGE DESIGN STD.	~	ASME B16.5
33	MAX. EXPERIMENTAL SAFE GAP(MESG)	mm	#
34	HYDROTEST PRESSURE BODY	kg/cm2	1.5 x design press.
35	FLANGE DRILLING	~	#
36	FLANGE FACE FINISH	AARH	AS PER ASME B16.5
37	PRESSURE DROP	psi.	SHALL NOT EXCEED 1 psi
38	HAZARDOUS AREA CLASSIFICATION	~	CLASS I, DIVISION 1, ZONE 0,1 (GAS GROUP I, IIA, IIA1)
39	MAXIMUM OPERATING PRESSURE	kg/cm2	#
40	MAXIMUM OPERATING TEMPERATURE	°C	#
41	SHORT TIME BURN	~	#
42	LEAK TEST & MEDIA	~	1.1 times of Max. Operating Pressure (Test Media- Air)
43	LEAK TEST HOLDING TIME	Min.	Min. 5 Minutes
44	UNPROTECTED PIPE LENGTH	Mtr.	Min. 3 mtrs.
45	CERTIFYING AGENCY / APPROVALS	~	#
46	FLAME VELOCITY	Mtr/sec.	#
47	NO. OF ELEMENTS BANK	Nos.	#
48	ATMOSPHERIC TEMPERATURE CONDITIONS	°C	(-)20°C to (+)60°C
49	ATMOSPHERIC PRESSURE CONDITIONS	Atm.	0.78 Atm. to 1.08 Atm.
	INSPECTION & TESTING		
50	FLAME TRANSMISSION TEST	~	Required
51	BURNING TEST(IF REQUIRED)	~	Required
52	FLOW TEST	~	Required
53	FLAME SPEED VS RUNUP DISTANCE CURVE	~	Required
54	ARRESTER FINISH	~	Red colour(#)
55	PNEUMATIC TEST PROCEDURE	~	#

56	HYDRO TEST PROCEDURE	~	#
57	HYDROSTATIC TEST	~	#
58	OPERATION & MAINTENANCE PROCEDURE	~	#

NOTE:-

1) VENDOR TO PROVIDE THE DATA AS MARKED "#".

2) FLANGES AND GASKETS SHALL CONFORM TO ASME B16.5 RESPECTIVELY.

3) VENDOR TO PROVIDE THE BURN BACK VELOCITY CONSIDERED FOR FLAME ARRESTOR DESIGN. THIS BURN BACK VELOCITY SHALL BE DIFFERENT FOR DIFFERENT GAS COMPOSITION

4) VENDOR TO PROVIDE THE FLAME ARRESTER PROCESS CALCULATION.

5) VENDOR TO MENTION THE MAXIMUM INITIAL OPERATING PRESSURE (IOP) WHICH THE FLAME ARRESTERS CAN HANDLE FOR VARIOUS FLAMABLE GAS MIXTURES.

6) FLAME ARRESTER MUST BE DESIGNED FOR MAXIMUM HEAT RELEASED BY FLAME, AND HENCE VENDOR TO PROVIDE THE HEAT TRANSFER CAPACITY FOR WHICH THE FLAME ARRESTER IS DESIGNED FOR. THIS REQUIRED KNOWING HOW MUCH HEAT ENERGY WAS ABSORBED BY THE ARRESTER PER UNIT VOLUME OF GAS IN ORDER TO LOWER THE FLAME TEMPERATURE.

7) FLAME ARRESTER SHALL BE CCOE/PESO CERTIFIED VENDOR TO PROVIDE PESO CERTIFICATES.

8) FLAME ARRESTER BODY-COLOR SHALL BE RED & RAL GRADE VENDOR SHALL CONFIRM ALSO PAINT ARE FLAME & HEAT RESISTANT.

		CUGL Central U.P. Gas Limited

DATA SHEET FOR AIR COMPRESSOR

DOCUMENT NO					

CENTRAL U.P. GAS LIMITED

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHK	APPR

`1.0	NO. OF UNITS	:	As per SOR	DRIVE: ELECTRIC MOTOR		
1.1	DUTY	:	Intermediate	LOCATION:		
1.2	Model No./Make	:				
2.0	**OPERATING CONDITIONS**					
2.1	service / stage	:	Air / #			
2.2	Gas handled	:	Air			
2.3	Composition	:	Air (Refer air composition)			
2.4	Corrosive due to:		NA			
2.5	Molecular Weight at Intake (Avg)		Refer Air composition			
2.6	Cp/Cv at intake / compressibility Factor		Refer Air composition			
2.7	Relative Humidity		90 %			
2.8	Suction Temperature (˚C)	:	Max. Ambient 47˚C			
2.9	Suction Pressure (Kg/cm², Gauge)	:	ATM			
2.10	Discharge Temperature (°C)	:	#			
2.11	Discharge Pressure (Kg/cm², G)	:	10 Kg/cm²g			
2.12	Required Capacity (CFM.)	:	# (Refer Technical specification)		Electric Motor Rating: #	KW
2.13	Drive arrangement Direct Coupling/V-belt		#		#	
2.14	standard Conditions referred to	:	Standard Atmospheric pressure (1.033 Kg/cm² abs) and Temperature of 15.6°C			
2.0	**SITE CONDITIONS**					
2.1	Place				Installation: Outdoor	
2.2	Site Ambient Temp. (°C)		Min : 2 °C Max :50 °C		Max. Relative Humidity (%) : 90%	
2.3	Max. MSL – 280 m		Max. Altitude Derating correction		#	
2.4	Area Classification	:	Class1 Div1 Group D or Zone 1 Group IIA/IIB (if Air Compressor placed inside package)			
3.0	**APPLICABLE CODES & SPECIFICATIONS**					
3.1	Compressor	:	#		Piping Code	#
3.2	Driver	:	Electric motor		Control Panel : Refer Tech Specs	
3.3	Air Cooled Exchangers	:	#		Testing Code	#
3.4	Pressure Vessel	:	ASME Sec. VIII Div.1		Material Code:	#
3.5	Fabrication Code	:	#		Design code	#
4.0	**MANUFACTURER SPECIFICATIONS**					
4.1	Vessel Capacity	:	#	Hydro test Pressure(kg/cm2)	#	
4.2	Shell Thickness	:	#	Duration of test	#	
4.3	Disc Thickness	:	#	Testing Media	Water	
4.4	Working Pressure(kg/cm2)	:	10 kg/cm2(g)	Test position	#	
4.5	Motor Rating HP	:	#	Motor Load (FLA)	#	
4.6	Piston Displacement(CFM)	:	#	Non-time delay Fuse	#	
4.7	Electrical supply Voltage	:	#	Time Delay Fuse	#	
4.8	Drain Point	:	Required	Inverse time circuit breaker	#	
4.9	Pressure Gauge	:	Required	Pressure switch	Required	
4.10	Safety Valve	:	Required	Air End fan	Required	
4.11	Phase Preventer	:	Required	Check valve	Required	
4.12	Suction Filter & breather	:	Required	Compressor Motor overload Relay	Required	
4.13	Crank case Oil pump	:	Required	Noise level	#	
4.14	Air Inlet tube OD	:	#	Air outlet Tube OD	#	

4.15	Compressor grouting	:	Required	Air compressor Shipping Weight	#
4.16	Dimension(L×W×H)	:	#	Compressor Auto start/Stop pressure	#
4.17	Compressor Suction flow rate(CFM)	:	#	Compressor Discharge flow rate(CFM)	#
4.18	No. of compression Stages	;	#	Mainline filter model	#
4.19	Nominal Filtration Range	:	0.3µm	Filtration efficiency	99.9 %
4.20	Oil mist density @ outlet Max.	:	#	Filter Element model	#
4.21	Rated capacity at Full load operating pressure	:	ACFM (#)	Max. full flow operating pressure	#
4.22	Drive motor nominal efficiency	:	#	Total package input power @ zero flow	#
4.23	Total Package Input Power at Rated Capacity and Full Load Operating Pressured	:	#	Specific Package Input Power at Rated Capacity and Full Load Operating Pressure (KW/CFM)	#
4.29	Isentropic efficiency	:	#	Unloaded valve	Required
4.30	On off light indicator	:	Required	Main Circuit Breaker	Required
4.31	Lubricating low oil pressure Indicator	:	Required	Free Air Delivery	#

		

DATA SHEET FOR TEMPERATURE GAUGE

DOCUMENT NO					

CENTRAL U.P. GAS LIMITED

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHK	APPR

TEMPERATURE GAUGE			
S. No.	**DESCRIPTION**	**SPECIFICATION**	**OFFERED**
1	Type of Service	CNG	
2	Type	Refer technical specification	
3	Well	Required	
4	Mounting	Local	
5	Dial Size	100 mm	
6	Color	White with black inscription	
7	Case material	SS316	
8	Window material	Shatterproof glass	
9	Connection location	Bottom	
10	Accuracy	+/- 1% FSD	
11	Enclosure	WP to IP 65 as per IEC 60529/IS 13947	
12	Zero adjustment screw	Required	
13	Stem	Bimetal	
a.	Type	#	
b.	Material	#	
c.	size	#	
d.	Dia.	#	
e.	Filled system	#	
f.	Compensation	Case adjustable union	
14.	Bulb type	#	
a.	Bulb Material	SS316	
b.	Bulb Union Thread	½'' BSP(M)	
15.	Extension Type	Rigid	
16.	Bulb dia.	To be suitable for thermowell	
17.	SAMA Class	#	
18.	Capillary Material		
a.	Armor flexible	#	
b.	Armor Material	#	
c.	Armor length	#	
19.	Over range protection	Yes	
20.	Thermowell		
a.	Material	SS316	
b.	Design standards	As per **ASME PTC 19.3TW**	
c.	Wake frequency calculation	#	
d.	Root diameter	#	

e.	Bore diameter	#	
f.	Tip diameter	#	
g.	Tip Thickness	#	
h.	Head Length	#	
i.	Immersion Length	#	
j.	Process connection	#	
k.	Stem style	#	
l.	Instrument connection	½'' BSP(F)	
19	Temperature gauge Make	Wika /General instrument /AN instrument/Baumer(Refer vendor list)	
20	Thermowell make/Model	Wika /General instrument /AN instrument/Baumer(Refer vendor list)	
21	Thermowell Ordering code	#	
22	Over Range Protection	130 %	

23.	**Notes.**
1.	(#) Marked data to be furnished by Vendor/Manufacturer
2.	At the time of approval of DS, Supplier shall furnish DS with Catalogues.
3.	Vendor to provide all Temperature gauge Tag List with Aluminum embossed plate (where mention with Tag no./Date of calibration/Due date of Calibration /Items serial no etc.)
4.	Vendor to provide Operating and Instruction manual before dispatch of cascade.
5.	Vendor to provide Thermowell operating manual with Thermowell GA drawings for detail engineering.
6.	U-length shall be selected in such a way that the Thermowell tip shall be preferably at the Centre of pipe to sense the temperature accurately.
7.	Vendor to provide wake frequency calculation of thermowell as per ASME PTC 19.3 TW including: Gas/Oil/Air applications etc.
a.	Frequency Limit
b.	Dynamic stress Limit
c.	Static stress Limit
d.	Hydrostatic Pressure Limit
8.	All Thermowell are tested as per ASME PTC 19.3 TW and final test report to be submitted for review during inspection.

		CUGL Central U.P. Gas Limited

DATA SHEET OF THERMAL MASS FLOW METER

DOCUMENT NO					

CENTRAL U.P. GAS LIMITED

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHK	APPR

Sr. No.	Parameter	Requirements
01.	Fluid	Natural Gas
02.	Measuring Principle	Thermal
03.	Operating Pressure	50 mbar(g)
04.	Molar Mass	17 to 22
05.	Ambient temperature	0 to 60°C
06.	Hazardous Area classifications	Class I, div I Gas Group D as per NEC or Zone 1, Group IIA / IIB as per IS / IEC Specification
07.	Range of Operation	0.6 - 16 SCM/Hr. / 0.5 - 12 Kg / Hr.
08.	Measured Error Mass	± 1.5% of indicated flow accepted (over the operating range of 2-12 Kg/Hr. on gas)
09.	Meter Size	0.5''
10.	Pressure drop at max. flow	2 mbar max.
11.	Repeatability	± 0.5% or better
12.	Material Tube	SS316 or better
13.	End connection	To suit the line size, flange Connections
14.	Power Supply (nominal)	230 ± 10% V, 45-65 Hz
15.	Output (Active)	~
16.	RS 485	required
17.	Outputs Information's	
18.	D1,D2 factor	#
19.	K1,K2 factor	#
20.	Density Factor	#
21.	Mass Flow Rate	required
22.	Mass Totalizer, non - resettable	Required
23.	Temperature	Required over MODBUS
24.	Integral Display	Display all outputs with specified accuracy, Programmable and sequential with password protection. Touch Screen or Touch Keypad Type
25.	Density	Required
26.	Pressure	Required
27.	Volume flow rate	Field configurable with password protection for molecular weight range: 17 to 22
28.	Volume flow totalizer	Field configurable with password protection for molecular weight range: 17 to 22
29.	Periodic mass & totalizer, non-resettable	Four (one each monthly, daily, fortnightly and one for configurable period)
30.	Programmer	Calibration software, perpetual license with portable hardware platform complete with all connectors, power Adopter, batteries. System should be suitable for effecting calibration changes, configuring the flow meter / transmitter, storing test result, plotting and Storing graphs, diagnostics, password protection etc. Carrying case, easily installable in the field for calibration set up
31.	Communication	MODBUS with RS 485, HART
32.	Mounting	Field mounting, (Vertical)
33.	Certification	CCOE

- **Control Valves**

  - On/Off valves shall normally be globe type, single seated or double seated. Material used for trim shall be SS 316, as a minimum. For higher pressure drops (greater than 10 kg/cm2g), flashing, cavitation's, erosive and slurry services and in general, all steam services, trim shall be stellated. (Wetted parts like seat ring, valve plug, plug guide, plug steam, guide busing and cage being termed as trim).

  - Valve actuator shall be pneumatic spring opposed diaphragm type, in general. Piston type actuators may be used for very high shut off pressure requirements. Additional equipment necessary to meet fail safe Condition shall also be included. In either case, actuator shall be able to withstand maximum shut-off Pressure with the minimum instrument air pressure specified.

- Solenoid valves, wherever used, shall be universal type and shall be continuous rated type with class F coil insulation as per IEC 85/IS 1271. Trim shall be of SS316.

- Self-actuating regulators for flow, pressure and temperature shall be used where loads are constant and requirements of precision and accurate controls are not stringent.

- **Pressure Relief Valves**

  - All pressure relieving devices shall be designed in accordance with ASMF code for 'Boilers and Pressure Vessels', API – 521 and Indian Boiler Regulations.

  - Conventional valves shall be specified for constant back pressure while bellows seal type valves shall be specified for variable back pressure more than 10% of set pressure. Pilot operated pressure relief valves shall be used for special services and where set pressure is closer than 10% of the operating pressure, in general.

  - The body material shall, as a minimum, be as per piping specifications. Nozzle and disc material shall be SS 316 as a minimum with machined stainless steel guide and spindle.

  - The spring material of pressure relief valves shall be as follows unless otherwise necessary because of process conditions;
  - - 29°C to 250°C : Cadmium/nickel plated carbon steel
  - Above 250°C : Tungsten alloy steel.
  - Below -29°C : SS316
  - Interlock and Shutdown System

  - The system shall be designed fail safe and shall meet the following requirements, as a minimum:

  - All initiating contacts shall be close under normal conditions and shall open under abnormal conditions.

  - All relays and solenoid valves shall be energized under normal conditions and shall de-energies under abnormal conditions Except CO2 flooding solenoid.

  - Emergency shut down switch contacts shall be wired in series with the final actuating device

  - to ensure positive shutdown.

  - If desired, because of operational or maintenance requirements, adequate trip by-pass facilities are to be provided with warning lights to indicate that the trip has been bypassed.

  - The electromagnetic relays shall be low power continuously rated type and shall have LED for status indication.

  - The relays shall be plug-in-bases shall have terminals for interconnection. Lugs type soldered connection shall not be acceptable.

  - Each relay shall have two numbers of 'NO' and three number of 'NC' contacts as a minimum each suitable to drive the connected load. Out of these, one 'NO' and one 'NC' contacts shall not be used.

  - Each shutdown circuit and solenoid valve shall be provided with a fuse terminal unit separately.

- **Programmable Logic Controller (PLC). This shall meet the following minimum requirements:**
  - PLC shall be either independent or redundant w.r.t CPU/UPS/Communication Card.

  - The software shall include the operating system and application program. The application

  - program shall include software for performing functions like interlock and shutdown logic,

  - Programming /program modification, documentation etc. Two copies of application program and two

  - Set of licensed system software shall be supplied

- The system shall be supplied with programming tools and related accessories.
- No two shutdown circuits shall be shared by same I/O module
- PLC shall be configured as a remote terminal unit of supervisory computer and data acquisition systems complete with dial up connectivity. One card for transferring data from minimum devices with RS 485 port shall be provided. For details of SCADA connectivity refer Annexure
- Vibration and Axial Displacement Monitoring
- The extent and type of monitoring shall be seismic type preferably. However, vendor shall furnish any additional requirements for monitoring deemed essential by them with reasons. The sensing probe shall be accessible for adjustment, repair and replacement without dismantling the machine.
- Monitoring instruments shall be having hazardous area classification with necessary statutory certifications.
- The vibration signal shall be continuous 4-20mA DC isolated current analog signal and shall be taken as input to PLC for indication/alarm/trip.

		CUGL Central U.P. Gas Limited

LIST OF RECOMMENDED THIRD PARTY INSPECTION AGENCY (TPIA)	Client Job Number	
	Total Sheets	2

DOCUMENT NO.					

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	**DATE**	**DESCRIPTION**	**PREP**	**CHKD**	**APPR**

SR. NO.	NAME OF TPIA	ADDRESS	PHONE NO.	FAX NO.
1	Tata Projects Ltd.	22,Sarvodaya Society,Nizampura,Baroda-390002	0265-2392863	0265-2785952
2	Bax counsel Inspection BureauPvt. Ltd.	303, Madhava,Bandra Kurla Complex, Bandra(E),Mumbai-400051	022-26591526,022-26590236	022-26591526
3	Germanischer Lloyd	4th Floor, Dakshna Building, Sec-11, Plot NO.2, CBD Belapur, Navi Mumbai 400 614	022-4078 1000	022-4024 2935
4	ABS Industrial Verification Ltd., Mumbai	404,Mayuresh Chambers,Sector-11,CBD Belapur(E),Navi Mumbai-400614	022-27578780 /1 /2	022-27578784 / 5
5	Certification Engineers International Ltd.	EIL Bhavan,5th floor,1,Bhikaji Camma Place,New Delhi-110066	011-26167539,26102121	011-26101419
6	Dalal Mott MacDonald	501, Sakar -II, Ellisbridge,Ahemedabad-380006	079-26575550	079-6575558
7	International Certification Systems	E-7,Chand Society, Juhu Road, Juhu, Mumbai-4000049	022-26245747	022-226248167
8	SGS	SGS India Pvt. Ltd.,SGS House,4B,A.S.Marg,Vikhroli(W),Mumbai-400083	022-25798421 to 28	022-25798431 to 33
9	Intertek Moody	9th Floor, Kanchenjunga Building, 18-Barakhamba Road, New Delhi-110001	011-4713 3900	011-4713 3999
10	TUV SUD South Asia	C-153/1, Okhla Industrial Ara, Phase-1, New Delhi-110020	011-3088 9611/9797	011-3088 9598
11	TUV Rheinland (India) Pvt. Ltd.	F-51, Kailash Complex GF, Veer Savarkar Marg, Vikhroli Park Site, Vikhroli(W), Mumbai-400079	022-4215 5435	022-4215 5434
12	Vincott International India Assessment Service Pvt. Ltd.	C-301, Mangalya Premises Cooperative Soc. Ltd, Off. Marol Maroshi Road, Andheri(E), Mumbai-400959	022-4247 4100	022-4247 4101

		CUGL Central U.P. Gas Limited
QUALITY ASSURANCE PLAN OF 250 SCMH COMPOSITE CNG DISPENSING UNIT	**TOTAL SHEET NO.**	12
DOCUMENT NO.		

CENTRAL U.P. GAS LIMITED

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHK	APPR

S.NO.	OPERATION / PARAMETER	CHARACTERISICS / PARAMETERS	ACCEPTANCE CRITERIA & CERTIFICATION	VENDOR / OEM	TPIA	CLIENT / PMC	REMARKS
Bought Out items & Equipment details(CNG COMPRESSOR UNIT)							
1.	Canopy & Frame Dimensional Report	Dimension Reports	As per Technical specification & GAD	P	W/R	R	
2.	Gas Intercooler	Dimensional, Chemical, Mechanical, Hydro test, Physical, Heat Chart, Cooling & heating load calculation	As per Technical specification / Data sheet / Calculation Reports	P	W/R	R	
2.	Oil Intercooler	Dimensional, Chemical, Mechanical, Hydro test, Physical, Heat Chart	As per Technical specification/Data sheet/Calculation Reports	P	W/R	R	
3.	Oil Heat Exchanger	Dimensional, Chemical, Mechanical, Hydro test, Physical, Heat Chart, WPS/PQR	As per Technical specification/Data sheet/Calculation Reports	P	W/R	R	
4.	Compressor block, Crank shaft, Connecting rod,Cylinder,Liner & Piston	Dimensional, Chemical, Mechanical, Hydro test, Physical, Heat Chart, Ultrasonic & Radiography report for Crankshaft, Connecting rod, Cylinder, Piston	As per Technical specification/Data sheet/Calculation Reports /Compliance certificate	P	W/R	R	
5.	Hydraulic Pump	Test/compliance/performance/ warranty certificates	As per OEM specifications/Data sheet	P	W/R	R	
6.	Pressure Regulating Valve/Direction & flow control valve/By-pass Relief valve	Test/compliance/performance/ warranty certificates	As per OEM specifications/Data sheet	P	W/R	R	
7.	Safety Relief Valve	Test/compliance/performance/ warranty certificates	Data sheet/Sizing calculation report	P	W/R	R	

8.	Temperature Gauge & Thermo-well	Test/compliance/performance/warranty certificates / calibration report	As per Technical specification/Data sheet/wake frequency Calculation Reports for all fluids	P	W/R	R	
9.	Pressure gauge	Visual, Size verification, Fitment & alignment, Functional & operational, Calibration report, Test certificates for bought out items, Hydro test, pressure test	Technical specification & Approved data sheets	P	W/R	R	
10.	Differential pressure gauge	Visual, Size verification, Fitment & alignment, Functional & operational, Calibration report, Test certificates for bought out items, Hydro test, pressure test	Technical specification & Approved data sheets	P	W/R	R	
11.	Pressure Transducer & Transmitter	Location as per P&ID, Fitment & alignment, calibration report, Test certificates of bought out items, pressure test, Operational & functional, current consumption w.r.t pressure, IP ratings, supply voltage, Output signal voltage	Technical specification & Approved data sheets	P	W/R	R	
12.	Temperature Transducer & Transmitter	Location as per P&ID, Fitment & alignment, calibration report, Test certificates of bought out items, pressure test, Operational & functional, current consumption w.r.t pressure, IP ratings, supply voltage, Output signal voltage	Technical specification & Approved data sheets	P	W/R	R	
14.	SS Needle / Block & Bleed valve	Chemical, Mechanical, Hydro test, Physical, Heat Chart	As per Technical specification / Data sheet	P	W/R	R	
15.	Check Valve	Chemical, Mechanical, Hydro test, Physical, Heat chart	As per Technical specification / Data sheet / calculation report	P	W/R	R	
16.	SS Tube	Chemical, Mechanical, Hydro test, Physical, Heat Chart	As per technical specifications / Data sheet	P	W/R	R	
17.	CS tube	Chemical, Mechanical, Hydro test, Physical, Heat Chart	As per technical specifications / Data sheet	P	W/R	R	
18.	Isolation Ball valve	Visual, Dimensional, Fitment & Alignment, Physical Test,	Technical specification & Approved	P	W/R	R	

		Chemical Test, Operational & functional, Leak test, Test certificates of bought out items, Cv verification w.r.t data sheet	data sheets				
19.	SS Tubing & Fittings	Visual, Dimensional, Fitment & Alignment as per P&ID shown, Physical Test, Chemical Test, Operational & functional, Leak test, Test certificates of bought out items	Technical specification & Approved data sheets	P	W/R	R	
20.	SS Manifold	Visual, sizing verifications, Fitment & Alignment, Operational & functional, Leak test, Test certificates of bought out items, Flow direction as per P&ID	As per OEM specification & design	P	W/R	R	
21.	Gas Inlet & Outlet filter	Visual, Dimensional, Fitment & Alignment, Physical Test, Chemical Test report, Operational & functional, Leak test, Hydro test, filter sizing calculation	Technical specification / Approved data sheets/ Filter Sizing calculation sheet	P	W/R	R	
22.	Gas Filter Elements	Visual, Dimensional, Fitment & Alignment, Test certificates of bought out items Operational & functional, Leak test, Hydro test, filter sizing & pressure drop calculation with elements	Technical specification / Approved data sheets/ Filter Sizing calculation sheet	P	W/R	R	
23.	Pneumatic Actuators	Performance report, Fitment & alignment , Test certificates, Compliance report , chemical & physical reports	As per Technical specifications/Data sheet	P	W/R	R	
24.	Air compressor Block & vessels	Performance report, Fitment & alignment , Test certificates, Compliance report , chemical & physical reports	As per Technical specifications /ASME code /Approved Data sheet	P	W/R	R	
25.	Pressure switch	Performance report, Fitment & alignment , Test certificates, calibration, Compliance report , chemical & physical reports	As per technical specifications / Data sheet	P	W/R	R	

26.	ESD & Hooter	Fitment & alignment , Test certificates, Compliance report , chemical & physical reports	As per Technical specifications / Data sheet	P	W/R	R	
27.	Solenoid Valve & manifold	Performance report, Fitment & alignment , Test certificates, Compliance report , chemical & physical reports	As per technical specification / Data sheet	P	W/R	R	
28.	Main Motor & Auxiliaries Motor	Routine Test, Functional Test, Compliance report ,Alignments test	Technical specification / Approved data sheets	P	W/R	R	
29.	Flameproof Junction Box	Test report, compliance report, Physical & chemical report	As per Technical specification /Data sheet	P	W/R	R	
30.	Mass Flow meter	Performance report, Fitment & alignment , Test certificates, Compliance report , calibration report, chemical & physical reports	Technical specification / Approved data sheets	P	W/R	R	
31.	Gas Detector	Performance report, Fitment & alignment , Test certificates, Compliance report , calibration report, chemical & physical reports	Technical specification / Approved data sheets	P	W/R	R	
32.	Flame Detector	Performance report, Fitment & alignment , Test certificates, Compliance report , calibration report, chemical & physical reports	Technical specification / Approved data sheets	P	W/R	R	
33.	Control panel	Test report, compliance report, Routine test ,Physical & chemical report	As per OEM specifications/Data sheet	P	W/R	R	
34.	Tube light & Aviation lamp	Test report, compliance report, Routine test ,Physical & chemical report	As per OEM specifications/Data sheet	P	W/R	R	

35.	PLC/HMI	Test report, compliance report, Routine test	As per OEM specifications/Data sheet	P	W/R	R	
36.	FRLS cable	Test report, compliance report, Routine test ,HV-IR test, Physical & chemical report	As per OEM specifications/Data sheet	P	W/R	R	
37.	CO2 cylinder	Hydro stretch test, leak test, Physical & chemical report, Filling permission(PESO) report	Technical specification / Approved data sheets	P	W/R	R	
38.	Air Dryer	Test report, compliance report, Routine test ,Physical & chemical report	As per Technical specifications/Data sheet	P	W/R	R	
39.	Flame arrester	Test report, compliance report, Routine test ,Physical & chemical report	As per Technical specifications/Data sheet	P	W/R	R	
40.	Structural stability/ FEA reports	Approved Load calculation report, stability, Static load analysis reports	As per Technical specification	P	W/R	R	
41.	Package CCOE approval certificates	Valid PESO package approval certificates, Number plate embossing with PESO no. & other details.	As per Technical specification & approved Name plate	P	W/R	R	
42.	All electrical PESO certificates	Valid PESO certificates of all electrical & hazardous components	As per PESO certificates	P	W/R	R	
43.	Fire & flame retardant PU foam	Test certificates & UL compliance reports	As per PESO & PNGRB guidelines	P	W/R	R	
44.	Pressure Vessels	Dimensional, Chemical, Mechanical, Hydro test, Physical, Ultrasonic test, DPT test & 100 % Radiography test	As per ASME sec. VIII div. 1 Code & standards, Wall thickness calculation	P	W/R	R	
45.	Vibration switch	Performance report, Fitment & alignment , Test certificates, Compliance report , calibration report, chemical & physical reports	Technical specification / Approved data sheets	P	W/R	R	

46.	Flexible Hydraulic & pneumatic hoses	Visual, Dimensional, Fitment & Alignment, Physical Test, Chemical Test report, Operational & functional, Leak test, Hydro test, Hose conductivity	Technical specification / Approved data sheets/ Manufacturer standards	P	W/R	R	
47.	Recovery bottle	Dimensional, Chemical, Mechanical, Hydro test, Physical, Ultrasonic test, DPT test & 100 % Radiography test	As per ASME sec. VIII div. 1 Code & standards, Wall thickness calculation	P	W/R	R	
48.	PRV & Slam shut off valve	Visual, Dimensional, Fitment & Alignment, Physical Test, Chemical Test report, Operational & functional, Leak test, compliance report	Technical specification / Approved data sheets/ Manufacturer standards	P	W/R	R	
49.	Moisture separator	Dimensional, Chemical, Mechanical, Hydro test, Physical, Ultrasonic test, DPT test & 100 % Radiography test, functional test	As per ASME sec. VIII div. 1 Code & standards, Wall thickness calculation	P	W/R	R	
50.	Pulse vessels	Dimensional, Chemical, Mechanical, Hydro test, Physical, Ultrasonic test, DPT test & 100 % Radiography test, functional test	As per ASME sec. VIII div. 1 Code & standards, Wall thickness calculation	P	W/R	R	
51.	Vent header	Dimensional, Chemical, Mechanical, Hydro test, Physical, Ultrasonic test, DPT test & 100 % Radiography test, functional test	As per OEM procedure	P	W/R	R	
52.	No flow switch	Visual, Fitment & orientation, Operational & functional, Manufacturer test report, calibration report	Technical specification / Approved data sheets/ Manufacturer standards	P	W/R	R	
53.	Conical & Y-strainer	Chemical, Mechanical, Hydro test, Physical, Heat chart, Operational & functional	Technical specification / Approved data sheets/ Manufacturer standards	P	W/R	R	
54.	VFD/SOFT Starter Panel	Dimesional,Visual,function, Routine test, Electrical wiring, GAD review	Technical specification / Approved data sheets	P	W/R	R	

Complete Compressor Assembly Simulation & Tripping Test Details							
	Complete Assembly @ pulsating pressure Leak Test	Leak Test Throughout on all Joints By using Soap solution and Holding Time up to 4hrs @ Pressure 200~250 Bar(g) Media-Natural Gas	Technical specifications & OEM test procedure.	P	W	W/R	
55.	Main Motor overload relay simulation	Tripping test during routine test	As per Approved control philosophy	P	W	W/R	
56.	Main Motor VFD starter simulation	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
57.	Main MCCB Over load test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
58.	MPCB functional test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
59.	Main Motor Space heater Functional test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
60.	Main Motor RPM & Rotational direction test	RPM check & Rotational direction test from motor D end side.	As per Approved control philosophy	P	W	W/R	
61.	Main motor Bearing & body Temperature	As per OEM standard practice	As per Approved control philosophy	P	W	W/R	
62.	Radiator Fan motor Overload Relay simulation test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
63.	Water pump Overload Relay simulation test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
64.	Air compressor motor Overload relay simulation test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
65.	Air compressor pressure switch functional test	Tripping test during routine test	As per Approved control philosophy	P	W	W/R	
66.	Cylinder Oil jacket Temperature check	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	

67.	Low & High air pressure Simulation test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
68.	Over & under voltage simulation test	Simulation check	As per Approved control philosophy	P	W	W/R	
69.	Over & under current simulation test	Simulation check	As per Approved control philosophy	P	W	W/R	
70.	Earth leakage current Trip test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
71.	High / Low earth leakage current simulation test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
72.	Phase over & under current Simulation check	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
73.	Combined Lightning current & surge arresters check	Physical verification as per Standards	As per Approved control philosophy	P	W	W/R	
74.	Compressor trip over Failure of Surge protection device	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
75.	Failure of any wire break	Crimping connection check	As per Approved control philosophy	P	W	W/R	
76.	Compressor trip over due to phase reversal	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
77.	Compressor trip due to phase un-balance	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
78.	Failure of Analog & Digital barriers	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
79.	Low & High suction temperature alarm check	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	

80.	Low & High suction Pressure alarm check	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
81.	Low suction flow simulation test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	
82.	Low & High oil level alarms check	Simulation check	As per Approved control philosophy	P	W	W/R	
83.	Low & High 1st stage Discharge Gas temperature alarm check	Simulation check	As per Approved control philosophy	P	W	W/R	
84.	Low & High 2nd stage Discharge Gas temperature alarm check	Simulation check	As per Approved control philosophy	P	W	W/R	
85.	Low & High 3rd stage Discharge Gas temperature alarm check	Simulation check	As per Approved control philosophy	P	W	W/R	
86.	Low & High Final discharge gas Temperature	Simulation check	As per Approved control philosophy	P	W	W/R	
87.	Low & High 1st stage Discharge Gas Pressure alarm check	Simulation check	As per Approved control philosophy	P	W	W/R	
88.	Low & High 2nd stage Discharge Gas Pressure alarm check	Simulation check	As per Approved control philosophy	P	W	W/R	
89.	Low & High 3rd stage Discharge Gas Pressure alarm check	Simulation check	As per Approved control philosophy	P	W	W/R	
90.	Low bank cascade Low & high pressure fault	Simulation check	As per Approved control philosophy	P	W	W/R	

91.	Med bank cascade Low & high pressure fault	Simulation check	As per Approved control philosophy	P	W	W/R	
92.	High bank cascade Low & high pressure fault	Simulation check	As per Approved control philosophy	P	W	W/R	
93.	Low & High final discharge pressure (Final stage) fault	Simulation check	As per Approved control philosophy	P	W	W/R	
94.	Low & High Dispenser Emergency pressure fault	Simulation check	As per Approved control philosophy	P	W	W/R	
95.	3 phase Relay failure	Simulation check	As per Approved control philosophy	P	W	W/R	
96.	Compressor auto start simulation test	Simulation check	As per Approved control philosophy	P	W	W/R	
97.	Compressor auto stop simulation test	Simulation check	As per Approved control philosophy	P	W	W/R	
98.	Compressor Auto start/Stop Bank test	Simulation check	As per Approved control philosophy	P	W	W/R	
99.	Gas Detector simulation test	Simulation check	As per Approved control philosophy	P	W	W/R	
100.	Flame Detector simulation test	Simulation check	As per Approved control philosophy	P	W	W/R	
101.	Co2 flooding system alarm simulation test	Simulation check	As per Approved control philosophy	P	W	W/R	
102.	Co2 weight loss Monitoring test	Simulation check	As per Approved control philosophy	P	W	W/R	
103.	Tube light functional test	Functional test	As per Approved control philosophy	P	W	W/R	
104.	Door limit & selector switch functional test	Functional test	As per Approved control philosophy	P	W	W/R	

105.	All ESD functional test	Functional test	As per Approved control philosophy	P	W	W/R	
106.	Failure of Mass flow meter meeting	Functional test	As per Approved control philosophy	P	W	W/R	
107.	Auto change over from primary CPU to secondary By failure due to any reason	Redundant CPU auto changeover test by manual failure	As per Approved control philosophy	P	W	W/R	
108.	Canopy structure Painting inspection at works, surface preparation to be inspected after cleaning and before application of first coat of primer	Functional test	As per Technical specifications	P	W	W/R	
109.	No load Mechanical run test (NLMRT) of the compressor with rated speed and shop driver(4 hours minimum)	Functional test	As per Technical specifications	P	W	W/R	
110.	High Bearing temperature simulation	Functional test	As per Technical specifications	P	W	W/R	
111.	Delivery test (200~240 kgcm2) Media Nitrogen / NG @ suction-14 ~19 kg/cm2	Performance test	As technical specification & OEM factory procedure	P	W	W/R	
112.	Noise test	Performance test	As per technical specification	P	W	W/R	
113.	Vibration test as per standard at site	Performance test	As per technical specification	P	W	W/R	
114.	Overall power consumption (KWH)	Performance test	As per technical specification	P	W	W/R	

115.	Input power @ full rated load	Performance test	As per technical specification	P	W	W/R	
116.	Three phase power in (KW)	Performance test	As per technical specification	P	W	W/R	
117.	Compressor Load %	Performance test	As per technical specification	P	W	W/R	
118.	Specific power consumption of gas in KWH/KG	Performance test	As per technical specification	P	W	W/R	
119.	Vibration damper functional test	Simulation as per OEM procedure	As per Approved control philosophy	P	W	W/R	

OPERATIONAL PHILOSPHY TEST

120.	**PRIORITY & CONTROL PHILOSPHY DETAILS**	**ACTUATOR SOV POSITION (NO/NC)**											
VENDOR TO SPECIFY SOV POSITION		**SUCT.**	**BDV. SUCT.**	**BDV DRAIN**	**2nd STG. VB DRAIN**	**3rd STG. VB DRAIN**	**FINAL DF DRAIN**	**LOW CASCAE BANK**	**MED ASCAE BANK**	**HIGH CASCAE BANK**	**DIS. EMERGY BANK**	**CO2 CYL. 1**	**CO2 CYL. 2**
When compressor normally stop													
When compressor normally start by pressing Push button													
When compressor normally stop by pressing Push button													
When compressor normally stop by pressing ESD													
When Gas detector Activates above LEL level.													
When compressor Auto start condition													
When compressor Auto stop condition													
When Flame detector Activate													

When Co2 flooding system Activate by pressure switch												
When Co2 SOV system failed												
When Low suction & High suction												
When stage 1 High & low pressure												
When Stage 2 High & low pressure												
When stage 3 High & low pressure												
When stationary cascade pressure @falls below set 190 kg/cm2												
When all stationary cascade bank pressure reached at @255 kg/cm2												
When Main motor trip/overload												
When auxiliary motor trip												
When over & under voltage												
When Low & High water pressure												
When Stg.1 Air Intercooler fail												
When Stg.2 Air Intercooler fail												
When Stg.3 Air Intercooler fail												
When oil Intercooler fail												
When low & High air pressure failure												
When Final Stage 2 gas discharge temperature(After intercool) High												
When Final Stage 3 gas discharge temperature(After intercool) High												
When High frame vibration observed												
When vent flare Mass flow meter												

meeting failed												
When Discharge Mass flow metering system signal loss.												
When High bearing temperature observed												
When no flow switch Failed												
When lubrication sump pressure High												
When lubrication sump pressure low												

ABBREVIATIONS

SUCT.- MAIN SUCTION **BDV SUCT.-** BLOW DOWN VESSEL SUCTION **BDV DRAIN.-**BLOW DOWN VESSEL DRAIN **VB DRAIN.-** VOLUME BOTTLE DRAIN

DF DRAIN.- DISCHARGE FILTER DRAIN **DIS. EMERGY.-**DISPENSER EMERGENCY BANK

Notes:

1. The above testing and acceptance criteria are minimum requirements; however, manufacturer shall ensure that the product shall also comply tothe additional requirements as per particular Technical Specification (PTS) and Data Sheet.
2. The supplier shall submit their own detailed QAP prepared on the basis of above / Technical specification for approval of Owner/Owner's Representative.
3. Supplier shall submit calibration certificates of all instruments/Equipment to be used for inspection and Testing to TPIA with relevant proceduresand updated standards for TPIA review/Approval. All reference codes / documents shall be arranged by vendor for reference of TPIA at the time of inspection.
4. Owner / Owner's representative include TPIA will have the right to inspect activity of manufacturing at any time.
5. TPIA along with Owner / Owner's representative shall review/approval all the documents related to QAP/Quality manuals/Drawings etc., submitted by supplier.
6. Contractor shall in coordination with supplier/sub vendor shall issue detailed production and inspection schedule indicating the dates and the Location of facilities Owner/Owner's representative and TPIA to organize inspection.
7. Special manufacturing procedure have to be specially approved or only previously approved procedures have to be used, in case of conflict between specification more stringent condition shall be applicable.
8. The supplier shall submit separate control logic sheet along with actuator/SOV operation philosophy.
9. The supplier shall read the Quality plan if any part is not witnessed then it shall be confirm before Third party inspection.

		CUGL Central U.P. Gas Limited
VENDOR DRAWING AND DATA REQUIREMENT	Total Sheets	05
Document No		

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR

VENDOR DRAWING AND DATA REQUIREMENT

S. NO	DESCRIPTION	To be submitted with Bid	To be submitted for Approval/ REVIEW	To be submitted for Shipment	Submit as certified Final / As Built
			Required	Required	Required
A	GENERAL				
1	PROJECT SCHEDULE				
2	DULY FILLED-IN "CHECKLIST FOR COMPLETENESS OF BID"				
3	DULY FILLED-IN "CHECKLIST FOR SCOPE OF SUPPLY"				
4	DEVIATION LIST (IF ANY) TO THE APPLICABLE SPEC., DATASHEETS				
5	UTILITIES REQUIREMENT SUMMARY				
6	FLANGE DETAILS OF PIPING CONNECTION WITH CONNECTION AT BATTERY LIMIT				
7	DULY FILLED IN EXPERIENCE RECORD PROFORMA				
8	GUARANTEE PARAMETERS AS SPECIFIED				
9	TENTATIVE LOAD DATA FOR FOUNDATION DESIGN				
10	LIST OF SUB-VENDORS FOR ALL BOUGHT OUT ITEMS INCLUDING ELECTRICAL & INSTRUMENTATION ITEMS				
11	LEAFLET, CATALOGUES FOR ALL ITEMS				
12	O & M MANUAL				
13	PESO CERTIFICATE FOR THE OFFERED MODEL				
B	**COMPRESSOR**				
1	DATASHEETS FOR THE FOLLOWING				
A	- COMPRESSOR				
B	- HEAT EXCHANGERS				
C	- PRESSURE VESSELS				

S. NO	DESCRIPTION	To be submitted with Bid	To be submitted for Approval/ REVIEW	To be submitted for Shipment	Submit as certified Final / As Built
D	- ELECTRIC MOTOR/ GAS ENGINE				
2	CATALOGUE FOR COMPRESSOR				
3	TYPICAL CROSS SECTIONAL DRAWING AND LITERATURE TO FULLY DESCRIBE THE DETAILS OF OFFERING				
A	- COMPRESSOR				
B	- SUCTION VALVE				
C	- DISCHARGE VALVE				
D	- PISTON ROD GLAND PACKING & PISTON RINGS				
E	- LUBE OIL PUMP				
4	V-BELT & PULLEY WITH SELECTION CHART & CALCULATION				
5	COOLER DATA / DRG WITH THERMAL & MECH DESIGN CALCULATION				
6	DESIGN CALCULATION, GA DRGS FOR PULSATION DAMPNER				
7	PIPING & INSTRUMENTATION DIAGRAMS FOR THE FOLLOWING				
A	- PROCESS GAS				
B	- LUBE OIL				
C	- COOLING WATER				
D	-ELECTRIC POWER/ FUEL CONSUMPTION				
E	- AIR START UP / VENT				
8	TORQUE ANGLE DIAGRAM, PISTON ROD LOAD VS CRANK ANGLE				
9	TORQUE SPEED CHARACTERISTICS				
10	ACOUSTIC / MECHANICAL EVALUATION REPORT				
S. NO	**DESCRIPTION**	**To be submitted with Bid**	**To be submitted for Approval/ REVIEW**	**To be submitted for Shipment**	**Submit as certified Final / As Built**
11	ITEMIZED PRICE LIST OF				

	MANDATORY SPARES				
12	ITEM LIST OF SPARES WITH PRICE FOR 5 YEARS				
13	DRG. FOR TESTING ARRANGEMENT & TEST PROCEDURE TO BE ADOPTED				
14	CERTIFICATE FOR FOLLOWING:				
A	HYDRAULIC TESTING				
B	NON DESTRUCTIVE TESTING				
C	MATERIAL COMPOSITION & PHYSICAL PROPERTIES				
D	LEAK PROOFNESS TEST OF FRAME				
E	LUBE PUMP, FRAME OIL PUMP, HYD OIL PUMP				
15	DESIGN / ACTUAL ASSEMBLY CLEARANCE CHART				
16	TEST RECORDS OF FOLLOWING				
A	MECHANICAL RUNNING S				
B	PERFORMANCE TEST / PACKAGE TEST				
C	NOISE LEVEL TEST YES				
17	LIST OF SPECIAL TOOLS & TACKLES FOR INSTALLATION & MAINTENANCE				
C	**ELECTRIC MOTOR/ GAS ENGINE**				
1	PERFORMANCE CURVES				
2	TECHNICAL LITERATURE/ CATALOGUE, SELECTION CHARTS, NOMOGRAPHS ETC.				
3	CONTROL SCHEMATICS 3				
Sl. NO	**DESCRIPTION**	**To be submitted with Bid**	**To be submitted for Approval/ REVIEW**	**To be submitted for Shipment**	**Submit as certified Final / As Built**
4	TYPICAL COMPONENT CROSS SECTIONAL DRAWING AND LITERATURE TO FULLY DESCRIBE THE DETAILS OF OFFERING				
5	TEST PROCEDURE				

6	FINAL ACCEPTANCE TESTING AND PERFORMANCE TESTED RECORDS				
7	SCHEMATIC DIAGRAM WITH START UP & SHUT DOWN PROCEDURE & LOGIC				
D	**INSTRUMENTATION**				
1	G.A. OF INSTRUMENT PANEL WITH BILL OF MATERIAL & WIRING DIG. FOR LCP				
2	INSTRUMENT DATASHEET				
3	LOGIC DIAGRAM / LADDER DIAGRAM / FUNCTIONAL DIAGRAM				
4	LOOP SCHEMATIC				
5	INTER CONNECTING DIAGRAM				
6	OPERATING / CONTROL WRITE UP				
7	ALARM / SHUT DOWN LIST7				
8	WIRING DIAGRAM / INTER CONNECTING PIPING				
9	START UP AND SHUT DOWN WRITE UP				
10	START UP AND SHUT DOWN INLET LOCK DIAGRAM				
11	ALARM AND SHUTDOWN LIST WITH SET POINT				
12	LOAD CONTROL PANEL LAYOUT				
13	TERMINATION DIAGRAM, PANEL WIRING DETAIL				
S. NO	**DESCRIPTION**	**To be submitted with Bid**	**To be submitted for Approval/ REVIEW**	**To be submitted for Shipment**	**Submit as certified Final / As Built**
14	LOOP SCHEMATIC				
15	INTER CONNECTING DIAGRAM				
16	CABLE SCHEMATIC				
17	BILL OF MATERIAL				
18	TEST / INSPECTION CERTIFICATE				
19	LIST OF RELIEF VALVES WITH SETTINGS				

SECTION-B

CASCADE

		CUGL Central U.P. Gas Limited
SCOPE OF WORK-CNG CASCADE	Total Sheets	09
Document No		

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR

Table of Contents

1. SCOPE OF SUPPLY

This document covers the details of supply of CNG storage Cascades. All works and clauses of this document shall be applicable unless specifically mentioned otherwise. This document shall be read in conjunction with Data Sheets, Technical Specification, Codes &standards,Drawings, and other documents forming a part of the MR Document.

The summary of scope of work for supply under this contract is:

a) CNG storage Cascades of 450 liter water capacity comprising with:

- CNG Cylinders with valves
- Interconnecting tubing, fitting with valves
- Pressure safety valve,
- pressure gauge on each bank,
- Temperature gauge on high pressure bank
- Non return valves as required for 3 bank operations.
- Cascade frame
- Vent header

b) Pre-Commissioning and Commissioning supervision of Cascades.

c) Anchor Bolt for Cascades.

d) Surface finish & Painting for complete Cascades.

e) Commissioning Spares

2. SCOPE OF WORK

Work tendered in this bid package consists of design/detail engineering, procurement, fabrication, testing, and supply, pre-commissioning, and commissioning supervision of CNG storage Cascades and including all such works which though specifically not indicated here but will otherwise be required to complete the work in all respects.

- Supply of all required materials as per scope of supply as indicated in this Document and technical specification.
- All works related to cleaning, flushing, hydro testing, dewatering and drying purging and filling of Nitrogen gas of CNG storage cascades during dispatch.
- All Fittings should be hydro-tested to a pressure of 1.5 times the minimum Working pressure 255/cm2g at 15 deg C.
- All associated testing, pre-commissioning checks as applicable at vendor work.
- Carrying out pre-commissioning and commissioning supervision of cascade at site.

3. BASIS OF WORK

Fabrication of CNG storage Cascades shall be carried out as per following:

a) Approved General Arrangement Drawing (GAD)/Calculation

b) Approved Piping and Instrumentation Diagram (P&ID).

c) Technical Specifications

d) Any other drawings/sketches prepared by Company and/or by the Bidder and approved by the Company.

e) Following codes, standards, and regulations to be considered:

- IS 7285: part-2 2017 -Specification for seamless steel cylinders for permanent and high pressure liquefiable gases.
- IS 3224: -Valve fittings for compressed gas cylinders excluding liquefied petroleum gas (LPG) cylinders.
- IS 5844- Hydrostatic stretch Test.
- IS 5903- Safety Devices of Gas Cylinders
- OISD – 179 -Safety requirements on compressors, storages, handling and refueling of natural gas for use in automotive sector.

All the codes & specifications referred above shall be of latest edition, at the time of award of contract.

4. DESCRIPTION OF WORK

The works related to fabrication, inspection, testing, supply, and pre-commissioning of CNG storage cascades are as elaborated below:

i. Bidder shall carry out all works strictly in accordance with the Issued for Construction (IFC)/Approved drawings and reference specifications/standards, drawings, documents, data sheets etc. enclosed with this tender document and instructions of Company/Engineer-in-Charge and other provisions of Contract document.

ii. Procurement and supply of all materials, equipment/instrumentations etc. as required which are included in the scope of supply of Bidder, transportation of all materials from manufacturer's works including loading, unloading, handling, storing and transportation to work site.

iii. Hydro testing, dewatering, flushing, drying purging and N2 filling at bidder's workshop in presence of Company/Company's Representative personnel.

iv. Installation of all types of valves (if any), all types of inline/online instruments (other than those covered separately), safety valves, tapping for thermo-wells, sample connections, pressure gauges, etc. for all sizes and ratings including installation and fixing of gaskets, bolts, studs & nuts of all sizes, ratings, and materials within the CNG storage cascades.

v. Painting of Cascades, cylinders, piping, and all associated items, as required, with paints in accordance with painting requirement as specified in technical specification.

vi. Preparation of fabrication drawings required for the purpose of fabrication of CNG storage cascades and shall be submitted to Company/Company's Representative personnel for approval.

vii. Preparation of as-built drawings, documents, and project records as per instructions of Engineer-in-Charge and shall be submitted to Company/Engineer-in-Charge for review and records after execution of work.

viii. Co-ordination, as required, with other Agencies/Contractor(s) including PESO till the time the commissioning operations are complete.

ix. Preparation of detailed procedures for fabrication, testing and pre-commissioning checks and such procedures shall be submitted to Company/Engineer-in-Charge for review and approval before execution of work.

x. Any other works not specifically listed herein but required for completion of the works in all respects.

xi. All cylinders should be designed, constructed, and tested in accordance IS: 7285- part II (2017 Amendment) or similar such other standard code approved by the chief controller of explosives.

xii. Material of flange, Header pipe, Female Nipple for vent manifold should be carbon steel (CS).

5. OTHER CONDITIONS OF WORK

a) Hydrostatic Testing

Complete CNG storage cascades shall be Pneumatic tested. The test shall be in accordance with enclosed with the tender document.

b) Non-Destructive Testing (NDT)

NDT requirements shall be in accordance with ASME code / Specification. Repeat Radiography due to defective radiograph on repaired joints due to Bidder’s fault and/ or additional radiography necessitated due to poor performance of Bidder’s welders shall be done at Bidder’s cost.

6. AS-BUILT DOCUMENTS

On successful completion of hydrostatic testing, the Bidder shall prepare As Built drawings & reports of entire cascades as specified in scope of work. All “As Built” drawings / reports shall be submitted as below.

Four sets of hard copies / soft copy in Pdf documents of following documents shall be submitted by Bidder. All documents shall be bounded together:

(i) As-built drawing of cascades GAD / Fabrication Drawing / P&ID/4G calculation etc.

(ii) Test Reports/Results/Records

Software used for the presentation of these documents shall beas follows:

	Type of document	Software
a)	Test Reports/Results/Records	MS Word/Excel (MS Office 2000)
b)	Drawings	AutoCAD

All documents/drawing shall be submitted by bidder in soft copy in PDF format or Hard copy. For preparation of as- built drawings, Bidder shall update the "Issued for Construction" (IFC) drawings approved by the Company.

7. BIDDER'S RESPONSIBILITIES

Bidder's responsibilities, besides the scope of work for supply to be performed by him defined earlier, shall also include the following:

a) Company shall provide the available information / gas chromatograph reports etc. Company gives no guarantee or warranty as to the accuracy or completeness of the information provided. It is the Bidder's sole responsibility to obtain sufficient information / Data from site/company/consultant.

b) Interpretation and verification of data/information furnished by Company. Any additional information/data/surveys etc. required by Bidder for detailed engineering shall be obtained by him. Company may assist him in obtaining such information/ data by issuing recommendatory letters etc.

c) Entire engineering for procurement & fabrication, including drawings, QA/QC procedures, etc. performed by the Bidder for the cascades system shall be reviewed and approved by Company. All works shall be executed based on approved documents only.

d) Review and approval of Bidder's documents by Company shall in no way relieve the Bidder from his sole responsibility for safe and efficient design, engineering, supply, and subsequent smooth operation of the system.

e) Bidder shall depute independent third party inspector from List of Recommended TPIA (attached with this Tender) for carrying out all necessary inspections and review of test results/reports etc.

f) Bidder shall carry out all testing and inspection of materials, equipment etc. through independent testing institutions, laboratories, if so desired by Company.

g) At the time of periodic hydro testing of cascades during the CAMC period, standby /replacement cascades shall be arranged by the bidder to ensure uninterrupted operations.

h) Any other work not specifically listed above but is required for successful completion of entire system.

i) Cascade manufacture year should be same as that of supply of machine to client.

8. CHECK LIST FOR SCOPE OF SUPPLY

a) Vendor shall furnish all the equipment of Storage Cascade System instruments and gauges and safety devices as per the enquiry document. Anything required over the above what

is specified, for safe and satisfactory operation of the equipment package shall be included by the Vendor in his scope.

b) Vendor to write YES/NO against each item. Vendor is required to include complete scope, as such 'NO' is not warranted. However, in case for any of the items if vendor's isreply is 'NO', Vendor should give reason for the same:

c) Vendor's scope of supply shall include but not limited to be following:

S. No.	DESCRIPTION	Specified by Purchaser YES / NO	Included by Vendor YES / NO	Remarks
1.0	**Each storage cascade package completes with:**	YES		
1.1	Specification - IS: 7285-Part 2 & similar such other standard code approved by PESO.	YES		
1.2	Cylinder material - Seamless alloy steel (Cr-Mo) or standard code approved by the Chief Controller of Explosives.	YES		
1.3	All the fittings, Valves, Safety devices,gauges are as per IS 3224 or standard code approved by the Chief Controller of Explosives.	YES		
1.4	Tubing's are of rigid type ASTM A 269 TP 316 stainless steel tube.	YES		
1.5	All cylinders are Hydro static Tested	YES		
1.6	Water capacity of single cylinder used in cascade 75 Liters.	YES		
1.7	Nos. of banks in cascade-three bank system	YES		
1.8	One cylinder should be burst test	YES		
1.9	4G Stationary calculation for one complete assembled package is done	YES		
1.10	Working pressure of cascade min.250 bar (g)	YES		
1.11	Pressure test for Leakage on cylinders with assembled condition	YES		
1.12	Isolation Valve complete with vending line valve and end plug installed on the inlet of the cylinder	YES		

S. No.	DESCRIPTION	Specified by Purchaser YES / NO	Included by Vendor YES / NO	Remarks
1.13	Copy of Calibration certificates for all instrument gauges etc. of Cascade package, Test certificates of all instruments with cylinder, tubing's, fittings of total package	YES		
1.14	BOQ with weight of each component	YES		
1.15	Drawing of cylinder of specified parameters and proposed to be used in offered cascades approved by PESO	YES		
1.16	Drawing of cascade frame	YES		
1.17	Storage cascade with frame assembly is shipped in fully and assembled condition only to be mounted on Foundation bolts laid at site.	YES		
1.18	GA drawing of the cascade	YES		
1.19	Warranty for a period of 12 months is provided from the date of final site acceptance of CNG facilities by the company.	YES		
1.20	Make of bought out items	YES		
1.21	Detailed time schedule for supply indicating time periods required for cylinder manufacturing, cascade frame fabrication, shop testing, dispatch of material from works at delivery site	YES		
2.0	**Spares**			
2.1	Mandatory spares as specified in " List for Mandatory Spares" (Indicate separate price for each item)	YES		
3.0	**Inspection and Testing**			
3.1	As specified on the inspection and testing clauses	YES		
4.0	**Vendor Data and drawings**			
4.1	All data & drawings as required per VDDR format as per Material Requisition.	YES		

S. No.	DESCRIPTION	Specified by Purchaser YES / NO	Included by Vendor YES / NO	Remarks
5.0	**Supervision during the Trial Run if required at site of the CNG storage cascade system**	YES		
6.0	**Technical Parameters to be confirmed by vendor**			
6.1	Pressure ranges from 14 - 19 bar (g) -250 bar at15° C	YES		
6.2	Fill pressure Kg/cm2g or [bar(g)] - 200	YES		
6.3	Operating Temperature range - [-15 C to +65 C]	YES		
6.4	Design code: IS 7285-Part-2, IS 3244 or as per applicable standard codes or approved by PESO	YES		
6.5	Calibration traceability - To NIST as per ISO 5168 / NABL	YES		
6.6	Enclosure weatherproofs to - IP65, NENA4x	YES		
6.7	Process Temperature effect - ± 0.01 % of normal flow rate/degree C on zero offset	YES		
6.8	All valves as per IS 3224 or as applicable standard code or approved by PESO	YES		
6.9	Safety relief devices as per IS: 5903 or applicable standard code or approved by PESO	YES		

		CUGL Central U.P. Gas Limited
DATASHEET-CNG CASCADE (450 WL)	Total Sheets	03
Document No		

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR

CNG STATIONARY CASCADE			
S. No.	**DESCRIPTION**	**SPECIFICATION**	**OFFERED**
1	Type of Service	CNG	
2	Capacity (in water litres)	450 (-0%, +5%)	
3	No. of Banks	THREE	
4	Cascade Dimensions	OISD-179	
5	Cascade frame structure is able to withstand 4G (four time of gravity) test from any direction without any distortion	YES	
6	**No. of Cylinders in each bank**		
a.	Low Pressure Bank	**#**	
b.	Medium Pressure Bank	**#**	
c.	High Pressure Bank	**#**	
7	**Cylinder**		
a	**Cylinder Make**	#	
b	Compliance Code	IS 7285 Part 2	
c	Cylinder size at 15°C (in water liters)	Not to exceed 125 Liters	
d	Cylinder operating condition	250 bar g at 15°C	
e	Cylinder testing parameters	IS: 7285 Part 2	
f	Cylinder Material	SEAMLESS ALLOY STEEL (Cr-Mo)	
g	PESO approval	YES	
h	Gas quantity stored in the cylinder at 15 °C	#	
8	**Cylinder Shut-Off Valve**		
a.	Make	OMB / TEKNO / VTI	
b.	Compliance Code	IS 3224:2004	
9	**Combination bursting disc and fusible plug**		
a.	Burst pressure (in bar g)	#	
b.	Fuse melting Temperature in (in °C)	#	
10	**Interconnecting tube size / Instrument**	Minimum 3/4" OD	
a.	Tube Material	ASTMA A 269/213 TP 316	
b	Tube Make	Sandvik/Tubacex	
c	Tube fitting	Double compression Ferrule	
d	Tube fitting/Valve Make	Swagelok/Parker	
e	Material	SS 316	
f	Make	Swagelok/Parker	
g	Temperature gauge & Pressure gauge	Wika / General instrument / AN instrument/Baumer	
11	**Pressure drop for each bank**		
a.	Low Pressure Bank	#	

b.	Medium Pressure Bank	#	
c.	High Pressure Bank	#	
12	**Coefficient of Flow (Cv)**		
13	**Notes.**		
	1. All tubing, tube fittings, piping shall be designed and meet the requirement as per ASME B31.3		
	2. (#) Marked data to be furnished by Vendor/Manufacturer		

GENERAL NOTES:	
i	VENDOR TO PROVIDE THE DATA AS MARKED "#" IN DATA SHEET.
ii	ALL BUTT-WELDED JOINTS SHALL BE FULL PENETRATION WELD & ROOT RUN SHALL BE CARRIED OUT BY TIG, IF ACCESSIBLE FROM OTHER SIDES SHALL BACK BE CHIPPED TO SOUND METAL & REWELD.
iii	FILLET WELDS SHALL BE EXAMINED BY MPI / DP METHOD.
iV	EARTHING LUG SHALL NOT BE GALVANISED OR PAINTED.
V	VENTING SYSTEM OF EACH CYLINDER SHALL BE PROVIDED BY SUPPLIER.
Vi	ALL FASTENERS SHALL BE ZINC COATED / HOT DIP GALVANISED AS PER ISO 10683 / ASTM A153.

TECHNICAL SPECIFICATION-CNG CASCADE	Total Sheets	13
Document No		

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR

Contents

1. SCOPE

This specification provides vendor the technical and operating conditions the CNG cascades must fulfill. Additional features other than those indicated herein which call fora better design, increase in efficiency, enhance reliability, optimization may be accepted subjected to Client's approval. The vendor may submit their bid for any alternative design as optional item which may be indicated separately describing all advantages The cascades shall be shipped in completely assembled condition. Gas supply line anddelivery connection shall be made at site.

The vendor shall bid their main offer, items according to the technical specifications mentioned below.

1.1 Cascade

1.1.1 Cascade shall be a group of identical cylinders of capacity interconnected with SS tubing, fitting and valves required to meet the specified total water capacity, dimensional and weight limitations. The cascades shall also be provided with structural frame having facility of lifting and placement.

1.1.2 The water storage capacity of static cascade shall be 450{(-) 0%, (+) 5%} (or as confirmed by bidder) water liters at 15-degree c (cylinders conforming to IS: 7285- part -2, 2004).

1.1.3 A cascade system is comprised of three banks (low, medium, high), which are high pressure storage vessels. Proportion for flow from the three banks shall be 50% (Low bank), 30% (Medium bank) and 20% (High bank).

1.1.4 The design, material, construction & testing of cylinder shall be as per IS 7285- Part 2-2017 and approved by (PESO) or Chief Controller of Explosive (CCOE) Government of India.

1.1.5 Storage cylinder shall be of same year of actual supply of the package.

1.1.6 Working pressure of cascades cylinder shall be minimum 250 bar g at 15 deg C.

1.1.7 Cylinder material shall be seamless alloy steel (Cr-Mo) as per design / drawings approved by PESO.

1.1.8 Cylinder neck threading shall be as per IS 3224-2002 or as per design approved by PESO.

1.1.9 Offered cascades shall be of 75 liters' water capacity cylinders and vendor shall observe minimum neck threads size of 25.4 mm standard. Type 4 threads with a taper of 1 in 8 on diameter confirming to IS-3224: 2004 or equivalent.

1.1.10 The cylinder shut-off valve shall be with combination fusible bursting disc conforming to requirements of IS 3224: 2002 or as per design approved by PESO.

1.1.11 The burst disc shall rupture on excess pressure as well as excess temperature either individually or combined. The burst disc discharge shall be common header for safe venting. Vendor shall indicate bust pressure and temperature. The vent height shall be minimum 03 meters from working platform as per PNGRB guidelines.

1.1.12 The cylinder shut-off valve orifice shall be designed for high flow to permit the combined flow of 100 kg/min from each bank at pressure of 250 bar g. vendor to furnish necessary calculations indicating overall pressure drop for each bank, coefficient of flow (Cv) valves,valve orifice size etc.

1.1.13 Number of cylinders in the cascades shall be divided into three independent banks of low, medium, and high pressure of CNG dispensing. Vendor shall optimize the number of cylinders in each bank for maximizing the recovery from the cascades storage and submit the calculations along with the bid. Vendor may assume the residual cylinder pressure of the vehicle coming for refill at 35 bar g.

1.1.14 The interconnecting tube work of cylinders' manifold in configuration shall be suitable for priority filing and sequential dispensing system by the electronic CNG dispensers at the retail outlets.

1.1.15 Full bore ball valves for isolation shall be provided at inlet of each fill line and at each bank outlet line. The end connection at battery limit shall be ¾" OD SS tube or ½'' OD SS tube subject to OEM standard design.

1.1.16 Ball valve must be of good quality and be appropriately selected frequency of use. Ball valve sets must be suitable for compressed natural gas operation of the gas composition indicated.

1.1.17 Valves and fittings subject to corrosion must be either inherently resistant or be coated with a corrosion inhibiting paint or surface treatment.

1.1.18 The interconnecting tube (Mainline tubing) work shall be minimum of ¾" OD tubing except for pressure gauge/vent line. The sizing of connecting tubing between each outlet and it associated cylinders shall be such that where they join the total incoming flow areas shall not be less than outgoing area. The loops in tube work shall be provided for absorbing concentration, expansion and vibration piping /tubing shall be suitably camped to the frame structure.

1.1.19 Pipe work should be designed, tested, and installed to ensure its safe operation at the worst conceivable conditions of flow, pressure, and temperature.

1.1.20 A test and inspection certified issued by manufacturer of the cylinder duly countersigned by an inspector that the cylinder meets the requirements of the standard or code referred above submitted to PESO shall be provided.

1.1.21 All cylinders should be new and unused. Used or re-certified cylinders are not acceptable. Before using the cylinder or before refilling the cylinder, which must have made Gas free, contained therein shall be purged by an inert gas or by the CNG gas. Cylinders of 75 lit water capacities at 15°c are only envisaged and all cylinders in a cascade shall be same capacity.

1.1.22 The Vendor should ensure that personnel assembling the piping work should be competent in the system employed.

1.1.23 The preferred valve types for isolation are ¼ turn ball valves. Such valves have similar material to the attached tube /fittings.

1.1.24 Cylinders in the cascade shall be placed either horizontally or vertically. In any configuration, minimum 30mm cylinder to cylinder gap shall be provided (conforming to requirements of OISD-179). The material used to separate the cylinders should be sufficiently strong enough and should not absorb moisture. Special precautions should be taken to avoid corrosion at the point of contact.

1.1.25 All cylinder valves and fittings must be rated for the full range of temperature and pressures and the manufacturer should stamp or otherwise permanently mark the valve body to indicate the services rating.

1.1.26 Double compression ferrule fittings shall be used to tube connection.

1.1.27 All cylinders to be hydrostatically tested and approved by third party certification body. Test certificates shall be duly endorsed by approval body and issued before delivery.

1.1.28 The location of inlet/outlet tube and pressure gauges shall be as per approved drawing.

1.1.29 Cascade to be purged with N2 after testing and shipped with a positive pressure of N2 at 1 bar g in the cascade before dispatch.

1.1.30 Suitable vent as attached in the drawing to be provided for stationary cascade. The height of the vent shall be 3m from the base of the cascade.

1.2 Marking of cylinders.

1.2.1 Every gas cylinder shall be clearly and permanently marked in accordance with the following conditions by stamping, engraving or similar process.

i. On the shoulder of the cylinder which shall be enforced by forging or other means, or

ii. On such a part which is inseparably bound with the cylinder, and which is not or only negligibly affected by the stresses due to the gas pressure within it.

1.2.2 The name plate shall not be affixed to the cylinder by soldering if there is risk of corrosion or embrittlement.

1.2.3 In conjunction with the original marking, space shall be provided for stamping the test date obtained at the periodic inspection.

1.2.4 Markings shall be as carried out and the letters and numerals used shall be such shape and size that the markings are clear and easily readable and does not give place for misreading.

1.2.5 All cylinders must be permanently stamped with the word CNG together with the following information.

i. Manufacturing's, owner's and inspector's marking and rotation number. (These markings shall be registered with the PESO ;)

ii. Specifying that the cylinder has been manufactured for “CNG only” with easy to visible angle

iii. A symbol to indicate the nature of heat treatment (such as normalizing, or tempering) given to the cylinder during manufacturing.

iv. The date of the last hydrostatic or hydrostatic stretch test with the code mark shall be registered with the PESO.

v. Working pressure and test pressure.

vi. Tare weight

vii. Water capacity.

viii. All the markings, except the manufacturer’s marking, which may be on the base shall be stamped on the neck end of the cylinder.

1.3 Marking on valves

Valves fitted to the cylinder shall be clearly and durably marked in accordance with the following provisions by stamping, engraving or similar process:

i. Specification of the valves.

ii. Year and quarter of manufacturer.

iii. Manufacturer’s symbol.

iv. Working pressure.

v. The name of chemical symbol of gas for which valve is to be used.

vi. The type of screw threads on the outlet namely left handed (L.H) or right handed (R.H).

vii. Inspector’s stamp.

1.4 Labeling of cylinders

1.4.1 Every cylinder shall be labeled with name “CNG ONLY” with letter of at least 25mm high in contrasting color and the name and addressed of the purchaser by whom the cylinder was filled with gas.

1.4.2 A warning in the following terms shall be attached to every cylinder containing compressed Natural Gas namely:

i. Do not change the color of the cylinder.

ii. This cylinder should not have filled with the gas other than CNG.

iii. No flammable material should be stored in the immediate vicinity of this cylinder or in the same place in which it is kept.

iv. No oil or similar lubricant should be used on the valves or other fittings of this cylinder.

v. Please look for the next date of test, which is marked on a metal ring inserted between the valve and neck of cylinder, and if this date is over, do not accept the cylinder.

1.4.3 All cascade storage system should be supplied in a three bank arrangement. Low bank 50%, medium bank 30% and high bank 20% of the total storage system

1.4.4 Supply of required nos. of 20 dia. J type foundation bolts with nuts, 200 mm long with thread length 50mm & supply of required nos. of dia. Anchor bolts with nuts, 100 mm long with thread length 50mm as applicable will be in the scope of vendor for suitable fixing of stationary storage cascades at site. (AS APPLICABLE)

1.5 Pipe work, valves, and fittings

Pipe work should be designed, tested, and installed to ensure its safe operation at the worst conceivable conditions of flow, pressure, and temperature.

All pipe work should be ASTM a 316 stainless steel tube as per datasheet. Double compression ferrule fittings shall be of SS 316 of make as per datasheet. The system should be “go-on-go” gaugable to demonstrate that fittings are properly tightened. Valves and control devices should incorporate the same end connector system. The number of fittings used should be minimized. The preferred valve types for isolation are
¼ turn ball valves such valves have similar material to the tube they are attached to. Ball valves must be suitable for compressed natural gas operation of gas composition indicated. Valves and fittings subject to corrosion must be either inherently resistant or be coated with a corrosion inhibiting paint or surface treatment.

The gas inlet connection of each bank shall be terminated with ¾” union after the isolation valve.

1.5.1 Relief devices should be positioned in such a way as to avoid charges of high pressure gas to the operator or persons in close vicinity.

1.6 Devices

1.6.1 Each cylinder used for the storage of CNG should be equipped with suitable pressure relieving device and a suitable isolating valve which should be readily accessible when installed in the storage bank. The isolating valve should not be capable of closing off the pressure relieving device or should be locked in the open position.

1.6.2 Relief devices should be positioned in such a way as to avoid charges of high pressure gas to the operator or persons in close vicinity.

1.6.3 Safety relief valves should be provided with means to seal to prevent tampering by unauthorized persons.

1.6.4 Minimum required rate of discharge from the safety valve should be at least equal to any input from the system whether stored or being compressed.

1.6.5 Each safety relief valve should be clearly marked by the manufacturer.

1.6.6 The maximum pressure in the storage system should not exceed 250 bar (g).

1.6.7 The cascade cylinders should be supplied with impact test certification.

1.7 Corrosion protection

1.7.1 Pressure vessels which are made of materials that are subject to corrosion by atmospheric conditions should be protected by painting or other equivalent means necessary to prevent corrosion.

1.7.2 Importance should be drawn to avoiding corrosion which can limit the working life of a cylinder and affect the fatigue characteristics in serious cases. The implementation of good periodic maintenance anti-corrosion procedures is strongly recommended.

1.8 Valves

All valves fitted to gas cylinders shall comply in all respects with the following specifications namely:

i. In respect of industrial Gas Cylinder, IS: 3224.

ii. Valves for cylinders shall have outlets provided with left hand screw threads for the pies or connections.

iii. The valves shall be attached to the cylinder neck by screwing and not by making any permanent attachment or inserting adapter in between.

1. The design of spindle operated valves shall be such that when fitted to the cylinders it shall not be possible to withdraw the spindle under normal operating conditions.

2. Each gas storage unit should have a quick action gas storage isolation valve installed in the steel supply pipe immediately adjacent to its gas storage unit to enable individual shut off and isolation of each unit. These valves will be within fence enclosure.

3. Separate common valve system to be supplied for each storage bank complete with non-return valve.

1.9 Cascade Frame

1.9.1 The frame shall be rigid and sturdy and shall not allow lateral and rotational movement of cylinders during regular road transport under any circumstances. Vendors shall take into account the rough patches / bumps on roads.

1.9.2 Frame shall be free standing and have facilities for lifting by crane and forklift the complete assembled cascade. Bottom and top of frame shall be reinforced to prevent Any twisting or strain to interconnections among cascade cylinder during lifting by crane,forklift and during the transport.

1.9.3 Cascade storage system to be skid mounted and complete with removable metal frames and non-metal/non-sparking spacer material.

1.9.4 Frame structure of each cascade shall be capable of withstanding 4G impact (four-time gravity) in vertical direction without any distortion. Vendor to submit 4-G static test calculation of one complete assembled cascade with all the cylinders mounted & lifted. Test results and report shall be submitted to VCS/Client.

1.9.5 Each storage system should be supplied with suitable lifting lugs. Bottom and top of frame shall be reinforced to prevent any twisting or strain to interconnections among cascade cylinders during lifting by crane, forklift and during transport.

1.9.6 Cascade and spacer frame to be painted with anti-rust and etching primer under coat. Importance should be drawn to avoiding corrosion which can limit the working life of a cylinder and affect the fatigue characteristics in serious cases. The implementation of good periodic maintenance anti-corrosion procedures is strongly recommended.

1.9.7 All cylinder tubing, manual isolation valves and pressure relief valves should be protected from knocking by any moving object and should not protrude outside the metal frame or brackets.

1.9.8 Frame shall be suitably covered with canopy to avoid the ingress of rainwater.

1.9.9 All items used in the frame shall be waterproof.

1.9.10 Supplier shall submit structural drawing of the frame giving details of the steel, welding procedure, corrosion protection for approval of owner/owner's representative before commencing fabrication work.

1.9.11 Frame shall support the cylinder adequately and allow the cleaning of cylinder.

1.9.12 Vent arrangement for each cascade shall be as per IS 7285 part 2, 2017.

1.9.13 Materials used for Vent piping shall be stainless steel 316.

1.9.14 The tubing material shall be of make as per datasheet.

1.9.15 All SS Tube fittings shall be of make as per datasheet.

1.10 Piping / Tubing / Fitting / Pressure gauges' / Temperature gauges

1.10.1 All rigid piping, tubing and other components on the storage system be designed for the full range of pressures, temperatures, and loadings to which they may be subjected with the factor of safety at least 4 based on the tensile strength at 20° C. Any materials used to include gasket and packing should be compatible with compressed natural gas and its service conditions.

1.10.2 All piping should be designed in accordance with engineering calculations based on requirements of ASME B31.3 in conjunction with EEMUA supplement to ASME B31.3 or equivalent design standards. Standards used should be used in total.

1.11 Vent arrangement

1.11.1 All welding piping should be fabricated and tested in accordance with ANSI/ASME B31.3, API 1104, or equivalent standard. Whichever standard is chosen for use; it should be used in total.

1.11.2 All piping to be tested after assembly to pressure equal to that of the pressure relief device setting and proved leak free.

1.11.3 Materials used for the piping shall be Stainless Steel to specification ASTMA 269 TP316 fully annealed seamless with maximum hardness of Rb80 or less and suitable for

bending and flaring. OD tolerance shall not exceed +0.005%. Tubes shall be of make as per datasheet.

1.11.4 Double compression ferrule fittings shall be used in tube connection tubes.

1.11.5 All fittings including valves shall be Swagelok, Parker make only.

1.11.6 Open ends on fittings and vents shall be provided with caps.

1.11.7 Every CNG storage unit including each manifold group or bulk storage tank should be provided with suitable pressure gauge for each bank. The pressure gauge should be directly connected to the tank or storage system. The gauge should be dial graduated to read approximately double the operating pressure.

1.11.8 A good quality industrial pressure gauge should be used with dial face of at least 100 mm or larger. Gauges should be built to requirements of BS 1780 or ANSI/ASME B40.1 or OISD-179 equivalent.

2. Liquid filled (glycerin) pressure gauges of diameter 4", (0-400 kg/cm2) Wika make with a 3- way relief/isolating valve on each bank shall be used. It is mandatory of Labeling on the gauge of calibration date.

3. Liquid filled (glycerin) Temperature gauges of diameter 4" Wika make (0-200-degree C) shall be used for each bank. It is mandatory of Labeling on the gauge of calibration date.

3.1.1 Temperature gauge of diameter 4” with necessary arrangement on high bank only shall be used. Thus, each cascade shall have only one Temperature gauge on high bank.

3.1.2 All end connections, pressure & temperature gauges, valves, and fittings of cascade shall be with tamper proof, wire cage enclosure. These shall be on one side of cascade for ease for operations.

3.1.3 Vendors shall provide a suitable draining/Vent arrangement duly certified/approved by PESO for the purpose or removing moisture and other contaminants that may accumulate within the piping / Tubing.

3.1.4 Material of vent tubing shall be SS 316 and make shall be of make as per datasheet.

3.1.5 Vent height shall be minimum 03 meters from working platform as per PNGRB guideline requirements.

3.2 Painting

Every cylinder is painted with the appropriate identification colors specified in IS: 4397 for industrial cylinders.

a) White color on cylinder body.

b) Red IS 537 on cylinder neck portion.

c) Yellow color on frame.

3.2.1 The paint shall be chosen, primed, and applied as to have service life of five (5) years. The exterior surface is required to be corrosion free for five (5) years and to be faded

free life without oxidation of paint surface for five years in an environment of bright sun light with an intensive UV content.

3.2.2 Surface preparation by Shot Blasting as per grade SA 2 1/2 IS 9954/ ISO 8501. Two coats of paint shall be applied with minimum thickness of 200 microns. The recommended painting system should be of category C5-I very high (Industrial) as specified in the standard ISO 12944 Part 1 – 8. The proposed Painting system shall conform to Table A5 of ISO 12944 - 5 standard.

Primer	Epoxy Zinc Phosphate Primer	100 µ
Final coat	High Build Epoxy	100 µ

4. PROTECTION OF VALVES & ACCESSORIES

4.1 All valves and accessories shall be safeguarded against accidental damage of interference.

4.2 Valves and accessories shall be mounted and protected in such a way that risk of accidental rupture of the branch to which the valve or accessory is connected is minimized.

5. EQUIPMENT

5.1 Piping, Fitting, valves, and Instruments:

a) All piping, fittings and meters mounted on the cascade shall be designed to withstand the most severe combined stresses imposed by the following, namely.

i. The maximum designated pressure of vessel.

ii. The super imposed pumping pressure of the shock loading.

b) The materials used for vessel equipment shall be sufficient ductile to withstand rough usage and accidental damage. Brittle materials such as cast iron shall not be used.

5.2 Protection of piping and equipment:

All piping and equipment shall be adequately protected to minimize accidental damage which may be caused by rough usage, collision or overturning.

5.3 Marking of connections:

All connections on the vehicle which require manipulation by the operator of the vehicle should be clearly marked to prevent incorrect operation. The form of this marking should correspond with the operating procedure laid down for the vehicle.

6. INSPECTION & TESTING

6.1 Before bringing CNG cascade to site, factory testing should be carried out to demonstrate the function of all equipment/items within the system (if desired.)

6.2 Vendor shall be given 2 weeks' notice of the date and location of tests so that the equipment may be witnessed if desired.

6.3 Upon delivery to the site, all the equipment should be assembled in a complete system except for the vent line which can be partly supplied loose and assembled at site. Thereafter, final site acceptance test would be carried out. Such tests should be witnessed and signed off by the Approved third party inspection agency. The supplier should rectify and replace all defects, faults, failures, etc. without any cost implication. The cost should include accommodation, travelling, expenses, etc.

6.4 Vendor shall carryout 4G static calculation of one complete assembled cascade with all the cylinders mounted and filled and submit the same for VCS/owner review.

6.5 Vendor shall carryout cylinder bursting test of one cylinder from the entire batch produced for supply in case offered cylinders are of new design (conforming to the requirement of IS 7285:2004). Vendor shall inform the schedule of the testing well in advance to enable owner or their authorized representative to depute technical personnel for witnessing the test.

6.6 Vendor shall carry out all standards shop test/QA/QC as per recommendation of manufacturer/chief controller of explosives. Copies of the testing/inspection carried shall be furnished to Client.

6.7 Vendor shall furnish record of storage capacity check of each cylinder in a cascade and the same need to be demonstrated to owner or their authorized representative.

6.8 Each assembled storage cascade with all tubing, valves shall be pressures tested to ensure existence of no leakage prior to dispatch.

6.9 Manifold of the cascade shall be tested to 250-bar g. the manifold shall be checked for sequencing.

6.10 There shall not be any back flow between any two banks with all valves open for three banks of cascades.

6.11 Dispatch clearance to be given by Client after final inspection to be witnessed by Client/third party inspection agency appointed by Client.

7. CALIBRATIONS, TEST CERTIFICATES AND THIRD PARTY CERTIFICATION

7.1 Every cylinder should be carried with hydrostatic or hydrostatic stretch test and a Leak test should have carried for each cylinder or cascades with all tubing's, valves and a certificate should be furnished to the owner.

7.2 All instrument gauges, valves, pressure gauges, safety relief devices, shut off valves tubing's and piping etc. should be pressure tested, calibrated and such test calibration certificates, should be presented upon delivery to site. If any of the test certificates is not in order, the suppliers should replace the affected equipment with valid certificate without any cost implication.

7.3 Bidder shall paste calibration tag to the all equipment. The calibration date should be within one month from date of factory inspection. If it is older than one month then vendor has to do it again and submit calibration reports before offering inspection.

7.4 Calculation shall be carried for 4G stationary of one complete cascade with all cylinders mounted and filled and the same should be submitted for review of the owner.

7.5 Certificate should be provided.

7.6 Burst test of one cylinder from the entire supplies shall be produced and incase offered once are new design the schedule for the test should be informed prior to enable the owner or their authorized representative to depute their personnel for witnessing test.

7.7 All standards shop sites/QA/QC as per the recommendation of the manufacturer/chief controller of explosives to be carried out and a copy of such certificates shall be furnished to the owner.

7.8 Record of storage capacity check of each cylinder in a cascade shall be furnished and same shall be demonstrated to the owner/its representative.

7.9 The bidder shall appoint Third Party Inspection Agency for carrying out the inspection at bidder's works as per approved QAP, approved drawings & tender documents and TPIA charges shall be borne by the bidder. SPL recommended only LR TPIA.

8. TRAINING REQUIREMENTS

8.1 The supplier should develop a training proposal and prepare a schedule for the company's review and approval.

8.2 The training program should be phased to suit the construction program such that the company's personnel are fully conversant with all aspects of the operations and maintenance of the storage system including all aspects of operations, including decanting CNG from mobile gas trailers, pressure control and integration of the overall system.

8.3 The training program should cover but not limited to the following subject areas:

i. The physical characteristics of the gas and the procedure and precautions to be observed in handling and control.

ii. Start-up, operations, and maintenance procedures for the CNG storage facilities.

9. PROTECTION DURING SHIPPING

The cascade shall be packaged to withstand rough handling during ocean shipping and inland journey. It shall be vendor's responsibility to avoid and protect system with any deterioration and that occurs during shipment. Sling points shall be clearly indicated on crates.

	PROJECT NUMBER:	CUGL Central U.P. Gas Limited
QUALITY ASSURANCE PLAN OF CNG CASCADE	**TOTAL SHEET NO.**	07

DOCUMENT NO					

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	**DATE**	**DESCRIPTION**	**PREP**	**CHK**	**APPR**

QUALITY ASSURANCE PLAN – HIGH PRESSURE GAS CYLINDER, CASCADE FRAME & FITTINGS								
S. No	**OPERATION / PARAMETER**	**CHARACTERISTICS / PARAMETERS**	**ACCEPTANCE CRITERIA & CERTIFICATION**	**INSPECTION FREQUENCY**	**VENDOR**	**TPAI**	**CA**	**REMARKS**
INCOMING MATERIAL								
1	Raw Material	Chemical Composition	Chrome Moly Steel, /IS: 7285-Part-2 ci. 5.2 Table-1	One sample per heat No.	P	R	R	Verification on of RMT certificate Received from RM Supplier.
IN-PROCESS INSPECTION								
2	Raw Material Cutting (seamless Tube)	Length	As per process heat	4-5 jobs during setting approval & every two hour.	P	R	R	
		Thickness						
		Outside Diameter						
		Surface Flaws						
		Ultrasonic Examination						
3	Bottom Forming	Bottom Thickness	1.5 T min (where T is wall thickness)	4-5 jobs during setting approval & every four hour.	P	R	R	
		Centre of Bottom	IS: 7285: Part-2					
		Side of Bottom Forting	Free from crack, excess metal, pin	4-5 jobs during setting approval & every two hour.				
		Visual Inspection						
		Ultrasonic examination	IS: 7285: Part-2	Each cylinder				
4	Neck Forming	Solid Neck Length	As per Approved Drawing	4-5 Jobs during setting Approval & every two hour.	P	W/R	R	
		Neck Diameter	As per Approved Drawing	4-5 jobs during setting approval & every two hour.				

		Surface finish, defects	Free from crack, excess metal, pin hole, ball formation, Roller mark and other Surface defects.	4-5 jobs during setting approval & every two hour.				
		Ultrasonic Examination	IS: 7285: Part-2	Each cylinder				
5	Heat Treatment	Hardness	As per approved drawing	Every cylinder	P	R	R	
		(As Tempered)	IS: 7285: Part-2					
		Mechanical Properties Tensile Strength	As per IS: 7285: Part-2	One random cylinder will be selected from Heat Treatment Batch conforming the mechanical properties like tensile test, impact test, Bend test etc., in presence of Inspecting officer.				
			IS: 7285: Part-2					
		Yield Strength						
		% Elongation						
		Impact test (at-20°C)	IS: 7285: Part-2					
		Bend Test	IS: 7285: Part-2					
		Burst Test	IS: 7285: Part-2					
6	Ultrasonic testing	Crank deduction	As per IS: 7285: Part-2	Every cylinder	P	R	R	
		Wall Thickness measurement	As per approved drg.IS: 7285-Part-2					
7	Neck cutting & threading	Neck Length	As per approved drawing	Audit check by Q.A staff	P	R	R	
		Machined neck step diameter	As per approveddrawing	Audit check by Q.A staff				
		Neck thread configuration	As per approveddrawing	Every cylinder				
		Visual inspection thread finish	Free from crack blow hole excess metal at inside neck, thread damage, flat threads etc.	Every cylinder				

8	Water capacity checking & hydrostatic strength testing.	Measurement of water capacity. Total Expansion and permanent expansion at test pressure. Holding Time = 30 sec min.	Tolerance on watercapacity +5 % IS- 7285: 2017	Every cylinder	P	W/R	R	
			Permanent expansion shall not exceed 10% of total expansion. IS: 7285:2017	Audit check by Q.A staff				
9	Air/N2 leakage Test	Access leakage from cylinder body,neck, and bottom side at working pressure. Holding Time=60 sec. pressure=250 kg/cm2	Free from Leakage. IS: 7285:2017	Every cylinder	P	W	R	
				Audit check by Q.A staff				
10	Bursting Test	The value of hoop stress shallbe not less than 0.95 of the minimum specified tensile strength of the cylinder material.	IS-7285-2017	One Cylinder of the first batch.	P	W/R	R	
11	Steam cleaning & Air Drying	Examination of Oil residue, Moisture etc.	Free from Oil, Moisture etc. when Cylinder is exposed to steam jet at steamtemp. 160-180°C for period minimum 5-6Minutes.	Audit check by Q.A staff	P	R	R	
12	Internal shot blasting	Scale free surface	Inner surface should be free from scales, metallic particles etc.	Audit Check by Q.A staff	P	R	R	

13	External shotblasting	Scale free surface	Cylinders should be free from scales & scales & another surface imperfection	Audit Check by Q.A staff	P	R	R	
14	Fixed data stamping	Stamp data	As per IS: 7285: 2017	Audit Check by Q.A staff	P	R	R	
15	Variable Data stamping	Stamp data	Verification of data asper drawing & test Result	Every cylinder check by Q.Astaff	P	R	R	
16	Vacuum Cleaning	Any scales, dust etc. inside cylinder	Free from scales, dust etc. from insidecylinder	Every cylinder check by Q.Astaff	P	R	R	
17	Weighing	Tare weight /calibration	As per approved drawing	Every cylinder check	P	R/W	R	
18	Painting (primer &finish painting)	Paint coating thickness	As per process sheet	Audit check by Q.A staff	P	R	R	
19	Marking		IS: 7285: 2017	Each cylinder	P	R	R	
20	Colour identification		IS: 7285: 2017	Each cylinder	P	R	R	
21	Cascade frame fabrication painting cascade frame complete	Visual (Welding etc.) Dimensional Physical Test Chemical Test	Approved Drawing/ Manufacturers standard. Owner's specification approved drawing	100%	P	R	R	
22	polyurethane/ Epoxy paint	Chemical propertie s	Approved Make / Owner's Specification		P	R	R	
23	SS Tubes	Physical Test Chemical Test Visual (Welding etc.) Dimensional Fitment & Alignmen t	Approved Drawing, Manufacture Test certificate for boughtout items.	As per tender / Owner'sinstruction.	P	R	R	

24	Fittings	Visual Dimensional pressure Test	Approved Drawing /Manufactures	As per tender / Owner'sinstructions	P	R	R	
		Fitment & Alignment	standard					
25	Valves 2 way	Visual dimensional fitment & Alignment	Approved Drawing/ Manufacturer Test Certificate for bought Out items.	As per tender/owner's instruction	P	R	R	
26	CNG Cascade Assembly	Visual (Welding etc.) Dimensional Fitment & Alignment	Approved drawing/Manufactu rer std.	Owner's specification/instructio n	P	W/R	R	
27	CU Tubes for vending of Burst Disc separator	Visual (welding etc.) Dimensional pressure test leakage Fitment & Alignment	Approved Drawing /Manufacturer std.	Owner's specification/instructio n	P	W/R	R	
28	Cylinder valves		As per approved CCOE Drawing, Bill of Material.	Owner's specification/instructio n	P	100 % W	R	
29	Gauge	Visual Dimensional Fitment & Alignment	Approved Drawing. Bill of Material.	Owner's specification/instructio n	P	100 % W	R	
FINAL INSPECTION								
30	Visual Inspection for Internal cleaningand PAINTING OF Cylinder and Cascade frame.		IS: 7285-2017	Each cylinder	P	100 % W		
31	Final dimensional checking of cylinders& cascade frame. Check every cylinder for neck threads &cleaning from inside/outside surface. Verification of stamped data like Cylinder Serial No., Tare Weight, WaterCapacity etc.		IS: 7285-2017	Each cylinder	P	100 % W		

DOCUMENTATIONS							
32	Documentation & Inspection Certificate	Review of Stage Inspection Reports / Test Reports & Issue of IC	MTC & Inspection Report	H	P	R	
33	Endorsement of Test certificate & issue of Release Note	IR/IRN	~	H	P	R	

LEGENDS: We witness; H=Hold; M=Monitoring; P=Perform; R=Review of documents; R/M=Random Check; A=Approved; TPAI=Third Party Inspection Agency

Notes:

1. The above testing and acceptance criteria are minimum requirements; however, manufacturer shall ensure that the product shall also comply with the additional requirements as per Technical Specification (TS) and Data Sheet.
2. The supplier shall submit their own detailed QAP prepared on the basis of above / Technical specification for approval of Owner/Owner's representative.
3. Supplier shall submit calibration certificates of all instruments/Equipment to be used for inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval. All reference codes / documents shall be arranged by vendor for reference of TPIA at the time of inspection.
4. Owner / Owner's representative include TPIA will have the right to inspect activity of manufacturing at any time.
5. TPIA along with Owner / Owner's representative shall review/approval all the documents related to QAP/Quality manuals/Drawings etc. Submitted by supplier.
6. Contractor shall in coordination with supplier/sub vendor shall issue detailed production and inspection schedule indicating the dates and the location of facilities Owner/Owner's representative and TPIA to organize inspection.
7. Special manufacturing procedure have to be specially approved or only previously approved procedures have to be used, in case of conflict between specification more stringent condition shall be applicable.
8. All reference codes/standards, Documents; P.O. Copies shall be arranged by vendor/Supplier for reference of TPIA/VCS at the time of inspection.

Name, Signature & Date: Prepared By:	Name, Signature & Date: Checked By:	Name, Signature & Date: Approved By:

		CUGL Central U.P. Gas Limited
VENDOR DRAWING AND DATA REQUIREMENT – CNG CASCADE	Total Sheets	03
Document No		

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR

S. No.	DESCRIPTION	To be submitted with Bid	To be submitted for Approval		To be submitted for Shipment		Submit as certified Final / As Built	
			Required	Days after PO	Required	Days after PO	Required	Days after PO
1.	Technical specification forCNG storage CASCADE and Accessories giving details of various components.			14				
2.	Process and instrument diagram			14				
3.	Installation requirements for all equipment included in the supply.			14				
4.	Typical cross sectional drawing and literature to fully describe the details of all major components such as cylinders, valve, gauges piping etc. data sheet indicating material of tube, tube size etc., piping and instrument diagram.							
5.	Leaflets, catalogues for all major items.							
6.	Factory acceptance test procedure.			14				
7.	Engineering manuals including O&M manual.			14				
8.	Maintenance schedule of the storage system along with list of spares for O&M during warranty period.			14				
9.	A complete zonal drawing of the storage Cascade (complete package), all certification for all components used within the hazardous areas should be provided.			14				
10.	Quality Assurance Plan (QAP) of Cascade Frame and Cylinders along with GAD, dimensional drawings, load data.			14				
11.	Copies of chief controller of Explosives approval.			14				

S. No.	DESCRIPTION	To be submitted with Bid	To be submitted for Approval		To be submitted for Shipment		Submit as certified Final / As Built	
			Required	Days after PO	Required	Days after PO	Required	Days after PO
12.	Cascade Data Sheet, GA drawings.			14				
13.	Schematic of cascade piping.			45				
14.	Drawing of cascade frame along with 4G static calculations for one complete assemble cascade with all the Cylinders mounted & filled.			14				
15.	Drawing of cylinder of specified parameters proposed to be used in offered cascade approved from chief controller of explosives, Government ofIndia.			14				
16.	Make of bought out items							
17.	Bill of quantities with weight of each component.			14				
18.	Detailed time schedule for supply indicating time periods required for cylinder manufacturing, cascade frame fabrication, shop testing, dispatch of material from works and delivery at site.			Weekly & Monthly				
19.	Test Certificates.							

SECTION-C
DISPENSER

		CUGL Central U.P. Gas Limited
SCOPE OF WORK- CAR DISPENSER	Total Sheets	14
Document No		

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR

Contents

1. SCOPE OF SUPPLY

This document covers the details of supply of car Dispenser. All works and clauses of this document shall be applicable unless specifically mentioned otherwise. This document shall be read in conjunction with Data Sheets, Technical Specification, Codes & standards, Drawings, and other documents forming a part of the MR Document.

Supply of dual arm car dispenser having flow capacity of minimum 15 kg/min.

Each CNG Dispenser shall have following as a minimum:

1.1 Car Dispenser:

a) Two CNG flexible electrically conductive twin (fill & vent) hose, with both hoses fitted with NGV-I for filling of vehicles. However, both the hoses shall be suitable to be attached with NZS-5425 nozzles. Loose supply of NZS 5425 nozzles with adaptor forboth hoses are included in bidders' scope. Vendor shall include the supply of 3-way valve with each hose for filling & venting of gas. Vendor shall also include supply of Breakaway Coupling, suitable for NGV Industry, in the hose. Hose shall be 3/8" ID 5000 psig, at least 3m long. Vendor shall demonstrate the function of breakaway coupling during performance test. The dispensers shall be designed in such a way that free movement of hoses is possible, by spring loaded high mast.

b) Two numbers of Coriolis mass flow metering system.

1.2 Three rows of liquid crystal backlit display for night viewing showing total sale in Rupees (00000.00), quantity of gas sold in kg (00000.00), unit price of CNG in Rs/kg (000.00) for each hose on either side of the dispenser (total two sets of three rows for each Dispenser, one display for each side). The whole dispenser electronic unit shall have IP - 65 protections and display cabinet shall have IP 54 protection.

1.3 Non-resettable and non-volatile totalizer up to 999999.99 for total CNG sold in Kg with an independent battery backup. For further details, refer: Instrumentation & Control specification.

1.4 Since the dispensers are used for custody transfer purpose, the totalizer must not reset in any eventuality not even in the case of electronic failure. Bidder to provide suitable electronic digital display unit separately for the totalizer. Updating of Dispenser totalizer reading shall be real time & continuous, instead of at the end of fill cycle. Totalizer reading of dispenser shall be taken from Inventory of Mass flow meter.

1.5 One number of three banks electronic software and controller including hardware for individual filling arm.

1.6 Holster/ cradle for each fill nozzles along with weather caps for the protection of nozzles. Holster/ cradle shall be suitable for both NZS and NGV nozzles. Holster/cradle shall be provided for NGV nozzle and shall be compatible to be attached with NZS-5425 nozzles. Supply of NZS 5425 is included in bidder's scope.

1.7 Hi-mast or equivalent arrangement with flexible hose arrangement for each fills hose so that the hose does not touch the ground.

1.8 Emergency stop switch is required on both side of the Car dispenser. However, the filling on both sides should stop in emergency condition, when any one of the emergency

switches is pressed. During activation of emergency switch, the power supply to the dispenser should be available.

1.9 Liquid filled 4" dia. (0-400 Kg/cm2g) pressure gauges showing the vehicle filling pressure for each filling arm.

1.10 Bubble tight manual shut-off valve for each fill hose.

1.11 Vendor has to supply the dispensers with solenoid operated valve or actuated Electro Valve with NAMUR Intrinsically Safe Solenoid Valve made of ANSI 316 SS, for ON-OFF control of flow, on the gas inlet with tube end connection (size to be specified by vendor). Valves shall be provided for each bank per hose separately. Valve make shall be as per approved vendor list. Client has an option to choose the type of valve for supply of Dispensers. Vendor to ensure the system design in such a way that any gas if passes, should be recorded by dispenser and there should not be any possibility of unmetered gas supply through dispenser in case of malfunctioning of valves.

1.12 The gas tubing inside the dispensers shall be seamless SS 316 fully annealed (Bright Annealed) conforming to ASTM A 269 with maximum hardness of RB 80 or less and suitable for bending and flaring. The tubes shall be fully annealed (bright annealed), with SS 2-wayBall valve at inlet and tube end connection suitable for connecting with SS Tube (size to be specified by vendor). Any open ends on fittings and vents shall be provided with caps/dust plugs.

1.13 Coalescent and particulate Stainless Steel filter of Grade 6 or better to be provided at inlet of each bank supply line with manual drain valve to ensure that the oil carry over in the CNG being filled to vehicle is < 1 ppm and particulate size is < 0.01 Micron. Filter housing for said filter must be capable for collection of oil for a drain interval of 24 hrs with oil carry over < 1 ppm. Filter elements made of paper shall not be accepted. Vendor to provide appropriately plugged drain valve outside the dispenser housing with suitable arrangement to collect the drained oil. Filter size shall be in accordance with max flow through the dispenser.

1.14 The CNG dispenser specification should meet the IS 15403:2000 (E) natural gas quality designation for use as a compressed fuel for vehicles.

1.15 Vendor shall ensure that the system design in such a way that in both options any gas if passes, should be recorded by mass flow meter and there should not be any possibility of unmetered gas supply through dispenser in case of malfunctioning of solenoid or actuated Electro valves. Any unmetered gas passing shall be recorded in the dispenser is retrievable as and when required.

1.16 OWNER's Logo and name to be displayed on both sides of dispensers, in OWNER approved color scheme. OWNER's Logo and name shall be painted on stainless steel panel with an appropriate colored background or alternatively, vendor shall provide self-adhesive PE film sheet with OWNER's Logo and name. The artwork shall be of three colours. The colours, Logo size and name size shall be informed to successful bidder during detailed engineering.

1.17 Any other item required for safe and accurate operation of Dispenser.

1.18 Any spare(s) required during commissioning shall be in the scope of vendor.

1.19 Supply of application program, ladder logic, list of error codes with description for programming the dispenser parameter.

1.20 If dedicated programming unit is required for programming/ parameter change. The same shall be submitted in "CD" along with supply of dispenser also hard copy of the same also be submitted.

1.21 Vendor shall make a provision to change the price of CNG through the keypad/Switches inside the dispenser unit that shall be covered with security lock. It shall also be possible to change the price from remote station (from SCADA/ from any part of the city). Data format required from Dispenser shall be in integer form. RS 485port shall also be provided for price change. In case standard RS 485 port is not available in the dispenser, then RS 232C to RS 485 convertor with all relevant hardware and software to be provided by vendor.

1.22 The PLC interfacing shall be through RS 485 signal only. In addition to this the flow meter shall have a head mounted display, where the parameters such as flow rate (Kg/hr), cumulative gas compressed (in Kgs) etc can be independently viewed. The inbuilt totalizer shall be non-volatile, non-resettable type and shall be suitable for hazardous area classification.

1.23 Mass flow meter input as well as output shall be considered in the logic to run the compressor. In case, mass flow meter is not functioning properly or their signal is not available to the PLC, compressor should trip or shall not start.

1.24 RS 485/Modbus serial port shall be provided for downloading the CNG sale data with the help of Purchaser's Personal Computer for each shift (8-hour interval). In case standard RS485 port is not available in the dispenser, then RS232C to RS485 converter with all relevant hardware and software to be provided by vendor. Suitable software shall be provided to obtain the same for each shift (8-hour interval).

1.25 Vendor shall provide a common processor and open communication protocol/ RS 485/Modbus/Ethernet port for RTU to transfer all the dispenser data to central SCADA system. In case standardRS485 port is not available in the dispenser, then RS232C to RS485 converter with all relevant hardware and software to be provided by vendor.

1.26 Vendor must note that non-standard/ propriety type communication protocol in dispenser for communication with RTU is not acceptable. Protocol must be standard as specified above or any standard protocol with compatible convertor shall be made available and must be compatible to any make of RTU (Owner's scope). RTU will have Serial communication port RS 485 protocol to interface with dispenser. Vendor is responsible to provide the communication port compatibility with RTU. Vendor is required to carry the communication port functional test and display all the values in Lap top or inapplicable device during dispenser inspection (FAT) at vendor premises. Also, functional test shall be carried out by vendor after installation and looping is junction box at site. Vendor shall also share the dispenser protocol details with Client

1.27 Vendor must furnish/ share the details of implemented MODBUS protocol like function codes for read and write, slave ID, list of signals to be transferred, CRC implementation, register addressing methods / mapping etc. with Client and provide their assistance during interfacing with RTU to automation vendor.

1.28 Any Gas Losses incurred due to fault in Dispensers to be debited to the bidder for recovery.

1.29 Statutory compliances like calibration of MFM, safety relief valve, PT, PG etc. will be in vendor's scope for comprehensive maintenance duration and shall be done minimum once in a year.

1.30 Bidder can also arrange Portable master calibration unit at site to calibrate MFM, safety relief valve, PT, PG. That master calibration unit should be calibrated by NIST. After calibration of the equipment, vendor to submit a calibration certificate of each item to the EIC/Client. Cost of calibration shall be borne by the bidder.

1.31 If it's required to send MFM, safety relief valve, PT, PG to the laboratories for calibration purpose then to avoid interruption in operation of CNG dispenser, bidder to arrange the other calibrated MFM, safety relief valve, PT, PG for CNG dispenser for that period.

1.32 Bidder to note that due to calibration requirement, CNG dispenser shall not be kept in an idle condition otherwise bidder shall be penalized as per cl. 8.1.4.

1.33 The dispenser shall be provided with electrical as well as mechanical counter for daily gas reconciliation.

1.34 The dispenser shall be provided with hanging facility of car nozzle.

1.35 The supplier shall provide training to client/filler.

1.36 It will be in bidder's scope to transport material from their plant to CUGL warehouse / site . It also includes loading and unloading arrangement like hydra as per site requirements.

1.37 It will be in bidder's scope to carry out calibration of all instruments and equipment as per industrial best practice. In case commissioning is delayed due to any reason and validity is expired, then it will be bidder's responsibility to carry out calibration of all instruments and equipment before commissioning. CUGL shall notify bidder prior to 15 days from date of commissioning.

2. CODE & STANDARDS

NFPA52	Standards for CNG Vehicular Fuel Systems
NGV 4.1/AG.A 2-92	Requirements for CNG Dispensing Equipment for Vehicles
NGV 4.2/AG.A 1-93	Requirements for Hoses for NGVs and Fuel Dispensers
ANSI/NGV1	Compressed Natural Gas Fuelling Connection Devices Standard for fuelling nozzles and receptacles
NGV 4/AG.A	Requirements for Breakaway Devices for CNG Vehicle Fuel Dispensers and Fuelling Hoses
AG.A 2-90	Compressed Natural Gas Fuelling Appliances.
AG 901	Code of practice for NGV refuelling stations.
IS 5572	Classification of hazardous areas (other than mines) for electrical installations.
IS 5571	Guide for selection of electrical equipment for hazardous area.
OISD 113	Classification of areas for electrical installations at hydrocarbon processing and handling facilities.

OISD 179	Safety requirements of compression, storage, handling and refuelling of CNG for use in Automotive sector.
OIML TC8/SC7	Recommendation with regards to CNG dispensers, December 2000.
	The Standards of Weights and Measures Act 1976.
	The Standards of Weights and Measures (Enforcement) Act, 1985.
	The Consumer Protection Act, 1986.
	The Standards of Weights and Measures (General), Amendment Rules, 2005 – Part X (Compressed Gaseous Fuel (CNG) Measuring Systems for Vehicles

3. DESIGN & ENGINEERING FOR DISPENSER

- Design & engineering
- Manufacturing & Assembling
- Procurement from Sub-vendors.
- Inspection & Testing at Works.
- Documentation and obtaining statutory approvals from the country of origin.
- Submit/ apply for obtaining type approval for the offered dispensers from Petroleum & Explosive Safety Organization, Govt. of India as per the provisions of Gas Cylinder Rules, 2016.

4. SAFETY

All Electrical devices shall meet the requirement for the area classification specified elsewhere in tender document. Tubing & other devices shall be so arranged that there is proper access for operation & maintenance.

5. AS-BUILT DOCUMENTS

On successful completion of hydrostatic testing, the Bidder shall prepare As Built drawings & reports of entire Dispenser package as specified in scope of work. All “As Built” drawings / reports shall be submitted as below.

Four sets of hard copies / soft copy in pdf documents of following shall be submitted by Bidder. All documents shall be bounder together:

(i) As-built drawing of Dispenser GAD / Fabrication Drawing / P&ID etc.

(ii) Test Reports/Results/Records

In addition, the above documents shall also be submitted in soft copy in pdf formats or Hard copy. Software used for the presentation of these documents shall beas follows:

Type of document Software

a) Test Reports/Results/Records MS Word/Excel (MS Office 2000)

b) Drawings AutoCAD

For the purpose of preparation of as-built drawings, Bidder shall update the "Issued for Construction" (IFC) drawings approved by the Company.

6. CHECK LIST FOR SCOPE OF SUPPLY

a) Vendor shall furnish all the equipment of Dispenser System instruments and gauges and safety devices as per the enquiry document. Anything required over the above what is specified, for safe and satisfactory operation of the equipment package shall be included by the Vendor in his scope.

b) Vendor to write YES/NO against each item. Vendor is required to include complete scope, as such 'NO' is not warranted. However, in case for any of the items if vendor's isreply is 'NO', Vendor should give reason for the same:

c) Vendor's scope of supply shall include but not limited to be following:

S. No.	DESCRIPTION	Specified by Purchaser YES / NO	Included by Vendor YES / NO	Remarks
1.0	**Each Dispenser package completes with:**	YES		
1.1	Frame material – STAINLESS STEEL 304 **(Sheet thickness Min. 16 gauge)**	YES		
1.2	Built-in Coalescing unit of 3-5 microns with manual drain valve at inlet.	YES		
1.3	Certificate of "Weights & Measures" approval for Dispenser & Mass Flow Meter	YES		
1.4	Certificate of "CCOE" / PESO approval for Dispenser & Mass Flow Meter & master meter (as applicable).	YES		
1.5	Certificate by Weights and Measures or the other statutory authorities of the country of origin is Provided.	YES		

S. No.	DESCRIPTION	Specified by Purchaser YES / NO	Included by Vendor YES / NO	Remarks
1.6	Fast fill type and electronic display – Car: 2 Sets of 3 rows	YES		
1.7	Dispenser with Tamper Proof Locking arrangement	YES		
1.8	Cabinet suitable to accommodate all valves, fitting flow meter and all required electronic equipment	YES		
1.9	Front/Side mounted Nozzle with lockable holder and safety lever/latch to firmly hold when not in use	YES		
1.10	Liquid filled Pressure Dial gauge of 4"size (Min)	YES		
1.11	Separate non-resettable straight forward reading Totalizer	YES		
1.12	ESD button mounted on both side of the dispenser or front panel.	YES		
1.13	One set of Isolation Valve complete with venting line valve and end plug installed on the inlet of the inlet steel pipes of dispenser.	YES		
1.14	Certificate by Weights and Measures or the other statutory authorities of the country of origin is Provided.	YES		
1.15	Electrical equipment and Instrumentation wiring are provided with Certificate of Area Classification.	YES		
1.16	Dispenser automatically and immediately shut off CNG supply to each fill hose individually in case of -Power failure, Failure of metering, Low flow, Failure of Totalizer, Overfill,pressure transducer failure.	YES		
1.17	Overall CV is indicated of dispenser from inlet of the dispenser up to outlet probe including mass flow meter, interconnecting tubing, valves, hoses, nozzles etc.,	YES		

S. No.	DESCRIPTION	Specified by Purchaser YES / NO	Included by Vendor YES / NO	Remarks
1.18	Dispenser is shipped in fully wired and assembled condition only gas supply connection, Instrument Air supply connection and power supply connection shall be made at site.	YES		
1.19	Warranty for a period of 12 months is provided from the date of final site acceptance of CNG facilities by the Company's.	YES		
2.0	**Spares**			
2.1	All necessary Spares and consumables during warranty period are in the scope of supplier.	YES		
3.0	**Inspection and Testing**			
3.1	As specified on the datasheets and Technical Specifications	YES		
4.0	**Vendor Data and drawings**			
4.1	All data & drawings as required per VDR format	YES		
5.0	**Erection, commissioning, and trial runs at site of the Dispenser**			
5.1	Additional Items not specified by purchaser but recommended by Vendor for safe smooth and normal operation. (Vendor shall indicate separate list of such items in his proposal)			
6.0	**Technical parameters to be confirmed by**			
6.1	Inlet Pressure Kg/cm2g -255	YES		
6.2	Fill Pressure Kg/cm2g -200	YES		
6.3	Operating Temperature range – [-10°C to 70°C]	YES		
6.4	Electrical Supply Single Phase AC, 230V±}10%, 50Hz±} 2%.	YES		

S. No.	DESCRIPTION	Specified by Purchaser YES / NO	Included by Vendor YES / NO	Remarks
6.5	Fill Nozzle **CAR**: NGV-1 for both arm, loose supply of NZS 5425 with adaptor for both side	YES		
6.6	Flexible fill & vent hose - Twin of Parker/Synflex/Mac	YES		
6.7	Fill hose pressure rating – Working pressure 5000 PSIG	YES		
6.8	**Sequential filling**- Three bank for Car Dispenser.	YES		
6.9	Temperature compensation – 200 kg/cm2 (g) equivalent at 15°C	YES		
6.10	Breakaway coupling – CAR side: 3/8". Fill and vent both the hoses shall be equipped with breakaway couplings. Breakaway couplings of WEH, OPW, Staubli or parker make shall be provided.	YES		
6.11	Principle of mass metering – Coriolis	YES		
6.12	Flow meter Coriolis type Model with integral flow indicator – CAR Flow meter make : E&H or Emerson-Micro motion	YES		Bidder to confirm the model considering flow rate of car dispenser
6.13	Minimum Flow rate – CAR : 15 Kg/min	YES		
6.14	Batch delivery accuracy - ± 1.0 % of batch or better	YES		
6.15	Mass flow accuracy for gas meter - ±} 0.5% (inclusive of sis & linearity, hysteresis & repeatability errors	YES		
6.16	Calibration tractability - To NIST as per ISO 5168	YES		

S. No.	DESCRIPTION	Specified by Purchaser YES / NO	Included by Vendor YES / NO	Remarks
6.17	Repeatability - ±} 0.25 %	YES		
6.18	Enclosure weatherproofs to - IP55, NENA4x	YES		
6.19	Pressure rating of Wetted parts - 5000 psi At 25°C as per ASME/ANSI B 31.3	YES		
6.20	Process Temperature effect - ±} 0.01% of nominal flow	YES		
6.21	Pressure influence – Nil	YES		
6.22	Surge and frequency Transient - Shall be in compliance with ANSI/ EEE(EFT) c 62.41(1991)	YES		
6.23	EMI effect on sensor and Transmitter - To the requirement of EMC directive (jan'94)	YES		
6.24	Vibration effect - As per SAMA PMC 31.1 1994	YES		

7. SCOPE OF WORK OF COMPREHENSIVE ANNUAL MAINTENANCE (CAMC)

7.1 General:

This contract covers the provision of services to undertake the Comprehensive Maintenance as per Company schedule and Breakdown repair of CNG dispensers as & when complaints are received at CNG control room / EIC. For the purpose of clarity, the agency providing maintenance services for above dispensers shall, herein after bereferred to as "Contractor" and the company hiring the services of the agency will, hereinafter be referred to as "Company" (CUGL Limited).

"Comprehensive Maintenance refers to preventive maintenance of equipment as per schedule which includes breakdown, equipment spare parts replacement, engineering and labor charges."

7.1.1 Preventive Maintenance:

To carry out the Preventive & Breakdown maintenance of dispensers strictly in accordance with the schedule provided by Company / OEM Manual.

The Contractor shall confirm to Company their availability to carry out the Maintenance in advance.

The spares required for carrying out preventive maintenance shall be in the scope of Contractor. The contractor personnel shall inform the exact time to the EIC before and after carrying out the maintenance.

The Contractor shall ensure all required consumables such as cotton waste, cleaning solvent, insulation tapes, thinner, soap solution, Teflon tape, probe, adopter and all hanging items such as three-way valves, CNG hose, Breakaway etc. including required tools & tackles, are available on site. Supply of consumables, tools & tackles etc. is in the scope of Contractor. Tools shall include multi meters, Laptop with required software (Pro-link etc.,) etc.

Contractor shall note down the dispenser performance before and after carrying out the maintenance. Contractor to submit report of Percentage difference between Mass Flow Meter and Non-rest-table Totalizer on fortnight or Monthly basis as per order of EIC. Later on after continuous operation, if calibration of installed Mass Flow Meter will be required. Same will be executed by Contractor at site with the help of laptop and suitable software. Only in case of lab calibration, if established by Contractor in front of CUGL Site in charge through proving exercise by Standard Master Calibration Device, During CAMC Contractor will be entitled to send the Mass Flow Meter, PG, PT, safetyrelief valve for calibration at its own cost.

Preventive maintenance will be carried out on Monthly basis during non-peak hours in consultation with EIC. Any maintenance that needs to be taken up shall be well planned in advance with due approval of EIC.

The contractor shall produce the compliance report of each maintenance activity on the next Working day to the Engineer - In - Charge. Compliance report shall be descriptive in nature. Provide proper communication facilities to all contractor personnel such as engineers, Technicians etc.

The contractor shall inform the Company, names and mobile numbers of all the service personnel who will be deployed for providing the services during the CAMC. An alternate number will also be informed to the company, which can be contacted in case all service personnel's mobile are not reachable. Changes, if any, will be notified to the company.

7.1.2 Break down Repair:

On receiving information from the CNG control room/Dealer/ EIC, contractor shall ensure that his team reaches the concerned retail outlet. Attend to dispenser breakdown service callson 24X7 basis. The service personnel will report to the call site within 2 hours from the time of receiving service call in M/s CUGL site or at whatever site dispensers are installed (Prior Information will be provided for location of installation of Dispensers).

Before proceeding to the outlet, the contractor personnel shall collect all necessary spares required for the repair depending on the nature of the complaints received. Upon reaching the retail outlet, the contractor personnel shall contact the CNG Control room toadvise his attendance on site and confirm the breakdown reporting.

The contractor shall coordinate with the Company representative for instructions on undertaking the repair work. After solving the complaint, the contractor shall inform CNG control room. Provide proper communication facilities to all contractor personnel such as engineers, technicians etc., Maintain records of the services provided, and submit the same to the company, once in a Month.

7.1.3 Reports to be submitted:

a) Reports (in soft copy and print form) of individual equipment as and when the dispensers are undertaken for preventive maintenance/break down/on complaint service. Report shall be descriptive in nature including nature and quantity of material used or repaired.

b) Monthly cumulative list on preventive maintenance/breakdown repair/ oncomplaint service of dispensers carried out with actual date and time of service.

c) Monthly cumulative list on consumption of spares in each dispenser consumed during preventive maintenance/breakdown repair/ on complaint service attend.

d) Separate analysis report on breakdown if anything occurred which needs special attention.

e) Report of Percentage difference between Mass Flow Meter and Non-Resettable Totalizer as per guaranteed parameter declared at the time of supply.

7.1.4 Break down penalty: (During CAMC Period)

In case, the contractor's service personnel are unable to reach the break down site within stipulated time or is unable to complete the maintenance within stipulated time, following penalty will be applicable. This amount will be deducted from the invoice raised by the contractor, at the end of the month.

a) Penalty for 1-hour delay in reaching at all site (i.e., beyond allowed 2 hours) – Rs 500/- per arm per dispenser.

b) Penalty for 2-hour delay in reaching at all site (i.e., Beyond allowed 2 hours)- Rs 1000/- per arm per dispenser.

c) If the shutdown time, which will be calculated from the time the dispenser is offered to service person on reaching site, is extended beyond 4 hours, a penalty of Rs 1,500/- per hour will be applicable after 4th hour.

d) Rs 2,500 towards non-availability of mandatory spares at operational sites.

e) Contractor shall not deploy the employee of age less than 18 years in any of the activities. If it is found, then it will be viewed seriously and heavy penalty of Rs. 20,000/-per instance and also the termination/blacklist will be done from our approved vendor list.

f) The contractor shall provide full Personal Protective Equipment (PPE) to each individual employee including, soft hat, eye protection, ear plug, and safety shoes. It is mandatory for all personnel to wear said PPE whilst performing their duties, failing which a penalty @ Rs. 500/- per incidence will be levied in addition to dismissal of the person.

	PROJECT NUMBER:	

DATASHEET-CAR DISPENSER	Total Sheets	04

Document No					

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR

CAR DISPENSER DATASHEET			
S. No.	**DESCRIPTION**	**SPECIFICATION**	**OFFERED**
1	**Dispenser**	Car	
1.1	Make		
1.2	Model		
1.3	Normal inlet Pressure Kg/cm2 g	255	
1.4	Maximum Fill Pressure kg/cm2g	200	
1.5	Operating Temperature range of wetted parts	(-) 10 °C to 60 °C	
1.6	Flow Rate (kg/min)	15	
1.7	Normal flow (kg/min)		
1.8	Minimum flow (kg/min)		
1.9	Overall Cv of dispenser from inlet of dispenser to outlet of fill nozzle		
1.10	Batch accuracy/ Arm side	±1.00% or better	
2	**Electrical supply**	AC 230 Volts 10% 50 Hz 5 %	
2.1	Tolerance value of voltage range for accurate operation		
3	**Fill Nozzle**		
3.1	Type	NGV1 for both sides. Hose shall be suitable for NZS 5425 also.	
3.2	Make	Refer Technical specification	
3.3	Pressure Rating kg/cm2 g	255 Kg/cm2 g	
4	Flexible fill & vent hose	Both should separate	
4.1	Type		
4.2	Make		
4.3	Pressure rating kg/cm2 g		
5	**Sequential filling**	Three Bank	
6	Mass flow meter		
6.1	No. of metering lines	Two independents	
6.2	Metering principle	Coriolis	
6.3	Make	E&H or Emerson-Micro motion	
6.4	Model		
6.5	Mass flow accuracy for gas meter (inclusive of linearity, hysteresis, repeatability errors)	0.5%	
6.6	Repeatability	0.25%	
7	Temperature compensation	YES	
8	Breakaway coupling	WEH, OPW, Staubli or parker	
NOTES:			

For all Electrical / Instrumentation items vendor shall provide certificates issued by statutory Inspection Authority confirming suitability of Design / Construction for specified Hazardous Area Classification.

MASS FLOW METERS (CORIOLIS TYPE) FOR DISPENSER

Units	Flow - >CNG	CNG Pressure > Kg/Hr	Temperature > °C	Level/Length >mm
GENERAL	1. Tag			
	2. Line No.			
	3. Service			
METER	4. Type			
	5. Function			
	6. Conn size: size & rating			
	7. Facing & facing			
	8. Body material			
	9. Wetted parts material			
	10. Enclosure			
	11. Conduit connection			
	12. Range			
	13. Accuracy			
CONVERTOR	14. Load resistance-ohms			
	15. Output			
	16. Power supply			
	17. Area classification			
	18. Intrinsically safe /Expl Proof			
	19. Enclosure			
	20. Conduit connection			
	21. Mounting			
	22. Distance from control room			
OPTIONS	23. Filter/Mesh wire			
	24. Mounting Brackets			
	25. Interconnecting			
	26. Special cabling			
	27. Cable glands			
	28. Accessories for hot tap			
SERVICE	29. Fluid & state			

CONDITIONS	30. Maximum flow			
	31. Minimum flow			
	32. Normal flow			
	33. Pressure-Open Max.			
	34. Temp. C – Open Max.			
	35. Oper. S.G. Mol. Wt.			
	36. Max, Order viscosity mpa. S(cp)			
	37. Max. Allowable Pr. Drop			
	38. Model No. Meter c convertor			
	39. Specification Remarks			
	40. Specification Remarks			

		CUGL Central U.P. Gas Limited
TECHNICAL SPECIFICATION- CAR DISPENSER	Total Sheets	20
Document No		

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	**DATE**	**DESCRIPTION**	**PREP**	**CHKD**	**APPR**

Contents

1. SCOPE

This specification provides vendor the technical and operating conditions the CNG dispenser must fulfill. Additional features other than those indicated herein which call for a better design, increase in efficiency, enhance reliability, optimization may be accepted subjected to Client's approval. The vendor may submit their bid for any alternative design as optional item which may be indicated separately describing all advantages The dispensers shall be shipped in completely assembled condition. Gas supply line and delivery connection shall be made at site.

The vendor shall bid their main offer, items according to the technical specifications mentioned below.

2. DISPENSER

2.1 The specifications described herewith are intended to give vendor the technical & operating conditions the Dispenser must fulfill. These are to be referred along with relevant document attached with tender. Vendor may indicate in his bid, the additional features, which dispenser has in terms of better design, enhance reliability etc., however such feature may be accepted subject to Client's review and approval.

2.2 The specifications of FLOW METER are described under Instrumentation & Control clause in this Specification below.

2.3 The Car dispensers shall be designed to handle flow rate of 15 kg/min under discharge to atmospheric condition. The dispensers shall be suitable for a turn down of not less than 50:1 on flow.

2.4 The normal operating pressure of CNG at dispenser inlet shall be 250Kg/cm² (g).However, supply from dispenser to the Car shall get positively cut off at outlet pressure of 200 Kg/ cm² (g) to ensure the safety of the vehicle.

2.5 Once the particular-cycle of filling has been completely stopped (on achieving the maximum fill pressure and/or minimum flow rate) then next filling can be started only after initialization.

The normal operating temperature of wetted parts of dispenser shall be (-) 10 °C to 55°C.

2.6 The Dispenser shall automatically and immediately shut-off CNG supply to fill hose individually (with error codes for diagnose) in case of:

- Power failure or excursion beyond permissible limit.
- Loss of display
- Power failure of mass meter (Provided with Single Error code for Power failure in Mass meter).
- Failure for metering (Provided with single error code if Mass meter becomes faulty & will not work)
- Flow beyond high and low limits

- Failure of totalizer
- Overfill by quantity and/or pressure
- Failure of pressure sensing transmitter
- Malfunctioning / Passing of electro valve/Pneumatic Valve
- Repeated operation of reset or start/ stop switch as per Client customization.
- Removal of any electrical wire connected to controller.
- Program step is in hold due to any error.

2.7 Fill Hose & Fill Nozzle

a) For Car Dispenser

Two CNG flexible electrically conductive twin (fill & vent) hose shall be included for supply of Dispensers meeting the requirement of NFPA-52 and NGV 4.2.

Both fill hose for car dispenser shall be suitable with NGV-I for filling of vehicles. Fill hose shall also be suitable for NZS-5425 nozzle with adaptor. The nozzle shall meet the requirements of NGV-1 Type-2, Class B nozzle. Vendor shall include the supply of 3-way valve with each hose for Filling & venting of gas. Vendor shall also include supply of Breakaway Coupling, suitable for NGV Industry, in the hose. Hose shall be 3/8" ID 5000 psig, at least 3m long. Vendor shall demonstrate the function of breakaway coupling during performance test.

3. DESIGN BASIS

Gas from storage cascade or compressor through priority panel is dispensed to CNG vehicles like Car via dispenser. The CNG Car Dispenser shall have Twin Arms, each with a flow capacity of 15 kg/min for under discharge to atmospheric condition. Pneumatic actuated or electro valves shall be used, If Pneumatic actuated valve, Instrument air / Exe proof electronically controlled solenoid then Instrument Air shall use for pneumatic controls of Dispenser. For electro valves operation power requirement shall be provided by bidder during detail engineering.

Each unit to have full automatic microprocessor based sequencing of 3 cylinder banks connected to dispenser through independent high pressure Stainless Steel (SS) tubes. Dispenser to have pressure control device to restrict fill pressure to 210 kg/cm2g at maximum allowable filling pressure for natural gas vehicle cylinder as per standard supply. Pressure control device to ensure complete shut off of gas flow at the pre-set pressure with dead band shift and shut off error within 2% of range. The preset fill pressure can vary from 150 kg/cm2g to 255 kg/cm2g. The pressure control device to have provision to manually set pressure between above range.

The supplier should prepare the design basis required to meet the requirement with respect to technical specification and liaise with PMC/Client to obtain necessary confirmation and approval.

4. UTILITY SPECIFICATION

Electric Power Supply

Single phase, AC, 230 Volts ± 10%, 50Hz ± 5% will be provided by Client. Surge protector is to be provided by the vendor at the 230 VAC inlets. All instrument (such as mass meter, solenoid, Electro valves, pressure transmitter/ switch etc.) supply as approved by PESO & ATEX. Suitable voltage conditioning unit shall be in the scope of vendor wherever required.

Note: Vendor to confirm that supplied dispensers are suitable with the above power supply. Vendor to include suitable voltage conditioning unit in their scope, if required.

For further details, refer Electrical Specification, attached with this job specification.

5. INSPECTION AND TESTING

The following activities shall be covered under inspection at vendor's works:

- Review of Q.A. documents.
- Review of calibration certificates for flow meter, dispenser, pressure transmitters, pressure gauges and all instruments.
- Review of all statutory certificates including W &M, type approval from PESO, Govt. of India.
- Review of area classification compatibility of all items including bought out items.
- Review of Mill Test reports.
- Review of NDT reports.
- Review of bought out sub-assemblies/major components, test/inspection certificates.
- Dimensional checks as per approved drawings and data sheets.
- Safety shutdown of dispensers.
- Immediate cut off of dispensers due to abnormalities.
- Functional Test
- All the dispensers shall be tested to demonstrate the functioning of all the components and controls.
- Performance Acceptance Test at Site
- All the dispensers shall be performance tested for flow capacity, measuring accuracy and dispenser.
- Functioning with CNG/Nitrogen. CNG/Nitrogen shall be arranged by vendor.

- During the shop test of dispenser, in case the dispenser flow capacity from inlet of dispenser to the outlet of Filling nozzle is found below the specified capacity the dispenser shall stand rejected.
- During the shop testing if the dispenser batch accuracy is found beyond ± 1.00% dispenser shall stand rejected.

6. PERFORMANCE GUARANTEE

6.1 The vendor shall guarantee the satisfactory performance of dispensing unit as per the operating parameters indicated in data sheets. The dispensers shall be performance tested after installation at site. Vendor shall carry out tests as required by Govt. Statutory Agencies.

6.2 Guaranteed Performance for the Dispensers shall be as follows:

Flow Rate (15 kg/min for Car Dispenser)

Batch Accuracy of ± 1.00 % or better.

Note:

i. All the dispensing units shall be tested by Vendor for their function & performance in presence of Client's authorized representative.

ii. Vendor to execute performance test of all the dispensing unit after commissioning for accuracy and repeatability and safety parameters.

iii. Vendor to make all arrangements for carrying out performance test viz. Std. Mass Flow Meter, Laptop etc., and Vendor shall also carry out tests as required by Govt. statutory agencies.

iv. Any part or component, which is not functioning to the satisfaction of Client, shall be repaired or replaced by the vendor without cost & time implication to purchaser and performance test shall be carried out all over again.

7. VENDOR DATA REQUIREMENT

Vendor data requirement shall be as per document number: C211036-CGD-ME-VDDR-3001C.

8. PROTECTION DURING SHIPPING

The Dispenser shall be packaged to withstand rough handling during ocean shipping and inland journey. It shall be vendor's responsibility to avoid and protect system with any deterioration and that occurs during shipment. Sling points shall be clearly indicated on crates.

INSTRUMENTATION SPECIFICATION

9. SCOPE OF INSTRUMENTATION

The purpose of this specification is to define the minimum general requirements and philosophy of instrumentation & control for the dispenser package.

This specification covers the design, engineering, procurement, supply and testing, calibration & commissioning of instrumentation and control system with all accessories and materials and any special test requirements required for completing the job in all respects.

Coriolis mass flow meter, electronics and other accessories shall be provided as required for the Dispenser arms.

Vendor's scope of instrumentation and control for the dispenser package shall include the following as:

- Basic instrumentation and control indicated in this document.
- All local and field-mounted instruments in dispenser panel.
- All additional instruments and control system necessary for safe and efficient operation of the dispensers which are not listed specifically in this document but which are required as per vendor's experience/recommendations.
- Piping/tubing including all miniature valves, fittings and mounting to install all sub vendor supplied instruments.
- All other erection material necessary for mounting of instruments in vendor's scope.
- Shop testing of all instruments and control system under vendor supply.
- Calibration, loop checking, pre commissioning and commissioning of the complete system.
- All weatherproof and explosion proof double compression type cable glands or as approved by PESO for all instruments, junction boxes, dispenser panel etc.
- All pressure relief valves.

In case of further clarifications, bidder shall obtain clarification/confirmation from Client/PMC before proceeding.

All instruments must be procured from Client recommend vendor list. However, for that instrument/equipment, which are not covered in the list, the sub vendors shall be approved by Client.

10. INSTRUMENTATION UNIT DESIGN PHILOSOPHY

10.1 All Electrical and electronic instruments shall be installed in accordance with NFPA 70, IEC for Gas Group IIA, IIB & Temperature Class T3 and shall have approval of a recognized certifying authority.

10.2 Mass flow meter shall be CORIOLIS type and shall conform to AGA 11 standard. Each and every mass flow meter 'zeroing' shall be done before delivery from vendor's works.

10.3 Mass flow meter design considerations, piping, meter, zero verification and proving facility shall be as per AGA 11 standard.

10.4 Control valve, actuator and solenoid / electro valves shall be of conventional type design, no integral design is acceptable.

10.5 Control valve body and trim materials selection shall be done by the bidder to ensure that there is no erosion, cavitation, and flashing. Trim & seat shall be fully stellited.

11. SPECIAL INSTRUCTION TO VENDOR

11.1 Supply of Car dispenser with twin arm of flow rate 15 kg/min under differential pressure of 200 kg/cm2g.

11.2 Each dispenser arm shall have Coriolis type mass flow meter with necessary sensor, electronic and special cable recommended by vendor. Performance record and Weight and Measure (W&M) Certification of the meter to be submitted for acceptance.

11.3 Three rows liquid crystal backlit displays for night viewing showing total sale in Rupees of (00000.00), quantity of gas sold in Kg. (00000.000), unit price of CNG in Rs/Kg (000.00) for each hose of the dispenser (total two sets and three rows for each dispenser).

11.4 Vendor shall make a provision to change the price of CNG through the keypad inside the dispenser unit that shall be covered with security lock. RS 485 port shall also be provided for price change. In case standard RS485 port is not available in the dispenser, then RS232C to RS485 convertor with all relevant hardware and software to be provided by vendor.

11.5 Non-resettable and non-volatile totalizer up to 999999.99 (8 digits and a decimal) for total CNG sold in Kgs. Since the dispensers are used for custody transfer purpose, the totalizer must not reset/change/jump in any eventuality not even in the case of electronic failure/power supply failure or excursion beyond permissible limit. If there is any abnormality in power circuit during filling, the running batch value should be added in totalizer. Dispenser electronics shall be common for both totalizers.

11.6 Totalizer figure would be displayed only when it is recalled through a remote keypad or some device integral to dispenser. The totalizer value would cover up to the last transactiondetails at the time of recall. These remote keypad devices should not be used for any programming of the dispenser and are distinct from those, if used for programming the dispenser while operating these keys in no way shall hinder the operations, functioning, veracity of display, storage of parameters and values. These remote keys can be used even when the filling is on without affecting up-counting/real time data.

11.7 Dispenser shall be capable of communicating with outside system using the open system architecture/protocol (OPC)/RS 485. Bidder must handover the details of communication port of dispenser and signals to be transferred to Client. It should be possible to transfer the data through twisted pair wires, transaction data as also flow meter data (both process and diagnostic) RTU.

11.8 One number of three bank electronic software and controller including hardware. Vendor shall include solenoid operated / electro valve made of ANSI 316 SS for dispensing of gas. Vendor to ensure the system design in such a way that in both options any gas if passes, should be recorded by dispenser and there should not be any possibility of unmetered gas

supply through dispenser in case of malfunctioning of valves. The valve assembly shall be fatigue free and tight shut off characteristics at least for 8000 operation hours.

11.9 Two number of Liquid filled 4" dia. (0-400 Kg/cm2g) pressure gauges showing the vehicle filling pressure for each filling arm. Pressure gauge shall be provided with shatterproof glass. Vendor to provide a bypass isolation valve with associated tubing to facilitate routine servicing/calibration of Pressure gauge without shut down of the dispenser.

11.10 One set each of (1/2 " for car with 1/2 " to 3/4" adapter) isolation valves complete with venting line valve and end plug should be installed on the inlet steel pipe of the dispenser. The valve should be located immediately before the dispenser and should be accessible to the maintenance personnel.

11.11 Temperature compensator to limit fill pressure to an adjustable value (with normal value 200 Kg/cm2g) equivalent at 15-degree C. A temperature compensation facility button shall be provided to enable or disable the temperature compensator.

11.12 To limit fill pressure to 200 Kg/ cm2 g, Vendor to provide the following options per hose / arm of the dispenser:

11.13 Pressure limiter (electronics transducer) (with adjustable value up to 250 Kg/cm2 g) as final safety to avoid overfilling.

11.14 Back-up Power supply for displays so that display remains at least for 10 minutes after power failure. Vendor shall provide battery backup of 72 hours to the RAM of dispenser controller.

11.15 Hardware required with the dispenser for Weights and Measures (W&M) certification.

11.16 All parameter setting shall be password protected. Facility of change of password also to be provided to enhance the security of password.

11.17 Car Dispensers shall be designed for handling flow rate of more than or equal to 15 kg/min. flow capacity with turn down of not less than 50:1.

11.18 The batch accuracy of dispensed gas shall be within ± 1.00%.

11.19 Bidder shall indicate overall flow coefficient Cv of dispenser from inlet to the dispenser up to outlet of nozzle including mass flow sensor, interconnecting tubing, valves, hose, fill valve etc.

11.20 Normal operating inlet pressure of dispenser shall be 220-250 Kg/cm²g. The dispenser supply to the vehicle shall be positively cut off at outlet pressure of 200 Kg/cm²g.

11.21 Normal operating temperature of wetted parts of dispenser shall be –10 to 55 deg C.

11.22 Vendor shall confirm that any momentarily flow of gas shall be registered in dispenser totalizer. Vendor shall envisage a temper proof design. Dispenser shall generate error signal in case of passing valve with date and time and display on the dispenser LCD.

11.23 After power on, the controller delay time to start filling be such that the mass meter and pressure transmitter are initialized properly to avoid any unmetered gas.

11.24 Complete control loop would be so fast that if the filling is terminated at any point of filling, the flow would stop immediately.

11.25 Reset switch assembly should be suitable for failure free operation and the same shall be supported with proper PTR for CNG duty.

11.26 Controller shall be in reset state for the SOV / electro valve open signal to be generated. Any departure to this shall stop the dispenser. Dispenser controller shall monitor the status of flow, monitor the status of flow meter / transmitter and in case of any abnormality from set condition the dispenser shall shut down.

11.27 In case the power supply is beyond acceptable limit the dispenser shall not start at all. The controller shall provide an operational alarm with pre-stated error code and it shallbe displayed on LCD display.

11.28 Flow meter signal shall be considered as the highest level of interrupt. It shall not be possible to fill any vehicle cylinders by repeated operations of reset switches. Reset time delay is required with adjustable time.

11.29 A Provision shall be available in dispenser unit, which shall be suitable for programmable/changeable filling pressure from 180kg/cm²g to 220kg/cm²g in vehicle. Original filling shall be same as defined elsewhere in data sheet.

11.30 Emergency stop switch is required on both side of the dispenser. However, the filling on both sides should stop in emergency condition, when any one of the emergency switch is pressed. However, during activation of emergency switch, the power supply to the dispenser should be available.

11.31 Overfill Protection

Overfill protection shall be through electronically programmed hose to terminate the fill after 200 Kg/cm²g.Vendor shall include 2 No. pressure transducer per hose to avoid overfilling. Calibration certificate shall be provided.

11.32 Electronics

Electronics shall be microprocessor based. The processor shall be the latest available in the field and shall be capable of processing the data faster. All the electronic cards shall be located in flameproof boxes inside the dispenser cabinet. No parts of electronics shall be filled with epoxy resin etc. The controller electronics should have immune to EMI interference and vendor to provide relevant certification in this regard.

The dispenser electronics should have self-diagnostic features and should generate error code accordingly. Vendor should define such error codes in trouble shooting guide and procedure of their rectification. Error code related to operational parameters should also be displayed and defined in trouble shooting guide. Password protection should be provided for entry of critical data through key pad.

The change in setting shall be done either through lap top computer or through hand held configurator through the port provided for this purpose with security lock.

Vendor shall provide suitable electronics for processing both arms dispenser data.Totalizer display and display for both arms in the dispenser shall be shown separately.

11.33 Tubing & Fittings

Materials used for the tubing shall be SS 316 fully annealed (Bright annealed) seamless conforming to ASTMA269 with maximum hardness of RB80 or less and suitable for bending and flaring. Open ends on fittings and vents shall be provided with caps/dust plugs.

11.34 Certification:

Equipment/instrument/systems shall be certified for use by statutory authorities for their use in area of their application.

For all intrinsically safe/flame proof equipment/instruments/systems, certification by any approving authority like BASEEFA, FM, UL, PTB, LCIE, Petroleum & Explosive safety organization (PESO), India is mandatory.

The supplier should specify the hazardous area in accordance with the IS 5572 / Australian Re-fueling Standard AG901 / NZS5425. All electrical equipment cabling, and earthing should be appropriate for the zone in which it is fitted, and all cables passing from the hazardous to safe area should be equipped with appropriate barriers where necessary.

All Instruments should be suitable for an area classification of “Class 1, Division 1, Group D as per NEC” OR “Zone 1, Group IIA / IIB as per IS 5780 / IEC 6007”. All dispensers mounted transmitters & temperature element should be intrinsic safe “exd” as per IEC 79-11. Solenoid / Electro Valves, Switches and related junction boxes should be flame proof “Exd” as per IEC 79-1.

Other special equipment / instruments, where intrinsic safety is not feasible or available, should be flameproof as per IEC 79-1. Flying leads from any of the instrumentation items are not acceptable. The Electronics of the dispenser shall not be open and shall be provided within a suitable enclosure. A complete dossier of all electrical equipment will be provided, showing area classification and certification of equipment.

11.35 The mass flow meter design having transmitter with local integral display, the mass flow meter signal through the transmitter shall be wired to the mother board used in the dispenser and there shall not be any difference in reading between this integral display unit and non-resettable display in the electronic control unit.

11.36 Dispenser manufacturer is required to submit approval of weight & measure department, Gov. of India. For the dispenser unit or for the mass flow meter installed in the dispenser unit. In future, if any non-conformity or objection is raised by W&M department or if any penalty action is taken against Client, vendor shall be fully liable, indemnify Client against any liquidity and shall bear all the cost implication, if any.

11.37 One no. of non-resettable and non-volatile totalizers per hose of the dispenser i.e. one integral local digital totalizer with display along with mass flow meter transmitter and the second totalizer of liquid crystal backlit display in kg. (999999.99) on the front panel of the dispenser shall be provided.

11.38 There shall be a non-resettable & non-volatile totalizer per hose of the dispenser with liquid crystal backlit display in kg. (999999.99) on the front panel of dispenser.

11.39 All equipment should be communicated with the common communication protocol. (MODBUS/PROFIBUS/HART)

11.40 All the safety norms to be followed by vendor as per Client guidelines.

11.41 All the approvals and certification to be provided by vendor for the hardware, software supply as per Client requirements.

11.42 During installation & commissioning vendor will ensure that routine operation of the equipment will not suffer, or vendor will install the equipment as per Client guidelines.

11.43 RFID Systems

The dispenser must be compatible with future RFID system suitable for monitoring and control of vehicle/vehicle on-board cylinder authentication mechanism. (TBD)

12. REQUIREMENT FOR AUTOMATION SYSTEM IN DISPENSER

12.1 It is intended to monitor / control following parameters through automation system:

- Mass Totalizer from Dispenser Motherboard.
- Mass Flow per Filling. (Note that Gas sale data- the reading which is visible to customer and used for billing purpose is mandatory to be transmitted to server whether it is from flow meter or motherboard or from both)
- To Read Gas Selling Price from Dispenser.
- To download the gas selling price into the dispenser from Server system.
- Mass Flow Meter Status.
- Tripping Status Dispenser.
- Reset Switch Operation Status.
- Dispenser Power Supply Status.
- Identity of vehicle using RFID (In-built option to be provided).

12.2 In addition to above bidder shall make provision for monitoring and control of following parameters as well

A. Shift Reports

Shift – A: 6:00 to 14:00)

(Shift – B: 14:00 to 22:00)

(Shift – C: 22:00 to 06:00)

- Showing Date /Start time/ Finish time of every shift.

- Individual Arm-wise and Dispenser-wise totals.
- Total sale for each shift in Kgs and Rs.
- Total sale with variable pricing.
- Full day report with total Sale for the 24 Hr. period.

B. Remote Price Change facility to facilitate.

- Station-wise sortable and selectable
- Time-wise selectable
- Area-wise selectable
- Variable price change in a day

C. Transaction reports

Remotely the following parameters can be viewed in transaction reports.

- Station Name and Dispenser serial number.
- Showing Date /Start time/ End time of every filling.
- Individual Arm-wise and Dispenser-wise totalizer at start of filling and end of filling.
- Transaction number totals for individual Arm-wise, Dispenser-wise and Station-wise to count number of fills in selectable particular duration. (Monthly and daily basis)
- Batch reading of fill.
- Sale for each batch in Kgs and Rs.
- Unit price Data.
- Dispenser power ON/OFF count.
- Pressure during last fill
- Vehicle pressure at start of filling
- Vehicle pressure at end of filling
- Temperature during the last fill
- End of sale indicator (Code number showing the reason that the last sale stopped. This is useful if a dispenser stops during a fill for no apparent reason).

12.3 The remote monitoring and automation will consist of reading, transferring and controlling all the data/parameter from the dispensers to RTU and then to owner supplied centralizedremote server in India as per Client requirement.

12.4 The above list is tentative and final list shall be decided during execution phase.

13. INSPECTION AND TESTING

- Functional and simulation test for the following shall be carried out at vendor's works and shall be witnessed by Client/Third party.
- Control panels along with all instruments mounted in it.
- Following tests shall be carried out by bidder at his works or his sub vendor's works and test certificates shall be furnished:

a) Calibration/test certificates for all instruments, control valves & safety valves.

b) Seat leakage test for control valve and safety valve.

c) Test certificates for safety valve set pressure and reset pressure.

d) Radiographic test certificates for control valve and safety valve used for ANSI 600 lbs and above rating.

e) Material test certificates for all line mounted instruments.

f) Sub-vendor conformity certificates.

14. LIST OF ATTACHMENTS

- Data sheet for CNG Dispenser.
- Data sheets formats (along with calibration certificate wherever applicable) for Mass flow meter.

ELECTRICAL SPECIFICATION

15. SCOPE OF ELECTRICAL

15.1 This specification defines the requirements of design, engineering, supply and installation, testing and commissioning of electrical facilities for CNG Dispenser Package.

15.2 It is not intended to cover all aspects of design but to indicate the basic requirements only. Vendor shall ensure that the design and installation on the skid is carried out as per good engineering practice to meet the requirements of safety, reliability, ease of maintenance and operation, aesthetics and interchange ability of equipment.

16. CODES AND STANDARDS

16.1 All electrical equipment and complete package shall meet the requirement of relevant Publications and Codes of Practice of Bureau of Indian Standards, statutory regulations and good engineering practices. Complete system must conform to the latest revisions of the following:

a) Indian Electricity Act and Rules framed there under.

b) Fire Insurance Regulations.

c) Petroleum Rules and any other regulations laid down by Petroleum & Explosive safety organization.

d) Regulations laid down by local statutory authorities and Electrical Inspectorate.

16.2 Vendor shall provide all assistance required for obtaining approvals from statutory authorities for materials, plant design/drawings and complete installation.

16.3 Where Indian Standards do not exist, the relevant IEC/British/ German VDE) standards shall apply. Any Other international standard may also be followed provided it is equivalent to or more stringent than the standards specified above.

16.4 In case of any discrepancy/conflict between the specified codes and standards, the following order of decreasing precedence shall govern:

i) Statutory Regulations.

ii) Codes and Standards.

Owner's concurrence shall, however, be sought before taking a decision in the matter.

17. AREA CLASSIFICATION AND EQUIPMENT SELECTION

17.1 In case of storage, handling or processing of flammable materials within the battery limits of the package, area classification shall be carried out in line with IS: 5572 & Petroleum Rules and OISD-179 guidelines where applicable.

17.2 Selection of the type of equipment for use in hazardous areas shall be done in accordance with IS: 5571 and other safety regulations as applicable. The electrical equipment shall meet the requirements of relevant IS, IEC or NEC standards. Increased safety type Ex (e) equipment shall not be permitted for use in Zone-1 areas. For Zone-2 areas, increased safety type Ex (e) or Non- Sparking Type Ex (n) equipment shall be provided as a minimum, subject to the same being acceptable to statutory authorities. Ordinary safe area type electrical equipment shall not be used in Zone-2 areas (even though this may be permitted by NEC for Div.2 areas).

17.3 Certificate from recognized agency to the effect is required to be produced that equipment supplied and/or installed conforms to above area classification."

17.4 Electrical equipment for hazardous areas shall be certified by CMRI and approved by PESO (or equivalent statutory authority of the country of origin) for installation and usein the specified hazardous area. Flameproof equipment of indigenous origin shall be BIS marked. Vendor shall furnish the necessary certificates indicating such approvals.

17.5 All the electrical and electronic component shall be in flame/explosion proof housing suitable for area classification: Hazardous area, Class 1, Division 1, Group D as per NEC or Class 1, Zone 1, Group IIA/IIB as per IS/IEC, Temperature Class T3, and completely enclosed in a securely lockable dispenser cabinet. No component of the dispenser shall be installed outside the cabinet.

18. EQUIPMENT SPECIFICATIONS

18.1 Specifications of equipment shall be furnished for review by the owner. All equipment and components shall be new and supplied by approved reputed manufacturers. Equipment requiring specialized maintenance or operation shall be avoided as far as possible and prototype equipment shall not be accepted. All equipment shall be complete

with all necessary weather protection including tropicalization to prevent damage due to climate, dust and corrosive vapors.

18.2 Vendor shall be responsible for any damage to the equipment during transit. All packages shall be clearly, legibly and durably marked with uniform block letters giving the relevant equipment material details. Each package shall contain a packing list in a waterproof envelope.

18.3 All electrical components and equipment shall be sized to suit the maximum load under the most severe operating conditions.

18.4 All electrical equipment shall be supplied with double-compression cable glands, made of nickel-plated brass, tested and certified to be used in zone-1, hazardous area.

18.5 All electrical components should be suitably weather proof to prevent short circuits, corrosion and should be suitable for installation in Hazardous classification as class I, Division 1, Group D.

18.6 Name of the manufacturer, type of enclosure protection and certificate no. with name of testing/Certifying agency shall be furnished with bids / for approval.

18.7 Although the supply is being arranged through UPS System, but in some remoteoccasions, the power supply may be from DG sets with poor regulations and thus power supply available from Client may contain harmonics, transients and surges etc. The Electronics shall be compatible to the supply system as no transient, surge or harmonics protection is provided by Client. Bidder to include suitable surge protection device/ voltage conditioning unit, as required, in their scope for accurate and safe operation of dispenser.

Rated voltage and frequency for the equipment shall be indicated below:

Ambient Temp: Max. 50 ºC & Min. 1 ºC

System Voltage: 230V + 10% Single Phase AC

System Frequency: 50 Hz + 5%

18.8 System Earthing: Solidly Earthed

We have envisaged solid earthing for the system. However, if specific earthing isrequired for the system – electronics, the same to be highlighted by bidder; otherwise, system earthing including making of earth-pits etc. shall be provided by the successful bidder.

18.9 General Requirement

All power supply J.B.'s shall be flame-proof type as per area classification.

Fill hoses should be conductive type to mitigate the static charges.

Provision for connecting earth strip at two points inside the dispenser.

Supply cable entry to dispenser shall be suitable for armored 2.5sq.mm. 4 cores.

18.10 There should be effective static charges (as generated in hoses) mitigation design. All hoses shall be conductive so that auto earthing of static charges (as generated in system) could be ensured. Vendor shall submit the requisite documents/demonstration against the same at vendor's shop.

MECHANICAL SPECIFICATION

Hoses:

Two CNG flexible electrically conductive (fill & vent both should be separate) hose, having following specification:

1. Car long hose breakaway to nozzle:

- Car Dispenser Fill hose (Long)
- 3/8" for Car dispenser.
- OD- 0.77" for car dispenser.
- Length- min 3000 mm for car
- Minimum Bend Radius-4",
- End SIZE 1: - 9/16"-18 UNF SAE6(M)
- End SIZE 2: - 1/4 NPTM, in SS 316
- Nominal Size-3/8",
- Working Pressure: 5000 PSI (345 Bar),
- Minimum Burst Pressure: 20000 PSI (1379 Bar),
- Temperature Range: -40° C to 65° C,
- Electrically conductive polymer core tube, two or more layers of fiber reinforcement, and abrasion resistant urethane cover. Cover must be pinpricked for use with CNG. High-strength conductive polymer core tube is required to dissipate static electrical build-up. Thick urethane covers for abrasion and wear resistance.
- Spring guards must be provided at both ends for the assembly.
- Hose should conform to NFPA 52 & ANSI / CSA NGV 4.2-2014 / CSA12.52-2014.

2. Car short hose dispenser to break away:

- Car Dispenser Fill hose- 1800 mm (Short),
- 3/8" in car dispenser.
- 0.77" in car dispenser.
- Length- 1800 mm,

- Minimum Bend Radius-4",
- End Size 1- 9/16"-18 UNF SAE 37* JIC (F) Swivel
- End size 2- 9/16"-18 UNF SAE6(M) (Both Ends), in SS 316
- Nominal Size-3/8",
- Working Pressure :5000 PSI (345 Bar)
- Minimum Burst Pressure: 20000 PSI (1379 Bar),
- Temperature Range: -40° C to 65° C,
- Electrically conductive polymer core tube, two or more layers of fiber reinforcement, and abrasion resistant urethane cover. Cover must be pinpricked for use with CNG. High-strength conductive polymer core tube is required to dissipate static electrical buildup. Thick urethane covers for abrasion and wear resistance.
- Spring guards must be provided at both ends for the assembly.
- Hose should conform to NFPA 52 & ANSI / CSA NGV 4.2-2014 /CSA .52-2014

3. Vent hose:

- Vent hose- 3000mm,
- Hose ID- 1/4",
- OD- 0.63",
- Length- 3000 mm
- Minimum Bend Radius-2",
- End SIZE 1: - 9/16"-18 UNF SAE6(M)
- End SIZE 2: - 1/4 NPTM, in SS 316
- Nominal size - 1/4"
- Working Pressure: 5000 PSI (345 Bar),
- Minimum Burst Pressure: 20000 PSI (1379 Bar),
- Temperature Range: -40° C to 65° C,
- Electrically conductive polymer core tube, two or more layers of fiber reinforcement and abrasion resistant urethane cover. Cover must be pinpricked for use with CNG. High-strength conductive polymer core tube is required to dissipate static electrical buildup. Thick urethane covers for abrasion and wear resistance.
- Spring guards must be provided at both ends for the assembly.

- Hose should conform to NFPA 52 & ANSI / CSA NGV 4.2-2014 / CSA52-2014

Nozzles:

Both hoses shall be fitted with NGV-I nozzle for filling of vehicles. Specification for NGV 1 nozzle is as follows:

Nozzle Type	NGV-1 TYPE 2, CLASS B
Normal working pressure	PN 200 bar
Temperature Range	0 deg C to +85 deg C
Max. Length	Max. 115 mm
Cv minimum	1.05
Max. weight	0.65 kg
Min flow rate	1500 SCFM @ 3000 Psig
Max nozzle body diameter	2 inches
Filling Line Male Thread	UNF 9/16"-18 Female or ¼" Male NPT

3- way valve:

Vendor shall include the supply of 3-way valve with each hose for filling & venting of gas. Specifications are as follows:

Connection Size	:	¼ "NPT Female (All three end)
Pressure Rating	:	5000 PSI (minimum)
Temperature Rating	:	0 to 70 deg. C
Minimum Life	:	40000 cycles at site conditions (one on & off is considered as one cycle)

Material of construction

Body	:	SS 316 as per ASTM A276 or as per ASTM A479 or ASTM A 182
Ball	:	SS 316 ASTM A479 or Alloy S21800 as per ASTM A276
Stem	:	SS 316 ASTM A479 or as per ASTM A276
End connection	:	SS 316 ASTM A479 or ASTM A 276
Seat carrier	:	SS 316 as per ASTM A276

Seat springs	:	Alloy X-750 / AMS 5542 / 17-7 PH
Seat	:	PEEK
O-rings	:	BUNA-N or BUNA-C or Fluorocarbon FKM
Backup rings/bearings	:	PEEK / PTFE
Orifice Size / Cv	:	min 4.75 mm / min 0.62
Weight	:	Max. 350 grams.

Design Features

1. The valve should be of trunnion ball design.
2. Blow out resistant two-piece ball/stem.
3. Should have positive handle stoppers.
4. Flow direction indication must be there on handle.
5. Directional indication must be provided for panel mounting.
6. Complete repair kit must be available and comprises of (all internals installed in valve body) following items:
   a) Stem
   b) Stem washer
   c) All sealing rings for stem i.e., stem O-rings, primary backup rings, secondary backup rings etc.
   d) All Seat with carrier
   e) All Seat retainer O-rings, backup rings, guide, springs etc.
   f) Connector end seals
   g) Ball trunnion
   h) Trunnion bearing

Break away: -

Vendor shall also include supply of Breakaway Coupling, suitable for NGV Industry. Vendor shall demonstrate the function of breakaway coupling during performance test.

		CUGL Central U.P. Gas Limited
QUALITY ASSURANCE PLAN OF CNG DISPENSER	**TOTAL SHEET NO.**	06
DOCUMENT NO		

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	**DATE**	**DESCRIPTION**	**PREP**	**CHK**	**APPR**

S.NO.	OPERATION / PARAMETER	CHARACTERISICS / PARAMETERS	ACCEPTANCE CRITERIA &CERTIFICATION	VENDOR	TPIA	CLIENT/PMC	REMARKS
Bought Out items & Equipment details (CNG Dispenser)							
1.	Dispenser Outer body cabinet	Visual, Thickness check, Fitment & Alignment, Material Test certificates, Chemical Test	As per Technical specification	P	W/R	R	
2.	Dispenser Inside frame & support structure	Visual, Thickness check, Fitment & Alignment, Material Test certificates, Chemical Test	As per Technical specification	P	W/R	R	
2.	Mass flow meter	Visual, Functional & operational of flow meter totalizer, Fitment & Alignment, Test certificates for Bought out items, Calibration reports	Calibration report/Test report & other parameters as per approved data sheet & Technical specifications	P	W/R	W/R	
3.	Actuator valves/Electro-magnetic solenoid valve	Visual, Functional & operational, Fitment & alignment, leak test, Test certificates for Bought out items, supply voltage, Output signal voltage, Flow sequencing check as per P&ID & control philosophy.	Test Report, Conformity report & Model verifications as per Approved data sheet	P	W/R	W/R	
4.	Filling hose	Visual, Dimensional, Sizing verifications, Fitment & Alignment, Physical Test, Chemical Test, Hydro test Report, Leak test reports, Hose conductivity test, Compliance report.	Technical specification & Approved data sheets	P	W/R	W/R	
5.	Mechanical & electronics totalizer	Operational & functional test, Accuracy match, calibration report Test certificates for bought out items	Technical specification	P	W/R	W/R	
6.	Software	Latest software version, Modbus register, Communication protocol, Baud rate, check single & three bank sequencing system, Check sequencing rate of each bank w.r.t flow rate(kg/min.)	Approved data sheet	P	W/R	W/R	
7.	Pressure gauge	Visual, Size verification, Fitment & alignment, Functional & operational, Calibration report, Test certificates for bought out items, Hydro test, pressure	Technical specification & Approved data sheets	P	W/R	W/R	

		test					
8.	Differential pressure gauge	Visual, Size verification, Fitment & alignment, Functional & operational, Calibration report, Test certificates for bought out items, Hydro test, pressure test	Technical specification & Approved data sheets	P	W/R	W/R	
9.	Pressure Transducer & Transmitter	Location as per P&ID, Fitment & alignment, calibration report, Test certificates of bought out items, pressure test, Leak test, Operational & functional, current consumption w.r.t pressure, IP ratings, supply voltage, Output signal voltage	Technical specification & Approved data sheets	P	W/R	W/R	
10.	Emergency Shut-off valve	Visual, Dimensional, Fitment & Alignment, Physical Test, Chemical Test, Operational & functional, Leak test, Test certificates of bought out items, C_v verification w.r.t data sheet	Technical specification & Approved data sheets	P	W/R	W/R	
11.	Isolation Ball valve	Visual, Dimensional, Fitment & Alignment, Physical Test, Chemical Test, Operational & functional, Leak test, Test certificates of bought out items, Cv verification w.r.t data sheet	Technical specification & Approved data sheets	P	W/R	W/R	
12.	Three way Valve	Visual, Dimensional, Fitment & Alignment, Physical Test, Chemical Test, Operational & functional, Leak test, Test certificates of bought out items, Cv verification w.r.t data sheet	Technical specification & Approved data sheets	P	W/R	W/R	
13.	SS Needle & Bleed valve	Visual, sizing verifications, Fitment & Alignment, Operational & functional, Leak test, Test certificates of bought out items	Technical specification & Approved data sheets	P	W/R	W/R	
14.	SS Tubing & Fittings	Visual, Dimensional, Fitment & Alignment as per P&ID shown, Physical Test, Chemical Test, Operational & functional, Leak test, Test certificates of bought out items	Technical specification & Approved data sheets	P	W/R	W/R	
15.	SS Non-return Valve	Visual, sizing verifications, Fitment & Alignment, Operational & functional, Leak test, Test certificates of bought out items, Flow direction as per P&ID	Technical specification & Approved data sheets	P	W/R	W/R	

16.	SS Manifold	Visual, sizing verifications, Fitment & Alignment, Operational & functional, Leak test, Test certificates of bought out items, Flow direction as per P&ID	Technical specification	P	W/R	W/R	
17.	Inlet filter	Visual, Dimensional, Fitment & Alignment, Physical Test, Chemical Test report, Operational & functional, Leak test, Hydro test, filter sizing calculation	Technical specification / Approved data sheets/ Filter Sizing calculation sheet	P	W/R	W/R	
18.	Filter Elements	Visual, Dimensional, Fitment & Alignment, Test certificates of bought out items Operational & functional, Leak test, Hydro test, filter sizing & pressure drop calculation with elements	Technical specification / Approved data sheets/ Filter Sizing calculation sheet	P	W/R	W/R	
19.	Display card	Visual, Functional and operational, Bakelite function, Supply voltage, digit segments functional test, Display cable crimping, Test certificates of bought out items, Number of display Rows, Digits shown.	Technical specification & Vendor data sheets	P	W/R	W/R	
20.	Micro-processor base Electronic Mother board	Visual inspection of Battery, fuse, SMPS, SPD, Relay, Coupler communication, all mass flow meter communication, RS485, SCADA port, UPS & Main power supply and Bench test certificates, Functional & Operational test	Technical specification & Electrical wiring Circuit diagram	P	W/R	W/R	
21.	FLP/WP junction Box	Visual, Dimensional, Fitment & alignment, Test Certificates of bought out items, Junction Box Body Earthing & all extra termination point with FLP dead plug & other are with Hood cap for cables.	Technical specification & Electrical wiring Circuit diagram	P	W/R	W/R	
22.	Fill & Vent break-way	Visual, Fill & vent Hose size verification & Pressure ratings Pneumatic leak test, De-coupling functional test at low pressure < 5kg/cm2, Test Certificates of bought out items.	Technical specifications	P	W/R	W/R	
23.	Safety Relief valve	Visual, Verification of Tag plate, Set pressure, Leakage rate (BPM) from Vent line if any, Test Certificates of bought out items, Leak Test @ 250 Bar(g.)	Technical specifications & Data sheet.	P	W/R	W/R	

Complete Assembly Testing Details							
24.	**Complete Assembly Leak Test**	Leak Test Throughout on all Joints By using Soap solution and Holding Time up to 30 Min. @ Pressure 250 Bar(g) Media-Nitrogen	Technical specifications & Data sheet.	P	W	W/R	
25.	**Performance (Batch Accuracy Test)**	Overall Batch Accuracy to Be +/-1.0 % otherwise Complete assembly to be Rejected	Factory Test procedure & Technical specifications	P	W	W/R	
25.1		Review of Weight scale, Mass flow meter, Electronics Totalizer, Mechanical Totalizer Reading to be match during sample records.	Factory Test procedure & Technical specifications	P	W	W/R	
25.2		Calibration Report of Master Meter or Weight scale, Tare procedure before inspection, Calibration of Mass flow meter	Factory Test procedure & Technical specifications	P	W	W/R	
25.3		Review of Dispenser Flow capacity during Filling of Cylinder @ Pressure between 120 Bar(g) to 80 Bar (g) during Performance Test at facilities.	Factory Test procedure & Technical specifications	P	W	W/R	
26	**Dispenser Response Test**	**Dispenser should shut off immediately & automatically on following conditions**					
26.1		Power failure or Excursion beyond permissible limit.	Technical specifications	P	W	W/R	
26.2		After power Loss of Display Backup up to 15 min.	Technical specifications	P	W	W/R	
26.3		Power Failure of Mass Flow Meter	Technical specifications	P	W	W/R	
26.4		Flow beyond High (15 kg/min.) and low limits (0.1 kg/min.)	Technical specifications	P	W	W/R	
26.5		Failure of Metering	Technical specifications	P	W	W/R	
26.6		Failure of Totalizer	Technical specifications	P	W	W/R	
26.7		Overfill of quantity of gas or pressure	Technical specifications	P	W	W/R	
26.8		Failure of pressure sensing transducer.	Technical specifications	P	W	W/R	
26.9		Failure of Pneumatic ball valve / electro valve	Technical specifications	P	W	W/R	

26.10		Repeated operation of Reset or Start/ Stop switch.	Technical specifications	P	W	W/R	
26.11		Removal of any electrical wire connection to controller.	Technical specifications	P	W	W/R	
26.12		Program step is in "HOLD" due to any error.	Technical specifications	P	W	W/R	
26.13		The number of start / stop of reset switch for starting gas refueling operation shall be counted. If it exceeds three times in a span of 20 seconds then the dispenser shall stop the further operation and display an error in Dispenser.	Technical specifications	P	W	W/R	

Notes:

10. The above testing and acceptance criteria are minimum requirements; however, manufacturer shall ensure that the product shall also comply tothe additional requirements as per particular Technical Specification (PTS) and Data Sheet.
11. The supplier shall submit their own detailed QAP prepared on the basis of above / Technical specification for approval of Owner/Owner's Representative.
12. Supplier shall submit calibration certificates of all instruments/Equipment to be used for inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval. All reference codes / documents shall be arranged by vendor for reference of TPIA at the time of inspection.
13. Owner / Owner's representative include TPIA will have the right to inspect activity of manufacturing at any time.
14. TPIA along with Owner / Owner's representative shall review/approval all the documents related to QAP/Quality manuals/Drawings etc., submitted by supplier.
15. Contractor shall in coordination with supplier/sub vendor shall issue detailed production and inspection schedule indicating the dates and the Location of facilities Owner/Owner's representative and TPIA to organize inspection.
16. Special manufacturing procedure have to be specially approved or only previously approved procedures have to be used, in case of conflict between specification more stringent condition shall be applicable.

		CUGL Central U.P. Gas Limited
VENDOR DRAWING AND DATA REQUIREMENT – CNG DISPENSER	Total Sheets	08
Document No		

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	DATE	DESCRIPTION	PREP	CHKD	APP

VENDOR DRAWING AND DATA REQUIREMENT –
CNG CAR DISPENSER

S. No.	DESCRIPTION	To be submitted with Bid	To be submitted for Approval		To be submitted for Shipment		Submit as certified Final / As Built	
			Required	Days after PO	Required	Days after PO	Required	Days after PO
1.0	**GENERAL**							
1.1	Filled in Material Requisition Compliance Schedule & checklist							
1.2	Filled in Deviation Schedule.							
1.3	Duly filled up "Experience Record Schedule". Vendor to note that information furnished by them shall be used to assess the provenances of offered Dispensers and Qualificationof vendor, accordingly vendorto furnish references of those cases which are matchingwith offered Dispensers.							
1.4	Installation manual							
1.5	List of components of Dispenser with Make & Specification of components. Vendor shall also submit "Technical Catalogues" of components							
1.6	Start-up, (SOP) operation & maintenance manual showing assembly details and critical tolerances. A copy of all certified drawings & documents to be enclosed.							
1.7	Lubricant list with specification							
1.8	Battery limit (interface) drawing/ information			21				
1.9	Drawing list and submission schedule			14				

S. No.	DESCRIPTION	To be submitted with Bid	To be submitted for Approval		To be submitted for Shipment		Submit as certified Final / As Built	
			Required	Days after PO	Required	Days after PO	Required	Days after PO
1.10	Project implementation schedule, ordering and inspection schedule for long lead and major items			14				
1.11	Pre-commissioning & commissioning procedure			21				
1.12	Performance guarantee test procedure			21				
1.13	Weights & Measures Certificates from the country of origin for offered models of CNG Dispensers unit model/mass flow meter model for dispensing specified mass flow rate at specified overall batch accuracy.			14				
1.14	The “Test Certificate” for mass flow meter.			21				
1.15	Weights & Measures approval from Indian Authorities.							
1.16	Type approval for the offered dispenser from Petroleum& Explosive safety organization, Govt. of India							
2.	**DESIGN**							
2.1	Process flow diagrams (PFDs) and Piping &Instrumentation diagrams (P&IDs) of sub systems and complete system with write-up on operation							

S. No.	DESCRIPTION	To be submitted with Bid	To be submitted for Approval		To be submitted for Shipment		Submit as certified Final / As Built	
			Required	Days after PO	Required	Days after PO	Required	Days after PO
2.2	Data sheets of Car CNG Dispensers, Mass flow meter duly filled up.							
2.3	Basic design calculations for system design, equipment selection							
2.4	Performance data, vendor literature for equipment selection, performance curves with duty point marked for individual equipment							
2.5	Specification for piping material & valves.							
2.6	Utility requirement							
2.7	Detail of control wiring diagram, interlock/ shutdown/control scheme with write up on operation. Sizing calculation for instrument items.							
2.8	Dispenser communication port details and requirement information as per specification and list of signals							
3.0	**CONSTRUCTIONAL FEATURES**							
3.1	G.A. drawing of Dispensers showing maintenance clearances required.							

S. No.	DESCRIPTION	To be submitted with Bid	To be submitted for Approval		To be submitted for Shipment		Submit as certified Final / As Built	
			Required	Days after PO	Required	Days after PO	Required	Days after PO
3.2	Cross section drawings of individual equipment/ skid, material & parts list.							
3.3	Termination & Wiring Diagrams							
4.0	**SPARES**							
4.1	List of spares with rates for two years normal operation per CNG Dispensers.							
4.2	Drawings, documents, data as asked under Electrical & Instrumentation specifications of this Material Requisition.							

VENDOR DATA REQUIREMENT (INSTRUMENTATION)

S. No.	DESCRIPTION	To be submitted with Bid	To be submitted for Approval		To be submitted for Shipment		Submit as certified Final / As Built	
			Required	Days after PO	Required	Days after PO	Required	Days after PO
1.	Drag and Document Schedule							
2.	Piping and Instrument Diagram							
3.	Instrument Index							
4.	Sub- Vendor List for Instruments and Accessories							
5.	Instrument Sizing calculations			21				
6.	Utility requirements							
7.	Level Sketches							
8.	Functional schematic							
9.	Logic diagrams			21				
10.	Instrument loop drawings							
11.	Control room layout			14				
12.	Panel front arrangement			21				

S. No.	DESCRIPTION	To be submitted with Bid	To be submitted for Approval		To be submitted for Shipment		Submit as certified Final / As Built	
			Required	Days after PO	Required	Days after PO	Required	Days after PO
13.	Power Supply Distribution							
14.	Wiring diagram for panels							
15.	Configuration diagram							
16.	I/O assignment							
17.	Details of OPC, configuration port, signals details etc							
18.	Instrument Duct/Tray layout							
19.	Instrument Cable schedule							
20.	Instrument location plans							
21.	Instrument installation drawings							
22.	Bill of material for installation items							
23.	Spare part list for							
24.	(a) 2 years operation							

S. No.	DESCRIPTION	To be submitted with Bid	To be submitted for Approval		To be submitted for Shipment		Submit as certified Final / As Built	
			Required	Days after PO	Required	Days after PO	Required	Days after PO
	(b) Start up and commissioning							
	(C) Spare instruments (10%).							
25.	Inspection and test procedures							
26.	Complete catalogues with part list for all vendor supplied instruments, controls etc.							
27.	Installation, operation and maintenance manuals							

Note: -
This list indicates the minimum drawings and document requirements. However, vendor shall submit a complete list of documents and drawing schedule listing all drawings and documents to be submitted by them during the course of execution of the job. The schedule shall list all drawings and documents alone with their number and expected date of submission**.**

		CUGL Central U.P. Gas Limited
VENDOR LIST FOR BOUGHT OUT ITEMS	Total Sheets	05
Document No		

CENTRAL U.P GAS LIMITED (CUGL)

CITY GAS DISTRIBUTION PROJECT AT KANPUR, UNNAO, JHANSI & BAREILLY GA

REV	**DATE**	**DESCRIPTION**	**PREP**	**CHKD**	**APPR**

1. Mass flow meter

i. All MFM certified by W &M India for CNG application,
ii. Emerson-Micro Motion (CNG 50) with integral display
iii. E&H (CNG Mass) with integral display

2. Pressure Transmitter

i. Druck
ii. Wika
iii. Honeywell
iv. ABB
v. Rosmount
vi. Siemens

3. Pressure Regulator & slam shut valve

i. M/s Pietro Fiorentini S.p.A (Italy)
ii. M/s Emerson Process Management
iii. M/s RMG Regel Messtechnik (Germany)
iv. M/s Mokved Valves BY (Netherlands)
v. M/s Tartarini
vi. M/s Fisher
vii. M/s Gorter controls (Netherlands)
viii. M/s Dresser
ix. M/s Nirmal (UPTO # 600)
x. ASPRO

4. Ball Valves

i. Hopkinsons Limited (UK)
ii. O.M.S. Saleri (Italy)
iii. Pibi Viesse
iv. Perar SPA (Italy)
v. Larsen & Toubro Ltd. (Audco India Ltd Chennai)
vi. Microfinish Valves Ltd. (Hubli)
vii. Pietro
viii. Fiorentini (Italy)
ix. Swagelok
x. SS Ball Valves – Parker (USA)
xi. Spirex Sarlo
xii. ABAC

5. Pressure Safety Valve

i. M/s Parcol SPA, Italy
ii. M/s Sarasin, France
iii. M/s Tai Milano SPA, Italy
iv. M/s Fisher Rosemount (Now M/s Emerson Process)
v. M/s Parker
vi. M/s Mercer-USA
vii. M/s Leser Fainger
viii. M/s Tyco sanmar
ix. Aspro

6. Pressure Gauges & temperature Gauges

i. M/s WIKA
ii. M/s Ashkroft

iii. M/s Baumer
iv. M/s Waree Instruments
v. M.s Samson Control,
vi. General Instruments

7. Fittings

i. M/s Swagelok
ii. M/s Parker
iii. M/s SSP
iv. M/s Aspro

8. SS valves (2/3 way)

i. M/s Swagelok (USA)
ii. M/s Parker (USA)
iii. M/s SSP
iv. M/s Aspro

9. SS Tubing

i. Sandvik
ii. Tubacex
iii. Parker (USA)
iv. FAE

10. Solenoid Valve

i. M/s ASCO
ii. M/s Rotex
iii. M/s parker Hanifen
iv. M/s MICRO
v. M/s Jefferson
vi. M/s Burkert
vii. M/s Seitz AG

11. On / Off Pneumatic Valve

i. M/s Parker
ii. M/s Swagelok
iii. M/s ABAC

12. Cables & wires

i. INCAB
ii. Universal
iii. ASEAN
iv. CCI
v. FORT Closter
vi. Finolex
vii. KEI
viii. Cord
ix. Polycab
x. RR Kabel

13. Barrier/ Isolators/Surge protector

i. MTL
ii. Phoenix

iii. P&F
iv. EATON
v. M/s Aspro

14. Fueling Nozzle

i. NGV/NZS
ii. OPW5000 series / Sherex
iii. WEH
iv. STAUBLI
v. Parker

15. NGV Nozzle

i. OPW
ii. Staubli
iii. Hoses
iv. Parker
v. Swagelok
vi. Eaton

16. Breakaway coupling

i. OPW ILB1
ii. Weh
iii. Parker
iv. Staubli
v. Aspro

17. Electric Motor

i. Siemens
ii. WEG,
iii. ABB,
iv. BALDOR,
v. Crompton Greaves and
vi. Bharat Bijlee

18. PLC

i. Siemens
ii. Schneider
iii. ABB

19. Dispenser Make

i. Parker
ii. TGT
iii. Delta

20. Cascade Cylinder's

i. Rama Cylinder
ii. EKC

21. Cascade Valves

i. Emer
ii. OMB

iii. VTI

22. FLP Switch gear / Junction Box / Conduit

i. Baliga
ii. FCG
iii. FPE
iv. Sterling
v. Flexpro
vi. Sudhir
vii. Junction Box- Cortem
viii. Conduit- El FIt

23. Switches / fuses / contactors

i. Seimens
ii. Schneider
iii. L&T
iv. ABB

24. Glands

i. Comet
ii. Dowells
iii. Sudhir
iv. FPE
v. Flexpro
vi. Baliga
vii. FCG

25. GD

i. Detcon (IR700)
ii. Det-tronics (PIRECL)
iii. Crowcon (Nimbus)
iv. ESP Safety (SGOES)
v. Honeywell

26. FD

i. Detcon (IR700)
ii. Det-tronics (PIRECL)
iii. Crowcon (Nimbus)
iv. ESP Safety (SGOES)
v. Honeywell

27. Dispenser Hoses

i. Parker
ii. Swagelok
iii. Eaton
iv. Synflex

28. Compressor Inlet Valves

i. Audco
ii. Microfinish
iii. Micon
iv. Flowchem
v. Petro

vi. Spirax Sarco

Any other make for bought out item other than above listed items shall be subjected to CUGL Approval

	CHECKLIST - TECHNICAL	

CHECKLIST – TECHNICAL

Bidder confirms following, as a minimum, has been enclosed in the offer.

S.NO.	Requirements	Compiled by Bidder(Tick)
1	Reference List of previous supply of Procured item	☐
2	Filled – up Data Sheets, duly signed and stamped by bidder enclosed.	☐
3	List of recommended commissioning spares and accessories for Procured item.	☐
4	List of recommended spares and accessories for two year normal operation for procured item.	☐
5	Compliance statement duly filled and stamped enclosed.	☐
6	GA & assembly drawings, cross section drawings including part list & material list enclosed.	☐
7	Other technical details & vendor's product catalogues enclosed.	☐

REV	**DATE**	**DESCRIPTION**	**PREP**	**CHK**	**APPR**

COMPLIANCE STATEMENT

COMPLIANCE STATEMENT

S.No	Requirement	Bidder's Confirmation
1	Bidder confirms that all materials proposed by the bidder are same/ superior to those specified in specification/ data sheets enclosed.	
2	Bidder confirms that the offer is in total compliance with the Technical requirements of the Material Requisition. Bidder confirms that deviation expressed or implied anywhere else in the offer shall not be considered valid.	
3	Bidder confirms that all spares and accessories required for two years of normal operation have been quoted separately.	
4	Bidder confirms that prices for start-up/commissioning spares and accessories have been included in the quoted items.	
5	Bidder confirms that in the event of securing order for the requisitioned item(s), good for manufacturing drawings of ordered item(s) shall have complete details with dimensions, part list and material list including back-up calculations in the first submission, failing which the vendor shall be solely responsible for any likely delay in delivery of item(s).	

Bidder's Signature with Stamp

REV	DATE	DESCRIPTION	PREP	CHK	APPR

DEVIATION SHEET

DEVIATION/ EXCEPTION/ CLARIFICATION SHEET

Sr. No.	Contractor's Inquiry Reference	Contractor's Requirement	Proposed Deviation by Supplier, with Technical Justification	Cost Impact, if any	Contractor's Conclusions

NOTES

1- Bidder confirms that apart of from the deviations/exceptions/clarifications listed above, the bid is in full compliance with Inquiry requisition.
2- Bidder shall submit this sheet duly filled up and signed by him along with his bid. In case there is no deviation, then also supplier shall submit this sheet along with his bid indicating NIL deviation.

(Contractor's Name and Signature with Seal)

REV	DATE	DESCRIPTION	PREP	CHK	APPR

DRAWINGS & DOCUMENTS

INFORMATION/ DOCUMENTS / DRAWINGS TO BE SUBMITTED BY SUCCESSFUL BIDDER

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

1. Inspection & test reports for all mandatory tests as per the applicable code as well as test reports for any supplementary tests, in nicely bound volumes.

2. Filled in Quality Assurance Plan (QAP) for Purchaser's/ Consultant's approval. These QAPs shall be submitted in two copies within 15 days from LOI/ FOI.

3. Detailed completion schedule activity wise (Bar Chart), within one week of placement of order.

Note : All drawings, instructions, catalogues, etc., shall be in English language and all dimensions shall be metric units.

REV	**DATE**	**DESCRIPTION**	**PREP**	**CHK**	**APPR**

	INSTRUCTION TO BIDDER	

INSTRUCTION TO BIDDERS

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

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

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

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

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

6. Vendors for bought out items to be restricted to the approved vendor list attached with bid document. Approval of additional vendor if required, for all critical bought out items shall be obtained by the supplier from the purchaser before placement of order. Credentials/PTR of the additional vendor proposed to be submitted by supplier for review and approval of Purchaser/ Purchaser's representative

REV	**DATE**	**DESCRIPTION**	**PREP**	**CHK**	**APPR**

	LIST OF SPARES	

LIST OF SPARES

S.No.	Part No.	Description	Quantity(Minimum)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

REV	**DATE**	**DESCRIPTION**	**PREP**	**CHK**	**APPR**

	REFERENCE LIST	

REFERENCELIST

Sl No.	Project	Year of Supply	Client , Address and Contact No.	Email	Size and Rating / thk	Service	
							Bidder' s Signature with stamp

REV	DATE	DESCRIPTION	PREP	CHK	APPR