SUPPLY,INSTALLATION,TESTING,COMMISSIONING AND COMPREHENSIVE MAINTENANCE FOR MOTOR DRIVEN 400 SCMH VARIABLE INLET PRESSURE (VIP) CNG INTEGRATED COMPRESSOR PACKAGE

E-Tender ID - 50606
Project No. P.014714
Document No. P.014714 G 11031 R007
Tender No. P.014714 G 11031 R007

CENTRAL UP GAS LIMITED (CUGL)
KANPUR | INDIA

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TECHNICAL DOCUMENTATION
Technical , Vol II of II, Rev. 0

TRACTEBEL ENGIE	TABLE OF CONTENTS SUPPLY OF MOTOR DRIVEN INTEGRATED VIP COMPRESSOR UNIT (400 SCMH)	P.014714 G 11031 R 007

CENTRAL U.P GAS LIMITED (CUGL)

TRACTEBEL ENGINEERING PVT. LTD.

ELECTRIC MOTOR DRIVEN INTEGRATED VIP UNIT (COMPRESSOR + CASCADE + DISPENSER) OF 400 SCMH CAPACITY

INTRODUCTION

0	23.05.2021	Issued for Procurement	Saurabh Sharma	Gunja Gupta	Nitish Nandi
Rev.	**Date**	**Description**	**Prepared By**	**Checked By**	**Approved By**

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1.0 INTRODUCTION

CENTRAL UP GAS LIMITED (CUGL), a joint venture company of GAIL and BPCL, is responsible for distribution of Natural Gas for household, commercial & Industrial sectors including setting up CNG refueling stations for vehicles etc. in Kanpur (including Unnao), Jhansi and Bareilly.

Natural Gas (NG) is today increasingly gaining popularity over as alternate auto fuel primarily because it is environment friendly, economical and more efficient as compared to other conventional auto fuels. Emission of harmful oxide and other polluting particulates is minimal in case of CNG.

TRACTEBEL ENGINEERING pvt. ltd. (TE) has been appointed for providing consultancy services for tendering activities for CNG Expansion Project (hereinafter referred as Consultant), by CUGL.

Tractebel Engineering Pvt. Ltd. (TE) is now inviting tenders on Competitive Bidding basis for procurement of **"400 SCMH ELECTRIC MOTOR DRIVEN INTEGRATED VIP COMPRESSORS PACKAGES (COMPRESSOR + CASCADE + DISPENSER)"** for this project.

The present document covers the technical specifications for the tender.

2.0 TECHNICAL SPECIFICATIONS

The technical specifications for this present tender enquiry are as listed in Material Requisition.

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CENTRAL U.P GAS LIMITED (CUGL)

TRACTEBEL ENGINEERING PVT. LTD.

ELECTRIC MOTOR DRIVEN INTEGRATED VIP UNIT (COMPRESSOR + CASCADE + DISPENSER) OF 400 SCMH CAPACITY

MATERIAL REQUISITION

0	23.05.2021	Issued for Procurement	Saurabh Sharma	Gunja Gupta	Nitish Nandi
Rev.	**Date**	**Description**	**Prepared By**	**Checked By**	**Approved By**

Project	:	City Gas Distribution Project for M/s. CUGL
Subject	:	**Electric Motor Driven Integated VIP Unit - Capacity 400 SCMH**

A. DESCRIPTION OF GOODS AND/OR SERVICES

Item	Quantity	Description	Identification Number
1.	**04 Nos.**	**400 SCMH Electric Motor Driven Integrated VIP Unit (Compressor + Cascade + Dispenser)** · Design, Engineering, Manufacturing, Shop testing and supply of CNG Electric Motor driven integrated compressor package having variable inlet pressure consisting of **Compression, Storage & Dispensing unit with discharge flow capacity of 400 SCMH** at the specified condition (as per Technical Specification) complete with drive electric motor, Cooling system, Lubrication system, auxiliary Air Compressor system, Priority panel, Flame proof control panel (Local), and other accessories including erection and commissioning spares including acoustic enclosures. · Services for Erection, Testing, and Commissioning and performance acceptance testing of compressor as defined in PTS- Motor driven CNG Compressor Packages. · Scope also includes Comprehensive Maintenance for each compressor during warranty period of one year and further Four years after warranty period. Capacity: 400 SCMH Suction Pressure Range : - **15-200 Kg/cm2 (g) (When used as a booster Compressor)** - **14-19 Kg/cm2 (g) (When used as an online Compressor)** Discharge Pressure: 255 kg/cm2 (g)	

B. REMARKS / COMMENTS

1.0 VENDOR'S SCOPE

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

2.0 INSPECTION

The bidder shall appoint Third Party Inspection Agency for carrying out the inspection at bidder's works as per approved ITP/QAP/QCT and TPIA charges shall be borne by the bidder.

3.0 APPLICABLE DOCUMENTS

Applicable documents are listed in hereafter under Section C of this MR, complemented with general specifications, guidelines and / or standards, as listed in LIST OF REFERENCED DOCUMENTS as a part of specification.

In the event of any conflict occurring in applying the referenced documents, the order of precedence shall be:

1 – Particular Technical Specification

2 – Attachments

4.0 VENDOR'S DOCUMENTS

4.1 Submittal of Calculation Note:

Design calculations will be well explained for demonstration of compliance to specified code(s) and standard(s). Limitation to a listing of input data and series of results is not acceptable. The applied formulations, sections, subsections, figures, subfigures from code(s) and/or standard(s) will be indicated at calculation steps to permit straight verification.

4.2 Vendor's Documents and Drawings

- All vendor documents and drawings shall be numbered according to Engineer's in- charge specification.
- All drawings shall use SI units.
- All graphical symbols to be recognized to industry standard.
- All text to be clearly legible when the drawing is reduced to A3 size.
- All drawings and calculations shall be checked, approved and signed by a competent and authorized person employed by the Contractor.
- Drawings to be issued bound in A3 size. In addition, the planning drawing to be issued in A1 for submission to the planning authority.
- Hard copy of Quality & design dossier (Drawing to be on A3 format) for review.
- All drawings shall be issued on CD in both Auto CAD & PDF formats.
- Installation, Commissioning, Operation & Maintenance manuals for CNG compressor package.

C. LIST OF ATTACHMENTS

The table herebelow lists the documents which are integral part of this Material Requisition. The applicable revision index of each document is mentioned in the column below the current Material Requisition revision index.	**Material Requisition revision**							
When the Material Requisition revision index is "A" or "1", all listed documents are attached. For other Material Requisition revision index, only modified or new documents are attached.	00	01						
Documents	**Revision of documents**							
SECTION-I: Compressor								
Particular Technical Specification (PTS) - Compressor Package	0							
Annexure - I – Guaranteed Parameters	0							
Annexure – II – Compressor Data Sheet	0							
Annexure – III – Electric Motor Data Sheet	0							
Annexure - IV – List of Motors	0							
Annexure - V – Specification for Instruments	0							
Annexure - VI – Recommended Vendor List	0							
Annexure - VII – Vendor Data Required	0							
Annexure - VIII – Deviation Schedule – Not Applicable as “No Deviation” Tender	0							
Annexure - IX – Deleted	0							
Annexure -X – Experience Proforma Record	0							
Annexure – XI – Parameters for SCADA	0							
Annexure – XII – Quality Assurance Plan	0							
Annexure - XIII – Data Sheet for -Medium Voltage Squirrel Cage Induction Motor, -Power Cable Sizes for 415 V Motors, -Pressure Vessels	0							
SECTION –II: Storage Cascade								
Particular Technical Specification (PTS) - Storage cascade	0							
Data Sheet – Cascades	0							
Data Sheet – Pressure Gauge	0							
Data Sheet – Temperature Gauge	0							
Documents	**Revision of documents**							

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Data Sheet – Pressure Safety Valve	0							
QAP - High Pressure Gas Cylinder, Cascade Frame & Fittings	0							
SECTION –III: Dispenser								
Particular Technical Specification – Dispenser	0							
Annexure - 1 – Recommended Vendor List	0							
Annexure - 2 –Vendor data requirement	0							
Annexure - 3 – Deviation Schedule – Not Applicable as "No Deviation" Tender	0							
Annexure - 4 – Deleted	0							
Annexure - 5 – Vendor data requirement	0							
Annexure - 6 – Quality Assurance plan	0							

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CENTRAL U.P. GAS LTD. (CUGL)

CITY GAS DISTRIBUTION PROJECT

PTS – **ELECTRIC MOTOR DRIVEN INTEGRATED VIP UNIT (COMPRESSOR + CASCADE + DISPENSER) OF 400 SCMH CAPACITY**

0	23.05.2021	Issued for Procurement	Saurabh Sharma	Gunja Gupta	Nitish Nandi
Rev.	**Date**	**Description**	**Prepared By**	**Checked By**	**Approved By**

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1.0 GENERAL.

Central UP Gas Limited (CUGL), a joint venture company of GAIL and BPCL, is responsible for distribution of Natural Gas for household, commercial & Industrial sectors including setting up CNG refueling stations for vehicles etc. in Kanpur (including Unnao), Jhansi and Bareilly.

1.1 Scope

- The intent of this tender is to outline minimum requirement for Design, Engineering, Manufacturing, Assembly, Inspection, Testing, Packaging, Supply, Erection & Commissioning including Performance Acceptance Test at site along with comprehensive AMC during One year warranty period and subsequent Four year period including supply of all spares and consumable items for " ELECTRIC MOTOR DRIVEN RECIPROCATING INTEGRATED VIP GAS COMPRESSOR PACKAGES" 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.
- Integrated CNG Compressor 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.
- Compressor packages may be installed in any of the GA of M/s. CUGL.
- Bidder shall be responsible for supply, erection, commissioning and field trial run. Noise level test and performance test of all packages at sites. The field trial run of the Integrated CNG Compressor package will be for minimum of 72 hours (can be in multiple runs) and the package should be kept under observation for stable operation and no major breakdown in which satisfactory performance of the package together with all accessories auxiliaries and controls shall be established for satisfactory performance for specified operating conditions.
- It will be the endeavour 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 operation of a particular package. The bidder has to keep the Integrated CNG Compressor package available round the clock and all the expenditures including spares and consumables, oil etc. to make the Integrated CNG Compressor package operational shall have to be borne by the bidder. The power required to run the Integrated CNG Compressor packages will be provided by CLIENT/ OMC. The vendor shall maintain the Integrated CNG Compressor packages in 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 between CLIENT and the bidder.
- The bidder shall depute adequate numbers of qualified, experienced and competent persons and supervisors for smooth maintenance of the Integrated CNG Compressor packages. The maintenance staffs have to be available round the clock daily throughout the year.
- Periodic inspections of Safety Valves, Transmitters, Pressure vessel gauge and any other equipment as per statutory norms of Delhi 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 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 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 vendor as 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 behaviour 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, O&M and all others relevant manuals for Integrated CNG Compressor package & its accessories, priority panel, electrical motor & all instrumentation.
- General Requirement

  The vendor must follow the MAINTENANCE REQUIREMENT as stated below but not limited to and ensure to provide trouble free services as defined in the bid documents.

  A. ACCOMMODATION/ TRANSPORTATION/ MEDICAL

  The vendor 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 owner shall have no obligation in this respect.

  B. DISCIPLINE

  The vendor shall be responsible for the discipline and good behaviour 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 vendor.

  C. GATEPASS / IDENTITY CARD

  The contract shall arrange to supply / renew identity card to his workforce at his own cost, if so required by OWNER for security or for any other reasons. Those vendor's personnel shall be required to carry their respective identity cards while on duty and produce on demand.

D. RIGHT TO GET SERVICES CARRIED OUT THROUGH OTHER AGENCIES

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

The maintenance services shall be provided in terms of shift pattern or the round the clock basis as mentioned in the bid document.

E. CLIENT will notify the start date for Comprehensive Maintenance services

- After the successful completion of test run & commissioning, system taking over certificate shall be issued by the owner.

2.0 MAINTENANCE OF COMPRESSOR PACKAGES

- The vendor shall deploy adequate number of technicians / supervisors / Engineers / helpers as well as tools, spares, consumables and equipment for smooth and proper maintenance of the Integrated CNG Compressor package supplied in terms of the contract. In case required to meet operational requirements, the vendor shall augment the same as per direction of Engineer–in-Charge. Vendor to submit a detailed organogram with key person details before starting maintenance of the Integrated CNG Compressor package.
- The vendor 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 i.e. 24X7.
- The contractor shall follow Central/State guidelines for labour laws, rules and regulations. 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
- The work force deployed by the vendor for maintenance service of Compressors, Dispenser & cascade shall be of sound relevant technical professional expertise which is otherwise also essential from the safety point of view of the personnel of the vendor as well as for the installation.
- Vendor 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.
- Regarding work completion, the decision of the Engineer-in-Charge will be final and binding.
- The vendor shall make his own arrangements to provide all facilities like boarding and transport etc. to his workmen.
- All personnel of the vendor entering on work premises shall be properly and neatly dressed and shall wear uniform, badges while working on premises of the Owner including work sites.
- Vendor shall maintain proper record of his working employee's attendance and payment made to them.
- The vendor's representative/supervisor shall report daily to the Shift-in-Charge for day to day working.
- All the safety rules and regulations prevailing and applicable from time to time at the installations as directed by OWNER will be strictly adhered to by the vendor.
- It will be the responsibility of the vendor to pay as per the minimum wages of the appropriate government applicable under the Minimum Wage Act 1948.
- The services shall be provided in terms of shift pattern on the round the clock basis. The vendor 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.
- The vendor 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 Integrated CNG Compressor packages.
- All arrangements for communication from control room to the contract person working on job under the services shall be the responsibility of the vendor, viz. cell phone / walky-talky.

- The successful bidder shall indemnify the Owner from any claim of the contract labour.
- The successful bidder shall comply to all the rules regarding PF, ESI etc. as stated in the tender document
- 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.
- Summary of breakdown hour's station wise with analysis shall be submitted to CNG control room on a fortnightly basis both in hard and soft form as per CLIENT format.
- The vendor has to submit the following documents on monthly basis along with the bill:
  - Ø Preventative maintenance compliance report for that month along with the detailed service report.
  - Ø Details of the Integrated CNG Compressor package breakdown, summary of break down hours for that month and the cumulative break down hours along with breakdown response time.
  - Ø Integrated CNG Compressor package parameter logbook for the month.
  - Ø Certificate to be given by the bidder stating that they have complied with all the labour regulations and are following the minimum wages act.
- Maintenance of Integrated CNG Compressor package packages during the warranty period.
- All spares, consumables, oil and lubricants required for carrying out the Maintenance of the complete compressor packages including periodic breakdown and any other materials required for maintenance of the compressor packages, shall be provided by the bidder.
- Vendor to furnish the list of consumables required for normal operation of the integrated compressor package and the time interval between change of the consumables like filters, valve repair kit for both solenoid valve, 2-way & 3-way valves, breakaway coupling, display, reset switches etc.
- All tools, tackles and fixtures required for carrying out the above maintenance of the Integrated CNG Compressor package shall be in scope of the bidder. The scope will also include handling equipment's like crane, forklift, chain pulley block etc. required during the any maintenances activity.
- Any correspondence required to be made with the principal company or OEM or various offices shall be made by the bidder or bidder's agent. All arrangements like phone, fax, computer, Internet etc. required for above correspondences shall be arranged by the bidder at his own cost.
- 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
  - Ø Estimated down time required for each type of maintenance schedule.
  - Ø List of spares and their quantities required for each type of maintenance schedule per Integrated CNG Compressor package.
  - Ø Type and number of man days required for each type of maintenance schedule per Integrated CNG Compressor package.
- The bidder shall plan such maintenances during non-peak hours and in consultancy with the Engineer In Charge (EIC) of CLIENT. 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 maintenances. All spares shall be kept in sealed OEM stamped packages. The packages shall be opened in front of CLIENT representative during maintenance. In case, the schedule maintenance of the OEM manual recommends to check and replace parts like valve spring, valve plates, piston rings etc. after certain time interval, same shall replaced or used further only on approval from the CLIENT representative. However, any untoward consequences for non-replacement of such parts shall be the responsibility of the bidder and spares, repair required to put back the unit into operation will be to bidders account.
- 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 calliper, 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 disposed off periodically with permission from CLIENT.
- The vendor 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 such as Integrated CNG Compressor package parameter log book, complaint log book, service report, break down summary report etc. shall be in scope of the bidder.
- All the maintenance / inspection job carried out by the bidder shall be recorded in a service report and the report of the same shall be jointly signed by CLIENT representative and submitted immediately after carrying out the maintenance. Service report format shall be approved by CLIENT.
- The EIC will be final authority to take decision with regards to maintenance or replacement of parts or any disagreement between the bidder and CLIENT, during the execution of the contract.
- The bidder shall carryout calibration of gas detectors and flame detectors every six months or earlier as per requirement or instruction of EIC of CLIENT. 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.
- The bidder shall carry out retesting of pressure vessels periodically i.e. every year or earlier as per Gas Cylinder rules 2016 / Static & Mobile Pressure Vessels Rules.
- All spares, consumables, oil and lubricants required for carrying out the Maintenance of the complete Integrated compressor packages for 1 year during warranty and 4 years period after warranty period including periodic breakdown and any other materials required for maintenance of the compressor packages, shall be provided by the bidder.
- All tools, tackles including special tools and tackles and fixtures required for carrying out the above maintenance of the Integrated CNG Compressor package shall be in scope of the bidder. The scope will also include handling equipment's like crane, forklift, chain pulley block, etc required during the any maintenances activity.
- Any correspondence required to be made with the principal company or OEM or various offices shall be made by the bidder or bidder's agent. All arrangements like phone, fax, computer, internet etc. required for above correspondences shall be arranged by the bidder at his own cost.
- 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 CLIENT. 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 to check and replace parts like valve spring, valve plates, piston rings etc. after certain time interval, same shall replaced or used further only on approval from the CLIENT representative.
- 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 calliper, micrometer screw gauge, fill gauge, bore gauge etc. shall be in scope of the vendor.
- All parts replaced by the bidder during the above contract period shall be properly packed and handed over to CLIENT, on replacement.
- The vendor 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.

- A Log Book for time records shall be maintained in the central Control Room (Vendors) wherein the records shall be made for the time integrated compressor package develops trouble and the time at which the trouble is rectified by vendor's maintenance staff.
- Statutory compliances like calibration of safety relief valve, PT, PG & stamping of weights & measure dept. will be in vendor's scope for comprehensive maintenance duration and shall be done minimum once in a year.

3.0 CODES AND STANDARDS

The following National & International Codes & Standards of Latest editions shall be applicable.

OISD 179, NFPA-52: 1995 or equivalent

NFPA – 37

NFPA – 12- CO_2 Flooding system

IS: 325/ IEC or International standards. – Standards for electric Motor

IS: 6382

Applicable ANSI, ASTM, NEC, NEMA code.

NAG-E 403 (ex ET-ENRG-GD-Nº 3)
NAG-E 441 (ex ET-ENRG-GD-Nº 141)
API – 618

API – 11P 2nd edition

API – 661 Specifications for Air cooled exchangers

ASME Section – VIII Div – 1/2 Design codes for pressure vessels.

Gas Cylinder Rules 2016.

Standard Specifications of Bureau of Indian Standards (BIS).

Specifications/Recommendations of IEC.

Indian Electricity Rules.

Indian Explosives Act.

Delhi Factory Rules, 1950

ASME / ANSI – B-31.3 Code for Process Piping

4.0 PRECEDENCE

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

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

Bidder shall necessarily furnish the following along with the bid, without which the offer shall be considered incomplete:

(1) Proven Track Record Formats duly filled in along with general reference list shall be submitted for the earlier supplied CNG compressor packages as per the BEC requirements.

(2) Checklist duly filled in with regards to scope of supply

(3) Completely filled in Data Sheets of compressor, motor

(4) Deviations if any to this Technical Specification

(5) Tentative Lay out/key plan/General Arrangement Drawing indicating size of skids, center distance between skids and space required along with maintenance requirements

(6) (a) Utilities requirements (b) Electrical Load summary

(7) Catalogues of Integrated CNG Compressor package, motor, instrumentation & controls

(8) Certificate from Compressor block manufacturer towards guaranteed shaft power calculation at 400 SCM per hour compression (on given parameter) and from Motor manufacturer towards their KWh consumption (KWh on guaranteed parameters) on above guaranteed shaft power to be submitted by bidders along with bid. A confirmation is required from bidders prior to bid opening.

5.0 PROCESS PARAMETERS

Complete Integrated CNG Compressor package shall be suitable to work under the following climatic conditions:

The climatic conditions to be considered for selection, design and derating of equipment shall be as indicated below:

- Amb. temp min/max ^{0}C : 2 ^{0}C / 47.5 ^{0}C
- Design wet bulb temp (WBT), ^{0}C : 27 ^{0}C
- Design relative humidity % : 90
- Altitude above MSL, M : 205
- Wind velocities km/hr (max) : 160

  Air Cooler Design ^{0}C : 47.5^{0}C DBT, 27^{0}C WBT & 90% RH

- Typical Gas Composition Range

GAS COMPOSITION		
	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
H2O	0.01 – 0.00	0.00
Total	**100**	**100**
Average C.V. (kcal/SCM)	8950 – 8150	8302.3

NOTE: Integrated CNG Compressor 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.

6.0 SCOPE OF SUPPLY FOR EACH INTEGRATED CNG COMPRESSOR PACKAGE

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

- Design, Engineering, Manufacture, assembly, testing at manufacturer's works, erection, commissioning, field trial runs, Equipment performance test along with associated electricals, instrumentation etc. as per bid document.
- VIP type 400 SCMH compressor package. (Detail specification REFER SECTION-1).
- The compressor will be initially used as booster compressor with suction pressure range of 15 - 200 kg/cm2(g) by taking gas from mobile cascade mounted on Light Commercial Vehicle (LCV). Later when the inlet pipeline is available at site, the compressor converted to online with inlet pressure range of 14-19 kg/cm2(g) without major modification. However, if required compressor may be directly installed as online.
- Flame proof Electric motor, the Motor rating should not be more than 50 KW.
- Three banks 450 Water Litre (minimum) capacity Cascade for 400 SCMH. (Detail specification REFER SECTION-2)
- The storage cylinders to be kept completely inside the enclosure of the machine.
- CNG Dispenser (1 no.) and Interconnected SS tubes & fittings. (Detail specification REFER SECTION-3).
- Dispenser should be detachable that can be used in separate location. If required vendor may be asked to connect 2 dispensers with the unit. Provision for necessary modifications shall be provided.
- Dispenser shall be supplied with standard enclosure.
- All interconnections between compressor, cascade and dispenser upto the battery limit shall be in the scope of bidder.
- Bidder need to submit copy of valid type approval for offered integrated compressor package from PESO along with the bid. Bidder must submit duly peso approved mechanical drawings/ mechanical design of the composite/Integrated compressor along with the Bid.
- Enclosure wall and doors shall be 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 to curtail sudden high pressure inside the enclosure.
- Since composite/Integrated Compressor is planned to be placed inside the forecourt in the CNG station hence design of the enclosure should be impact resistant of slow moving vehicle and bidder should submit detailed calculations for the value of impact to be sustained by the enclosure offered by the bidder.
- 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 Thermal Mass flow meter to measure Vent Loss.
- All Mass flow meter shall be provided with a Liquid Crystal Display (LCD) for ongoing flow monitoring.

  and totalizers.
- Bidder shall submit necessary engineering drawings, documents and calculations used to reduce or bypass the inlet gas pressure while compressor is working as a Booster.
- PLC based control panel with HMI. PLC based control system with 10" touch screen display. PLC shall be provided with mounting rack, CPU, Input output cards, Power supply card, communication card. PLC CPU shall be redundant (1W+1S) with auto switch over without manual intervene. Both CPU shall be connected with High-speed ling for bump less change over between primary and secondary CPU. This shall not affect compressor operation. Failure alarm of CPU shall be provided in HMI. A 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.

- PLC shall be mounted in EX proof enclosure. Cabinet specification with Statutory certificate shall be submitted during engineering stage for approval.
- 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.
- 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.
- Block & bleed valves/Two valve SS316 Manifold to be provided for Pressure gauges and pressure Transmitters.
- 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.
- 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.
- Air-cooled heat exchanger for inter stage and discharge gas.
- 6 line (3 bank) Priority Panel at Compressor Discharge.
- 2 way/ 3 way valves with full flow ball valve for priority line.
- All interconnecting oil, gas, water, air piping within the compressor package, including priority panel, cascade & dispenser & interconnecting tubing.
- Impulse and pneumatic piping/Tubing for all valves, fittings as specified & required for mounting the instruments.
- Junction boxes as required for interfacing to compressor package mounted control panel.
- NRV at final discharge.
- Structural supports within the Integrated CNG Compressor package for all piping, instruments etc.
- One no. relief valve at each stage discharge, first (1st) stage suction and Blow Down Vessel.
- 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.
- Coupling/V-belts/pulleys.
- Common CO2 extinguishing system consisting of two cylinders, piping, valves and control systems as per details given in this specification. Block & bleed valves/Two valve SS316 Manifold to be provided for Pressure gauges and pressure Transmitters.
- Compressor Inlet and outlet manual and automatic isolating valves for maintenance & emergency.
- Complete Erection, Testing & Commissioning of integrated compressor packages.
- Field Performance test at site
- Supply of all essential spares as specified, erection & commissioning spares.
- One set of priced spare parts catalogue along with the priced bid (Part-II), as built drawings and Maintenance catalogue with each Integrated CNG Compressor package.
- An oil drain pot outside of the package shall be provided to collect all drains from packing, distance pieces, processes etc. The capacity of the drain pot should not be more than 2.5 Litres.

- 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.
- Priority refuelling system inside of the package.
- Drive belt, if used shall be anti-static fire retardant type.
- Duplex suction filters with filteration level upto 5 Micron to be provided outside battery limits of the package at the inlet of package with DP gauge after Y- type strainer. Filters should be installed in series.
  - § Suction filter shall be placed remotely as metering and filteration skid is not envisaged.
- Two stage filtration at discharge so as to limit oil carryover is to be provided.
- Three no. Emergency stop button (push type) along with one hooter in office/customer interface room.
- Wires mesh type guard for heat exchanger fan.
- Secondary lubrication system with check valve protector, HP Filter (for all lubricating points) & DNFT flow switches with standby pump according to manufacturer safe design. Secondary lubrication system with divider block shall be provided.
- Erection, Maintenance and all others relevant manuals for integrated compressor package & its accessories, priority panel, electrical motor & all field instruments, dispenser, storage cascade etc. for easy operation & trouble shooting.
- Annual comprehensive maintenance services for a period of 1 year during the warranty period, including supply of all spares and consumable items.
- Annual comprehensive Maintenance services for a period of 4 (Four) years after the warranty period including supply of all spares and consumable items.
- 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)
- Master operator cum Maintenance technician needs to be available at one location of Client's choice along with mandatory tools and spares. Master operator shall also provide necessary training to Client staff for successful operation as and when required.
- For added safety, manufacturer shall provide Compressor, Cascade & Dispenser in three separate sections, isolated from each other using heavy gauge steel sheet wall of minimum 15 mm thickness

- Cables
  a) Main incoming Power cable from owners Power Distribution Board (PDB) to main control 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) from instrument 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 control room) to Compressor PLC and RS 485 port cable of Compressor PLC to Client's RTU. Vendor shall provide all the RS 485 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.

- Supply of Communication Cables, cable glands, termination of cable and cable laying from dispenser & Compressor PLC (in Integrated package) to junction box is in Vendor's scope. Supply of standard make, WP IP 42 junction boxes, terminal blocks and installation of junction box shall be is in Vendor's scope. Junction box shall have 8 inputs cables entry points (side) and two outgoing entry points including spare (bottom), cable entry from top is not accepted, size of junction box to be decided by vendor. All the spare entry shall be plugged properly. 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.
- Communication cable is single pair (1Px 1.5mm2), multi strand, armoured cable with HR PVC insulation and PVC st2 inner and outer sheath. Tentative cable length form each dispenser to junction box is approx. 50 meters, however vendor shall provide cable length as per requirement.
- Vendor must share junction box termination details with CLIENT.
- 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.
- 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.
- CLIENT's Logo and name to be displayed on dispenser side, in CLIENT approved colour scheme. CLIENT's Logo and name shall be painted on stainless steel panel with an appropriate coloured background or alternatively, vendor shall provide self-adhesive PE film sheet with CLIENT'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.
- On-Site Training to CLIENT personnel (Three days each for three separate groups).
- Training to CLIENT personnel at vendors 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, operational & maintenance procedures, practical hands on experience on assembling, dismantling. etc.
- Integrated Compressor package shall be suitable for outdoor installation without roof / shed.
- From safety point of view, manufacturer to provide Compressor, Cascade & Dispenser in three separate sections, isolated from each other using heavy acoustic wall.
- Maximum footprint of Integrated compressor frame Package shall not exceed 4.0 Sq Mtr. Maximum with integration of all accessories.

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

8.0 BATTERY LIMITS

- Supplier shall arrange its own ups supply for testing, installation and commissioning compressor control circuitry. UPS of adequate rating along with battery backup to be part of vendor's scope.
- All customer interface connections (i.e. Gas inlet & gas outlet) shall be brought out to the package edge.

- As and where specified on the data sheets all vents (i.e. Relief valve, distance piece, packing and starting air) shall be manifolded and terminated at skid edge outside the enclosure and vented to safe height at package roof. Silencer has to be provided in the starting air vent line.
- All drains from different process equipments, distance piece and packing shall be manifolded and terminated as single point for customer interface duly flanged with isolation valve. Drains should be through a common header and discharge to be allowed in a pit to avoid spillage around Integrated CNG Compressor package package.

9.0 UTILITIES

- 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.
- Bidder shall make his own provision for Instrument air if required with an electric motor driven air compressor with a suitably sized receiver & Refrigerant type air drier system. Air Compressor motor should be 415 V squirrel cage motor DOL / star delta starter having overload protection, single phase preventer. Gas based actuator to used for compressor & dispensers hence no air compressor is required
- Drain should be through a common header and discharge to be allowed in pot outside the package (capacity not more than 2.5 litres) to avoid spillage around the Integrated CNG Compressor package.
- All electrical and instrumentation terminals shall be as specified.
- Purchaser shall provide 415 V, 3Ph, 50Hz, 4 wire electric power for compressor motor drive at a single point.
- Purchaser shall provide the 230V, 50Hz, 1Ph UPS, 3 wire for LCP at single point in the electrical room.

SECTION – I: TECHNICAL SPECIFICATION FOR CNG COMPRESSOR - VARIABLE INLET PRESSURE (200-15 BAR)

1.0 GENERAL DESCRIPTION

The Integrated CNG Compressor package is to be installed at CNG station.. The gas composition is as detailed above.

The compressor will be initially used as booster compressor with suction pressure range of 15 - 200 kg/cm^2(g) by taking gas from mobile cascade mounted on Light Commercial Vehicle (LCV). Later when the inlet pipe line is available at site, the compressor converted to online with inlet pressure range of 14-19 kg/cm^2(g) without major modification.

Package capacity shall be 400 Sm^3/h at suction pr. of 16kg/cm2(g), inlet line pressure range 15 - 200 kg/cm2(g) with performance range 14 to 19 kg/cm2(g) with discharge pressure 255 kg/cm^2(g) with 6-line (3 Banks) priority panel electric motor as detailed in scope of work and technical specification.

Note: While working as a booster compressor inlet tubing provided will be of SS 316 ¾"size.

A. GENERAL DATA

1.1	Compressor type	
1.1.1	Oil lubricated	Oil lubricated reciprocating type
1.2	Type of cooling	Gas cooling and cylinder cooling should be by air only.
1.3	No. of compression stages	03
1.4	Cylinders	Horizontal Balanced Opposed design with lined cylinder/ trunk piston Design. Vertical Compressor block design is not acceptable
1.5	Maximum intake temperature	35^o C
1.6	Compressor package BKW at Specified flow including all losses such as mechanical, leakage, transmission & power absorbed by compressor driven and other electric driven auxiliaries.	To be indicated in KW Detailed break up to be given as per Annexure –I
1.7	Maximum motor power	To be indicated with 10 % margin over BKW as per Annexure - I
1.8	Drive mode	V- belts/Direct coupled. Direct drive (from prime mover to compressor) is preferred over belt driven. Power Transmission should be thro' flexible coupling.

B. COMPRESSOR PERFORMANCE DATA

2.1	Gas pressure at compressor inlet	Refer below Section 2.5	
2.2	Compressor Discharge Pressure	255 Kg/Cm^2 g at 52 deg. C (Max)	
		Compressor Discharge temperature 52ºC (After cooler) with ambient air temperature of 47.5ºC and gas inlet temperature of 35ºC (max.).	
2.3	Compressor speed	To be indicated by bidder.	
2.4	Ambient Conditions		
2.4.1	Ambient temperature	1.7 ^{0}C to 47.5 ºC.	
2.4.2	Maximum relative humidity	90 %	
2.5	Required guaranteed capacities of electric motor driven compressor packages at rated suction pressure and discharge pressure as mentioned below:		
	Rated Suction pressure at which guaranteed flow is required, and at 35 deg. C (MAX), in Kg/Cm^2 g.	Rated Discharge pressure in Kg/Cm^2 g and at 52 ºC (MAX.)	Average Guaranteed capacity at rated suction and discharge pressure in Sm3/hr (SCMH)
	200 to 15	**255**	**400**

Hereinafter the rated suction pressure, where guaranteed flow is required, will be referred as Rated Suction Pressure, which means 16 Kg/Cm^{2}g for 400 SCMH compressors. Suction pressures will be measured at inlet flange of the Integrated CNG Compressor package. Bidder has to ensure that compressors are designed such that the desired flow is achieved (without any negative tolerance) at Rated Suction Pressure.

Note:

a) **Guaranteed average flow is 400 SCMH at 200 to 15 Kg/CM2**

b) No advantage shall be given in case bidder offers compressor with flows higher than as detailed above for various types.

c) Graph for specification power consumption to be provided

d) Bidders offer shall be based on firm and final compressor model on which basis the offer shall be evaluated and no alternate compressor model or change of model, after submission of bid shall be entertained / considered. This is very important and all bidders shall take full cognizance of this matter before submitting the bid.

e) Bidder to indicate the capacity and absorbed power of the offered compressors at various suction conditions starting from 200 Kg/Cm2 g to 16 Kg/Cm^2 g (Temperature 35 deg C max.) and 255 Kg/Cm^{2}g and 52 deg. C (max) discharge condition.

Performance curves and tables i.e. Flow versus suction pressure and temperature and power curves i.e. absorbed power versus suction pressure and temperature at specified discharge conditions shall be furnished. In addition to above, flow capacity and absorbed power values for suction conditions from 200 Kg/Cm2 g to 16 Kg/Cm2 g in steps of 0.5 Kg/Cm2 shall also be given in tabular form. The graph shall be plotted at various suction pressures ranging from 200 Kg/Cm2g to 16 Kg/Cm2g and at various suction temperatures ranging from 20 to 35^o C. Similarly, the graphs shall be plotted at various discharge pressures ranging from 16 Kg/Cm2g to 255 Kg/Cm2g, however at 52^{0}C (max) discharge conditions.

f) Bidder to note that the compressor package required shall be suitable for operating at a suction pressure from 200 Kg/Cm2g to 16Kg/Cm2g at 35 deg. C. Reduction of suction pressure if acheived by means of pressure regulating valve (PRV) then necessary calculation of temperature reduction and solution shall be submitted. Gas inlet pressure regulator of 300# class rating with an outlet discharge range of 200 Kg/Cm2 g to 16 Kg/Cm2 g adjustable shall be provided within the compressor package. The first stage suction of the compressor must be capable of taking suction from 200 barg to 16 barg.

Bidder to note that negative tolerance on the guaranteed capacity will not be acceptable. Also no advantage shall be given for positive tolerance of the capacity.

2.0 SAFETY

a) 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.

b) 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.

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

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

e) 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.

f) Each package ENCLOSURE shall have One no. (1) LEL detectors with display (IR Type) and one no. (1) Ultra Violet (UV) fire detectors inside the enclosure.to cover the enclosure effectively as already spelt in the scope of supply.

g) All material used in the package shall be flame retardant.

h) Relief valves shall be provided at suction and discharge and each inter stages of compressor with setting as per cl.7.20.4 of API-11P with R.V. venting as per cl. 7.20.4 of API-11P.All vented to common relief valve header.

2.1 Carbon Dioxide (CO2) Flooding System

a) CO2 flooding system should be installed for the protection of CNG compressor by automatic actuation system. The package should be protected by automatic operated CO2 flooding system designed as per NFPA-12.

b) Gas Detection by installation of hydrocarbon gas detector with display (IR type) with self check function and transmitter with adjustable alarm levels (0-100%) with preset of 10%, 20% and 50%.

c) Installation of flame detector (UV-IR type) with self check function and transmitter, alarm on detection of flame.

d) CO2 flooding system will consist of 2 nos. brand new CO2 cylinders of 45 Kg capacity. One cylinder will act as main & other as stand by, which shall have identical arrangement and connected to the system. The cylinders should be placed in a shed raised above ground level to protect from weather and direct sunrays as per Gas Cylinder Rules, 2016. Cylinders shall be fitted with automatic actuated Valves, Solenoid valves.

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.

Cylinder should be ISI marked as per IS: 7285 and PESO approved.

e) 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.

f) Interlock of CO2 Flooding system with compressor as per following sequence:

g) Compressor shall trip on detection of gas at preset level.

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

i) Compressor shall not start if the CO2 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.

j) Maintenance Override Switch shall be provided to keep the system off during maintenance.

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

l) 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.

m) 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.

n) Suitable online weight (CO2) loss monitoring/ indication device to be provided to ascertain the health of the CO2 flooding system.

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

p) The system designed by the supplier shall be duly approved by CLIENT.

q) Technical specifications, Operation and Maintenance Manual, PESO 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) shall be provided with the system.

r) 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.

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

t) Piping of CO2 flooding system shall be seamless high pressure pipe of Schedule 40 of 50 mm dia of appropriate length with a minimum safe distance of 4 Meter from CNG Compressor, The fittings like elbows, Tees, Union, sockets should be of same schedule and capacity for installation in a high pressure system as per NFPA-12.

u) Flameproof online weighing system, complete frame with shed and all accessories should be of good quality, weighing scale should be of reputed make.

v) Specifications:

Non Return Valve for CO2 High Pressure Hose:

As per BIS specifications

Operating Media: CO2

Body Material: Brass, BIS: 319

Ball: SS 316

Pin: SS 316

Seal: Teflon (PTFE)

Working Pr.: 60Bars

Test Pressure: 90 Bars for 1 min

Weight: 70gm

Outlet Size: ¾ BSP at manifold end

Inlet Size: ½" BSP at CO2 Discharge Hose end

Temp. Range: -29° C to 66° C

Hose Adopter:

As per BIS specifications

Operating Media: CO2

Body Material: Mainly Brass

Test Pressure: 250 Bar

Max. Working Load: 150 Bar

Temp. Range: -29° C to 66° C

Discharge Nozzle:

As per BIS specifications

Operating Media: CO2

Body Material: Leaded Tin Bronze as per BIS: 318:1981

Design Nozzle Pr.: Not less than 20.6 kgf/cm2 at 27° C

Test Pressure: 140 kgf/cm2

Marking for Code No. (on the basis of equivalent single orifice dia.): As per BIS: 6382:1982

Temp. Range: -29° C to 66° C

High Pressure Hoses:

As per BIS 7285:1974

Operating Media: CO2

Hose Type: Double wire breaded (perforated) rubber covered

Min. Bursting Pr.: 420 kgf/ cm2 at 54° C

Length: 40 cm

Cross-section: ½"

End Connection: ½" BSP (F) xW21.614 TPI

End Fittings: Brass

Temp. Range: -29° C to 66° C

2.2 Following warning and caution signage shall be marked on the housing/package:

"No Smoking"

Caution notice "This Machine may automatically start at any time".

"Flammable Gas"

3.0 BASIC DESIGN OF COMPRESSOR

3.1 Following specification is intended to give the bidder the technical and operating conditions the compressor must fulfil.

3.2 The bidder shall meet all applicable statutory codes, national law and local regulation for safety and environment protection.

3.3 The design shall conform to API 618 / API 11P, 2nd edition / other relevant reputed international standards/Gas application design (bidders to indicate).

3.4 Cylinders of compressor should be horizontal balanced/ trunk piston design. Compressor shall utilize preferably separate suction and discharge valves. Valve should be of preferably plate or spring type (non-metallic type) developed specifically for Natural gas.

3.5 Near Zero Gas Loss compressor package design is envisaged– Bidder to provide confirmation from compressor block manufacturer towards **Discharge** of Process Gas into the environment **while in operations and in idling condition**. Compressor should be design in such a way that no gas venting is done in case of emergency shutdown due to power cut etc.

3.6 State of the art technology shall be applied to the piston ring to ensure reliability and oil control with polymer rings fitted to the final stage according to manufacturer safe design. The bidder to indicate the life of piston rings of all stages in terms of running hours.

3.7 Each pressurized component of the compressor package shall be subjected to hydraulic proving test and the final assembly shall be performance tested and certified.

3.8 The inter stage and final stage cooler tube material shall be carbon steel. Bidder to submit cooler sizing calculation for review.

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

3.10 The relief valve sizing shall be in accordance to IBR, ASME code for boiler & pressure vessel and API RP-520. The relief valve and associated piping shall be sized for full block discharge.

3.11 Compressor maximum vibrations of cylinders shall not exceed 10 mm/sec. unfiltered peak velocity. Maximum vibration level 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 or Vibrations should be limited according to manufacturer safe design.

3.12 In case of lubricated cylinder & packing design, single plunger per point force feed mechanical lubricator shall provide lubrication to compressor cylinders. Lubricators with double ball check valve shall be provided at each lubricator point. Digital no flow timer shall be provided to stop the compressor in case of loss of cylinder lubrication.

3.13 The bidder along with the offer shall furnish the recommended lubricating oil type, grades & specification along with their quantity and frequency of change. The recommended oil shall be compatible with gaskets, O-ring, seals, packing, lubricator parts and other parts coming into contact.

3.14 Coolant tank must be provided with proper opening for flush/ clean of the tank, so that coolant level trip system works properly. Switch position should be such that sludge doesn't deposit on float sensor. Material of coolant make up tank should be SS304.

3.15 Gauge panel with physical gauges for temperature and pressure shall be provided and should be visible from outside of the package. LCD display as an extension of PLC display is not acceptable.

3.16 Proper oil draining system for the package is required. Packager should provide proper pocket system in package structure for draining coolant/ oil from inside the package. Package base frame block must be interconnected & slope must be provided.

3.17 Level trips of oil & coolant must be provided with wire open alarm according to manufacturer safe design.

3.18 Package inlet flow meter should have isolation valve in upstream and NRV/Valve at downstream of flow meter. Flow meters which are on piping should be connected with flexible hoses and should have proper clamping support to avoid vibration so that correct reading are observed.

3.19 All cables entries should be from bottom/side in the FLP boxes (local control panel). There should be no cabling from the bottom of the package. All the cables should be routed from the side or top for easy trouble shooting.

3.20 All instruments and their cables should be at appropriate distances from the exhaust line/hot parts.

3.21 Status of all field instruments viz. switches should be displayed on PLC.

3.22 Direction of flow should be marked on the pipe line and nomenclature of all vessel (e.g. 1st stage discharge dampener etc.) should be written on them. Cross head inspection windows should be transparent for easy of inspection during running. Set values should be prominently marked on the gauges.

3.23 Accessories To Be Included

Gas tight crankcase ZERO venting.

Packing case & pressure packing.

Drive motor with pulley/flywheel

Inter-stage coolers for all stages.

Final cooler.

Oil pump, oil filter

Oil cooler.

Crankcase breather piped back to suction.

Oil/moisture separators appropriate for selected cylinder configuration.

Automatic condensate drains system for all separators to remove oil / moisture periodically and ease starting.

Separator drain valves piped to collection drain block suitable for connection to gas recovery system.

Safety relief valve on each stage of compression.

Safety relief valve discharges connected to common manifold suitable to allow dispersion of gas via a vent stack and flame arrestor / trap.

PRV at the inlet of the system.

BDV at the inlet of the system.

Interconnecting piping between cylinders, coolers and separators.

Pulsation dampeners.

Interconnecting water piping between radiator and compressor.

Interconnecting instrumentation piping.

Suction & Discharge Mass flow meter

Thermal Mass flowmeter for vent loss

Priority panel with SS tubing- 3Bank

Cascade -3 Bank

Dispenser -3 Bank

3.24 Offered package shall be complete with compressor, electric motor, piping, cooling system, suction and

discharge filters, priority fill system, control panel safety and control devices and other accessories required for automatic and safe operation of the system. The supply shall include all interconnecting piping/tubing/cables. Cooling system shall be of closed circuit type. Only lubricated and air cooled compressor block is acceptable.

3.25 The compressor package control system shall be designed for unattended safe operation in automatic mode and shall unload, start, load, stop safely. The compressor shall start in auto in case high bank storage pressure falls below 200 barg and stop once the pressure in all three banks of storage cascade reaches 250 barg.

3.26 Integrated 6 line (3 bank) priority fill system to be provided. The priority fill system shall ensure filling as per following sequence:

- CNG Vehicle
- High bank of storage cascade.
- Medium bank of storage cascade
- Low bank of storage cascade
- The priority fill system shall ensure that in any case CNG vehicle shall be given first priority.

Compressor shall be designed to ensure flow capacity as follows:

S No	Suction Pressure	Flow Capacity
1.	**When used as an online compressor:** Flow capacity as on-line integrated compressor at suction pressure of 16 kg/cm^2. discharge pr. 255 kg/cm^2	400 sm3/hr
2.	**When used as a Booster compressor:** Average flow capacity (over range of suction pressure from 200 kg/cm^2 to 15 kg/cm^2 (varying on continuous basis) . discharge pr. 255 kg/cm^2	

Maximum BKW = As per bidders design

Motor Rating = To be indicated by the Bidder

Maximum power requirement including the accessories to be indicated by the bidder and shall be minimum for the requested performance.

Noise level shall not exceed 75 $\pm$3dBA at 1m from the compressor package enclosure.

Framework shall be mounted on a suitable skid type base, external-lifting lugs shall be provided at each corner. Duplex Suction filter, air compressor & UPS (if applicable) & CO2 flooding system can be placed separately (outside of the canopy) and Electrical control panel can be placed in remote safe area for optimisation of the foot print size. However, rest all items i.e. flow meters, priority panel, cascade, dispenser, junction boxes & PLC Control panel etc. should be enclosed / mounted on the same frame & maximum footprint of that compressor frame Package shall be limited to 4.0 m^2. These package dimensions & integration of all accessories is essence of this tender & hence any deviation in these values & integration will not be accepted.

3.27 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.

3.28 An automatic restart shall be provided on restoration of power with a 10-second delay after temporary interruption. Existing alarm condition shall remain indicated.

3.29 The compressor shall be vented into BDV before restarting in order to avoid overload to the main drive. In any case venting of gas to atmosphere is not allowed. There is need to have a blow down vessel so that gas is vented to vessel. The size of the BDV should be the sufficient to allow main drive to start. BDV volume to be

designed in such a way that gas accumulated in the process should not be vented out in any case of main power supply failure /stopping/ emergency push of package. Calculation for BDV volume shall be considering 20% higher than calculated volume and it should be calculated on higher range (50 bar) of the operating pressure (16 bar to 50 bar). Bidder shall submit calculation for same at the time of designing/drawing approval to client. BDV should be preferably placed on top of package and if placed inside package, it should be in vertical position.

3.30 Prime mover (Electric Motor)

The motor shall be flame proof/ explosion proof and confirm to IS: 2148 suitable for zone 1 group II area as per IS/IEC. The Motor shall be of standard frame size as per IS/IEC and rated for continuous duty with high efficiency and shall be designed for star-delta starting. The Motor shall be provided with class 'F' insulation, however, temperature rise shall be limited to the temperature specified for class 'B' insulation as per IS and shall be suitable for voltage variation of 415V+ 10%. The bidder shall indicate the guaranteed total power requirement in KW. The motor rating shall be 110% of the greatest BKW required by the compressor.

Electrical panel for motor starter (VFD/Soft starter etc) to be provided with both induced draught and forced draught ventilation

3.31 Motor Specification (To be provided separately for 400 SCMH)

Electric Motor

a) Type of drive Totally Enclose Fan Cooled (TEFC) high efficiency as per IEEMA standard-19-2000

b) Protection	Flame proof & weather proof enclosure
c) Insulation	Class F with class B temperature rise
d) Mounting	Horizontal Foot Mounting
e) Specification standard	By Bidder
f) Supply Voltage(assumed)	415(+/-) 10% volt, 3 phases,50(+/-) 5%Hz
g) Synchronous speed	By bidder
h) Motor rating	By Bidder
i) Motor Efficiency	By Bidder
j) Power factor	By Bidder
k) Speed of motor	By Bidder
l) Nos. of hot & Cold starts of motor	2 hot and 3 cold starts per hour
m) Coupling Type	By Bidder
n) Torque speed cure	By Bidder

o) Starting torque

Speed, thermal withstand curve load, current speed curve, Efficiency power factor vs load curve by Bidder

Motor Accessories

a) Compressor grooved flywheel (if any)

b) Motor grooved drive pulley (if any)

c) Drive VEE belts (if any)

d) Flexible coupling for direct drive

e) Drive guard

f) Adjustable motor slide rails for belts tensioning to be used (if any)

Note:

1) Motor shall be three phase, AC, asynchronous, flameproof, high efficiency (IE2 or better, as per IEC60034-30), Ex'd' rated, continuous duty, service factor 1.1, on IEC standard type. Designing shall be

done on basis of 47.5 degrees package ambient temperature. Motor shall be suitable for soft starter / Star delta/ VFD. Service factor shall not play any role in finalizing the rating of motor.

2) Main Motor Starter: Soft-starter / VFD.
3) Considering all de-rating factors as applicable, rating of soft starter (at 50 degree Celsius) shall match or be greater than the selected main motor rating.
4) Soft starter panel, LCP or any other power/ control panel need to be appropriately forced cooled to maintain the temperature favorable for switch gear employed in panel.
5) Soft starter for motors should be three phase controlled type
6) Appropriate cable (wrt: size, material, and shielding) to be used for soft starter drive.
7) Cables used inside the package must be FRLS type. Sufficient distance to be maintain b/w cables and gas/oil tubings inside the package
8) Routing of soft starter and power cable shall be separated from control supply/ instrument cables.
9) Successful Bidders shall take prior approval of the Make for the items not covered above for which complete technical credentials of the proposed vendors shall be required to be submitted for evaluation by Purchaser/ Consultant
10) Some of the items indicate only Indian makes. Successful foreign bidders may take prior approval of any other make also for which complete technical credentials of the proposed vendors shall be required to be submitted for evaluation by Purchaser/ Consultant.

3.32 Cooling system

Each compressor package shall be complete with its own cooling system. The cooler shall be air-cooled heat exchanger. The gas temperature after after-cooler shall not exceed 52 degree C.

Special attention to be given while designing the gas cooler considering the local conditions. Bidders shall ensure that final delivered gas temperature is less than 52^0C.

Direction of flow should be marked on the pipe line and nomenclature of all vessels (e.g. 1st stage discharge dampener etc.) should be written on them. Cross head inspection windows if applicable should be transparent for ease of inspection during running. Set values should be prominently marked on the gauges.

Packages design should be such that its vent should not go upward (package vent in vertical direction not required) i.e opening of package vent should be in horizontal directional with duct arrangement.

3.33 Oil Filter

The ingress of oil into CNG adversely effects vehicle emission and storage system. Only lubricated cylinder compressors are allowed and vendor shall supply oil separators after cooler at each stage with automatic drain. The maximum permissible oil content in CNG is 5 PPM.

Vendor to supply a proven, maintenance free oil removal system after after–cooler to remove oil from compressed gas. The offered oil mist removal system shall restrict the oil to less than 5PPM in discharge of compressor.

3.34 Gas recovery system

If required, the Vendor shall provide gas recovery system with gas recovery vessel. The gas recovery vessel shall be provided with pressure relief valve and necessary instrumentation to avoid cold flaring of gas. Gas recovery vessel shall be ASME/IBR code designed.

3.35 Piping & Appurtenances

The materials for gas piping shall be seamless carbon steel of ASTM A-106 Grade B. The piping / tubing at the outlet of the compressor and of priority fill system shall be of seamless stainless steel of proper pressure rating and specifications as under:

SS TUBING SPECIFICATIONS:

· Seamless SS Tubing

· Material of construction Stainless Steel 316L

- Tube hardness shall be less than 80 RB
- Sizes : Metric system (inch)
- Max Working Pressure : 326 barg

SS FITTINGS & VALVES SPECIFICATIONS:

- Material of construction Stainless Steel 316
- Sizes : Metric/SI
- Standard : ASTM/ ASME/ DIM
- End connections : Single or Double ferrule Compression type / NPT
- Max Working Pressure : 326 barg
- PSV Vent Line to be extended above the package to safe height.

3.36 Electrical System

- All electrical equipment of compressor package shall be installed in accordance with NFPA 70, NEC for Class 1, Division 1, Group D, and IS 5571 and shall have approval of a recognized certifying authority.
- CLIENT shall provide 415+ 10% volts, 3 phase and 50+ 3% Hz electrical connection at CNG station electrical panel only. Vendor shall distribute electrical power to all equipment and control system by providing cables and suitable switch-gear distribution panel.
- The electrical power supply distribution panel, switch gear panel and starter shall be in flame proof construction. 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.
- Heavy duty on-load phase changeover should be provided for H.E motor.
- Semiconductor fuses to be provided, where applicable.
- All illumination fittings should be single phase AC supply based.
- All wire/ cable to be used in compressor and panel shall be of copper conductor and FRLS type through proper cable tray conduit etc.
- Compressor Motor and hence soft starter/VFD should always start on NO-LOAD for all start method (AUTO or MANUAL mode), selected for operation of compressor, no matter whatever may be the last stopping mode of the compressor viz, programmed or un-programmed. Loading in motor in no manner shall be more than the value as defined by motor manufacturer in motor characteristic curves.
- Sufficient space to be provided for Motor JB for cable glanding work.
- Suitable arrangement to be provided for easy extraction of motor from package
- Multifunction meter to be provided for metering of package total energy and other parameters (viz; KVAH, KWH, Voltage, current, PF, Frequency, MDI (KVA), MD (KWH) inside the panel and output display shall be on HMI screen.
- Bidder to ensure that spares and service support of all switchgears, soft starter, instruments, or meter etc used in package/ panel, shall be available in Indian market.
- Overall power factor of the whole package should not be less than 0.99. vendor have to make arrangement inside the panel to maintain power factor at 0.99 or more by providing through means of SVG(static var generator) / capacitors etc.
- Motor feeder shall be provided with energy meter, MCCB with single phase presenter , contactors (AC-3 Duty), bi-metal relay switch fuse unit, earth leakage relays & voltmeter, push buttons, (for start/stop/trip/ etc. Ammeters should be part of PLC HMI. Stop push buttons shall be lockable and have stay put except in case of critical devices such as lube oil pumps etc.

3.37 Earthing System

The design & installation of earthing system shall be as per IS 3043 or equivalent international specification. One or more no of earth plates with provision of inter connection to main earth grid shall be provided. All hardware used for earthing system shall be hot dip galvanized or zinc passivated.

All cables shall be terminated at equipment by means of double compression type compression glands and shall be flame proof cable glands if located in hazardous area

3.38 Phase sequence preventer (Current based) shall be provided. Phase changeover to be provided for motors controlled through soft starter. Dedicated earth fault/leakage sensing relay to be provided inside the panel for electrical safety

3.39 Vibration

Compressor maximum vibration 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 5mm/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 or vibrations should be limited according to manufacturer safe design. Local flameproof enclosure inside compressor to have provision of extra holes along with dead end plug to accommodate control cables for any future modification.

4.0 INSTRUMENTATION & CONTROLS

4.1 All the instruments and control shall be suitable for area Class I, Group D, Division1

4.2 All package mounted transmitters & temperature elements shall be intrinsic safe as per IEC 79-11 and solenoid valves, switches and related junction boxes shall be flame proof ‘d’ as per IEC 79-1. Other special equipment / instrument, where intrinsic safety is not feasible or available, shall be flame proof/ explosion proof as per IEC 79-1. All pressure gauges shall have an accuracy of + 1% of FSD and 65mm dial size. Pressure sensing elements shall be minimum of SS316 and movement of SS304. All pressure gauges on process lines having range more than 40kg / cm2g.

4.3 Following curve to included along with documents:

a) Discharge flow v/s suction pressure curve
b) Energy consumption v/s suction pressure curve
c) Discharge flow v/s energy consumption

4.4 There shall be provision of Two suction Coriolis based mass flow meters inside the compressor package. Flow meters shall be suitably installed and clamped as per OEM guidelines/ recommendations to avoid measurement errors due to external vibration. Relevant calibration certificates to be provided. Flow meters should have integral display to show instantaneous values of mass flow. The totalizer readings from the flow meter should be communicated to PLC and PLC shall record the flow readings. Shift wise, day wise and month wise flow totalizer readings should be available in PLC display.

4.5 1 Number Thermal Mass flowmeter for measuring Vent loss shall be installed as per Manufacturer’s design.

4.6 The temperature gauge shall be generally mercury in steel field type. Capillary tubing shall be min. SS304 with SS flexible armouring. The gauge shall have an accuracy of +1% FSD and 65mm dial size. The range shall be 1.5 times of operating temperature. In PLC pressure process values should be taken from pressure transmitters and should be independent from pressure gauges installed on local gauge panel. Temperature process values should be taken from temperature transmitters and should be independent from temperature gauges installed on local gauge panel. 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.

4.7 Individual (2/3 core) cabling is required for each field instrument from field JB to avoid multiple JB’s and multicore cables in field for easy trouble shooting & replacement.

4.8 Each cable shall be neatly tagged & dressed for each instrument.

4.9 Make of PLC should be as per vendors list, selection will be as per Bidder/manufacture standard to handle required input/output data specified in the tender .

4.10 There shall be provision of relay for DO cards between PLC & SOV & barriers/ isolators for DI cards between

field & PLC. The barriers and isolators should be multichannel for easier replacement.

4.11 All the instrumentation shall be capable or operating for full range of operation.

4.12 Separate junction boxes shall be provided for each type of signal i.e. analog, digital, solenoids RTD, thermocouple, intrinsic safe and for power supply. No cable shall share power & signal.

4.13 Suitable bypass for interlocks shall be provided for start-up.

4.14 Compressor package shall be provided with the following indicators:

- Pressure indicator each stage suction and discharge.
- Oil pressure indicator on each pressure lubrication system
- Hydraulic oil cooler inlet & outlet temperature on local gauge panel (if required)
- Hydraulic oil pressures each stage on local gauge panel (if required) The Compressor package shall be provided with the following trip devices:
  a. High oil temperature devices
  b. Low suction pressure protection devices
  c. High discharge temperature protection device
  d. Coolant flow low devices
- Flame detection
- Gas detection
- Emergency stop devices
- Fail safe/ wire break alarm for safe operation
- Interlocking provision in PLC program for tripping of machine

The compressor package shall be furnished with the following trip logic that shall stop the compressor and suction of compressor shall be isolated:

- On high oil temperature
- On low suction gas pressure
- On high discharge pressure
- On high discharge gas temperature
- On coolant flow low
- On fire detection
- On gas detection
- On pressing manual sop button at local control panel
- On pressing emergency stop devices

4.15 Compressor package shall be furnished with following tripping circuit (the motor shall stop and suction of compressor shall be isolated)

- On actuation of gas detector alarm.
- On actuation of flame detection alarm.
- On pressing of manual stop button at compressor package
- On pushing of emergency stop device

4.16 Each compressor package shall be provided with an audible and visual alarm system for annunciation on compressor abnormalities.

4.17 Junction box shall be of explosion proof type with 10% extra terminal strip & cable gland shall be of double compression type.

4.18 Gas detectors and flame detectors should be mounted with the canopy.

4.19 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.

4.20 All instrument shall be of internationally reputed manufacturer

4.21 Emergency shut down devices

The emergency shut down (ESD) system is also in scope of vendor. This shall be in accordance with NZS 5425. A fail safe system shall be designed and incorporated to isolate cascades storage from dispensers, stop compressor isolate the compressor suction storage line and cut off power supply on activation of ESD switch. This ESD switch shall have to be manually reset to restart the compressor package again.

4.22 Compressor mounted Control Panel

- There shall be two independent ports available in the PLC with all the parameters available on each individual port.
- One port shall be for remote monitoring of the parameters. Besides PLC display, all the parameters which are measured should be monitored on a HMI/ MMI for remote monitoring as well as of remote operation. Data should be stored at 2 places simultaneously, in case of failure of one device data can be retrieved from second device. Trends, alarms, events should be logged for at least 3 months on day/ hour/ minutes/ basis.
- Second port shall be available for any third party interface which shall be OPC compliant for networking or SCADA. The recorded data or part of the data may be required to transmit to remote locations over open/ secured network through internet/ Ethernet using local cable/ data card/ sim card (GPS/ GPRS/ CDMA). Vendor shall provide fully wired & configured Modem to transmit the data to remote location. This modem shall be dedicated for SCADA connectivity other than the modem for Compressor diagnostic.. Vendor shall provide protocol details to CLIENT and also provide necessary support for third party interface for remote data connectivity.
- PLC shall incorporate all process parameters (specified elsewhere) and status of compressor, engine & priority panels and shall be modular in construction with respect to CPU, Power supply, Interface. PLC components/ system shall be tropicalized, MIL standard adopted with complete wiring and necessary terminals. Wiring to be color coded with cross ferruling in position. PLC shall be capable of carrying out on line routines for at least ten separate loops without affecting the scan, cycle & updating time etc. PLC shall be configured as a remote terminal unit of supervisory computer and data acquisition system complete with GPRS and Ethernet connectivity. One card for transferring and accessing data from minimum twenty devices with RS485 port shall be provided. In case of failure of master/ active controller/ CPU, standby controller/ CPU should take over the control in bump less manner. All values & data should be available through both the controllers immediately, i.e. there should be no data loss.
- Successful bidder to include in scope live demonstration of remote monitoring of all PLC logged parameters in one machine at his works. CLIENT may ask for the same. However, this may be required to be demonstrated at site.
- PLC based logic circuits shall be used for control & interlock of the compressor package with RS485 SCADA Connectivity as per details in Annexure-IX.
- Local control panel shall be furnished with annunciation window (HMI) alarm of individual protection device and a common hooter for audible alarm.
- Local panel should have separate push button for start, stop, emergency stop, alarm acknowledge, alarm rest & test button for checking healthiness of annunciation system will be part of HMI.
- PLC shall be housed inside flameproof IIA/ IIB (Ex'd'). Local operator panel shall also be provided on the flameproof enclosure. The operator panel is provided for parameterization, indication, monitoring, and alarms and first out sequence of the system. PLC system shall have memory modules for storing user programs, symbol lists, program comments and should facilitate debugging/ trouble shooting without the application program. Program shall be ladder logic and communication shall be in English for each run.

Program should have signal/ parameter tags as labels for easy identification/ troubleshooting. Each section of the program whether it is in the form of rung or page or network should have comment to classify the interlock being executed. A soft copy of the program should be sent by email/ CD.

- PLC & electronic shall be housed in flameproof control panel & shall be mounted on compressor skid itself. Main cable entry shall be bottom to up. Also control panel shall have 2 nos. spare 2.5 sq mm slots with copper gland arrangement.
- Bidder to quote for complete package with all relevant panels required for the compressor to perform as desired. The electric panel shall consist of electric MCC, switchgear, contactors, power supply distribution panel etc. and shall be located in hazardous area. The compressor package with control panel (including PLC and other controls) and other electric/ electronic instruments etc. shall meet hazardous area classification of Class I, Division I, Group D as per NEC or Zone I, Group IIA/ IIB as per IS/ IEC.
- CPU shall be redundant (1W+1S) with auto switch over without manual intervene, Power supply, Interface & IO Cards.

4.23 HUMAN MACHINE INTERFACE

HMI shall be provided with text/graphic display and operating system software for interlocking, monitoring and control. All operational buttons shall be on display except the Emergency stop button. 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 back side 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 as well as SCADA.

Power	24V DC +/- 15%
Power consumption	Vendor to specify (VTS)
Processor	32-bit RISC CPU @min.800 MHz
Processor Memory	4 MB Flash memory for program
Device Memory	1 GB min.
Printer port	Yes
Application memory	512K min
Communication port	Modbus / Profibus/ TCP/IP etc. compatible with any PLC
Function keys	As per manufacturer's standard with scrolling keys
Programs	Memory Bits, Memory register, timers, counters etc
Operation Inputs	Digital inputs, Digital Outputs, Analog Inputs,Analog outputs etc
Display resolution	1024(L) X 600 (H) pixels (Minimum)
Touch type	Resistive touch with audible feedback on touch
Display Size & Type	10", TFTLCD /LED with backlight
Color	True color
Contrast ratio	Vendor to confirm
Serial port	RS232, RS 485 excluding programming port

Real time clock (RTC)	Standard Date & Time
Ingress Protection	Front side: IP 65 & Back side: IP 20
Operating Temperature	0-50 degree C
Relative humidity	90%
Dimension (WXHXD)	By vendor
Mounting	Panel mounted,

4.24 Priority fill system

Vendor shall supply 3-bank (6 line) priority fill system with compressor top-up facility inclusive of regulating valves, check & by pass valves, all mounted inside the integrated CNG compressor package. All fittings and tubes used in priority system shall be of stainless steel of suitable pressure rating. The priority fill system is to be installed to ensure that vehicle filling takes priority over cascade filling and direct CNG to three storage banks in correct sequence. The compressor shall shut down once all three-cascade storage banks are filled to 250 barg g. Compressor shall start on pressing of manual start push button & automatically when the cascade storage high bank pressure of compressor falls to 200 barg and shutdown automatically when all 3 stages of stationary cascade are filled to a pressure of 250barg.

4.25 Documents

4.25.1 Operation and Maintenance Manual (In English) – 02 Copies

4.25.2 Calibration certificates of all instruments & devices

4.25.3 P&ID Diagrams

4.25.4 Interlock Block Diagrams

4.25.5 Bill of Material with Tag No & Technical Specifications

4.25.6 Wiring Diagram of Electrical & Instrument Panel

4.25.7 Electrical Power & Control Diagram

4.25.8 Specifications of Electric Motor & Characteristic Curves

4.25.9 Foundation Drawings

4.25.10 Capacity vs. Suction Pressure curve

4.25.11 Capacity vs. Energy Consumption curve

4.25.12 List of special tools & tackles to be provided along with the bid.

5.0 SKID AND ENCLOSURE

Each compressor module shall be housed within a purpose built acoustic enclosure only. The units shall incorporate a rigid framework with a combination of fixed and removable panels. Enclosure wall and doors shall be fire resistant and insulated from inside with rockwool or better shall be used in acoustic enclosure.

The enclosure shall be assembled onto the package base plate at the supplier's works to give a fully transportable unit.

LED Lights used inside package should be designed for 220V AC, 50 Hz supply. There should be an inbuilt provided chain pulley system for handling of heavy equipments like main motor / heat exchange fan motor inside the package

Enclosures shall be designed to include cooling air inlet and outlet louvers together with a forced ventilation system to prevent the possibility of gas build up inside the enclosure. Suitable interlocks shall be built in for clearing entrapped gases (if any) within the enclosures before the startup of the electric motor / compressor.

Packages design should be such that its vent should not go upward (package vent in vertical direction not required) i.e. opening of package vent should be in horizontal directional with duct arrangement.

The maximum temperature within the enclosure shall be limited to 52^0C. Adequate ventilation fans shall be provided to meet the above and also to account heat dissipation of the coolers/ all other components.

Enclosures shall be engineered to give a noise level of maximum 75 $\pm$ 3 Dba + measured at 1 meter. Specifying maximum burn extent with UL certification covering aluminum or steel with perforated steel inner face. Materials shall be non-combustible to deter spread of flame requirements.

The enclosure shall be designed for ease of access to the equipment within and has suitable entry doors.

To prevent the discharge of gas into the enclosure, all safety relief valves within to be connected to a manifold. From this connection a single pipe passes through the enclosure roof to a vent stack to allow satisfactory dispersion of gas at a height of minimum 3m above ground level.

A viewing window at operating level to be fitted to allow monitoring of gauges, etc. without entering the enclosure.

External emergency stop push-button shall be fitted to wall of enclosure close to main access door. Total 3 Nos. of Emergency shut off push buttons with hooter. One to be provided local at package mounted area, one on panel and one in customer interface room (control / sales room). Bidder to assume that the sales / control room and compressor area, each, will be max 50 Mtrs away from the compressor. Bidders to include the cables along with cable trays / flexible PVC ducts for Emergency stop push buttons and have to install the same at the site. Cables shall be PVC insulated with steel armored and of 1.1 KV grade. Any unutilized cables shall be returned to CLIENT with no extra cost.

Enclosure shall have gas detection & Fire detection system consisting of 01 no. Infrared type LEL detectors and 01 no. flame detectors (UV type) shall be provided. The detectors shall be re- calibrated at site during commissioning. Also the performance of the detectors shall be demonstrated at the time of commissioning.

Adequate fixed flameproof lighting (minimum at 1 location) shall be provided inside the enclosure.

Bidder shall optimize the compressor package for minimum possible space requirements considering space constraints of sites where the compressors are proposed for installation.

Suitable gradient shall be provided on the enclosure roof for rain drainage and to avoid water pockets. Enclosures shall be designed with proper rain protection in the ducting or any other cut out to protect the inside equipment from rain water.

For handling of all heavy parts for maintenance purpose suitable lifting arrangement shall be provided according to manufacturer standard i.e. beam fitted with chain hoist arrangement or similar. The chain hoist arrangement i.e. chain pulley block shall be removable type, which can be disassembled and shifted onto the other machines. 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, 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.

All FLP lighting inside enclosure should have LED lamp.

The bidder shall be providing a degree of protection equivalent to IP44 as defined in AS 1939.

All the pressure temperature & level indicators shall be visible from outside of enclosure.

The package shall be protected by automatically operated CO2 flooding system designed as per NFPA-12, which should have minimum following features as stated clause 4.1 of technical specification.

5.1 Painting and protection:

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

Painting of Internal process piping should be either manufacturer standard or as per international color coding standard, e.g- Gas line-Yellow, Water line- green, Air line-Blue, Fire suppressing system – Red etc. The paint

shall be chosen, primed and applied to have a service life of ten years the exterior of equipment and enclosure is required to be corrosion free for ten years.

6.0 INSPECTION & TESTING

a) For all the shop inspection & tests specified to be witnessed by CLIENT or CLIENT's authorized representative. The bidder has to provide 15 days advance notice prior to said inspection & test. The bidder shall be responsible for all sub bidders of specified inspection & testing requirements.

b) Bidder shall keep following data available for at least 5 years for examination by purchaser.

c) All necessary certification of materials, such as mill test reports.

d) Purchaser specification for all items on bills of materials.

e) Test data to verify that requirement of the specification have been met

f) Result of quality control test.

g) Pressure retaining parts including auxiliaries shall be hydrostatically tested with water at following minimum test pressure for a minimum period of 1 hour :

· Cylinder: 1-1/2 times maximum allowable working pressure.

· Cylinder cooling jacket & packing case 1-1/2 times coolant pressure but not less than 8 barg effective.

6.1 Mechanical Running Test (MRT)

a) These tests shall have mechanical operation of compressor, driver and accessories, Instruments, control system and the coolers.

b) The MRT for the 25% compressors block of the lot 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 the premises of compressor block OEM. The compressor need not be pressure loaded for MRT test. During this test following shall be recorded at agreed intervals (as applicable).

- 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, cylinder 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.

6.2 Mechanical String Test

Mechanical String Test for 4 hrs is a mandatory requirement to be performed at packager's shop before despatch in presence of CLIENT representatives (or a third party as arranged by CLIENT). 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. At least 25% of the package lot ordered shall be string tested. String test on N2 or air is not acceptable. It shall be on natural gas.

6.3 Erection, Testing & commissioning at Site

The bidder shall be responsible for erection, testing, commissioning & performance test and noise level test of all packages at site. Commissioning of various equipment and systems shall be carried out by the bidder as per the accepted procedures and as per the instruction of the manufactures of the equipment. The units will be considered commissioned only after the successful performance tests are carried out by the bidder.

The bidder shall ensure integrity of compressor package and safety of electrical supply system available at back end while testing package, at site. Also, bidder shall arrange its own control/ single phase (UPS supply) for testing and commissioning of package.

6.4 Field Trial Run

Bidder shall conduct a field trial run of each online compressor package for minimum 72 hrs. in which satisfactory operation of complete package together with all accessories controls shall be established for specified operation conditions. In case of any defect, discrepancies under specified site conditions, bidder shall first rectify the same and repeat the field trial run. The bidder shall record data of field trial run.

6.5 Noise Level Test

During the field trial run, noise level test shall be carried out and bidder shall demonstrate /achieve the granted noise level. All necessary instruments /accessories required for fields trial run and noise level test shall be arranged by the bidder.

6.6 Performance Acceptance Test (PAT)

Before conducting performance acceptance test at site, Bidder is required to clear all punch points (if any) raised by CLIENT / CLIENT's authorized representative.

Compressor Package Performance test at sites shall be carried out as per ASME PTC9/equivalent according to manufacturer standard. All necessary instruments/accessories required for this test at site shall be arranged by the bidder and repatriated after successful performance test by the bidder.

All such instrument shall be pre-calibrated. In case any defect/deficiency is noticed under the specified site conditions bidder shall first rectify the same and repeat the performance test. Bidder to quote for performance test per compressor package separately at site inclusive of boarding, lodging office space, local transport for bidder personnel and hiring ;of local contractor, crane etc. bidder shall be liable to pay all local taxes, levies applicable and strictly comply with rules, laws prevailing in India.

Performance test shall be conducted at site for minimum 4 hours continuous duration at guaranteed parameters as quoted by the bidder (PAT procedure shall be in accordance with ASME-PTC-09).

However, if load is not available at site intermittent running for 4 hours shall be permitted with maintaining minimum continuous operation of ½ hour. Bidder to submit PG test procedure for review / approval. Complete package shall be performance tested as a module whereby along with motor & compressor performance bidder shall demonstrate all controls, shutdown, trips/alarms etc.

The test shall be the basis of, acceptance/rejection of the package thereon. Bidder shall submit the detail test procedure for the same, which shall be approved by OWNER. The test for the package shall be witnessed by OWNER/ OWNER's representatives.

7.0 GUARANTEE, LOADING AND PENALTY CRITERIA

The bidder shall furnish the guaranteed value for the following:

Compressor Capacity: Compressor shall guarantee the capacity as mentioned in Guaranteed Parameters.

Compressor BKW: Bidder shall indicate guaranteed BKW including all losses such as mechanical, transmission etc.

Motor Power Output of the prime mover (KW)

Total power required for the package including power consumed by accessories.

7.1 Compressor Capacity (As applicable for 400 SCMH)

(As variable input compressor)

a) Bidder shall guarantee 400 SCMH average capacity for variable suction pressure compressor with suction pressure varying from 200 to 15 kg/cm2(g) on continuous basis and suction temperature of 35^0C, discharge

pressure of 255 kg/cm2(g) continuously with the no negative tolerance for errors in instruments and measurements.

(As Online compressor)

b) Bidder shall guarantee 400 SCMH capacity for Online suction pressure compressor with suction pressure varying of 16 kg/cm2(g) on continuous basis and suction temperature of 35^0C, 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 =1.44 SCM

(Based on density of Gas @ 0.692 Kg/SCM)

Density of Gas = Relative Density of Gas (0.56526) X Density of Air (1.22541 Kg/m3)

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.

7.2 Loading:

Loading against Package Gas Loss

The bidder shall design the compressor 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 compressors towards supply, special tools and tackles, erection and commissioning will be loaded as per following formulas:

F = G x H X I X N x W

Where,

F = Loading amount in Rs.

G = Vent/Leakage rate quoted in percentage

H = Cost of Natural Gas per Kg – Rs. 20/- per kg

I = Factor towards lifecycle in hours @ 73,000 hours

N = Number of machines

W = 278 kg for 400 SCMH

Note: Guaranteed parameters shall be confirmed during PAT at site and AMC 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 compressor 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 compressor package. This quoted figure will be used for evaluation and total quoted price for all compressors 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 400 SCMH (278 Kg) of CNG produced

Q = Lowest Energy consumption rate quoted in KWH for every Average 400 SCMH (278 Kg) of CNG produced

H = Cost of Energy INR12/Kwh

I = Factor towards lifecycle in hours @ 73,000 hours

N = Number of machines

Note:

1. Motor rating of more than 50 KW is not acceptable and will be summarily rejected.

2. Guaranteed parameters shall be confirmed during PAT at site and AMC 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.

Penalty towards Excess Gas Loss:

At the start of O&M period or even at any point of time during the O&M period, cost towards excess gas loss beyond the quoted figure shall be deducted from O&M 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 O&M bill

G = Monthly Vent/Leakage loss observed during O&M period

Q = Vent / Leakage loss quoted in percentage

H = Cost of Natural Gas/Kg – Rs. 20/- per Kg

D = Production during the month (Discharge meter)

Considering:

G 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 O&M period or even at any point of time during the O&M period, cost towards excess power consumption beyond quoted figure shall be deducted from O&M 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 278 Kg of CNG x CNG produced during the month / 278

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 400 SCMH

Following calculations shall be used for penalty towards package efficiency loss:

This penalty shall be imposed on compressor blocks not capable of delivering rated capacity of 400 SCMH

Following calculations shall be used for penalty towards package efficiency loss:

F = 2 x {(400 x H x RD x AD) – M}

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 16 Kg/Cm^2.
- In case pipeline pressure at the station itself is less than 16 Kg/Cm2, then the penalty shall be imposed if the package delivery falls below discharge values corresponding to the station pressure.

Penalty for Non-Performance during Period of Maintenance

Details of Penalty for non -performance of equipments

a. On normal day (i.e. the day other than the schedule maintenance day):

i. The party has to ensure that the equipment 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:

- Upto 4 hours: Nil
- 4 hours to 12 hours: Rs. 5,000/- per day
- 12 hours to 24 hours: Rs. 10,000/- per day.
- More than 24 to 72 hours – 50 % of Monthly Maintenance charge
- More than 72 hours up to 7 days – 75 % of total Monthly Maintenance charges shall be deducted
- More than 7 days – Entire Monthly Maintenance charges shall be deducted

Vendor will make all efforts to maintain (availability) for duration of > 98%. In Case of monthly average availability is below 98%. Then penalty @ of Rs 5,000 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 equipments for which the party has to indicate the time required for each type of schedule maintenance.

ii. If the equipment is down for beyond the time indicated for the agreed schedule maintenance, the party would be penalized as per follows:

- Upto 4 hours: Nil
- 4 hours to 12 hours: Rs. 5,000/- per day
- 12 hours to 24 hours: Rs. 10,000/- per day.
- More than 24 to 72 hours – 50 % of Monthly Maintenance charge
- More than 72 hours up to 7 days – 75 % of total Monthly Maintenance charges shall be deducted
- More than 7 days – Entire Monthly Maintenance charges shall be deducted

Note:

- Further, CUGL reserves the right to suspend the CAMC with prior notice of 15 days to the vendor, due to reasons such as lockdown initiated by the Govt due to which Compressor cannot operate/ Shutdown due to the business requirement of CUGL.

- In case of major manufacturing defect observed in package, service provider is required to replace the defective equipment for smooth operation of CNG station. In case bidder fails to do the same, recovery of defective equipment cost shall be done from service provider.
- In case any component of package is not working, maintenance is delayed from schedule and technical issues are not rectified by service provider within the 7 days from intimation given by CUGL, 10% of monthly O&M cost shall be kept hold till the rectification of problem.

8.0 SPECIAL TOOLS AND TACKLES

- Special tools & tackles for erection and commissioning and for operation & maintenance are required to be arranged by successful bidder.
- Vendor shall maintain sufficient spares to fulfill the warranty & subsequent 4 years 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

9.0 DOCUMENTATION

- The drawings/documents to be submitted by the bidder shall be divided in three categories:
  a. Drawing documents to be supplied with the offer
  b. Drawing /document to be submitted for approval (After placement of order)
  c. Drawing/document to be submitted for information (After placement of order)
- The bidder shall submit list of drawings, which shall be submitted by them in above three categories. All drawing /document shall be submitted in 2 sets.
- Title block of each drawing shall contain at least following information:

Name of the Client :

Name of the Consultant :

Name of the Project : ALL IN ONE CNG COMPRESSOR FOR CNG STATION

Name of Bidder :

Descriptive title :

Drg. No :

Revision No :

Sheet No./ Total No. of sheet in the drawing:

- Bidder shall furnish relevant calculation and protection relay setting table for the equipment /system being supplied by them, It shall also contain the manufacture's catalogue, operation and maintenance manuals for all types of relays/components used,
- The bidder shall submit all drawing within specified time, in requisite number, for each equipment/item for approval.
- Approval of drawings by Owner.
- The bidder shall submit furnish drawings as indicated/agreed for each item for approval of the Owner/Consultant.
- Owner/Consultant will scrutinize drawing/data furnished by Bidder and comments, if any, will be communicated to the Bidder within 2 weeks from the date of receipt.
- The Bidder shall submit all the drawings/documents in two (2) sets. All the drawing of sub-bidder/bidders etc. shall be checked by Bidder for correctness and compliance with requirement of order/contract and signed before submission to Owner.
- The drawings shall be stamped in either of following category and one print shall be returned to the Bidder.

"APPROVED"

"APPROVED SUBJECT TO INCORPORATION OF COMMENTS"

"NOT APPOVED"

"FOR INFORMATION ONLY"

- Wherever drawings are returned to the Bidder with the marking "Approved subject to incorporation of comments" the bidder shall make the necessary modifications/corrections and resubmit the revised drawings and data for final approval.
- Bidder shall be responsible for correctly incorporating all the points conveyed to him and resubmit the drawings to the Owner for final approval. Specified number of copies of approval drawing and reproducible of specified quality shall be submitted after the final approval of drawings.
- Approval of drawing by owner shall not relieve the suppliers of his contractual obligations and responsibility for engineering design, workmanship, materials and performance of equipment, Work shall be carried out exactly as indicated on the approved drawings and data and no alterations shall be made without the written approval of the Owner,
- If any subsequent alterations are found necessary and approved by the Owner, all drawings and data affected by such alterations shall be duly revised and re-submitted for the approval.
- Bidder shall incorporate/cause to incorporate all change made in the drawings from approval stage to the handing over of equipment and submit as built drawings in the requisite sets (these will be in addition to the sets submitted at the time of approval/for information and up to commissioning). The drawing to be submitted shall include all the drawings submitted for approval, information as also the drawings required for normal operations, trouble shooting repair, and maintenance and testing of equipment etc.
- Bidder shall submit the following drawings/data/document in bound volume prior to submission of final bill to the Owner in soft and hard copies (2 Sets).
- All drawings submitted to Owner for approval information
- Equipment manufacturing drawings submitted for information of Owner.
- Equipment drawings required for operation and maintenance.
- Fault calculations, protection relay setting calculations and recommended settings.
- Inspection reports, factory and site test certificates in bounded volume.
- As built drawings incorporating all site modifications.
- Instruction manuals
- Operation and maintenance procedures for individual equipment and total system.

ANNEXURES FOR SECTION - I

(BIDDER TO SUBMIT FILLED UP ANNEXURES FOR 400 SCMH SEPARATELY)

ANNEXURE – I : GUARANTEED PARAMETERS

(FILLED SEPARATELY FOR VIP-400 SCMH COMPRESSOR - MOTOR DRIVEN)

For Basis of loading and penalty

Sr. No.	Parameter	Bidder's Data	Unit
1	Average flow capacity Over range of suction pressure from 200 kg/cm2 to 15 kg/cm2 varying on continuous basis.-**when used as Booster compressor** Absolute flow at suction pressure of 16 kg/cm^2 **-when used as Online compressor** Bidder to confirm 400 SCMH	400	SCMH
2	Power consumption of package in KWH for 400 SCMH delivery (basis for loading and penalty)- **when used as Booster compressor**		KWH
	Power consumption of package in KWH for 400 SCMH delivery (basis for loading and penalty)- **when used as Online compressor**		
3	Gas loss as % of production, including loss from SRV, due to oil top ups and idling (basis for loading & penalty)		%

SR. NO.	PARAMETER	BIDDER'S DATA	UNIT
4.	COMPRESSOR BKW IN KW @ RATED CONDITIONS (NO + VE TOLERANCE)		KW
5.	COMPRESSOR BKW IN KW @ RV SET CONDITIONS (NO + VE TOLERANCE)		KW
6.	NET OF ALL AUXILIARIES/PACKAGE VENTILATION LOADS IN KW		KW
7.	SITE RATED BKW OF ELECTRIC MOTOR (NO – VE TOLERANCE)		KW
8.	NOISE LEVEL @ 1 METER FROM ENCLOSURE (REQUIRED 75 ± 3 DBA)		DB
9.	FOOTPRINT AREA OF COMPRESSOR PACKAGE QUOTED (REQUIRED **4.0 SQM – 3.7 M X 1.1 M**)		MTR.X MTR.

Note:

- 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 400 SCMH under the condition described above. Deliver less than 400 SCMH is not acceptable and will be summarily rejected.
- **Motor rating of more than 50 KW is not acceptable and will be summarily rejected**

ANNEXURE – II : COMPRESSOR DATA SHEET

1.0	**PROJECT: CNG Expansion Project**		**DATA SHEET NO:**	
1.1	NO. OF UNITS	:	As Per SOR	DRIVE: Electrical Motor
1.2	DUTY	:	Continuous	LOCATION:
2.0	**OPERATING CONDITIONS**			
2.1	Service/Stage	:	Compressor for CNG Stations/ Three	
2.2	Gas Handled	:	Natural Gas	
2.3	Composition (%)	:	Natural Gas	
2.4	Corrosive due to:			
2.5	Molecular Weight at Intake (Avg.)			
2.6	Cp/Cv at intake/compressibility Factor			
2.7	Relative Humidity			
2.8	Suction Temperature (°C)	:	35°C max	
2.9	Suction Pressure (Kg/cm², Gauge)	:	15-200 Kg/cm² Gauge	
2.10	Discharge Temperature (°C)	:	Maximum 52^0C After Cooler	
2.11	Discharge Pressure (Kg/cm², G)	:	255Kg/cm² (Gauge)	
2.12	Required Capacity (SM³/hr.) : 400			Driver 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	
3.0	**SITE CONDITIONS**			
3.1	Place	:		Installation: Outdoor
3.2	Site Ambient Temp. (°C)	:	Min : 1.7 °C Max : 47.5 °C	Max. Relative Humidity (%) : 90%
3.3	MSL – 205 m			
3.4	Area Classification	:	Class1 Div1 Group D or Zone 1 Div1 Group IIA Group IIB	
4.0	**APPLICABLE CODES & SPECIFICATIONS**			
4.1	Compressor	:	API 11P, 2nd edn. ; API 618	Piping: ASME/ANSI B 31.3
4.2	Driver	:	Electrical Motor Data Sheet	
4.3	Air Cooled Exchangers	:	API 661	Water cooled exchangers : TEMA 'C' - NA
4.4	Pressure Vessel	:	ASME Sec. VIII Div.1/2	Control Panel : Refer Tech Specs
5.0	**MANUFACTURER'S SPECIFICATION**			
5.1	Name	:		Model:
5.2	No. Off	:		Compressor RPM/Stroke (mm):
5.3	Type	:		Drive Arrangement:
5.4	Service/Stage			
5.5	Mol. Wt. At Intake (Avg.) (Gas Composition)	:		Cp/Cv Value/ Compressibility Factor at Intake
5.6	Adiabatic Power (KW)	:		Shaft Power @ RV set pressure (KW)
5.7	Driver Rating & Speed (KW/RPM)	:		Noise level:

5.8	Suction Line (Size/ Rating)	:		Discharge Nozzle (Size/Rating)
5.9	Direction of Rotation from Driving End:			
5.10	Compressor Weight :	Max. Erection Weight:		Max. Maintenance Weight::
5.11	Diff. Pr. In Suc. Strainer, Piping, puls Dampener:		Diff. Pr. In after Cooler	

5.12	PERFORMANCE DATA OF PACKAGE			
	Gas	Suction Pr 15 kg/cm2g		
		Ist Stage	IInd Stage	IIIrd Stage
	Mol. Wt at intake			
	Specific Gravity			
	Cp/Cv Value / compressibility Factor at intake			
	Cp/Cv Value / compressibility Factor at discharge			
	Suction Pressure, kg/cm2 g			
	Suction Temp. °C	35		
	Suction capacity, SM3 / Hr			
	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			
5.13	DESIGN DATA	Suction Pressure 200 Kg/ Cm2g		
		Ist Stage	IInd Stage	IIIrd Stage
	Mol. Wt at intake			
	Specific Gravity			
	Cp/Cv Value / compressibility Factor at intake			
	Cp/Cv Value / compressibility Factor at discharge			
	Suction Pressure, kg/cm2 g			
	Suction Temp. °C	35		
	Suction capacity, SM3 / Hr			
	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			
6.0	**CYLINDER & PACKAGING DATA**			

6.1	Service / stage	Ist Stage	IInd Stage	IIIrd Stage
6.2	Cylinder bore (mm/No. off)			
6.3	Single / Double Acting			
6.4	Liner (yes/ No.)			
6.5	Type of Valves			
6.6	Piston Displacement (M3/Hr)			
6.7	Volumetric Efficiency (%) Min/ Nor/max			
6.8	Mean Piston Speed(m/sec) [<3.5 m/sec]			
6.9	Suction / discharge valve gas velocity (m/sec)			
6.10	Relief valve setting (kg/cm2 g)			
6.11	Max. allowable cylinder pressure (kg/cm2 g)			
6.12	Max. allowable cylinder temperature (°C)			
6.13	Pneumatic Test By (kg/cm2 g)			
6.14	Hydrostatic test (kg/cm2 g)			
6.15	Hydrostatic test water jacket (kg/cm2 g)			
6.16	Suction / discharge nozzle orientation			
6.17	No.of suction / discharge valves			
6.18	Piston Rod Dia (mm)			
6.19	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			
6.20	Max. Permissible Piston Rod loads (kg)			
6.21	Rod packing cooling by liquid (yes/No.)			
6.22	Rod packing lubrication (Yes/No)			
6.23	Rod packing vent to			
6.24	distance piece type			
6.25	Cylinder jacket cooling by			
7.0	**LUBRICATION SYSTEM**			
7.1				
	□ Splash	□ Force feed Lubricated		
	□ Pressure lubrication including piping, valves and	□ 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 reqd,	□ Lubricator equipped with sight 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 hr)		
	Change lube oil after	Hours		
	Type of bearing : Main Big End:	Small End:		
8.0	**COMPRESSOR CONTROLS**			
8.1	□Automatic start / stop on storage pressure level and manual start stop	□ Actuators (To be included in supply)		
8.2	□Automatic drain of separators	□ Manual on machine		

8.3	□ Compressor to start automatically after power interruption with 10 seconds delay.		□ Intermediate devices (to be included in supply)		
8.4	□Automatic recovery of gas form gas recovery vessel		□ Solenoid valves		
8.5	□Automatic closing of suction isolating valve on compressor trip		□ Manual -mounted in a local panel.		
			□ Controller(For auto control)		
			□ Pressure switches (For auto control)		
8.6	Compressor shall unload on Power failure/ stoppage through (Vendor to indicate) □Automatically □ Manually		□ Any other instrument required.		
8.7	Compressor shall load on start through (Vendor to indicate)		□ Automatically □ Manually		
8.8	Recommended time duration for compressor operation @ 0% capacity (minutes)				
8.9	Recommended number of starts/ stops for the Motor : Per Hours				
AUXILIARIES					
9.0	**COOLERS**				
9.1.1		Oil Cooler (Required)	After cooler	Inter coolers	
9.1.2	Cooler Type				
9.1.3	Tube Material				
9.1.4	Tube sheet material shell Material				
9.1.5	Shell Material				
9.1.6	ASME / IBR CODE STAMP/TPIA	Yes	Yes	Yes	
9.2	Suction Strainer	Temporary Mesh Size			
9.3	Volume Bottles / Pulsation Dampers		1st Stage	2nd Stage	3rd Stage
9.3.1	Type at Suction /Discharge				
9.3.2	Residual Pulse Amplitude (peak to peak)		3% / 3%		
9.3.3	Maximum Allowable Working Pressure (kg/cm2g)				
9.3.4	Capacity (M3)				
9.3.5	ASME / IBR CODE STAMP/ TPIA		Yes	Yes	Yes
9.4	Separator	1st Suction	1st Discharge	2nd Discharge	Final Discharge
9.4.1	Type				
9.4.2	Max allowable Pr (kg/ cm2g)				
9.4.3	Capacity (M3)				
9.4.4	ASME / IBR CODE STAMP /TPIA	Yes	Yes	Yes	Yes
9.5	Oil Mist separator at final discharge to limit oil carry over to 5 PPM				
9.5.1	Type			Capacity:	
9.5.2	Max allowable Pr (kg/ cm2g)			ASME / IBR CODE STAMP /TPIA: Yes	
9.6	Gas Recovery vessel			Capacity:	
9.6.1	Max allowable Pr (kg/cm2g)				
9.6.2	ASME / IBR CODE STAMP /TPIA			yes	
10.0	**INSTRUMENTATION**				
10.1	PRESSURE INDICATION			PRESSURE SWITCHES	
10.2	Gas At inlet			Frame oil header (1 no. For trip on low pressure.)	
10.3	Gas at discharge (each stage)			Jacket water system failure	
10.4	Frame oil Header			Compressor discharge Pr high (Each stage)	
10.5	Frame oil filter (Differential local)			Compressor discharge Pr Low (Final stage)	

10.6	Gas at after cooler exit (local)	Compressor suction pressure low
10.7	Hydraulic Oil Pr. (each stage)	Compressor suction pressure high
10.8	**TEMPERATURE INDICATION**	Frame High vibration
	Gas at suction to compressor	TEMPERATURE SWITCHES
	Gas at Discharge of Comp (Each stage before cooler)	Temperature after compressor discharge before cool (each stage)
	Gas at after cooler	
10.9	Oil cooler oil outlet	
10.10	**OTHER INSTRUMENTS**	**LEVEL TRANSMITTERS**
10.11	Junction Box with interconnecting wiring	Suction K.O.D (for automatic drain)
10.12		Discharge K.O.D (for automatic drain)
10.13	Pressure Relief Valve at discharge each stage	BAFFLE FLOW SWITCHES OR ORIFICE DIFF. PRESS SWITCHES
10.14	Pressure Relief Valve at suction to compressor	Low cooling water flow
10.15		Water outlet -after cooler
10.16	Instruments for closed circuit cooling water system	SIGHT FLOW INDICATORS
10.17	Hour meter	As reqd. in close ckt. cooling system
10.18	Gas detection system	Sight flow indicators, cylinder and packing lubrication oil lines
10.18	Flame detection system	LEVEL GAUGE AND INDICATORS
10.19	Forced feed lubrication failure to stop comp.	Frame oil (Bull's eye type)
10.20	Priority fill panel	Packing / cylinder lubrication oil
10.21	Emergency shut down system	Make up water tank
10.22	Other instrument for safe running of compressor	
	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)	
11.0	**INSTRUMENT PANEL**	
11.1	PNEUMATIC CONTROLS FOR	TRIP CIRCUIT TO BE CONNECTED TO MAIN DRIVER CONTROL SWITCH
11.2	Capacity Indication	Cause of shut down
11.3	Pressure Regulator	Frame Oil Pressure-Low
11.4		Low Cooling Water Flow
11.5	PUSH BUTTONS AND SIGNAL LIGHTS FOR	
11.6	Main Motor & Aux.Motors	Compressor discharge PR.(Each stage)
11.7	Ammeters for main and Aux. Motors	Compressor suction Pr. Low
11.8	ESD	Compressor suction Pr.
11.9	Common machine trip-alarm	
11.10	**Following to be included in vendor's scope of supply :**	
11.11	All interconnecting oil gas water piping & tubing as per schematic attached.	

11.12	All electrical power distribution and interconnection as specified.				
11.13	Intrinsically safe system for trips (Ref. Inst. specs)				
11.14	Electrical circuits to be housed in Explosion Proof Cabinet (Refer Elect. & inst. Specs)				
11.15	Electrical circuits to be provided for repeating pre alarm and trip alarm on the local panel.				
11.16	Annunciation system with test / acknowledgement push buttons & sole first off sequences				
11.17	Motor Interlock against loaded start				
11.18	Motor Interlock against start without air cooler fan running				
11.19	Motor interlock against start without pre-lubrication				
11.20	Provision shall be made for common alarm and trip alarm				
11.21	Any additional instruments & controls required for safe operation of compressor (as recommended by compressor vendor)				
12.0	**MATERIAL OF CONSTRUCTION & GRADES**				
12.1	Stage	1st	2nd	3rd	Remarks
12.2	Cylinder & Head				
12.3	Liner				
12.4	Piston				
12.5	Piston Ring				
12.6	Piston Shoe (Wear Band)				
12.7	Valve seat				
12.8	Valve stop				
12.9	Valve / plate / Ring				
12.10	Valve spring				
12.11	Cylinder Packing Ring				
12.12	Crank Shaft F.S (Forged steel)	Connecting Road (CR) F.S	CR cap. Bolts FS		
12.13	Main bearing: Big End Beating: Small end bush:				
12.14	Piston Rod Yield strength Hardness(RC) Surface Finish				
12.15	Pulsation Dampers / Volume Bottles	Suction/Discharge KOD			
12.16	Non Return Valve- Shall be compressor Discharge valve type				
13.0	**INSPECTION AND TESTING**				
13.1	X-ray examination for welded joints for heat exch./ Press. Vessel / gas Piping (Certificate to be furnished)	NO only TC			
13.2	Ultrasonic testing for piston rod, connecting rod, crank shaft, big end bolts, main brg. studs.	YES			
13.3	Magnaflux testing for crankshaft, piston rod, connecting rod	YES			
13.4	Dye penetrant testing for cylinder liners , piston	YES			
13.5	Shop inspection by purchaser during construction	YES			
13.6	Barring over to check clearance	YES			
13.7	Mechanical running test with shop job driver at compressor vendor's works	YES			
13.8	Stripping check and internal inspection	for one comp			
13.9	Hydrostatic test of Cylinders, Pressure Vessels	Yes			
13.10	Leak proof test of crank case (min 24 hrs with With kerosene)	Yes			
13.11	Fit up test at compressor packager's	Yes			
13.12	Performance Acceptance Test	YES			
13.13	Field noise level test	YES			
13.14	Field trial run at site for 12 hours	YES			
13.15	Functional / continuity tests - control panel (At sub vendor's works)	YES			

13.16	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 & Pumps	Safety Relief Valves (Temp / F	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.								
	Service								
	Size Type (Induced Force)					Craft/No. of Bays			
	Surface per Unit-Finned Tube (m2)					Bare Tube (m2)			
	Heat Exchanged (KW)					MTD. Eff °C			
	Transfer Rate * Finned Tube : Bare Tube, Service Clean W/m2 °C								
	PERFORMANCE DATA-TUBE SIDE								
				Min. Suc. Pr.		Normal. Suc. Pr.		Max. Suc. Pr	
				In	Out	In	Out	In	Out
	Gas Composition	Inter Cooler 1st Stage	Flow Kg/s						
			Temp °C						
			Pr. Kg/cm2						
			Total Heat KJ/Kg						
		Inter Cooler 2nd Stage	Flow Kg/s						
			Temp °C						
			Pr. Kg/cm2						
			Total Heat KJ/Kg						
		After Cooler Stage	Flow Kg/s						
			Temp °C						
			Pr. Kg/cm2						
			Total Heat KJ/Kg						

	Oil Cooler Stage	Flow Kg/s						
		Temp °C						
		Pr. Kg/cm2						
		Total Heat KJ/Kg						
	Water/Air Cooler Stage	Flow Kg/s						
		Temp °C						
		Pr. Kg/cm2						
		Total Heat KJ/Kg						
	Total Heat all streams KJ							
	Pressure Drop Allow/Calc Kg/cm2 g							
	Soft Starter/Star Delta Data Sheet to be provided by the Compressor.							

	Performance –Data –Air Side
	Air Quantity (Total Kgs.)

ANNEXURE - III - DATA SHEET FOR ELECTRIC MOTOR

ITEM NO.:			As per requirement
QUANTITY:			
DESCRIPTION:			
A.	APPLICABLE SPECIFICATION AND STANDARDS		IS:325 / IEC / EQUIVALENT INTERNATIONAL STANDARDS
B.	SERVICE CONDITIONS:		
		Max. Ambient Temp. (Deg. C)	
		Min. Ambient Temp. (Deg. C)	
		Design Ambient Temp. (Deg. C)	
		Altitude Above MSL (MTS)	
		Relative Humidity (Max.) (%)	
		Environment	
		Location (Indoor / Outdoor)	
		Area (Safe / Hazardous)	
C.	SYSTEM CHARACTERISTICS:		
		Systems Voltage with ± %	415 V ±10%
		Number of Phases	3
		Rated Frequency with ± %	50 Hz ±5%
		Combined Variation	±10%
		Fault Level	25 KA
		Space Heater Supply	Space heater for 30KW & above rating motor
		Low Voltage Stator Winding Heating Supply	NA
D.	Motor Rating / Details:		
		Rated Output	As per Vendor
		Rotor Type	Squirrel Cage
		Syn. Speed (RPM)	As per pump and fan vendor
		Direction of Rotation	Bi-Directional
		Insulation Class	‘F’, Temperature Rise Limited to ‘B’
		Duty	S1, Continuous
		Winding Treatment	Moisture Protection Varnish
		Insulation Process	Anti Corrosive Treatment
		Starting Method	Star / delta
		Starting Current	Vendor to Furnish
		Minimum Voltage Start at Terminal	80% of 415V
		Starting Torque	Min. 200% of FLT
		Pull Out Torque	
		No. of Hot Starts	2 Nos.
		No. of Cold Starts	3 Nos.
		Shaft Extension	Required
		Type of Coupling	
		Earth Terminals	2 Nos. on Body & 2 Nos. on T. Box
		Greasing Arrangement	Yes
		Name Plate	Yes, as per IS:325
		Starter Connection	Vendor to Furnish
		Efficiency at	
		100% load	
		75% load	
		50% load	
E.	ENCLOSURE:		
		Degree of Protection	EExd IP55
		Mounting Arrangement	As per requirement.
		Type of Cooling	TEFC
F.	TERMINAL BOX		
i)	Terminal Box (Main)		1 No.
		Type	

		Fault Withstand	
		No. of Terminals	6 Nos.
		Side of Terminal Box seen from the Driven End	RHS
ii)	Auxiliary Terminal Box		--
	1.	Separate Terminal Box for	
		Space Heaters	YES
		Thermisters	--
G.	TESTS TO BE WITNESSED		
		Type Tests	CMRS test certificate to be furnished
		Routine Tests	As per IS:325
H.	ACCESSORIES		
		Anticondensation Heaters	Yes
		PTC Thermisters	NA
		Voltage Rating of Space Heaters	230V, …..
		Foundation Bolt	Yes
		Cable Glands	Required
		Earthing Terminals	Body & T. Box
		Motor peak Amplitude Vibration at no Load at Bearing should not exceed	40 Microns for 1500 RPM 15 Microns for 3000 RPM
		Max. Motor Noise Level Measured at a Distance of 1.5 Mts. from Motor	75 dB
I.	CABLES		
	1.	Type & Size	
		- Motor	Vendor to furnish
		- Space Heater	Vendor to furnish
		- Thermister	NA
	2.	Cable Lugs	
		- For Motor	Copper
		- Space Heater	Copper
		- Control Cables	NA
	3.	Cable Glands – Type Material	
		- Motor	FLS-Double Compression, Ni-Cd Plated
		- Space Heater	FLS-Double Compression, Ni-Cd Plated
		- Control Cables	FLS – Double Compression Ni-Cd Plated
		J. PAINTING	
		TYPE	Epoxy
		SHADE (AS PER IS:5)	692 (Smoke Grey)

Note:
Certificate from Compressor block manufacturer towards guaranteed shaft power calculation at 400 SCM per hour compression (on given parameter) and from Motor manufacturer towards their KWh consumption (KWh on guaranteed parameters) on above guaranteed shaft power to be submitted by bidders along with bid. A confirmation is required from bidders prior to bid opening.

ANNEXURE – IV

LIST OF MOTORS

S.No.	DESCRIPTION	KW	DUTY	QTY.

NOTE: -Motors are in hazardous area classification Zone 1 and Zone 2. Therefore, the Motors shall be flame proof. Vendor shall furnish the list of motor(s).

ANNEXURE – V: SPECIFICATIONS OF INSTRUMENTS

SPECIFICATION OF CORIOLIS MASS FLOW METER (SUCTION)

Sl. No.	PARAMETER	REQUIREMENT
1.	Fluid	Compressed Natural Gas
2.	Measuring Principle	Coriolis Principle
3.	Operating Pressure	**200 (max.) bars ,16 (Normal) bars, 8 (min.) bars**
4.	Molecular Weight	17 – 22
5.	Ambient Temperature	0 – 60 ^{O}C
6.	Hazardous area classification	Class I, Div I, Gas Group D as per NEC or Zone1,Group IIA/ IIB as per IS/IEC specifications
7.	Range of operation	250 – 650 SCMH 194 – 500 KG/HR
8.	Accuracy	± 0.5% of indicated flow accepted (over the whole operating range on gas)
9.	Rangeabiliy for specified accuracy (Min.)	50:1
10.	Line Size	2.0 "(Flange type),300# WNRF (Material: 316 L)
11.	Pressure drop at max. flow	< 0.2 Kg/cm^{2}g
12	Repeatability	± 0.25% or better
13.	Material - Tube	SS 316 or Better
14.	End Connection	To suit the line size(1.0") , Flange connections
15	Power supply (nominal)	230±10% V, 50±2 Hz, 1 Φ
16	Outputs (Active)	
16.1.	4 – 20 mA dc	Reqd.
16.2.	Frequency	Reqd.
16.3.	RS 485	Reqd.
17	Outputs Informations	
17.1	Mass Flow rate	Reqd.
17.2	Mass totalizer, non-resettable	Reqd.
17.3	Temperature	Reqd.
17.4	Integral Display	Display all outputs with specified accuracy, programmable and sequential with password protection, Touch screen or touch keypad type
18	Communication	**MODBUS with RS485**
19	Mounting	Field mounting
20	Certification	Hazardous area compatibility, Weather proof certification i.e. IP 67 ,Material Test, Manufacturer's certification, Custody Transfer approval, AGA 11 Conformance certification and Calibration Certificate on water and Natural Gas from accredited test labs with traceability acceptable internationally

SPECIFICATION OF CORIOLIS MASS FLOW METER (DISCHARGE) & (PART OF DISPENSER)

Sl. No.	PARAMETER	REQUIREMENT
1.	Fluid	Compressed Natural Gas
2.	Measuring Principle	Coriolis Principle
3.	Operating Pressure	**300 (max.) bars ,250 (Normal) bars, 100 (min.) bars**
4.	Molecular Weight	17 – 22
5.	Ambient Temperature	0 – 60 ^{O}C
6.	Hazardous area classification	Class I, Div I, Gas Group D as per NEC or Zone1,Group IIA/ IIB as per IS/IEC specifications
7.	Range of operation	250 – 650 SCMH 194 – 500 KG/HR
8.	Accuracy	± 0.5% of indicated flow accepted (over the whole operating range on gas)
9.	Rangeabiliy for specified accuracy (Min.)	50:1
10.	Line Size	0.5 "(TUBE END)
11.	Pressure drop at max. flow	< 0.2 Kg/cm^{2}g
12	Repeatability	± 0.25% or better
13.	Material - Tube	SS 316 or Better
14.	End Connection	To suit the line size (0.5") ,
15	Power supply (nominal)	230±10% V, 50±2 Hz, 1 Φ UPS
16	Outputs (Active)	
16.1.	4 – 20 mA dc	Reqd.
16.2.	Frequency	Reqd.
16.3.	RS 485	Reqd.
17	Outputs Informations	
17.1	Mass Flow rate	Reqd.
17.2	Mass totalizer, non-resettable	Reqd.
17.3	Temperature	Reqd.
17.4	Integral Display	Display all outputs with specified accuracy, programmable and sequential with password protection, Touch screen or touch keypad type
18	Communication	**MODBUS with RS485**
19	Mounting	Field mounting
20	Certification	Hazardous area compatibility, Weather proof certification i.e. IP 67 ,Material Test, Manufacturer's certification, Custody Transfer approval, AGA 11 Conformance certification and Calibration Certificate on water and Natural Gas from accredited test labs with traceability acceptable internationally

SPECIFICATION OF THERMAL MASS FLOW METER (TO MEASURE VENT LOSS)

SR. NO.	PARAMETER	REQUIREMENT
1	Fluid	Natural Gas
2	Measuring Principle	Thermal
3	Operating Pressure	50 mbar g
4	Molar Mass	17 -22
5	Ambient Temperature	0-60°C
6	Hazardous area classification	Class I, div I Gas Group D as per NEC or Zone 1, Group IIA / IIB as per IS / IEC Specification
7	Range of Operation	0.6 - 16 SCM/Hr
		0.5 - 12 Kg / Hr
8	Measured Error Mass	± 1.5% of indicated flow accepted (over the operating range of 2-12 Kg/Hr on gas)
9	Meter Size	0.5"
10	Pressure drop at max. flow	2 mbar max.
11	Repeatability	± 0.5% or better
12	Material Tube	SS 316 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	
17.1	Mass Flow Rate	Required
17.2	Mass Totalizer, non – resettable	Required
17.3	Temperature	Required over MODBUS
17.4	Integral Display	Display all outputs with specified accuracy, programmable and sequential with password protection. Touch Screen or Touch Keypad Type
17.5	Density	Required
17.6	Pressure	Required
17.7	Volume flow rate	Field configurable with password protection for molecular weight range: 17 to 22
17.8	Volume flow totalizer	Field configurable with password protection for molecular weight range: 17 to 22
17.9	Periodic mass & totalizer, non-resettable	Four (one each monthly, daily, fortnightly and one for configurable period)
18.	Programmer	Calibration software, perpetual licence 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
19	Communication	MODBUS with RS 485,
20	Mounting	Field mounting, (Vertical)
21	Certification	PESO

SPECIFICATION SHEET FOR FLAME DETECTORS

1	**Flame detectorType:**	UV and IR Detector
2	**Wave Length**	UV radiation over the range of 180 to 250 nanometers (1800 to 2500 angstroms)
		IR radiation in therange of 4.35 Microns range.
3	**Field of View**	120° cone of vision (or) Better.
4	Sensitivity	Approved Performance Specification-50 feet (15.2m) distance for a 1 sq. ft (0.092m2)heptane fire.
5	Response Time:	Less than 3 seconds
6	Status Indicator:	LEDs indicate status of Healthy, fault, and alarm conditions
7	Operating Medium	Natural Gas.
9	Nominal supply voltage:	24 VDC
10	Supply voltage range:	20 to 32 VDC
11	Maximum supply current:	400 mA during COPM only
12	Typical current:	80 to 150 mA Depends on relays ETC
13	Maximum output signal load:	600 Ohms
14	**Output signals:-**	**4-20mA, Relay, HART or RS485**
	a). Analog (mA):	
	Output signal range:	0 to 20 mA *
	FAULT signal:	0 to 0.2 mA *
	COPM fault signal:	2.0 ± 0.2 mA *
	Ready signal:	4.0± 0.2 mA
	IR only signal:	8.0 ± 0.2 mA
	UV only signal :	12.0 ±0.2 mA
	WARN signal:	16.0 ±0.2 mA
	ALARM signal:	20.0 ± 0.2 mA
	b). Relay Contacts: (Alarm and Fault)	Fire relay (alarm)- NO and NC required. (Latching / Non-Latching, Selectable) Fault relay - NO and NC required. Contact rating : Contact rating 30 VDC, 2 A or 125 VAC, 1 A
	c).HART or RS 485	Latest HART protocol 6 \ 7 or RS 485
15	**Vibration**	As the detector will be installed inside the reciprocating compressor package , these will be prone to vibrations .So the detector should be capable to resist the vibration level up to 14 mm/s.
16	**Complete Approvals (Sensor, Transmitter and Terminal box /**	CCOE/ PESO,CSA, FM, ATEX, HART Registered, and AMS Aware

	Junction Box)	Class 1, Div 1, groups B, C, and D (-40°C to +65°C),Type 4X, Exd IIC ,T5
17	**SIL**	SIL 2 (Exida or TUV report or certificates)
18	**PESO (**Petroleum & Explosive Safety Organisation)	PESO Approval is Mandatory for the Quoted Model .
19	**Ingress Protection**	IP66/67, NEMA 4
20	**Reliability**	IEC 61508
21	AMS Aware:	Certified by AMS
22	RFI/EMI Protection:	Complies with EN 50130-4, EN 61000-6-4
23	**RFI/EMI Protection:**	Complies with EN 50130-4, EN 61000-6-4, EN 60079-0:2009; EN 60079-1:2007 or latest
24	**WARRANTY**	Two year warranty against sensor and electronics for the supplied product. ONSITE SERVICE TO BE PROVIDED DURING WARRANTY PERIOD
25	**UV/IR Sensor and Transmitter's MOC**	**Housing:** UV/IR Sensor Housing with LED Display and Relay Unit, in anodized Aluminum with powder coated finish only from OEM with prior approval from CLIENT (Explosion proof enclosure).
26	**Accessories Required**	**Mounting:** SS Roof mounted or wall mounted. For threaded type detectors suitable termination box (approved for use inside hazardous area) shall be provided.The detector shall be supplied with suitable accessories etc as applicable for installation 2 No's Cable Glands (3/4" Double compression)
27	FLAME DETECTOR BUILT-IN TEST	AUTOMATIC AND MANUAL TEST
28	FLAME DETECTOR IMMUNITY	False alarm sources like Arc welding, X-Ray's or hot vibrating object, lightening.
29	**Manuals (soft and Hard Form)**	Operation,Maintenance,Calibration and Troubleshooting
30	**Software (soft and Hard Form)**	Software or additional device, cables required for calibration or troubleshooting of instrument shall be supplied free of cost with instrument.
31	FLAME DETECTOR CALIBRATION	must be inbuilt or else calibration device must be supplied along with FD at free of cost.
32	CALIBRATION PROCEDURE	(BOTH ZERO AND SPAN) FOR THE MODEL QUOTED TO BE PROVIDED IN DETAIL
33	CERTIFICATES:	Vendor shall provide all documentry evidence for the above certificates
	Note:	
1	Complete Unit shall be of single OEM make for (UV/IR Sensor, Transmitter with Local LED indication & Relay).	
2	The Make, Model no., Part.no.(Sensor, Transmitter,JB) and any accessories quoted shall be clearly mentioned in the technical bid.	
3	Any deviation to the specification shall be clearly mentioned in the tender document	

SPECIFICATION SHEET FOR GAS DETECTORS

1	**Type**	Infrared Sensor with Transmitter, with Local Display and Indicator
2	**Design**	**(4 Channel Double compensated having heated optics design/ IR with self heated optics design).**
3	**Measurement Range**	0-100% LEL
4	**Operating Medium**	Natural Gas.
5	**Operational and Certified Temperature Range**	65 °C Maximum
6	**Power Supply**	18 to 32Vdc(24Vdc nominal)
7	**Power Consumption (IR Sensor)**	< 4.5W max
8	**Current Demand**	< 235 mA at 18V
		< 190 mA at 24V
		< 155 mA at 32V
9	**Output Signals :-**	4-20mA, Relay, HART or RS 485
	a).Analog (mA):	4-20mA,Non-Isolated,Current Source or Sink.
	Maximum 4-20mA Loop Resistance	600 Ohms
	Measuring Range (0-100% FSD)	4-20 mA
	Inhibit	1 to 3mA(Default 2mA)
	Warning	0 to 6mA(Default 3mA)
	Fault	1mA
	Over-Range	20 to 21.5mA(Default 21 mA)
	b).Contact output:	03 Relay output: (Alarm 1, Alarm 2 and Fault). Contact rating: 2 A, 230 VAC/24 VDC.
	c). HART or RS 485	Latest HART protocol 6\7 or RS485
10	**Status Indicator:**	Status indication: LED indication along with real time Local Display of %LEL. Indication for No gas leak, Low alarm, High alarm, optics failure and calibration in progress shall be available
11	**Vibration**	As the detector will be installed inside the reciprocating compressor package , these will be prone to vibrations .So the detector should be capable to resist the vibration level up to 14 mm/s.
12	**Accuracy**	± 3 % LEL through-out the range.
13	**Response Time (T 90)**	Less than 10 seconds
14	**IR Sensor and Transmitter's MOC**	**Housing:** IR Sensor Housing SS316. Display and Relay Unit Housing shall be Aluminum with powder coated finish only from OEM with prior approval from CLIENT (Explosion proof enclosure)**Mounting:** SS Roof mounted or wall mounted. For threaded type detectors suitable termination box (approved for use inside hazardous area) shall be provided.

15	**Accessories Required**	The detector shall be supplied with suitable Sunshade/ Deluge protection,Strom baffle,Weather protection,Dust barrier,Gassing Cap, etc as applicable protection against dust particles.
16	**Safety Approval / Certificate**	Required Safety SIL-2 approval for IR Sensor and Transmitter having display & Relays and Terminal box / Junction Box.
17	**ATEX/UT/UT/CSA/FM/CCOE**	ATEX: BAS992259X II 2GD EEx d IIC T100°C (Tamb -40°C to +55°C) T135°C (Tamb -40°C to +65°C)
		UL / CSA Class 1, Div 1, groups B, C, and D (-40°C to +65°C) GOST and SAA
		CE,IEC,EEC,EMC, CENELEC AND Eexd.
		IP66/67, NEMA 4
18	**PESO (Petroleum & Explosive Safety Organisation)**	PESO Approval is Mandatory for the Quoted Model
19	**SIL Documents**	SIL 2 (Exida or TUV certificates only)
		SIL 2 Certification is required and it should be certified to IEC 61508(Exida or TUV certificates only).
20	**Performance Approval**	EN61779 EXAM, BVS 03 ATEX G 016 X, CSA,FM C22.2 152
21	**EMC Compliance Software**	EN 50270 ; EN 50271 , EN 6100 or latest
22	**Manuals (soft and Hard Form)**	Operation, Maintenance, Calibration and Troubleshooting
23	**Software (soft and Hard Form)**	Software or additional device, cables required for calibration or troubleshooting of instrument shall be supplied free of cost with instrument.
24	**Gas Detector Calibration Facility**	Must be inbuilt or else calibration device must be supplied along with GD at free of cost.
25	**Calibration Procedure**	(BOTH ZERO AND SPAN) For the model quoted to be provide in detail.
26	**Certificates :**	Vendor shall provide all documentry evidence for the above certificates
	Note:	
1	Complete Unit shall be of single OEM make for (IR Sensor, Transmitter with Local Display & Relay).	
2	The Make, Model no., Part.no.(Sensor, Transmitter,JB) and any accessories quoted shall be clearly mentioned in the technical bid.	
3	Any deviation to the specification shall be clearly mentioned in the tender document	

SPECIFICATION FOR KWH METER

1	**Meter type**	3Phase 4 wire Static Energy meter
2	**Accuracy class**	0.5 S as per IS14697
3	**Connection**	Transformer Operated
4	**Rated Voltage**	240V(P-N), 415V(P-P) ± 10%
5	**Rated Basic current**	5A
6	**Rated maximum current**	10A
7	**Rated Frequency**	50 HZ
8	**Power Factor range**	Zero lag- Unity- Zero lead
9	**Standards compliance**	IS 14697, IEC 62052-11, IEC 62053-21, IS 15959
10	**Calibration**	Meter shall be calibrated at factory and no modifications should be permissible
11	**Energy Audit Data**	a. Meter serial number b. Date and time c. Cumulative forwarded active energy d. Cumulative reactive energy - Lag e. Cumulative reactive energy - Lead f. Cumulative forwarded apparent energy g. Cumulative Maximum Demand in kW and kVA with date and time
12	**Metering philosophy**	**Metering should be 2 quardrant lag only and programmed accordingly**
13	**Auto/Manual Scroll mode**	a. LCD test b. Date c. Time d. Cumulative Active Energy e. Cumulative Apparent Energy f. Cumulative Reactive Energy – Lag g. Cumulative Reactive Energy – Lead h. Active Maximum demand with date and time i. Apparent Maximum demand with date and time j. Active load k. Reactive load l. Apparent load m. Phase wise power factor n. Average power factor o. R phase voltage p. Y phase voltage q. B phase voltage r. R phase current (line) s. Y phase current (line) t. B phase current (line) u. Instantaneous average power factor with sign for lag/lead v. Frequency reading
14	**Maximum demand Registration**	Meter should store and display maximum demand in kW/kVA with date and time. Demand integration period should be 30 minutes. It is preferred that MD is computed using separate counter rather than by difference of initial and final energy counter.
15	**Auto Reset of Maximum Demand**	Meter should reset to zero and date should be customisable date

SPECIFICATIONS FOR DISCHARGE FILTER

SUPER FINE FILTER (Coalescing Filter)

Super fine filter for removal of liquid (e.g. water & oil) and solid particles down to 0.01 microns out of compressed natural gas

Residual Oil Contents less than 0.01 mg/m3.

Filter Designed :

Paint Compatible
CE mark in accordance with European Directive for Pressure Equipment, PED (97 / 23 / EC)
Are Designed to meet the ATEX European Directive for Explosion Protection, (94 / 9 / EC)
All natural gas filters in accordance to CE Eex 2GD IIB T6.

Standard equipment:
Complete filter including manual drain.

Specification Filter Elements.

Filter Fabric : Borosilicate Microfibre Fabric coated with polypropylene homopolymer support - fabric.

Drainage Layer: Parafil - Fibre fabric incorporated in the filter fabric (Without Foam Sock)

Rib Mesh : Stainless Steel VA 1.4306
Temperature : + 1 ° C to + 80 ° C
Direction Of Flow : From Inside to Outside.

NOTE : Bidder to get the inspection done by TPIA accordance with European Directive for Pressure Equipment, PED (97 / 23 / EC) if CE marks are not available.

ANNEXURE – VI: RECOMMENDED VENDOR LIST

Item code / Description	**AIR FILTER REGULATORS**
VENDOR NAME	**Remark**
ASEA BROWN BOVERI LTD.	
BLUE STAR LTD	
DIVYA CONTROL ELEMENTS PVT. LTD.	
PLACKA INSTRUMENTS & CONTROLS PVT. LTD	
SHAH PNEUMATICS	
SHAVO NORGREN (I) PVT. LTD	
VELJAN HYDRAIR PVT. LTD.	
PARKER	
SWAGELOK	
VANAZ ENGINEERS LIMITED	
ITEM CODE / DESCRIPTION	**COALESCENT FILTER / REGULATORS**
VENDOR NAME	**REMARK**
ASEA BROWN BOVERI LTD.	
BLUE STAR LTD	
PLACKA INSTRUMENTS & CONTROLS PVT. LTD	
SHAH PNEUMATICS	
SHAVO NORGREN (I) PVT. LTD	
V AUTOMAT & INSTRUMENTS PVT. LTD.	
VELJAN HYDRAIR PVT. LTD.	
COMPAC NEWZEALAND	
ITEM CODE / DESCRIPTION	**FIELD INSTRUMENTS (P, DP, F,L,T)**
VENDOR NAME	**REMARKS**
ABB AUTOMATION LTD.	
ASHCROFT	
BROWN BOVERT LTD.	
MURPHY	
CCS	
WAREE	
FISHER ROSEMOUNT INDIA LIMITED	
FISHER ROSEMOUNT SINGAPORE PTE LTD.	
FUJI ELECTRIC CO. LTD.	
HONEYWELL INC.	
TATA HONEYWELL	
YOKOGAWA ELECTRIC CORPORATION	
YOKOGAWA BLUE STAR LTD.	
WIKA	
DRUCK	
BEKO	

FILTRATION TECHNIQUE	
ITEM CODE / DESCRIPTION	**PRESSURE GAUGES**
VENDOR NAME	**REMARKS**
AN INSTRUMENTS PVT. LTD.	
BADOTHERM PROCESS INSTRUMENTS B. V.	
BOURDON HAENNI S.A	
BRITISH ROTOTHERM CO. LTD	
BUDENBERG GUAGE CO. LTD.	
DRESSER INC.	
GENERAL INSTRUMENTS CONSORTIUM	
MANOMETER (INDIA) PVT. LTD.	
NAGANO KEIKI SEISAKUSHO LTD.	
WAAREE INSTRUMNETS CONSORTIUM	
BAUMER	
WALCHANDNAGER INDUSTRIES LTD.	
WIKA ALEXANDER WIEGAND & CO GMBH	
WIKA INSTRUMENTS INDIA PVT. LTD.	
DRUCK	
ASHCROFT	
BEKO	
FILTRATION TECHNIQUE	
ITEM CODE / DESCRIPTION	**TEMPERATURE GAUGES**
VENDOR NAME	**REMARKS**
AN INSTRUMENTS PVT. LTD.	
GENERAL INSTRUMENTS LTD	
WIKA	
ASCHCROFT	
BAUMER	
ITEM CODE / DESCRIPTION	**PRESSURE RELIEF/SAFETY VALVE**
VENDOR NAME	**REMARKS**
ALSTHOM FLUIDS SAPAG	
ANDERSON GREENWOOD CROSBY	
BHEL (TRICHY)	
ASPRO	
DRESSER INC.	
FUKUI SEISAKUSHO CO. LTD.	
INSTRUMENTATION LTD. (PALGHAT)	
NAKAKITA SEISAKUSHO CO LTD.	
NUOVO PIGNONE SPA (ITALY)	
PARCOL SPA	
SAFETY SYSTEMS UR LTD.	
SARASIN RSBD	

SEBIN VALVES INDIA PVT. LTD.	
TAI MILANO SPA	
TYCO SANMAR LTD.	
TYCO VALVES & CONTROLS INDIA PVT. LTD	
SWAGELOK	
PARKER	
COMPAC NEWZEALAND	
FARINOSLA	
FAINGER LASER	
MERCER	
FISHER ROSEMOUNT (EMERSON)	
OFE & OE GROUP KEYSTONE VALVES PVT. LTD	
BARODA SEBIM VALVES PVT. LTD.	
HALOL	
ITEM CODE / DESCRIPTION	**SUCTION & DISCHARGE FILTER**
VENDOR NAME	**REMARKS**
BEKO FILTER	
ULTRA FILTER	
FILTRATION TECHNIQUE	
PARKER	
ITEM CODE / DESCRIPTION	**VIBRATION SWITCH**
VENDOR NAME	**REMARKS**
MURPHY	
METRIX	
ROBERTSHAW CONTROL	
ITEM CODE / DESCRIPTION	**CARTRIDGE FILTERS**
VENDOR NAME	**REMARKS**
BEKO FILTER	
ULTRA FILTER	
FILTRATION TECHNIQUES	
ZANDER GMBH (GERMANY)	
GRAND PRIX FAB (PVT.) LTD., NEW DELHI	
MULTITEX FILTRATION ENERGY PVT. LTD.,	
ITEM CODE / DESCRIPTION	**AIR COMPRESSOR**
VENDOR NAME	**REMARKS**
INGERSOL RAND (IR)	
ELGI	
ANESTA IWATA MOTHERSON	
EMTEX	
KPCL	
CHICAGO PNEUMATICS	

ITEM CODE / DESCRIPTION	SELF ACTUATED PR. CONTROL VALVE
VENDOR NAME	**REMARK**
DANIEL INDUSTRIES INC	
DRESSER PRODUITS INDUSTRIES	
ASPRO	
ESME VALVES LTD.	
FISHER ROSEMOUNT SINGAPORE PTE LTD.	
FISHER EXMOX SANMAR LIMTED	
GORTER CONTROLS B.V.	
INSTROMET INTERNATIONAL NV	
KEYE & MACDONALD INC	
NUOVO PIGNONE SPA (ITALY)	
PIETRO FIORENTINI SPA	
RICHARDS INDUSTRIES (FORMERLY TRELOAR)	
RMG REGEL + MESSTECHNIK GMBH	
VANAZ	
NIRMAL INDUSTRIES LIMITED	
COMPAC INDUSTRIES LTD., NZL.	
ITEM CODE / DESCRIPTION	**SOLENOID VALVES/ACTUATOR**
VENDOR NAME	**REMARK**
ALCON ALEXANDER CONTROLS LIMITED	
ASCO (INDIA) LIMITED	
JEFFERSONS	
ASCO JOUCOMATIC LTD.	
ASCO JOUCOMATIC SA	
AVCON CONTROLS PVT. LTD.	
BARKSDALE INC.	
BLUE STAR LTD.	
HERION WERKE	
SCHRADER SCOVILL DUNCAN LIMITED	
SEITZ AG	
ROTEX AUTOMATION LIMITED	
OPERATED VALVES ASCO	
PARKER HANIFEN	
HABONIM VASS	
FESTO	
COMPAC NEW ZEALAND	
MICROMECANICA	
ITEM CODE /DESCRIPTION	**SPECIAL CONTROL VALVES**
VENDOR NAME	**REMARK**
FISHER ROSEMOUNT SIGAPORE PTE. LTD.	
FLOWSERVE PTE. LTD. (FORMERLY DURIRON)	

HOPKINSONS LIMITED	
METSO AUTOMATION PTE LTD. (FORMERLY NELES)	
NUOVO PIGNONE SPA (ITALY)	
SPX VALVES & CONTROLS (FORMERLY DEXURIK)	
COMPAC IND. LTD. NZL	
ITEM CODE /DESCRIPTION	**TWO WAY / THREE WAY VALVES/ 2-WAY DRAIN VALVES**
VENDOR NAME	REMARK
SWAGELOK	
PARKER	
COMPAC	
HAMLET	
HYLOCK	
SEALEXCEL	
OASIS	
STAUFF	
SSP	
ITEM CODE /DESCRIPTION	**FLAME DETECTOR/ SURGE PROTECTORS**
VENDOR NAME	**REMARK**
MEGGITT AVIONICS	
GENERAL MONITORS/ MSA	
SPECTREX	
DETRONICS	
HONEYWELL	
NET SAFETY	
CROW ON	
SIEGER	
ISOLATORS	
BARRIERS	
ESP SAFETY	
PHOENIX	
P&F	
MTL	
ASPRO	
ITEM CODE /DESCRIPTION	**GAS DETECTOR (IR TYPE)**
VENDOR NAME	**REMARK**
DETRONICS	
HONEYWELL	

NET SAFETY	
GENERAL MONITORS/ MSA	
CROW ON	
SIEGER	
ESP SAFETY	
DRAGGER	
ITEM CODE /DESCRIPTION	**PLC**
VENDOR NAME	**REMARK**
SIEMENS	
SCHNEIDER	
ALLAN BRADLEY, ROCKWELL	
ROCKWELL AUTOMATION	
EMERSON	
HONEYWELL	
YOKOGAWA	
ABB	
PHOENIX	
ITEM CODE /DESCRIPTION	**COMPRESSOR MAIN MOTOR**
MAKE	**REMARK**
CROMPTON GREAVES	
SIEMENS	
WEG	
ABB	
LHP	
KIRLOSKAR	
BHARAT BIJLEE	
ITEM CODE /DESCRIPTION	**MAIN MOTOR VFD STARTER**
MAKE	**REMARK**
SIEMENS	
SCHNIEIDER	
FUJI	
ABB	
ITEM CODE /DESCRIPTION	**SOFT STARTER**
MAKE	**REMARK**
SIEMENS	
SCHNEIDER	
ABB	
FUJI	
ITEM CODE /DESCRIPTION	**CO2 CYLINDER VALVE WITH ACTUATOR FOR CO2 FLODDING SYSTEM**
VENDOR NAME	**REMARK**
GINGEKERR	
CEODUEX (ROTAREX)	
KIDDE	
FIKE	
ANSUL	
LPG	

VTI	
ROTEX	
KEW	
ITEM CODE / DESCRIPTION	**SS TUBING**
VENDOR NAME	**REMARK**
SANDVIK	
FAE	
TUBACEX (SCHOELLER-BLECKMNN)	
PARKER	
RATNAMANI	
ITEM CODE / DESCRIPTION	**SS FITTINGS/ VALVES**
VENDOR NAME	**REMARK**
SWAGELOK	
PARKER	
ABAC	
HAMLET	
HYLOK	
VOSS	
SSP	
STAUFF	
ITEM CODE / DESCRIPTION	**MASS FLOW METERS**
VENDOR NAME	**REMARK**
EMERSON PROCESS MANAGEMENT	**CORIOLIS TYPE**
ENDRESS & HAUSER CMBH & COMPANY	**CORIOLIS TYPE & THERMAL MASS TYPE**
MAGNETROL	**THERMAL MASS TYPE**
PROCESS CONTROL DEVICES (PCD)	**THERMAL MASS TYPE**
ITEM CODE / DESCRIPTION	**FLP SWITCH**
VENDOR NAME	**VENDOR NAME**
BALIGA	
FCG	
FPE	
FLEXPRO	
ITEM CODE / DESCRIPTION	**SWITCHES/FUSES/CONTRACTORS**
VENDOR NAME	**REMARK**
L&T	
GEC	
SIEMENS	
ITEM CODE / DESCRIPTION	**CABLES & WIRES**
VENDOR NAME	**REMARK**
CORDS CABLES INDUSTRIES	
ASSOCIATED CABLES	
INCAB	

UNIVERSAL CABLES LTS/OEM Cables	
ASEAN	
CCI	
FORT GLOSTER	
FINOLEX	
KEI	
POLYCAB	
HAVELLS	
ITEM CODE / DESCRIPTION	**PRESSURE TRANSMITTERS**
VENDOR NAME	**REMARK**
DRUCK	
WIKA	
HONEY WELL	
ABB	
ROSMOUNT	
WAREE	
ITEM CODE / DESCRIPTION	**RTDs**
VENDOR NAME	**REMARK**
GENERAL INSTRUMENTS PVT LTD	
NAGMAN SENSORS PVT LTD	
PYRO ELECTRIC	
WIKA	
SIEMENS	
BAUMER	
WAREE	
ALTOP	
ITEM CODE / DESCRIPTION	**PLUG VALVE**
VENDOR NAME	**REMARK**
AIR & NORDSTROM VALVES INC	
XOMOX	
SANMAR INDIA LTD, NEW DELHI	
AIR & NORDSTROM VALVES INC	
SERCK AUDCO VALVES	
SUMITOMO CORPORATION	
FISHER XOMOX SANMAR	
L&T (AUDCO INDIA LTD, CHENNAI)	
PARKER	
STAUFF	
ITEM CODE / DESCRIPTION	**ON OFF BALL/NEEDLE VALVE**
VENDOR NAME	**REMARK**
PARKER	
SWAGELOK	
ABAC	

SPIRAX SARCO	
WORCESTER	
WAREE	
BAUMER	
STAUFF	
SSP	
L&T	
SANKEY CONTROL	
ROTEX	
AUDCO	
ITEM CODE / DESCRIPTION	**PRESSURE & TEMPERATURE SWITCH**
VENDOR NAME	**REMARK**
INFOS	
SWITZER	
CCS	
ITEM CODE /DESCRIPTION	**REGULATORS**
VENDOR NAME	**REMARK**
COMPAC IND. LTD.	
FISHER ROSEMOUNT SIGAPORE PTE. LTD.	
FLOWSERVE PTE. LTD. (FORMERLY DURIRON)	

Notes:

1. Above vendor list is indicative only and any other vendor(s) apart from as mentioned above may be accepted subject to approval by Owner/Owners representative based on their past track record / credentials. However, no relaxation or advantage in delivery period will be given to the successful bidder on account of this approval.
2. For the vendors of items not covered in above vendor list, but required for completion of project successfully, supplier shall take approval form Owner/Owners representative for the same during project execution. Bidder shall submit the required certifications, documents, PTR and Performance letters from clients for the same.

ANNEXURE – VII : VENDOR DATA REQUIRED

S. NO	DESCRIPTION	PRINTS WITH BID	CERTIFIED INFORMATION REQUIRED AFTER PURCHASE ORDER	
			FOR REVIEW	FOR RECORDS
A	GENERAL			
1	PROJECT SCHEDULE		YES	YES
2	DULY FILLED-IN "CHECKLIST FOR COMPLETENESS OF BID"	YES		
3	DULY FILLED-IN "CHECKLIST FOR SCOPE OF SUPPLY"	YES		
4	"NO DEVIATION "	YES		
5	UTILITIES REQUIREMENT SUMMARY	YES		YES
6	FLANGE DETAILS OF PIPING CONNECTION WITH CONNECTION AT BATTERY LIMIT		YES	
7	DULY FILLED IN EXPERIENCE RECORD PROFORMA	YES		
8	GUARANTEE PARAMETERS AS SPECIFIED	YES		YES
9	TENTATIVE LOAD DATA FOR FOUNDATION DESIGN			YES
10	LIST OF SUB-VENDORS FOR ALL BOUGHT OUT ITEMS INCLUDING ELECTRICAL & INSTRUMENTATION ITEMS		YES	
11	LEAFLET, CATALOGUES FOR ALL ITEMS		YES	
12	O & M MANUAL		YES	
13	PERFORMANCE ACCEPTANCE TEST PROCEDURE		YES	YES
14	TYPICAL PESO APPROVAL WITH DRAWINGS AND DOCUMENTS	YES	YES	YES
B	**COMPRESSOR**			
1	DATASHEETS FOR THE FOLLOWING			
A	- COMPRESSOR	YES	YES	YES
B	- HEAT EXCHANGERS		YES	YES
C	- PRESSURE VESSELS		YES	YES
D	- ELECTRIC MOTOR	YES	YES	YES
2	CATALOGUE FOR COMPRESSOR	YES		YES
3	TYPICAL CROSS SECTIONAL DRAWING AND LITERATURE TO FULLY DESCRIBE THE DETAILS OF OFFERING			YES

S. NO	DESCRIPTION	PRINTS WITH BID	CERTIFIED INFORMATION REQUIRED AFTER PURCHASE ORDER	
			FOR REVIEW	FOR RECORDS
A	- COMPRESSOR			YES
B	- SUCTION VALVE			YES
C	- DISCHARGE VALVE			YES
D	- PISTON ROD GLAND PACKING & PISTON RINGS			YES
E	- LUBE OIL PUMP			YES
4	V-BELT & PULLEY WITH SELECTION CHART & CALCULATION			YES
5	COOLER DATA / DRG WITH THERMAL & MECH DESIGN CALCULATION		YES	
6	DESIGN CALCULATION, GA DRGS FOR PULSATION DAMPNER		YES	
7	PIPING & INSTRUMENTATION DIAGRAMS FOR THE FOLLOWING	YES	YES	
A	- PROCESS GAS		YES	
B	- LUBE OIL		YES	
C	- COOLING WATER		YES	
8	TORQUE ANGLE DIAGRAM, PISTON ROD LOAD VS CRANK ANGLE		YES	
9	TORQUE SPEED CHARACTERISTICS		YES	
10	ACOUSTIC / MECHANICAL EVALUATION REPORT		YES	
11	ITEMIZED PRICE LIST OF ESSENTIAL SPARES		YES	
12	ITEM LIST OF SPARES WITH PRICE FOR 5 YEARS		YES	
13	DRG. FOR TESTING ARRANGEMENT & TEST PROCEDURE TO BE ADOPTED		YES	
14	CERTIFICATE FOR FOLLOWING:		YES	
A	HYDRAULIC TESTING		YES	
B	NON DESTRUCTIVE TESTING		YES	
C	MATERIAL COMPOSITION & PHYSICAL PROPERTIES		YES	
D	LEAK PROOFNESS TEST OF FRAME		YES	
E	LUBE PUMP, FRAME OIL PUMP, HYD OIL PUMP		YES	
15	DESIGN / ACTUAL ASSEMBLY CLEARANCE CHART		YES	
16	TEST RECORDS OF FOLLOWING			

S. NO	DESCRIPTION	PRINTS WITH BID	CERTIFIED INFORMATION REQUIRED AFTER PURCHASE ORDER	
			FOR REVIEW	FOR RECORDS
A	MECHANICAL RUNNING S		YES	
B	PERFORMANCE TEST / PACKAGE TEST		YES	
C	NOISE LEVEL TEST YES		YES	
17	LIST OF SPECIAL TOOLS & TACKLES FOR INSTALLATION & MAINTENANCE	YES		YES
C	**ELECTRIC MOTOR**			
1	MOTOR DATA SHEET	YES	YES	
2	TECHNICAL LITERATURE / CATALOGUE, SELECTION CHARTS, NOMOGRAPHS ETC.	YES	YES	YES
3	GA DRAWING	YES	YES	
4	TERMINAL BOX ARRANGEMENT DRAWING		YES	
5	MOTOR CHARACTERISTIC CURVES		YES	
6	TORQUE SPEED CURVES		YES	
7	CURRENT TIME CURVES		YES	
8	P.F AND EFFICIENCY		YES	
9	TYPE TEST CERTIFICATES		YES	
10	CERTIFICATE FROM THE RELEVANT STATUTORY AUTHORITY (BASED ON THE COUNTRY OF MANUFACTURE) FOR SUITABILITY OF THE OFFERED MOTOR FOR INSTALLATION IN THE SPECIFIED AREA CLASSIFICATION		YES	
11	PRE-COMMISSIONING AND COMMISSIONING PROCEDURE		YES	
D	**INSTRUMENTATION**			
1	G.A. OF INSTRUMENT PANEL WITH BILL OF MATERIAL & WIRING DIG. FOR LCP		YES	
2	INSTRUMENT DATASHEET		YES	
3	LOGIC DIAGRAM / LADDER DIAGRAM / FUNCTIONAL DIAGRAM		YES	
4	LOOP SCHEMATIC		YES	
5	INTER CONNECTING DIAGRAM		YES	
6	OPERATING / CONTROL WRITE UP		YES	
7	ALARM / SHUT DOWN LIST7		YES	
8	WIRING DIAGRAM / INTER		YES	

S. NO	DESCRIPTION	PRINTS WITH BID	CERTIFIED INFORMATION REQUIRED AFTER PURCHASE ORDER	
			FOR REVIEW	FOR RECORDS
	CONNECTING PIPING			
9	START UP AND SHUT DOWN WRITE UP		YES	
10	START UP AND SHUT DOWN INLET LOCK DIAGRAM		YES	
11	ALARM AND SHUTDOWN LIST WITH SET POINT		YES	
12	LOAD CONTROL PANEL LAYOUT		YES	
13	TERMINATION DIAGRAM, PANEL WIRING DETAIL		YES	
14	LOOP SCHEMATIC		YES	
15	INTER CONNECTING DIAGRAM		YES	
16	CABLE SCHEMATIC		YES	
17	BILL OF MATERIAL		YES	
18	TEST / INSPECTION CERTIFICATE		YES	
19	LIST OF RELIEF VALVES WITH SETTINGS		YES	
20	CERTIFICATE FROM THE RELEVANT STATUTORY AUTHORITY (BASED ON THE COUNTRY OF MANUFACTURE) FOR SUITABILITY OF THE OFFERED INSTRUMENTS FOR INSTALLATION IN THE SPECIFIED AREA CLASSIFICATION		YES	

ANNEXURE – VIII: DEVIATION SCHEDULE FOR INTEGRATED CNG COMPRESSOR PACKAGE

Vendor:		
S.No.	Vendor to specify Specification number and clause number against which Deviation is sought	Description of Deviation and give reasons in support of Deviation
	----------NO DEVIATION----------	----------NO DEVIATION----------

ANNEXURE – IX : DELETED

ANNEXURE –X: EXPERIENCE PROFORMA RECORD

A) EXPERIENCE RECORD PROFORMA OF INTEGRATED CNG COMPRESSOR PACKAGE				
SR. NO	**DESCRIPTION**	**INFORMATION OFFERED COMPRESSOR**		**INFORMATION OF EXISTING COMPRESSOR**
	REQUIREMENT AS PER TENDER	**Min.: 400 sm3/h**		
1	Status of bidder			
	a) Compressor manufacturer			
	b) Electric Motor manufacturer			
	c) Packager			
2	**COMPRESSOR**			
	Name of compressor manufacturer			
	Place of compressor manufacturer			
	Compressor model			
	Anticipated Life in running hours			
	Compressor max frame BKW			
	Comp Manufacturing code			
	Lubricated or non lubricated			
	Nos of stages			
	Max stage temperature ^{o}C (150^{o}C)			
	Compressor max RPM			
	Compressor operating RPM			
	Piston speed m/s			
	Vibrations at comp cylinders <10 mm / sec. Unfiltered peak velocity Vibration comp frame : Unfiltered peak velocity of 5 mm/sec or 200 micron unfiltered peak to peak vibration whichever is less			
	Material for all stages			
	Cylinder (C.S)			
	Piston Rings (PTFE)			
	Rider Rings (PTFE)			
	Piston Rod (Forged steel)			
	Valve (Rings / plates / spring) : (SS/SS/SS)			
3	**PERFORMANCE OF COMPRESSOR**			
	GUARANTEED POINT:			
A	Flow capacity (overfull range of suction pressure from 15 barg to 200 barg)			

A) EXPERIENCE RECORD PROFORMA OF INTEGRATED CNG COMPRESSOR PACKAGE				
SR. NO	**DESCRIPTION**	**INFORMATION OFFERED COMPRESSOR**		**INFORMATION OF EXISTING COMPRESSOR**
	REQUIREMENT AS PER TENDER	**Min.: 400 sm3/h**		
B	Minimum Flow capacity corresponding to suction pressure of 16 barg.			
C	BKW required by compressor including compressor's lube oil pump BKW			
D	Power required for all fans including radiator fan in Kw			
E	Ventilation fans for enclosure No of fans Type of fans (included or forced draft)			
F	Site Capacity of Motor (max of "B+D" above) * 1.1			
	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			
	---- Piston rod : max design			
	--- Piston rod: calculated at safety set pr condition			
	--- Max cross head pin loading: Design '			
	--- Cross head pin loading: calculated at safety set pr condition			
	Guaranteed gas loss through rod deals; sm3/h			
	Other information of compressor			
	a) Year of manufacturing of the compressor			
	b) Name and address of user with FAX no, phone no, E-mail address			
	c) Nos of hours the compressor have clocked on bid due date (Enclose certificate from user)			
4	**ELECTRIC MOTOR**			
	Make			
	Model			
	Rating			
	Speed			

A) EXPERIENCE RECORD PROFORMA OF INTEGRATED CNG COMPRESSOR PACKAGE				
SR. NO	**DESCRIPTION**	**INFORMATION OFFERED COMPRESSOR**		**INFORMATION OF EXISTING COMPRESSOR**
	REQUIREMENT AS PER TENDER	**Min.: 400 sm3/h**		
5	**PACKAGE**			
	Name of Packager			
	Place of Packaging			
	Name of Enclosure Manufacturer			
	Palace of enclosure manufacturer			
	Sound level at 1 m distance from package in db (A) 75±3			
	Skid size (LxBxH)			
	Skid Gross Weight (Comp. + Motor + Aux.) Kg			
	Make and model LEL detector – 1 no. each comp			
	Make and model fire detector – 1 no. each comp			
	2 nos. min C02 cylinder with online weight monitoring.			
	Volume of enclosure in m3			
	Nos. of explosion proof tube light in each enclosure			
	Coupling Direct / V – belt			
6	**Other information of complete package**			
	a) Year and place of manufacturing of the package			
	b) Name and address of user with FAX no, phone no, E-mail address			
	c) Nos of hours the complete package have clocked on bid date (enclose certificate from user)			
7	**Gas recovery system**			
	Gas recovery system with pr relief valve, pr regulator, pr gauge, manual & automatic drainage system			
8	**Gas Delivery system**			
	High pr piping with SS 316, tubing, compression fittings, NRV			

A) EXPERIENCE RECORD PROFORMA OF INTEGRATED CNG COMPRESSOR PACKAGE				
SR. NO	**DESCRIPTION**	**INFORMATION OFFERED COMPRESSOR**		**INFORMATION OF EXISTING COMPRESSOR**
	REQUIREMENT AS PER TENDER	**Min.: 400 sm3/h**		
	KOD			
	Coalescent filter			
	PLC based Priority panel with full bore ball valve			
	Final gas outlet connection from priority panel 3/4" SS valves and 1" OD SS compression fittings			
9	**ESD system**			
10	**Volume bottles / dampers at each compressor stage of compressor**			
	Vessels			
	Drainage system			
11	Manual double isolation valve			
12	Automatic valves			
13	**Heat exchanger**			
14	Code of construction API 661			
15	Gas sections of coolers shall be as per API – 11P requirements			
16	Tube material			
17	Piping between stages shall be continuous with flange connection			
18	Other tubing shall be SS 304/ 316 as per TS.			
19	Gas recovery vessel provided			
20	Area classification; " class 1, group D, division 1 as per NEC " OR " Zone 1, group IIA / IIB as per IS/IEC"			
21	The size of the complete package			
25	Instrumentation as indicated in TS			
30	Cabling – Double compression type cable glands and copper lugs			
31	Junction box with metallic enclosure			

ANNEXURE – XI : PARAMETERS FOR SCADA

Parameters required for SCADA

We want to monitor / control all parameters available on the PLC through SCADA system.

Hardware Details: Connector Type, Communication Standard, Communication port Pin details,

Communication Port Configuration: Baud Rate, data bits, stop bit, parity

Polling Constraints: Minimum time period between two consecutive poll cycles.

Protocol Details: Protocol name and message structure for different read / write functions.

Function codes for reading digital and Analog inputs

Function code for writing analog values in the IED registers

List of parameters available in the IED which can be accessed from the IED through serial port.

Register address of each parameter in the IED.

System to be provied for remote / local monitoring of paramters like Kwh, Amperes,voltage, power factor, HMR, flow meter readings etc

A Sample of the details is given below for understanding:

PROTOCOL DETAILS:

Sr.No.	Description	**Content/Details**
1	Protocol	MODBUS RTU
2	Connection Type	FCC –68 RJ45
3	Communication standard	RS232D
4	Signals supplied	Tx, Rx, GND
5	Baud Rate(Speed)	300, 600,1200,4800,9600,19200
6	Format	Software configurable
7	Port Configuration	Speed : 19,200 bps Data Bits : 8 Bits Stop Bit : 1 Bit Parity : None
8	Min. Time period between consecutive Query	2 Sec.

Ø PORT PIN Details:

Ø Example: RS232 Pin Details:

- § IED SCADA
- § RJ45
- § GND
- § DTR
- § RTS
- § TXRX
- § RXTX
- § CTS
- § DCR
- § DCD

Ø Function Code & Message Structure:

Function Code: 3 – Read Output Register
Poll Format:
Address 1 Byte
Function 1 Byte
Start Item 2 Byte

NO. ITEM 2 BYTE
Response Format:
Address 1 Byte
Function 1 Byte
Length 1 Byte
Date Item 1 4 Byte
Date Item n 4 Byte

Ø Function Code & Message Structure:

Function Code: 2 – Read Input Status
Poll Format:
Address 1 Byte
Function 1 Byte
Start Item 2 Byte

NO. ITEM 2 BYTE
Response Format:
Address 1 Byte
Function 1 Byte
Length 1 Byte
Date Item 1 2 Byte
Date Item n 2 Byte

Memory Mapping, Data Type & Parameter Information:

A. Digital Parameters :

Sr. No.	Description	Address
1	Flow computer malfunction Alarm	8247
2	Mass Flow Low alarm	8245
3	Mass Flow High alarm	8246

B) Analog Parameters:

Parameter	Register details			
	Engineering Range and Unit	GC Register	Register Format	
Density	Kg/m3 (500-600)	8655-56	Float	
Pressure		8657-58	Float	
Temperature		8659-60	Float	
Mass Flow Rate		8661-62	Float	
Totalized mass flow		8663-64	Float	
Yesterday's Total Mass flow		8665-66	Float	
Today's Total Mass Flow		8667-68	Float	
Corrected volumetric Flow rate		8669-70	Float	
Yesterday's Total corrected Volumetric Flow		8671-72	Float	
Totalized Mass Flow at 6 AM (Snapshot of cumulative)		8673-74	Float	

ANNEXURE – XII

QUALITY ASSURANCE PLAN

Sr.No	Description	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By		
						Vendor	TPIA	Owner/ Owner's Representative
1.1	Hydrotest of Cylinder, Press. Vessels, Heat Exchangers		Technical Specification	Technical Specification	Test Report	W	W	R
1.2	Hydrotest of Cylinder Heads		Technical Specification	Technical Specification	Test Report	W	R	R
1.3	Leak Proof Test of Crank Case (4 Hours . with Kerosene) Refer Note :4		Technical Specification	Technical Specification	Test Report	W	W	W
1.4	Ultrasonic Test of - Crank Shaft, Connecting Rod, Piston Rod Etc. Refer Note: 1		Technical Specification	Technical Specification	Test Report	R	R	R
1.5	Magnetic Particle Test of - Crank Shaft, connecting Rod., Piston Rod Refer Note: 1		Technical Specification	Technical Specification	Test Report	R	R	R
1.6	Radiography as Applicable - Pressure Vessels, Heat Exchanger. Gas Piping (Only 10% Joints To Be Witnessed)		Technical Specification	Technical Specification	Test Report	W	W	R
1.7	Barring Over to check Cylinder End Clearance And Piston Rod Runout		Technical Specification	Technical Specification	Test Report	W	W	R
1.8	No Load Mechanical Run Test Of the Compr. with Rated (Or More) Speed And Shop Driver. (4 Hrs. Min.)		Technical Specification	Technical Specification	Test Report	W	W	W

1.9	Strip Check And Internal Inspection After "NLMRT" Of All Compressors **Refer Note: 2**		Technical Specification	Technical Specification	Test Report	W	W	W
1.10	Electric Motor Performance Test- at Sub-Vendor's Works as per ISO Std. **Refer Note: 3**		Technical Specification	Technical Specification	Performance Test Report	R	R	R
1.11	Material Test Certificates for: Crank Shaft, Connecting Rods, Cylinder Liner, Piston (Compliance Cert.), Pressure Vessels, Heat Exchanger		Technical Specification	Technical Specification	MTC	R	R	R
1.12	Canopy Structure Painting Inspection At Works. Surface Preparation to be Inspected after cleaning and before application of First Coat of Primer.		Technical Specification	Technical Specification	Inspection Report	W	W	R
1.13	Functional / HV / Continuty Test for Control Panel (at Sub Vendor's Works**)**		Technical Specification	Technical Specification	Test Report	W	R	R
1.14	Mechanical String Test for 4 Hours, 25% of Package Lot for CNG Compressor		Technical Specification	Technical Specification	Test Report	W	W	W
1.15	Test Certificates For - Safety Switches, Safety Relief Valves, Solenoid Valves		Technical Specification	Technical Specification	Test Certificate	R	R	R
1.16	Final Mock-Up Assembly of the Package - As Per GAFD, P& I Drawings. Wiring Diagram		Technical Specification	Technical Specification	P&ID, Wiring Diagram	W	R	R
1.17	Performance Test (at site) at Guaranteed Parameters.		Technical Specification	Technical Specification	Performance Test Report	W	W	W

1.18	Field Trial Run for 72 Hrs.		Technical Specification	Technical Specification	Field Trial run report	W	W	W
LEGENDS	W = WITNESS, R = REVIEW OF DOCUMENTS, Y = DOC. SUBMISSION BY VENDOR / SUB-VENDOR							
NOTES:								
1	Crank Shaft, Connecting Rod: UT / MPT shall be conducted in either in forging-OR-in finish condition							
2	Strip test is limited to open Crank Case cover, Crosshead guide & Distance piece. Cover and opening of bore & other (sails. Piston one valve per cylinder).							
3	Review of manufacturer's test reports/certificates of all compressor package.							
4	Witness of tests by TPIA or owner/owner's representative.							
5	Inspection of the components / assembly, shall be conducted as per standard Test Procedures.							
6	All reference codes/ Standards, documents, P.O. copes shall be arranged by vendor/ supplier for reference of Owner / Owner's representative / TPIA at the time of inspection.							
7	The owner shall submit their own detailed QAP prepared on the basis of above technical specification for approval of Owner/ Owner's representative.							
8	**Bidder to furnish FAT test Procedure for Review**							
NOTE:	TPIA (THIRD PARTY INSPECTION AGENCY WILL BE APPOINTED BY SUPPLIER AFTER DUE APPROVAL FROM OWNER.							

ANNEXURE - XIII

DATA SHEET

DATA SHEET: MEDIUM VOLTAGE SQUIRREL CAGE MAIN INDUCTION MOTOR ELECTRICAL DESIGN DATA

1.	Motor tag no.			
2.	Voltage (V)	415V ± 10%	Phase 3	Frequency (Hz.) 50 Hz±3%
3.	Fault level (KA)	**NOT APPLICABLE**		
4.	Method of starting	**VFD/SOFT STARTER**		
5.	Phase	**THREE**	Connection – **AS PER STARTING METHOD**	No. of terminal – **AS PER STARTING METHOD**
6.	Design Ambient temp (^{0}c)	**50 ^{0}C (IN ACCOUSTIC ENCLOSURE)**		Temp. rise (^{0}c) **70 ^{0}C (Maximum)**
7.	Cable size (mm^2)	AS PER SPEC ATTACHED		Type **CU. COND. PVC INS.**
8.	Enclosure type	IP 55, Ex-d, IIA, IIB,T3		Cooling **TEFC**
9.	Insulation class	CLASS-F with temperature rise of CLASS B		
10.	Haz. Area classification/ Gas Group	ZONE-1, GROUP-IIA, IIB, Temp Class T3 as per IS/IEC		
11.	Type of explosion protection: Ex (d)		Applicable standards: **IS/IEC**	
Technical particulars from Driven equipment manufacturer				
12.	Suggested Motor Rating in KW/ Manufacturer		# / #	
13.	Shaft kw/kw at end of curve		# / #	
14.	Speed/ rotation of equipment from Coupling End		# / #	
15.	Starting/ max. Torque required (mkg)		# / #	
16.	WK^2 of equipment including/ excluding lywheel (kgm^2)		# / #	
17.	Thrust up/ down (kg)		# / #	
18.	Equipment/ coupling type		# / #	
19.	Starting Condition-On no load/ Under loaded condition		#	
Technical particulars from motor manufacturer				
20.	Manufacturer	*		
21.	KW Rating	*	No. of poles	*
22.	Frame designation	*	Mounting (Horizontal)	*
23.	Full load speed (Max. 1500 rpm)	*	Full load Torque (mkg)	*
24.	Starting torque as % of full load torque	*		
25.	Full load current (A)	*		
26.	Starting current at 100% Voltage (A)	*		
27.	Breakdown or pull out torque %	*		
28.	Rotation viewed from coupling end	*		
29.	Starting time at 75%V	* (sec.)	Starting time at 100%V	* (sec)
30.	Time (Te) for increased safety motors at 100% Voltage (secs.)		NOT APPLICABLE	
31.	Locked rotor with stand time cold/ hot at 75% V(sec)	*	At 100% V(sec)	*
32.	WK^2 of motor (kg m^2)	*		
33.	Power factor at 100% load	*	Power Factor at 75% load	*
34.	Efficiency at 100% load	*	Efficiency at 75% load	*
35.	Space heater watts/ volts	***/ 240V AC**		
36.	Bearing type/ no. DE	*/*	Bearing type/ no. NDE	*/*
37.	Type of Lubrication	*		
38.	Weight of motor (kg)	*		
39.	Canopy required/ Not required	NOT REQUIRED		

TO BE FILLED BY BIDDER BASED ON THE PACKAGE DESIGN

* TO BE FILLED BY MOTOR MANUFACTURER

Bidder must quote for only one make of motor. Bidder shall submit filled up data sheet for the selected make of motor only.

Motor Terminal Box must be suitable for the cable size indicated on data sheet.

POWER CABLE SIZES FOR 415V MOTORS

S.No.	Motor Rating KW	CABLE SIZE mm2		No. of Cores	CABLE DIAMETER - mm (APPROX)		
		CU	AL		Overall	Under Armour	Over Armous
	Below 3.7 KW	4		3			
	3.7	6		3			
	5.5	10		3			
	7.5	10		3			
	11.0	16		3			
	15.0	16		3			
	18.5	16		3			
	22.0	16		3			
	30.0	25		3			
	37.0	25		3			
	45.0	35		3			
	55.0	50		3			
	75.0	95		3			
	90.0	120		3			
	110.0	2x95		3			
	125.0	2x120		3			
	132.0	2x120		3			

NOTES:

1. Above table is valid for 2/4/6 pole motors. For low speed motors cable sizes shall be defined at the time of detail engineering.
2. Cable size for motor space heater shall be 3x2.5 mm^2 with Cu Conductor.
3. Cables will be 650/1100V, copper conductor, FRLS-XLPE insulated, FRLS-PVC extruded inner sheath armoured with overall FRLS-PVC sheath.

   Cables external to Integrated CNG Compressor package will be supplied by Owner. All cabling inside the package is the scope of Supplier.

DATA SHEET: PRESSURE, VESSEL

(To be filled in by the Vendor)

PROJECT		
UNIT		
ITEM NO.		
EQUIPMENT		
CLIENT		
JOB NO.		
PACKAGE		
MR. NO.		
CODE FOR DESIGN AND CONSTRUCTION	ASME SEC-VIII DIV1	
DESIGN CONDITION		
PRESSURE (kg./ cm^2g)		
TEMPERATURE (^{0}C)		
OPERATING CONDITIONS		
PRESSURE (kg./ cm^2g)		
TEMPERATURE (^{0}C)		
CORROSION ALLOWANCE	3 MM	
SERVICE	CNG LETHAL [X] OTHERS CO_2	
LIQUID LEVEL (mm)		
SPECIAL SURFACE FINISH INSIDE VESSEL	REQD. [ ] NOT REQD. [ ]	
TYPE OF VESSEL	HORIZONTAL [ ] VERTICAL [ ]	
DIAMETER (mm)		
HEIGHT TL TL (mm)		
SKIRT/ LEG HEIGHT		
JOINT EFFICIENCY	SHELL 1.0	HEAD 1.0
RADIOGRAPHY	SHELL100%	HEAD 100%
POST WELD HEAT TREATMENT		
MATERIALS OF CONSTRUCTION	SA 516 GR 60/70	

SHELL, REINFORCEMENT PADS

HEADS/ CONES

SHELL FLANGES

NOZZLE FLANGES

NOZZLE NECK

MAN-WAY NECK

PIPE FITTINGS

GASKETS (EXTERNAL)

GASKET (INTERNAL)

SKIRT/ LEG SUPPORT

INTERNAL PARTS

EXTERNAL PARTS

INTERNAL BOLTS/ NUTS

CLIP ATTACHMENTS (EXTERNAL)

ANY OTHER GENERAL REQUIREMENT

NOTE: VENDOR SHALL SUBMIT COMPLETED DATA SHEET ALONG WITH OFFER WHEREVER ENGG. DRAWING IS NOT ATTACHED FOR THE VESSEL.

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1. DOCUMENT DISTRIBUTION SCHEDULE

1.1. Documents and drawings under column no. 3 shall be submitted with each copy of the bid.

1.2. Documents listed under column 4 are to be submitted in 2 copies

1.3. Documents listed in column 5 are to be submitted as hard bound indexed book containing the following details in Two (2) copies to be submitted within 4 weeks of release note/dispatch of materials/ equipment from vendor's works.

For column no. 3, 4 & 5 refer Annexure – VII (Vendor Data Required).

2. DETAILS TO BE INCLUDED IN FINAL DOCUMENTS BOOKS

2.1. Copy of P.O. and all amendments.

2.2. Copy of Purchase Requisition and all amendments.

2.3. Manufacturing Data Book containing all test certificates of components, raw materials, stage manufacturing tests and inspections, final tests & inspection documents including welders' qualification & welding procedure qualification, repairs & reworking carried out in shops. All raw material test certificates must be correlated to the P.O. Item No. & component to which they relate by clear noting on the certificates.

2.4. Spares details including assembly drawings, part numbers, delivery, prices and ordering information.

2.5. All design calculations carried out by the vendor.

2.6. Final Drawing Index and all as-built drawings reduced to A3/ A4 size and wherever reduction is not possible, full size copies duly folded and placed in plastic pockets.

2.7. Catalogues/leaflets of sub-vendors/suppliers of various bought out components highlighting the components actually supplied correlated to P.O Item Numbers.

2.8. Operating and maintenance instructions including lubrication schedules with details of suppliers for procurement by OWNER for subsequent needs.

2.9. Release Note and Packing List.

2.10. Any other documents asked for in the Purchase Requisition.

2.11. All final drawings shall also be given to purchaser in digitized form on CD-ROM compatible to AUTOCAD software.

2.12. Final documents including operation and maintenance manual should be submitted, one copy per package plus one original.

2.13. Operation and maintenance manual shall include assembly and disassembly, specification (torque chart), parts manual, complete list of bill of material, bought out spares and accessories. One original plus individual copies for the no. of compressor packages supplied.

3. SPECIAL INSTRUCTIONS FOR SUBMISSION OF DWGS./DOCUMENTS:

3.1. Fold all prints to 216 MM x 279 MM size & roll transparencies.

3.2. Vendor to forward the drawings and documentation to CLIENT (Attention vendor prints control department) clearly specifying purchasers Job no. & Req. No.

3.3. The drawing/Document no. with Rev. No. is essential. The number may be upto a maximum of 28 characters in length.

3.4. Each Drawing/Document submitted to CLIENT must be checked and signed/stamped by vendor before it is submitted to CLIENT.

3.5. Revision number must change during subsequent submission of vendor document.

3.6. Multi-sheet documents other than drawings must be submitted in their entirety in the event of a re-submission even if only a few sheets are revised.

3.7. Final submission in bound volumes shall necessarily have a cover page giving project title, Item name, P.O No. particulars of owner, consultant & vendor and an index giving list of drawings & documents included (with revision no.).

3.8. All vendor drawings to be provided with a blank space measuring 75 mm W x 38 mm H for marking of review codes etc. by CLIENT.

3.9. The review of the vendor drawings shall be done by CLIENT, as applicable, under the following review codes:

Review Code 1	No comments.
Review Code 2	Proceed with manufacture/fabrication as per commented drawings. Revise drawings required
Review Code 3	Document does not conform to basic requirements.

3.10. Review of vendor drawings by CLIENT would be only to check compatibility with basic designs & concepts & would in no way absolve the contractor/vendor of his responsibility to meet applicable codes, specifications & statutory rules/regulations.

Vendor shall submit within 10 days after placement of FOI, the complete list of drawings/ documents with submission dates against each. Critical drawings, only, the list of which will be agreed during kick-off meeting shall be reviewed jointly at CLIENT's office.

SECTION – II: TECHNICAL SPECIFICATION FOR CASCADE

1.0 SCOPE

This document covers, minimum requirement for design, engineering, procurement, fabrication/manufacture, assembly, inspection, testing of CNG Cascades to be supplies with integrated CNG package.

2.0 SITE ENVIRONMENT

The climatic conditions to be considered for selection, design and derating of equipment shall be as indicated below:

Maximum Wind Velocity	:	160 Km/hr
Maximum Ambient Temperature	:	47.5 °C
Minimum Ambient Temperature	:	1.7°C
Design wet bulb Temperature (WBT)	:	27 °C
Relative Humidity	:	90%
Altitude, M above MSL	:	205 meters

The equipment offered shall be suitable for smooth, efficient and trouble free service in the tropical climate prevailing at site as indicated above.

The equipment shall be designed to give efficient and reliable performance under outdoor industrial conditions and shall be rendered protected against rats, lizards and other vermin.

3.0 INSTRUCTIONS TO VENDORS

This specification describes the technical specification of the equipment to be supplied and/or installed for CNG stations of CLIENT.

Various parts of the specification shall be read in conjunction with each other. In cases where requirements given in different parts differ, the most stringent shall govern.

The specification indicates the scope and requirements completely and clearly as possible. 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.

Vendor may contact CLIENT and obtain clarifications, required, if any, at any stage, after award of LOA.

The Vendors are advised to visit the sites before submission of their offers, to ascertain for themselves type, nature and extent of work involved and actual site conditions. Failure to do so shall not absolve the Vendor of their responsibilities regarding supply, installation, testing, commissioning etc. under their scope of work. Further more, no plea of the Vendor based on unfavorable site conditions and/or non-availability/lack of information shall be considered.

The Vendor shall confirm clause by clause acceptance of technical specification. Comments and/or deviation if any, of the Vendor on Owner/Consultant's NIT document (including technical specification) shall be given clause wise. Clauses, on which no specific comment or deviation will be indicated in the offer, shall be treated as accepted by the Vendor.

It will be the responsibility of the Vendor to comply fully with relevant National/International standards, Indian Explosives Act, Regulations of Insurance association of India and Factories Act, while supplying materials and/or carrying out work as per this specification.

Vendor's responsibility shall also include preparing and submitting all necessary drawings, calculations, test certificate etc. as required by concerned inspectorate / authorities.

The Vendor, free of cost and without affecting agreed milestones, shall carry out modifications suggested by the statutory bodies.

Civil engineering work i.e. foundation, trenches etc. shall be arranged by Owner. The vendor shall submit foundation and other drawings indicating requirement of work to be carried out by Owner within two weeks of placement of order. In case the requisite information regarding requirement of slots, holes, pipe and other fixing inserts etc. as required for proper installation of equipment is not indicated by the Vendor within two weeks form placement of order, such facilities shall have to be arranged/provided by the Vendor at their own cost.

All work shall be carried out to the satisfaction of the Owner. Any work found to be carried out without the approval of Owner or work which is considered to be unsatisfactory and of poor quality of workmanship shall be rectified by the Vendor without any additional cost.

The Vendor shall not vary the scope of work as detailed in the approved drawings and specification, without written permission of the Owner. The work shall be done as per approved prints of the drawing only.

The Vendor shall submit a bar chart showing all important milestones for the completion of supply within 15 days from the date of issuance of Fax of Intent (FOI) and shall provide the fortnightly progress report in duplicate accordingly.

The Vendor shall attend progress meetings and all other meetings called by the Owner. The Vendor's representative shall have the authority to make all decision related to the Contract.

All expenses for all the above activities shall be done and borne by the Vendor.

All pages of the offer shall be numbered and contents with page numbers shall be given at the beginning. All pages of the offer shall be submitted in bound volume.

4.0 GAS COMPOSITION

GAS COMPOSITION		
	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
H2O	0.01 – 0.00	0.00
Total	**100**	**100**
Average C.V. (kcal/SCM)	8950 – 8150	8302.3

5.0 CODES AND STANDARDS TO BE FOLLOWED:

The design, construction manufacture, supply, testing and other general requirements of the Storage Cascades should be strictly in accordance with the Applicable Standards and Codes and should comply fully with relevant Indian/International standards, Gas Cylinder Rule 2016, Indian Explosives Act – 1884, Stationary and Mobile Pressure Vessels (Unfired) Rules (SMPV)1981, Design Code,7285 (Part-2):2016, CNG Cylinder Valves, IS:3224-1979 (Amendments 1983,84,85,86,92,98), Hydrostatic Stretch Test, IS:5844-1970, Safety Devices of Gas Cylinders, IS:5903-1970, regulations of Insurance Association of Indian and Factories Act while carrying out work as per the specification.

The bidder without any additional cost and delivery implications should carry out any modification suggested by the statutory bodies either during drawing approval or during inspection, if any.

CODES & STANDARDS TO BE FOLLOWED:

IS 7285 (Part-2):2004 Specification for seamless steel cylinders for permanent and high pressure liquefiable gases.

IS 3224:2002 Valve fittings for compressed gas cylinders excluding liquefied petroleum gas (LPG) cylinders.

OISD – 179 Safety requirements on compressors, storages, handling and refueling of natural gas for use in automotive sector.

GAS CYLINDER RULES – 2016

FRAME STRUCTURAL STEEL SPECIFICATION-IS: 2062: 1992 GRADE-A

INDIAN EXPLOSIVES ACT.

SAFETY DEVICES OF GAS CYLIDNER IS:5903-1970, Regulations of insurance association

NFPA 52 Standards for CNG Vehicular systems

All the applicable statutory codes, national laws and local regulations for safety and Environment protection shall be followed by the vendor for design , engineering, fabrication etc. the vendor shall obtain form concerned authorities all necessary approvals.

6.0 EXTENT OF SUPPLY AND SERVICES

6.1 Supply

Supply of CNG storage cascades of capacity minimum 450 water liter (-0%, + 5%) at 15°C for 400 SCMH compressor with following minimum details:

- All cylinders should be designed, constructed and tested in accordance with the Indian IS: 7285(Part2):2004 or similar such other standard code approved by the Petroleum & Explosive Safety Organization.
- Each cylinder equipped with cylinder shut-off valve and Combination Bursting Disc & Fusible Plug (Conforming to IS 3224:2002).
- Robust painted Iron cascade frame. The iron surface shall be properly cleaned, primer and paint selected and applied to have a service life of at least five years. The exterior of the equipment is required to be corrosion free for at least five years and to have a fade free life without oxidation of paint surface for at least five years in an environment of bright sunlight with an intensive UV content. The bidder to specify the grade of paint intended to be used.
- Interconnecting tubing/piping, fitting, valves.
- Non return valves (NRVs) as required for three-bank operation.
- Pressure gauge on each bank.
- All other items required for use of cascade as mobile for transportation of gas shall be properly fitted and the drawing of cascade shall be approved by CLIENT prior to supply.

6.2 The services to be rendered by vendor shall include but not limited to the following:

- Obtaining approvals from concerned departments/agencies/statutory authorities such as BIS Certificate, PESO etc.

- Procurement of raw materials, bought out components, fabrication, shop assembly.
- Shop inspection and testing including third party inspection (TPIA) or inspections by CLIENT's delegate and statutory approvals.
- Testing at site.
- Packaging, crating, dispatch of cascades.
- Cascade commissioning assistance.
- Paintings as per the present document.
- Preparation and submission of documents/drawings as per schedule.

7.0 TECHNICAL SPECIFICATIONS

The following specification is to give the vendor the technical and operating conditions the cascades must fulfill. Features other than those indicated herein but which call for a better design, increase in efficiency, enhance reliability, optimization may be accepted subjected to CLIENT's approval. The cascade shall be shipped in completely assembled condition. Gas supply line and delivery connection shall be made at site.

The vendor shall bid in their main offer, items according to the technical specifications outlined below.

7.1 Cascade

- Cascade shall be a group of identical cylinders of capacity required to meet the specified total water capacity, dimensional and weight limitations. The cascades shall be provided with structural frame having facility of lifting and placement.
- Cascade storage Capacity.

  The water storage capacity of static cascade shall be minimum 450 (-0%, +5%) water litres at 15 degree C (Cylinders conforming to IS:7285 (Part 2)-2004) for 400 SCMH compressor.
- The water liter capacity of any individual cylinder in –group of cylinders forming cascades shall not exceed 125 liters at 15 degree C for 450 water liter capacity (Min.) cascades.
- The design, construction & testing of cylinder shall be as per IS 7285 – 2004 and approved by Petroleum and Explosives Safety Organization (PESO), Government of India for use in India for specified condition.
- Working pressure of cascade cylinder shall be minimum 250 bar g at 15 degree C.
- Storage cylinder manufactured older than 2017 shall not be accepted.
- Cylinder material shall be seamless alloy steel (Cr-Mo) as per design/drawings approval by Petroleum and Explosive Safety Organization (PESO), Govt of India.
- Cylinder neck threading shall be as per IS 3224-2002 or as per design approved by Petroleum and Explosive Safety Organization (PESO), Govt of India.
- In case cascades with 50 litres cylinders are offered vendor shall observe minimum neck threads size of dia 25.4 mm standard. Type 4 threads with a taper of 1 in 8 on diameter confirming to IS-3224:2002 or equivalent.
- The cylinder shut-off valve shall be with combination Bursting Disc and Fusible Plug conforming to requirements of IS 3224:2002 or as per design approved by Petroleum and Explosive Safety Organization (PESO), Govt of India.
- The burst disc shall rupture on excess pressure as well as excess temperature either individually or combined. The burst disc discharge shall be manifold to a common header for safe venting. Vendor shall indicate burst pressure and temperature.

- The cylinder shut-off valve orifice shall be designed for high flow to permit the combined flow of 100kg/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) values orifice size etc.
- Number of cylinders in the cascade shall be divided into three independent banks of low, medium and high pressure of different storage pressures. Vendor shall optimize the number of cylinders in each bank for maximizing the recovery from the cascade storage and submit the calculations along with the bid. Vendor may assume the residual cylinder pressure of the vehicle coming for refill at 30 bar g.
- The interconnecting tube work of cylinders manifold in configuration suitable for priority filling and sequential dispensing system by the electronic CNG dispensers at the Retail Outlets.
- Full bore ball valves for isolation shall be provided at inlet of each fill line and at each bank outlet line. The final end connection at battery limit shall be 3/4" OD with nut and double ferrules for directly connecting a ¾ "OD tube.
- The interconnecting tube work shall be minimum of ¾ "OD tubing. The sizing of connecting tubing between each outlet and its 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 contraction, expansion and vibration piping/tubing shall be suitably clamped to the frame structure.
- All cylinders should be new and unused. Re-certified cylinders are not acceptable. Before using/refilling, the cylinders which has to be made free of air contained gas shall be purged by an inert gas or by the CNG gas. All cylinders in a cascade shall be of same capacity.
- Cylinders in the cascade may be vertically or horizontally placed. In case of horizontal configuration, minimum 30 mm 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.
- 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 service rating.
- Double compression ferrule Fittings shall be used in the connection tubes.
- 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.
- The location of inlet/outlet tube and pressure gauges shall be as per approved drawing.
- Cascade to be purged with N2 after testing and shipped with a positive pressure of N2 in the cascade. Suitable vent as attached in the drawing to be provided for stationery cascade.

7.2 Piping/Tubing/Fitting/Pressure Gauges

- Materials used for the piping shall be stainless steel 316 fully annealed seamless confirming to ASTM A269 with maximum hardness of Rb80 or less and suitable for bending and flaring. OD tolerance shall not exceed +0.005%.
- All fittings including valves shall be as per recommended vendor list. Material shall be SS 316 conforming to ASTM A269. Open ends on fittings and vents shall be provided with caps.
- Double compression ferrule fittings shall be used in tube connections.
- Liquid filled pressure gauge of diameter 4", (0-400 kg/cm2) with a 3 – way isolating valve on each bank shall be used. Thus each cascade shall have three pressure gauges. Pressure gauges shall be securely mounted.
- All end connections, pressure gauges, valves and fittings of cascade shall be within tamper proof, wire cage enclosure. There shall be on one side of cascade for ease of operation.
- Material of vent tubing shall be Copper & Brass fitting as per ASTM B75, B 68 and make shall be as per recommended vendor list.

7.3 Painting

Cylinders shall be painted as per Gas Cylinder Rules/IS code as follows:

- White color on cylinder body.

- Signal red on cylinder neck portion.

- Yellow color on frame.

The paint shall be chosen, primed and applied as to have a service life of five (5) years. The exterior surface is required to be corrosion free for five (5) years and to have fade free life without oxidation of paint surface for five years in an environment of bright sunlight with an intense UV content.

Surface preparation by Shot Blasting as per grade SA 2 1 / 2 IS 9954/ ISO 8501. Three coats of paint shall be applied with minimum thickness of 300 micron. 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.

8.0 INSPECTION AND TESTING

- Vendor shall carryout cylinder bursting test of one cylinder from the entire batch produced for supply to CLIENT in case offered cylinders are of new design (conforming to the requirement of IS 7285:2004). Vendor shall inform the schedule of the test well in advance to enable Owner or their authorized representative to depute technical personnel for witnessing the test.
- 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.
- 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.
- Each assembled storage cascade with all tubing, valves shall be pressure tested to ensure existence of no leakage prior to dispatch.
- Manifold of the cascade shall be tested to 250 – bar g. The manifold shall be checked for sequencing and no back flow between any two banks with all valves open.
- 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. Successful bidder will propose three names from the list and owner will approve the TPIA.

9.0 DOCUMENTATION

Following documents shall be submitted with the offer:

- Drawing of cylinder of specified parameters and proposed to be used in offered cascades, approved by Chief Controller of Explosives, PESO Nagpur and Government of India.
- Schematic of cascade piping.
- Bill of quantities with weight of each component.
- Make of bought out items.
- GA Drawing of the Cascade.

Following documents shall be submitted after release of order:

- Detailed quality control procedure/QAP, duly approved by PESO, Nagpur, for manufacture of cylinder, fabrication of frame etc within two weeks of release of order.
- Schematic of cascade piping, drawing of cascade frame and bill of quantities with weight of each component and make for Owner's review and approval.

- The supplied cylinders shall have the certification from PESO, Government of India. Nagpur for suitability of each cylinder for filling and storage of CNG upto 250 bar g at 15 degree C in India.
- Vendor shall furnish the material test certificates for all bought out items like cylinder raw material, tubing/piping, valves, check valves and fittings with the shipment.
- QA/QC report for manufacture of cylinder and testing with shipment.
- Two (2) sets of Operation & Maintenance manual. All test certificates and all others relevant documents per cascade in soft (PDF format) in CD/DVD & hard copy.

10.0 EXPERIENCE RECORD PERFORMA FOR CASCADE

Vendor must fill the following format, which is essential to access the bidder's capability.

S.No.	Parameter	Information on offered model	Information on existing cascade (Location)		
1	No. of units		1	2	3
2	Service				
3	Working pressure of cascade in bar g				
4	Site min/max temp.				
5	Normal flow from each bank kg/hr				
6	Cascade water capacity-liters				
7	Water capacity of single cylinder used in cascade - liter				
8	Material of cylinder				
9	Thickness of cylinder wall and disc end in mm				
10	Material of vent tubing				
11	Piping material and make				
12	Valve make				
13	Valve type and dia				
14	Nos. of banks in cascade				
15	Nos. of cylinder in low bank				
16	Nos. of cylinder in medium bank				
17	Nos. of cylinder in high bank				
18	Water capacity of cylinders in individual banks				
19	Contact person				
20	4 G static calculation for one complete assembled package				
21	Cylinder burst test for one cylinder				
22	Design standard (CODE) used				
23	Total weight of cascades in tones				
24	Burst pressure and temperature for burst disc in bar g and deg C				
25	Hydrostatic or Hydrostatic stretch test				
26	Pressure test for leakage				
27	Approval from PESO Nagpur				
28	Dimensions of package maximum				
29	Date of commissioning of cascade				
30	Where cascades are located: Address and fax/telephone no. of				
31	Major problems encountered, if any				

CASCADE DATA SHEET

S.No.	Parameter	Specification	Offered
1	Type of Service	CNG	
2	Capacity(Min. in water liter)	450 (-0%. +5%) **	
3	No. of Banks	3	
4	Cascade Dimensions	OISD-179	
5	Cascade frame structure is be able to withdraw 4 G four time of gravity) test from any direction without any distortion	Yes	
6	No. of Cylinders in each bank		
a.	Low Bank	*	
b.	Medium Bank	*	
c.	High Bank	*	
7	Cylinder		
a.	Cylinder make	EKC/ RAMA	
b.	Compliance Code	IS 7285(Part2):2004	
c.	Cylinder Size at 15 degree C (in water liter)	Not exceed 125liters	
d.	Cylinder Operating Condition	250 bar g at 15 degree C	
e.	Cylinder Testing parameters	As per IS:7285:2004	
f.	Cylinder Material	Seamless alloy steel (Cr-Mo)	
g.	PESO approval	Yes	
h.	Gas quantity stored in the cylinder at 15 degree C		
8	Cylinder Shut-off Valve		
a.	Make	Tekno /OMB/EMAR SPA	
b.	Compliance Code	IS 3224:2002	
9	Combination Bursting Disc and Fusible Plug	To be provided	
a.	Burst Pressure (in bar g)	*	
b.	Fuse Melting Temperature (in degree C)	*	
10	Interconnecting Tube Size	Minimum ¾ " OD	
11	Pressure Drop for each bank		
a.	Low Bank	*	
b.	Medium Bank	*	
c.	High Bank	*	
12	Coefficient of Flow (Cv)		

Note:

1. All tubing fittings & other piping components shall conform to recommendations of ANSI B31.3" Process Piping".
2. (**) – For 400 SCMH Integrated compressor.
3. (*) – To be furnished by bidder.

TRACTEBEL ENGIE	QUALITY CONTROL TABLE HIGH PRESSURE GAS CYLINDER , CASCADE FRAME & FITTINGS					QCT No. : P.014714 M 11077 R 020 Rev 0 Date : Prepared by : SS Checked by : GG Approved by : NN		
S.NO.	**OPEARTION / PARAMETER**	**CHARATERISTICS/ PARAMETERS**	**ACCEPTANCE CRITERIA & CERTIFICATION**	**INSPECTION FREQUENCY**	**VENDOR**	**TPIA**	**CA**	**REMARKS**
1	Raw Material	Chemical Composition	Chrome Moly Steel,Grade-DS-202/IS:7285-2004 Cl. 5.2 Table-1	One sample per heat No.	P	R	R	Verification of RMT Certicate Received from RM supplier.
IN PROCESS								
2	Raw Materiasl Cutting (seamless Tube)	Length	As per process heat	4-5 jobs during setting approval & every two hour.	P	W/R	R	
		Thickness	Minimum as per approved drawing Tolerance + 30%	3-4 jobs during setting approval & every four hour.				
		Outside Diameter	As per Approved drawing (Tolerance ± 1 %) IS-7285 : 2004	3-4 jobs during setting approval & every four hour.				
		Surface Flaws	Free from Lamination, crack,Dent, corrosion , silvers etc.	3-4 jobs during setting approval & every four hour.				
		Ultrasonic Examination	IS-7285 : 2004	Each Cylinder				
3	Bottom Forming	**Bottom Thickness** Centre of Bottom Side of Bottom **Footring** Visual Inspection **Ultrasonic Examimation**	1.5 T min (where T is wall thickness) IS: 7285 : 2004 Free from crack,excess metal, pin hole, ball formation,roller mark and other surface defects. IS: 7285 : 2004	4-5 jobs during setting approval & every four hour. 4-5 jobs during setting approval & every four hour. Each Cylinder	P	W/R	R	
4	Neck Forming	Solid Neck Length Neck Diameter Surface finish, defects **Ultra sonic Examination**	As per Approved Drawing As per Approved Drawing Free from roller mark, Pit mark, excess metal at neck, crak and other surface defects IS: 7285 : 2004	4-5 jobs during setting approval & every two hour. 4-5 jobs during setting approval & every two hour. 4-5 jobs during setting approval & every two hour. Each Cylinder	P	W/R	R	

TRACTEBEL ENGIE	QUALITY CONTROL TABLE HIGH PRESSURE GAS CYLINDER , CASCADE FRAME & FITTINGS					QCT No. : P.014714 M 11077 R 020 Rev 0 Date : Prepared by : SS Checked by : GG Approved by : NN		
S.NO.	**OPEARTION / PARAMETER**	**CHARATERISTICS/ PARAMETERS**	**ACCEPTANCE CRITERIA & CERTIFICATION**	**INSPECTION FREQUENCY**	**VENDOR**	**TPIA**	**CA**	**REMARKS**
5	Heat Treatment	Hardness (As Tempered) Mechanical Properties Tensile Strength Yield Strength % Elongation Impact test (at -20 ^{0}C) Bend Test Burst Test	As per approved drawing IS:7285 : 2004 As per IS;7285 : 2004 IS: 7285 : 2004 IS: 7285 : 2004 IS: 7285 : 2004 IS: 7285 : 2004	Every Cylinder One random cylinder will be selected from Heat treament Batch comformimg the mechanical properties like tensile test, impact test, bend test etc, in presence of inspecting officer. One Cylinder from prototype batch.	P	W	R	
6	Ultrasonic testing	Crack dtection Wall Thickness measurement	As per IS:7285 -2004 As per approved drg. IS:7285-2004	Every Cylinder	P	W	R	
7	Neck cutting & Threading	Neck Length Machined neck step diameter Neck thread configuration. Visual inspection thread finish.	As per approved drawing. As per approved drawing. As per approved drawing. Free from crack blow hole excess metal at inside neck, thread damage, flat threads etc.	Audit Check by Q.A staff. Audit Check by Q.A staff Every Cylinder. Every Cylinder.	P	W	R	
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 water capacity + 5 % IS-7285 : 2004 Permanent expansion shall not exceed 10% of total expansion. IS: 7285 : 2004	Every Cylinder. Audit Check by Q.A staff	P	W	R	
9	Air Leakage Test	Access leakage from cylinder body, neck and bottom side at working pressure. Holding Time= 60 Sec.	Free from Leakage. IS: 7285 : 2004	Every Cylinder. Audit Check by Q.A staff	P	W	R	

TRACTEBEL ENGIE	QUALITY CONTROL TABLE HIGH PRESSURE GAS CYLINDER , CASCADE FRAME & FITTINGS							
						QCT No. : P.014714 M 11077 R 020 Rev 0 **Date** : **Prepared by** : SS **Checked by** : GG **Approved by** : NN		
S.NO.	**OPEARTION / PARAMETER**	**CHARATERISTICS/ PARAMETERS**	**ACCEPTANCE CRITERIA & CERTIFICATION**	**INSPECTION FREQUENCY**	**VENDOR**	**TPIA**	**CA**	**REMARKS**
10	Bursting Test	The value of hoop stress shall be not less than 0.95 of the minimum specified tensile strenght of the cylinder material.	IS-7285- 2004	One Cylinder of the first batch .	P	W	R	
11	Steam Cleaning & Air Drying	Examination of Oil residue, Moisture Etc.	Free from Oil residue, Moisture etc when Cylinder is exposed to steam jet at steam temp. 160-180 ^{0} C for period minimum 5-6 minutes.	Audit Check by Q.A staff	P	R	R	
12	Internal shot blasting	Scale free surface	Inner surface should be free from sclaes, metallic particles etc	Audit Check by Q.A staff	P	R	R	
13	External shot blasting	Scale free surface	Cylinder should be free from scales & Other surface imperfection	Audit Check by Q.A staff	P	R	R	
14	Fixed data Stamping	Stamp Data	As per IS:7285 : 2004	Audit Check by Q.A staff	P	R	R	
15	Variable Data stamping	Stamp Data	Verification of data As per Drawing & Test Result	Every Cylinder check by Q.A staff	P	R	R	
16	Vacuum cleaning	Any scales, dustetc inside cylinder	Free from scales, dust etc from inside cylinder.	Every Cylinder check by Q.A staff	P	R	R	
17	Weighing	Tare weight/ Calibration	As per approved Drawing	Every Cylinder check by Q.A staff	P	W	R	
18	Painting (Primer & Finish painting)	Paint coating thickness	As per process sheet	Audit Check by Q.A staff	P	W	R	
19	Marking		IS: 7285 : 2004	Each Cylinder	P	R	R	
20	Color Identification		IS: 7285 : 2004	Each Cylinder	P	R	R	
21	Cascade Frame Fabrication Painting Cascade Frame Complete	Visual (Welding etc) Dimensional Physical Test Chemical Test	Approved Drwaing/ Manufactures Standard. Owner's Specification Approved Drawing	100%	P	R	R	
22	Polyuretherane/ Epoxy paint	Chemical Properties	Approved Make / Owner's Specification		P	W	R	
23	SS Tubes	Physical test Chemical Test Visual (Welding etc) Dimensional Fitment & Alingment	Approved Drawing, Manufacture Test Certificate for bought out items.	As per tender / Owner's Instruction	P	R	R	

TRACTEBEL ENGIE

QUALITY CONTROL TABLE
HIGH PRESSURE GAS CYLINDER , CASCADE FRAME & FITTINGS

QCT No.	:	P.014714 M 11077 R 020 Rev 0
Date	:	
Prepared by	:	SS
Checked by	:	GG
Approved by	:	NN

S.NO.	OPEARTION / PARAMETER	CHARATERISTICS/ PARAMETERS	ACCEPTANCE CRITERIA & CERTIFICATION	INSPECTION FREQUENCY	VENDOR	TPIA	CA	REMARKS
24	Fittings	Visual Dimensional Pressure Test Fitment & Alingment	Approved Drwaing/ Manufactures Standard.	As per tender / Owner's Instruction	P	R	R	
25	Valves 2 Way	Visual Dimensional Fitment & Alingment	Approved Drawing, Manufacture Test Certificate for bought out items.	As per tender / Owner's Instruction	P	R	R	
26	CNG Cascade Assembly	Visual (Welding etc) Dimensional Fitment & Alingment	Approved Drwaing/ Manufacture Std.	Owner's specification/ Instruction	P	W	R	
27	Cu Tubes for venting of Burst Disc seperator	Visual (Welding etc) Dimensional Pressure Test Leakage Test Fitment & Alingment	Approved Drwaing/ Manufacture Std.	Owner's specification/ Instruction	P	W	R	
28	Cylinder Valves	Visual Dimensional Fitment & Alingment	As per Approved CCOE Drawing, Bill of Material.	Owner's specification/ Instruction	P	100% W	R	
29	Gauge	Visual Dimensional Fitment & Alingment	Approved Drawing, Bill of Material.	Owner's specification/ Instruction	P	100 % W	R	
30	**Final Inspection of Finished Cylinders:** Visual inspection for internal cleaning and painting of Cylinder and Cascade frame. 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, Water Capacity etc.		IS:7285-2004	Each Cylinder	P	100 % W	R	

LEGEND : W= WITNESS; H= HOLD; M= MONITORING; P= PERFORM; R= REVIEWS OF DOCUMENTS; R/M= RANDOM CHECH; A= APPROVED; TPIA= THIRD PARTY INSPECTION AGENCY

Notes

1. The Above Testing and acceptance critera are minimum requirements, however, manufacturer shall ensure that the product shall also comply to the additional requirements as per Particular Technical specifications(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 relavant procedures and updated standards for TPIA reveiew/Approval.All reference codes / documents shall be arranged by Vendor for reference
4. Owner / Owner's representative including TPIA will have the right to inspect any activity of manufacturing at any time.
5. TPIA along with Owner/Owner representative shall review/approve 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 locations to facilitate Owner/Owner's representative and TPIA to organise Inspection.
7. Special manufacturing procedures have to be specially approved or only previously approved procedures have to be used, in case of conflict between specifications 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/IGL at the time of Inspection
9. Certification requirement shall comply with European standard EN 10204 - 3.2 (latest edition).

SECTION – III: TECHNICAL SPECIFICATION FOR CNG CAR DISPENSER

SECTION: A - GENERAL SPECIFICATION

1.0 SCOPE OF SUPPLY & SERVICES

1.1 Supply of double arm type having flow capacity of ≥ 15 kg/min for a single arm under discharge to atmospheric condition. Each Car Dispenser shall have following as a minimum:-

1.1.1 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. 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. Both hoses should be provided with protective spiral cover .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. Supply of NGV-I to NZS-5425 adapter nozzles shall be in bidder's scope

Two numbers of Coriolis true mass flow metering system.All Mass flow meter shall be provided with a Liquid Crystal Display (LCD) for ongoing flow monitoring and totalizers.The preferred make shall be E&H or Emerson (Micromotion)

- 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 protection and display cabinet shall have IP 54 protection.

- 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 Section B: Instrumentation & Control specification.

- One number of three banks electronic software and controller including hardware for individual filling arm.

- Two numbers of holster/ cradle for 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.

- Two number of Hi-mast with flexible hose arrangement or Appropriate arrangement to be provided in order to allow free movement of flexible hose, prevent strain on the fill hose connection and to avoid touching the ground.

- 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. During activation of emergency switch, the power supply to the dispenser should be available.

- Two nos. of liquid filled 4" dia. (0-400 Kg/cm2g) pressure gauges showing the vehicle filling pressure for each filling arm.

- Two Nos. bubble tight manual shut-off valve for fill hose.

- Vendor has to supply the dispensers with solenoid operated valve or actuated Ball Valve with NAMUR Intrinsically Safe Solenoid Valve made of ANSI 316 SS, for ON-OFF control of flow, on the gas inlet with 1/2" tube OD end connection. Valves shall be provided for each bank per hose separately. Valve make shall be approved by CLIENT and during detail engineering. 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 solenoid valves.

- 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), 1/2" OD with a 1/2" SS 2-way Ball valve

at inlet and 1/2" OD end connection suitable for connecting with 1/2" OD SS Tube. Any open ends on fittings and vents shall be provided with caps/ dust plugs.

- 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 carryover 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 carryover < 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.
- The CNG dispenser specification should meet the IS 15403:2000 (E) natural gas quality designation for use as a compressed fuel for vehicles.
- 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 Ball valves. Any unmetered gas passing shall be recorded in the dispenser is retrievable as and when required.
- Any other item required for safe and accurate operation of Dispenser.
- Any spare(s) required during commissioning shall be in the scope of vendor.
- Supply of application program, ladder logic, list of error codes with description for programming the dispenser parameter.
- 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.
- 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. It shall also be possible to change the price from remote station (from SCADA/ from any part of the city). 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.
- RS 485 serial port shall be provided for down loading the CNG sale data with the help of Purchaser's Personal Computer for each shift (8 hours 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 hours interval). This port shall be made available outside the explosion proof electronic housing for Purchaser's use.
- Vendor shall provide a common processor and open communication protocol/ RS 485 port for RTU to transfer all the dispenser data to central SCADA system. 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.
- 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. 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 in applicable 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
- 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 M/s CLIENT and provide their assistance during interfacing with RTU to automation vendor.

Vendor must submit the following documents within 2 weeks of placement of LOI/ PO for review and approval of CLIENT:

a) Detailed project schedule giving all activities such as Design and review, Major bought out items (such as Mass flow meter, electronics, Valves, Hoses etc.), Sub-assemblies, Stage inspection, Final Assembly, Final factory testing of dispensers, Final inspection, dispatch etc.

b) Process and instruments diagram (P&ID) of gas flow giving Bill of Material. The Bill of Material shall clearly indicate all items, quantity of all items installed per dispenser, make and part number etc.

c) Certification from Weights and Measures department, PESO Department or other statutory authorities of the country of origin for offered model dispenser for specified flow and accuracy.

2.0 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 Organisation, Govt. of India as per the provisions of Gas Cylinder Rules, 2016.

3.0 EXPERIENCE RECORD SCHEDULE FOR DISPENSERS

Sr. No.	Parameter	Information on offered Model	Information on existing dispenser									
			1	2	3	4	5	6	7	8	9	10
1.	Number of Units											
2.	Fluid handled	CNG										
3.	Gas molecular weight range											
4.	Site min/max temp.											
5.	Dispenser rated flow											
6.	Dispenser overall Cv											
7.	Dispenser batch accuracy %											
8.	Dispenser with temperature Compensation	Yes										
9.	Number of Hoses	Twin										
10.	Mass flow meter make/model.											
11.	Where dispenser is located: Address and fax/telephone number of contact person.											
12.	Any other information on Installation											

13.	Date of commissioning of Dispenser											
14.	Number of hours completed as on bid due date.											
15.	Major problems encountered, if any											

4.0 DESIGN BASIS FOR DISPENSER

- Area Classification

For details refer Electrical Specification at section-C attached with this Specification.

- Codes and Standards

Following Codes and Standards are referenced to and made part of this Material Requisition.

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 Fueling Connection Devices Standard for fueling nozzles and receptacles.
NGV 4/AG.A	Requirements for Breakaway Devices for CNG Vehicle Fuel Dispensers and Fueling Hoses
AG.A 2-90	Compressed Natural Gas Fueling Appliances.
AG 901	Code of practice for NGV refueling 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 refueling 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

Any other Codes & Standards mentioned elsewhere in this Specification/MR. or which are required to be complied with as per the prevailing Government of India regulations shall also be followed.

5.0 PRECEDENCE

In case of any conflict between Job Specification & other documents, the following order of precedence shall apply:

Data sheets.

Particular technical Specifications (PTS)

Indian Standards/Codes as applicable, International Standards/Codes as applicable.

6.0 CNG SPECIFICATION TO BE HANDLED BY DISPENSERS:

Apart from Gas composition, the proposed specification of the CNG is as follows:

Gas Temperature : -10ºC to +70ºC

Oil Content : 10 PPM

Particulate matter : Less than 5 microns

Odorant : ≤10 mg/sm3 (Ethyl Mercaptane).

The CNG specification should meet the IS 15403:2000 (E) natural gas quality designation for use as a compressed fuel for vehicles.

7.0 SAFETY

7.1 All Electrical devices shall meet the requirement for the area classification specified elsewhere in tender document.

7.2 Tubing & other devices shall be so arranged that there is proper access for operation & maintenance.

8.0 TECHNICAL SPECIFICATIONS FOR CAR DISPENSER

8.1 The specifications described herewith are intended to give vendor the technical & operating conditions the Dispenser must fulfil. These are to be referred along with relevant description including in earlier sections. Vendor may indicate in his bid, the additional features, which his dispenser has in terms of better design, enhance reliability etc., however such feature may be accepted subject to CLIENT's review and approval.

8.2 The specifications of FLOW METER are described under Instrumentation & Control Specification Section-B attached with this Specification.

8.3 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.

8.4 Dispensers shall be based on three banks sequential filling. The sequential panel shall be within the cabinet of the dispenser itself and not as a separate unit. Sequencing should be on flow rate and pressure.

8.5 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.

8.6 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.

8.7 The normal operating temperature of wetted parts of dispenser shall be (-) 10 °C to 55°C.

8.8 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

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.

8.9 Fill Hose & Fill Nozzle

8.9.1 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. (As per specification & make provided in point no.3.1.1)

Both fill hose shall be fitted with NGV-I for filling of vehicles. The nozzle shall meet the requirements of NGV-1 Type-2, Class B nozzle (As per specification & make provided in point no. 3.1.1). 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 (As per specification & make provided in point no. 3.1.1). Hose shall be 3/8" ID 5000 psig, at least 3m long. Vendor shall demonstrate the function of breakaway coupling during performance test.

Designing of the dispensers would take into account severity of service. The dispensers shall be designed in such a way as to operate in cyclic (start, fill, stop, start.) round the clock basis with about 1 minute (typical) interval between stop and start modes. The dispenser also to work satisfactorily when the time between stop and start is indefinitely high, e.g. during lull time or when the dispenser is commissioned after it was decommissioned for prolonged period or in storage after initial commissioning. For this purpose if any specific storage facility is required, the same to be indicated by the bidder.

9.0 DATA SHEETS

Vendor shall fill up data the as per enclosed Data Sheet, attached with this job specification and submit along with bid.

10.0 CLIMATIC CONDITIONS

- Wind Velocity : 160.0 Km/Hr
- Minimum ambient temperature : 1.0 ºC
- Maximum ambient temperature : 47.5 ºC
- Maximum relative humidity : 98% non-condensing
- Maximum shed temperature : 47.5 ºC

11.0 UTILITY SPECIFICATION

- Electric Power Supply

Single phase, AC, 230 Volts ± 10%, 50Hz ± 3% will be provided by CLIENT. Surge protector device (Separate or inbuilt) is to be provided by the vendor at the 230 VAC inlet. All instrument (such as mass meter, solenoid, pressure transmitter/ switch etc.) power supply shall be of 24V DC only. 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, Section-C, attached with this job specification.

12.0 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 ± 1.5% dispenser shall stand rejected.

13.0 PERFORMANCE GUARANTEE

- 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 CLIENT site. Vendor shall carry out tests as required by Govt. Statutory Agencies.
- Guaranteed Performance for the Dispensers shall be as follows:

Flow Rate (≥ 15 kg/min for Car Dispenser)

Batch Accuracy of + 1.5%.

Note:

1 All the dispensing units shall be tested by Vendor for their fuction & performance in presence of CLIENT authorised representative.

2 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.

3 Vendor to execute performance test of all the dispensing unit after commissioning for accuracy and repeatability and safety parameters.

4 Vendor to make all arrangements for carrying out performance test viz. Std. Mass Flow Meter, Laptop etc. Vendor shall also carry out tests as required by Govt. statutory agencies.

14.0 VENDOR DATA REQUIREMENT

Vendor data requirement shall be as per attached specification Annexure-2.

SECTION: B:

INSTRUMENTATION & CONTROL SPECIFICATION

1.0 SCOPE

The purpose of this specification is to define the minimum general requirements and philosophy of instrumentation & control for the dispenser package of CLIENT.

This specification cover 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:

a) Basic instrumentation and control indicated in this document.

b) All local and field-mounted instruments in dispenser panel.

c) 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.

d) Impulse & pneumatic piping/tubing including all miniature valves, fittings and mounting to install all sub vendor supplied instruments.

e) All other erection material necessary for mounting of instruments in vendor's scope as per CLIENT installation standard.

f) Shop testing of all instruments and control system under vendor supply.

g) Calibration, loop checking, pre commissioning and commissioning of the complete system.

h) All weather proof and explosion proof double compression type cable glands for all instruments, junction boxes, dispenser panel etc.

i) All pressure relief valves.

In case of further clarifications, bidder shall obtain clarification/confirmation from CLIENT before proceeding.

All instruments must be procured from CLIENT recommend vendor list. However for those instrument/equipment, which are not covered in the list, the sub vendors shall be approved by CLIENT.

2.0 DESIGN PHILOSOPHY

2.1 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.

2.2 Mass flow meter shall be CORIOLIS type and shall conform to AGA 11 standard.

2.3 Each and every mass flow meter 'zeroing' shall be done before delivery from vendor's works.

2.4 Mass flow meter design considerations, piping, meter, zero verification and proving facility shall be as per AGA 11 standard.

2.5 Control valve, actuator and solenoid valves shall be of conventional type design, no integral design is acceptable.

2.6 Control valve body and trim materials selection shall be done by the bidder to ensure that there is no erosion, cavitations and flashing. Trim & seat shall be fully stellited.

3.0 SPECIAL INSTRUCTION TO VENDOR

3.1 Supply of Car dispenser with two arm of flow rate ≥ 15 kg/min under differential pressure of 200 kg/cm2 g.

3.2 Each dispenser arm shall have Coriolis type mass flow meter with Display mounted on the flow meter with necessary sensor, Transmitter and special cable recommended by vendor. Performance record and Weight and Measure (W&M) certification of the meter to be submitted for acceptance.

3.3 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).

3.4 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.

3.5 Non-resettable and non-volatile totalizer upto 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.

3.6 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 transaction details at the time of recall. These remote key pad device 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.

3.7 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.

3.8 One number of three bank electronic software and controller including hardware. Vendor shall include solenoid operated 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.

3.9 Two number of liquid filled 4" dia. (0-400 kg/cm^{2}g) pressure gauge showing the vehicle filling pressure. 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.

3.10 Temperature compensator to limit fill pressure to an adjustable value (with normal value 200 Kg/cm^{2}g) equivalent at 15 degree C. A temperature compensation facility button shall be provided to enable or disable the temperature compensator.

3.11 To limit fill pressure to 200 Kg/ cm^2 g, Vendor to provide the following options per hose / arm of the dispenser:

a) One number of pressure limiter (electronics transducer) (with adjustable value up to 250 Kg/cm^2 g)

b) One number of mechanical pressure regulator or One number of pressure limiter (electronics transducer) with adjustable value upto 250 Kg/cm2 g.

c) One number additional pressure relief valve may also be provided as final safety to avoid overfilling.

In case vendor is providing Pressure regulator, same shall be designed in such a way that there shall not be any flow restriction to the maximum flow of dispenser.

3.12 Back-up Power supply for displays so that display remains at least for 5 minutes after power failure. Vendor shall provide battery backup of 72 hours to the RAM of dispenser controller.

3.13 Hardware required with the dispenser for Weights and Measures (W&M) certification.

3.14 All parameter setting shall be password protected. Facility of change of password also to be provided to enhance the security of password.

3.15 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.

3.16 The batch accuracy of dispensed gas shall be within ± 1.5% or better.

3.17 Bidder shall indicate overall flow coefficient Cv of dispenser from inlet to the dispenser upto outlet of nozzle including mass flow sensor, interconnecting tubing, valves, hose, fill valve etc.

3.18 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.

3.19 Normal operating temperature of wetted parts of dispenser shall be –10 to 55 deg C.

3.20 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.

3.21 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 un-metered gas.

3.22 Complete control loop would be so fast that if the filling is terminated at any point of filling, the flow would stop immediately.

3.23 Reset switch assembly should be suitable for failure free operation and the same shall be supported with proper PTR for CNG duty.

3.24 Controller shall be in reset state for the SOV 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.

3.25 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 shall be displayed on LCD display.

3.26 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.

3.27 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.

3.28 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.

3.29 Overfill Protection

Overfill protection shall be through electronically programmed hose to terminate the fill after 200 Kg/cm²g. Vendor shall include one number pressure transducer and one number pressure regulator per hose. Pressure relief valve shall be provided to avoid overfilling. Relief valve set pressure shall be at 250kg/cm²g with resetting at 245kg/cm²g. Relief valve setting to be adjustable from 225kg/cm²g to 260kg/cm²g with resetting at 220 to 255 kg/cm²g respectively. Calibration certificate shall be provided.

3.30 Electronics

3.30.1 Electronics controller 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.

3.30.2 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.

3.30.3 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.

3.30.4 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

3.31 Tubing & Fittings

Materials used for the tubing shall be SS 316 fully annealed (Bright annealed) seamless conforming to ASTM A269 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.

3.32 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-fuelling 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 “exia” as per IEC 79-11. Solenoid Valves, Switches and related junction boxes should be flame proof “Exd” as per IEC 79-1.

Other special equipments / instruments, where intrinsic safety is not feasible or available, should be flame proof 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.

3.33 The mass flow meter shall have sensor, transmitter with local integral display. Transmitter along with display shall be mounted on Mass flow meter sensor body for viewing mass flow meter diagnostic data. Mass flow meter transmitter along with display shall be separately powered. There shall be separate part no. in catalogue for Mass flow meter sensor, transmitter and display so that these can be replaced in future under fault condition. There shall be two communication port on mass flow meter . Both ports shall be used simultaneously one for transmitter configuration and other with dispenser controller/ mother board connection. The mass flow meter signal through the transmitter shall be wired to the dispenser mother board/ controller used in the dispenser and there shall not be any difference in reading between this mass flow meter display unit and non-resettable display in the electronic control unit

3.34 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.

3.35 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. Besides this, an electro-mechanical type totalizer shall also be provided with 7 digits.

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. Besides this, a 7-digit electro-mechanical totalizer shall also be provided.

3.36 All equipment should be communicated with the common communication protocol. (MODBUS/PROFIBUS/HART)

3.37 All the safety norms to be followed by vendor as per CLIENT guidelines.

3.38 All the approvals and certification to be provided by vendor for the hardware, software supply as per CLIENT requirements.

3.39 During installation & commissioning vendor will ensure that routine operation of the equipment will not suffer or vendor will install the equipments as per CLIENT guidelines.

3.40 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)

4.0 REQUIREMENT FOR AUTOMATION SYSTEM IN DISPENSER

4.1 It is intended to monitor / control following parameters through automation system:

a. Mass Totalizer from Dispenser Motherboard.

b. 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)

c. To Read Gas Selling Price from Dispenser.

d. To download the gas selling price into the dispenser from Server system.

e. Mass Flow Meter Status.

f. Tripping Status Dispenser.

g. Reset Switch Operation Status.

h. Dispenser Power Supply Status.

i. Identity of vehicle using RFID (In-built option to be provided).

4.2 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)

a) Showing Date /Start time/ Finish time of every shift

b) Individual Arm-wise and Dispenser-wise totals.

c) Total sale for each shift in Kgs and Rs.

d) Total sale with variable pricing.

e) 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

4.3 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).

4.4 The remote monitoring and automation will consist of reading, transferring and controlling all the data/parameter from the dispensers to RTU and then to any centralized remote server in India as per CLIENT requirement.

4.5 The above list is tentative and final list shall be decided during execution phase.

5.0 VENDOR DATA REQUIREMENTS

Vendor data requirement shall be strictly as per Annexure-4 this job specification.

6.0 INSPECTION AND TESTING

6.1 Functional and simulation test for the following shall be carried out at vendor's works and shall be witnessed by CLIENT/Third party.

6.2 Control panels along with all instruments mounted in it.

6.3 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-vendors conformity certificates.

7.0 LIST OF ATTACHMENTS

Data sheet for CNG Dispenser for CAR.

Data sheets formats (along with calibration certificate wherever applicable) for

Mass flow meter

Control valve

Solenoid valve

Self actuated control valve

Pressure relief valve & Pressure Gauge and transmitter

SECTION: C: ELECTRICAL SPECIFICATION

1.0 GENERAL

1.1 This specification defines the requirements of design, engineering, supply and installation, testing and commissioning of electrical facilities for CNG Dispenser Package.

1.2 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.

2.0 CODES AND STANDARDS

2.1 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.

2.2 Vendor shall provide all assistance required for obtaining approvals from statutory authorities for materials, plant design/drawings and complete installation.

2.3 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.

2.4 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.

3.0 AREA CLASSIFICATION AND EQUIPMENT SELECTION

3.1 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.

3.2 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).

3.3 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 use in the specified hazardous area. Flameproof equipment of indigenous origin shall be BIS marked. Vendor shall furnish the necessary certificates indicating such approvals.

3.4 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.

Certificate from recognized agency to the effect is required to be produced that equipment supplied and/or installed conforms to above area classification."

4.0 EQUIPMENT SPECIFICATIONS

4.1 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 vapours.

4.2 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.

4.3 All electrical components and equipment shall be sized to suit the maximum load under the most severe operating conditions.

4.4 All electrical equipments shall be supplied with double-compression cable glands, made of nickel-plated brass, tested and certified to be used in zone-1, hazardous area.

4.5 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

4.6 Although the supply is being arranged through UPS System, but in some remote occasions, 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.

4.7 Rated voltage and frequency for the equipment shall be indicated below:

Ambient Temp:	Max. 48 ºC & Min. 1 ºC
System Voltage:	230V + 10% Single Phase AC
System Frequency:	50 Hz + 3%
System Earthing:	Solidly Earthed

We have envisaged solid earthing for the system. However, if specific earthing is required 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.

4.8 Name of the manufacturer, type of enclosure protection and certificate no. with name of testing/Certifying agency shall be furnished with bids / for approval.

4.9 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 armoured 2.5sq.mm. 4 core.

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 vendors shop.

SECTION D: MECHANICAL SPECIFICATION

Specifications / make of hose, break away coupling, 3 way valves, SS fittings & nozzles are as follows:

1. Hoses - PARKER/SWAGELOK/EATON
2. Breakaway coupling - OPW/STAUBLI/WEH
3. 3 way valves - PARKER/SWAGELOK
4. NGV nozzles - OPW/ WEH/ STAUBLI
5. SS fittings -PARKER/ SWAGELOK/HAMLET/HY-LOK/SSP/VOSS

Hoses:

Two CNG flexible electrically conductive (fill & vent both should be separate) hose, having following specification:

1. Car long hose breakaway to nozzle:
   a. Car Dispenser Fill hose (Long)
   b. Hose ID- 3/8",
   c. OD- 0.77",
   d. Length- 3000 mm,
   e. Minimum Bend Radius-4",
   f. End SIZE 1:- 9/16"-18 UNF SAE6(M)
   g. End SIZE 2:- 1/4 NPTM , in SS 316
   h. Nominal Size-3/8",
   i. Working Pressure: 5000 PSI (345 Bar),
   j. Minimum Burst Pressure: 20000 PSI (1379 Bar),
   k. Temperature Range: -40° C to 65° C),
   l. 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 cover for abrasion and wear resistance.
   m. Spring guards must be provided at both ends for the assembly.
   n. Hose should conform to NFPA 52 & ANSI / CSA NGV 4.2-2014 / CSA12.52-2014
2. Car short hose dispenser to break away:
   a. Car Dispenser Fill hose- 1800 mm (Short),
   b. Hose ID- 3/8",
   c. OD- 0.77",
   d. Length- 1800 mm,
   e. Minimum Bend Radius-4",
   f. End Size 1- 9/16"-18 UNF SAE 37* JIC (F) Swivel
   g. End size 2- 9/16"-18 UNF SAE6(M) (Both Ends),in SS 316
   h. Nominal Size-3/8",
   i. Working Pressure :5000 PSI (345 Bar)
   j. Minimum Burst Pressure : 20000 PSI (1379 Bar),

k. Temperature Range : -40° C to 65° C,

l. 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 cover for abrasion and wear resistance.

m. Spring guards must be provided at both ends for the assembly.

n. Hose should conform to NFPA 52 & ANSI / CSA NGV 4.2-2014 /CSA .52-2014

3. Vent hose:

a. Vent hose- 3000mm ,

b. Hose ID- 1/4",

c. OD- 0.63",

d. Length- 3000 mm

e. Minimum Bend Radius-2",

f. End SIZE 1:- 9/16"-18 UNF SAE6(M)

g. End SIZE 2:- 1/4 NPTM , in SS 316

h. Nominal size - 1/4"

i. Working Pressure : 5000 PSI (345 Bar),

j. Minimum Burst Pressure : 20000 PSI (1379 Bar),

k. Temperature Range : -40° C to 65° C,

l. 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 cover for abrasion and wear resistance.

m. Spring guards must be provided at both ends for the assembly.

n. Hose should conform to NFPA 52 & ANSI / CSA NGV 4.2-2014 / CSA52-2014

Nozzles:

Both hose 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	PN200 bar
Temperature Range	0°C to +85°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 1/4” 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. 326 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.

DATA SHEETS

CNG DISPENSER FOR CAR

SR. NO.	PARAMETER	SPECIFICATION	OFFERED
1.0	Dispenser	Car	
1.1	Make		
1.2	Model		
1.3	Normal Inlet Pressure Kg/cm2 g	250	
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	Nominal 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	± 1.5%	
1.11	Electrical Supply	AC 230 Volts ± 10% 50Hz ± 3%	
1.11.1	Tolerable value of voltage range for accurate operation		
1.12	Fill Nozzle		
1.12.1	Type	NGV1 & NZS 5425	
1.12.2	Make	OPW	
1.12.3	Pressure Rating Kg/cm2 g	250 Kg/cm2 g	
1.13	Flexible fill & vent hose	Both should separate	
1.13.1	Type		
1.13.2	Make		
1.13.3	Pressure Rating Kg/cm2 g		
1.14	Sequential filling	Three bank	
1.15	Mass Flow Meter		
1.15.1	No. of metering lines	Two independent	
1.15.2	Metering principle	Coriolis	
1.15.3	Make		
1.15.4	Model		
1.15.5	Mass Flow accuracy for gas meter (inclusive of linearity, hysteresis, repeatability errors)	± 0.5%	
1.15.6	Repeatability	±.0.25%	
1.16	Temperature compensation	Yes	
1.17	Breakaway coupling	Yes	
NOTE: 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 CAR DISPENSER					
Units:	Flow -> CNG		CNG-Kg/Hr Pressure->	Temperature-> ^{o}C	Level /Length->mm
General	1.	Tag No.			
	2.	Line No.			
	3.	Service	Natural Gas		
	4.				
Meter	5	Type	Coriolis		
	6	Function	Transmitter cum Display		
	7	Conn. Size: Size &Rating,			
		Facing & Finish	SS316		
	8	Body Material	SS316		
	9	Wetted Parts Material	SS316		
	10	Enclosure			
	11	Conduit connection			
	12	Range			
	13	Accuracy	+/- 0.5%		
	14				
	15				
Convertor	16	Load Resistance – ohms.			
	17	Output	4 – 20 ma dc, Frequency, Rs 485		
	18	Power Supply	230±10% V, 50±2 Hz, 1 and 24V DC		
	19	Area Classification	Class I, Div I, Gas Group D		
	20	Intrinsically safe /Expl. Proof	Intrinsically safe		
	21	Enclosure	Flame Proof		
	22	Conduit connection			
	23	Mounting			
	24	Distance from control room			
	25				
	26				
Options	27	Filter/Mesh Wire			
	28	Mounting Brackets			
	29	Interconnecting			
	30	Special cabling			
	31	Cable glands			
	32	Accessories for hot tap			
	33				
	34				
	35				
Service Conditions	36	Fluid & state			
	37	Maximum Flow			
	38	Minimum Flow			
	39	Normal Flow			
	40	Pressure – Open. Max.			
	41	Temp. C – Open. Max.			
	42	Oper. S.G. Mol. Wt			
	43	Max. order Viscosity mpa . s(cp)	< 0.2Kg/cm2g		
	44	Max. Allowable Pr. Drop			
	45	Model No. Meter convertor			
	46	Specification Remarks			
	47	Specification Remarks			

Notes:

☐ DEVIATION ☐ NO DEVIATION

CONTROL VALVES					
Units:		Flow -> CNG	CNG-Kg/Hr Pressure->	Temperature-> °C	Level /Length->mm
General	1	Tag No.			
	2	Inlet Line No.			
	3	Outlet Line No.			
	4	Service	Natural Gas		
	5	Line Size Schedule			
	6	Inlet Line I.D. Outlet line ID			
Body	7	Type of Body			
	8	Body Size Port Size			
	9	Guiding No. of Ports			
	10	End Conn: Flgd. Size & Rating			
	11	Facing & Finish			
	12	Body Material	SS 316		
	13	Bonnet Type			
	14	Packing Material			
	15	Lubricator Isol. Valve			
	16	Trim form			
	17	Trim Mat. Plug. /Disc/Ball & Seat			
	18	Other wetted parts			
	19	Soft seating Materials			
	20	ANSI Leakage Class	VI		
Act.	21	Type			
Uat or.	22	Close at Open at			
	23	Failure Position			
	24	Handwheel & Location			
Position	25	Air Supply Pressure			
	26	Input Output			
	27	Bypass Gauges			
Options	28	Solenoid Valve			
	29	I/P convertor			
	30	Filter with Gauge			
	31	Limit Switch			
Service Conditions	34	Fluid State	Natural Gas		
	35	Flow Liquid Min: Normal: Max			
	36	Flow vapour Min : Normal : Max			
	37	Flow Water Min Normal Max			
	38	Inlet Pr. Nor. Min.			
	39	P @Flow rat Min :Normal : Max			
	40	Pressure Shut Off			
	41	Temp. Open. Max.			
	42	Open S.G. Mol. Wt.			
	43	Cp/Cv Compress Factor			
	44	Flash% visc.mPas (open)			
	45	Deg. Of Superheat % Solids			
	46	Vapour Pr. Critical Pr.			
	47				
Valve Data	48	CV Min. Cv Max.			
	49	CV Nor. Selected CV			
	50	Predicted Sound Level Dba			
	51	Inlet Velocity m/s			
Model Nos.	52	Valve Actuator			
	53	Positioner Solenoid Valve			
	54	IBR Certification			

SOLENOID VALVES					
Units:		Flow -> CNG	CNG-Kg/Hr Pressure->	Temperature-> °C	Level /Length->mm
General	1	Tag No.			
	2	Line No.			
	3	Line Size & Sch.			
	4	Service			
Valve	5	No. of ways			
	6	Size – Body Port			
	7	End Connection			
	8	Material Body	SS316		
	9	Material Trim			
	10	Body Rating			
	11	Operating mode NC/NO/Univ.	NC		
	12	Packing			
	13				
	14				
	15	Enclosure	SS		
Electrical	16	Area Classification	Class I, Div I, Gas Group D		
	17	Cable Entry			
	18	Ty. Of Energisation Dropout			
	19	Power Supply	230 Vac		
	20	Power Consumption VA/W			
	21	Inrush Current			
	22	Insulation Class			
	23	Voltage – Energising – Dropout			
	24				
Options	25	Manual reset			
	26	Latching on Energ./De-Energ.			
	27	Bug screen for vent port			
	28	Intrinsically safe			
	29				
	30				
Service Conditions	31	Fluid			
	32	Press. Open / Max.			
	33	Temperature C-Open/ Max			
	34	Maximum Flow			
	35	S.G. at open Temp. Mol. Wt.			
	36	Viscosity mPa.s (cp)			
	37	Allowable Press Frop			
	38	Del. P Shut Off			
	39	Valve CV			
	40				
	41				
	42	Model No.			
	43	Specification Remarks			

SELF ACTUATED PRESSURE CONTROL VALVES

Units:	Flow -> CNG		CNG-Kg/Hr Pressure->	Temperature-> °C	Level /Length->mm
General	1	Tag. No			
	2	Line No.			
	3	Line Size & Sch.			
	4	Service			
	5				
Valve	6	Ty. Of Regulator: Std/pilot op			
	7	Size: Body Port			
	8	End Conn.:- Size & Rating			
	9	- Facing & Finish			
	10	Body Material	SS 316		
	11	Trim Material			
	12	Set Point			
	13	Impulse Conn.: Int. / Ext.			
	14	Conn. Size & Type if external			
	15	Material of Diaphragm			
	16	Bonnet Type			
	17	Cv: Min. Max.			
	18	Cv: Normal			
	19	Selected Valve CV.			
	20	Predicted Sound Level (dBA)			
	21	Inlet Velocity			
	22	Packing of Seals			
	23	Lubricator ISO – Valve			
	24	Guiding No. of Ports			
	25				
Accessories	26	Pressure Indicator			
	27	Relief Valve			
	28	Line Stainer			
Service conditions	29	Fluid & State			
	30	Flow - Min. / Max.			
	31	Flow - Normal			
	32	Inlet Pr. - Max. / Min			
	33	Inlet Pr. - Normal			
	34	Del. Pr. – Max. Min			
	35	Del. Pr. - Shut Off			
	36	Temperature °C - Oper. Max.			
	37	Oper. S.G. Mol Wt.			
	38	Cp/ Cv compress factor			
	39	Flash% | open visc. Mpa. S (cp)			
	40	Deg. Of Superheat % solids			
	41	Vapour Pr. / Critical Pr.			
	42	Model No. Valve / Actuator			
	43				
	44	IBR certificate			
	45	Specification Remarks			

PRESSURE RELIEF VALVES					
Units:	Flow -> CNG		CNG-Kg/Hr Pressure->	Temperature-> °C	Level /Length->mm
General	1	Tag No.			
	2	Line No.			
	3	Vessel Protected			
	4	Safety / Relief			
Valve	5	Type:			
	6	Full Nozzle Full Lift/ Mod Nozzle	Full nozzle full lift		
	7	Bonnet Type	Closed		
	8	Conv. / Bellows / Pilot Operated			
	9	Inlet Conn.: Size & Rating			
	10	Facing & Finish			
	11	Outlet Conn.: Size & Rating			
	12	Facing & Finish			
	13	Cap Over Adj. Bolt			
	14	Screwed/Bolted			
	15	Lifting Gear – Type			
	16	Test Gag			
	17				
Material	18	Body and bonnet	SS 316		
	19	Nozzle and Disc			
	20	Spring			
	21	Bellows			
	22	Resilient Seat seal			
Options	23				
	24				
Basis	25	Code			
	26	Basis of selection			
	27				
Service conditions	28	Fluid and state			
	29	Corrosive constituent			
	30	Required flow capacity			
	31	Mol. Wt./ S.G. at Ref Temp.			
	32	Open Pressure			
	33	Open temp C / Ref Temp C			
	34	Valve discharge to			
	35	Back Press. / Const or variable			
	36	Set Pressure			
	37	Cold Bench Test pressure			
	38	% Over pressure/ % blow down			
	39	Cp/cv [compressibility Factor]			
	40	Viscosity At Ref. Temp. mPa s(cp)			
	41	Vess.: Walltemp.C/ Surf Area-m^2			
	42				
Orifice	43	Calculated Area cm^2			
	44	Sel. Area cm^2 / Orifice Design			
	45	No. of valves Reqd. for capacity			
	46	Total Area - cm^2			
	47	Actual Flow Capacity			
	48				
	49	Model No.			
	50				
	51	IBR Certification			

PRESSURE TRANSMITTER

Units: Flow -> CNG CNG-Kg/Hr Pressure-> Temperature-> °C Level /Length->mm

General

1. Function - Transmission & Indication
2. Type: - 2 Wire, Electronic smart transmitter with HART Protocol of latest version
3. Case: - Die cast Al
4. Mounting: -
5. Electrical Area Classification Class I, Div I, Gas Group D
6. Enclosure : WP to IP 65
   Enclosure Class
7. Intrinsically safe: - Yes
8. Air Supply
9. Power Supply- 24 V DC
10. Cable Entry: 1/2" NPT(F) with aluminium plug
11. Accuracy: - +/- 0.075% of span
12. Repeability: -
    TRNSMITTER
13. Output
14. Trans. Power Supply Controller
15. Output:-
16. A/M switch:-
    No. of positions:-
17. Set point adjustment
18. Manual Regulator
19. Mode
20. Chart
21. Chart Driver
22. Moving parts matl.; -
23. Chart Speed: -

Measuring Unit

24. Service: - Natural Gas
25. Element : -
26. Body Material: -
27. Element Material SS 316
28. Process conn.: -
    process conn. Location
29. Diaphragm seal
    wetted parts materials: -
    other Material
    Process Conn.:
    Size & Rating
    Facing & Finish: -
    Capability Material:-
    Armour Flexible: -
    Armour Flexible Matl.: -
    Capillary length:- mm
    Flushing/filling conn. With
    Miscellaneous
30. Over range protection
31. Options: -
    (a) Intrinsically Safe
    Output meter
    (b) Air Filter Regulator
    (c) Mounting Accessories
    (d) 3-way manifold
    (e) ----------
32. Load Capability:-

TAG NO.	OPERATING PRESSURE	MAXIMUM PRESSURE	MAXIMUM TEMPERATURE	RANGE		CONTROL	SERVICE	OPTIONS
				Span	Set			

PRESSURE GAUGES

Units: Flow -> CNG CNG-Kg/Hr Pressure-> Temperature-> ^{o}C Level /Length->mm

1. Type: - Direct
2. Mounting: -
3. Dial Size: - 100 mm
   Colour: -
4. Case Matl. :- SS316
5. Bezel Ring :- Bayonet type SS316
6. Window Matl.:- Shatterproof glass
7. Enclosure : - WP to IP 65
8. Pressure Element :- Bourden Tube
9. Element Matl.:- SS316
10. Socket Material +/-1% of FSD
11. Accuracy +/-1% of FSD
12. Zero adjustment Micropointer

13 Connection
connection location: - Bottom
14 Movement: -
15 Diaphragm Seal:-
Type
wetted parts material – Element Matl.
SS316
Lower Boy Matl.
Non-wetted parts materials :
Process connection: size & Rating
Facing & Finish
Capability Material
Armour – Flexible – Matl.
capability Length
Flushing / filling connection
16 Over Range Protection:- 130% of FSD
17 Blow out Protection:- Yes
18 Options: (a) Snubber
(b) Syphon
(c) Gauge Saver
(d) Liquid filled casing
(e)----------

TAG No.	Range	Operating Pressure	Maximum Service Pressure	Maximum Service Tempe.	Fluid	Service	Options

ANNEXURES

ANNEXURE-1: RECOMMENDED VENDOR LIST

ITEM CODE / DESCRIPTION	**COALESCENT FILTER / REGULATORS**
VENDOR NAME	REMARK
ASEA BROWN BOVERI LTD.	
BLUE STAR LTD	
PLACKA INSTRUMENTS & CONTROLS PVT. LTD	
SHAH PNEUMATICS	
SHAVO NORGREN (I) PVT. LTD	
V AUTOMAT & INSTRUMENTS PVT. LTD.	
VELJAN HYDRAIR PVT. LTD.	
COMPAC NEWZEALAND	
ITEM CODE / DESCRIPTION	**FIELD INSTRUMENTS (P, DP, F,L,T)**
VENDOR NAME	**REMARKS**
ABB AUTOMATION LTD.	
ASHCROFT	
BROWN BOVERT LTD.	
MURPHY	
CCS	
WAREE	
FISHER ROSEMOUNT INDIA LIMITED	
FISHER ROSEMOUNT SINGAPORE PTE LTD.	
FUJI ELECTRIC CO. LTD.	
HONEYWELL INC.	
TATA HONEYWELL	
YOKOGAWA ELECTRIC CORPORATION	
YOKOGAWA BLUE STAR LTD.	
WIKA	
DRUCK	
BEKO	
FILTERATION TECHNIQUE	
ITEM CODE / DESCRIPTION	**MASS FLOW METERS**
VENDOR NAME	**REMARK**
	CORIOLIS TYPE,
EMERSON PROCESS MANAGEMENT	———————
ENDRESS & HAUSER CMBH & COMPANY	
ITEM CODE / DESCRIPTION	**PRESSURE GAUGES**
VENDOR NAME	REMARKS
AN INSTRUMENTS PVT. LTD.	
BADOTHERM PROCESS INSTRUMENTS B. V.	
BOURDON HAENNI S.A	
BRITISH ROTOTHERM CO. LTD	
BUDENBERG GUAGE CO. LTD.	
DRESSER INC.	
GENERAL INSTRUMENTS CONSORTIUM	
MANOMETER (INDIA) PVT. LTD.	
NAGANO KEIKI SEISAKUSHO LTD.	
WAAREE INSTRUMNETS CONSORTIUM	
BAUMER	
WALCHANDNAGER INDUSTRIES LTD.	
WIKA ALEXANDER WIEGAND & CO GMBH	
WIKA INSTRUMENTS INDIA PVT. LTD.	
DRUCK	
ASHCROFT	
FILTERATION TECHNIQUE	

BEKO	
ITEM CODE / DESCRIPTION	**PRESSURE RELIEF VALVE**
VENDOR NAME	REMARKS
ALSTHOM FLUIDS SAPAG	
ANDERSON GREENWOOD CROSBY	
BHEL (TRICHY)	
ASPRO	
DRESSER INC.	
FUKUI SEISAKUSHO CO. LTD.	
INSTRUMENTATION LTD. (PALGHAT)	
NAKAKITA SEISAKUSHO CO LTD.	
NUOVO PIGNONE SPA (ITALY)	
PARCOL SPA	
SAFETY SYSTEMS UR LTD.	
SARASIN RSBD	
SEBIN VALVES INDIA PVT. LTD.	
TAI MILANO SPA	
TYCO SANMAR LTD.	
TYCO VALVES & CONTROLS INDIA PVT. LTD	
SWAGELOK	
PARKER	
COMPAC NEWZEALAND	
FARINOSLA	
FAINGER LASER	
MERCER	
FISHER ROSEMOUNT (EMERSON)	
OFE & OE GROUP KEYSTONE VALVES PVT. LTD	
BARODA	
HALOL	
ITEM CODE / DESCRIPTION	**SELF ACTUATED PR. CONTROL VALVE**
VENDOR NAME	REMARK
DANIEL INDUSTRIES INC	
DRESSER PRODUITS INDUSTRIES	
ASPRO	
ESME VALVES LTD.	
FISHER ROSEMOUNT SINGAPORE PTE LTD.	
FISHER EXMOX SANMAR LIMTED	
GORTER CONTROLS B.V.	
INSTROMET INTERNATIONAL NV	
KEYE & MACDONALD INC	
NUOVO PIGNONE SPA (ITALY)	
PIETRO FIORENTINI SPA	
RICHARDS INDUSTRIES (FORMERLY TRELOAR)	
RMG REGEL + MESSTECHNIK GMBH	
VANAZ	
NIRMAL INDUSTRIES LIMITED	
COMPAC INDUSTRIES LTD., NZL.	
ITEM CODE / DESCRIPTION	**SOLENOID VALVES /ACTUATOR**
VENDOR NAME	REMARK
ALCON ALEXANDER CONTROLS LIMITED	
ASCO (INDIA) LIMITED	
JEFFERSONS	
ASCO JOUCOMATIC LTD.	
ASCO JOUCOMATIC SA	
AVCON CONTROLS PVT. LTD.	
PARKER HANNIFIN, USA	

BARKSDALE INC.	
BLUE STAR LTD.	
HERION WERKE	
SCHRADER SCOVILL DUNCAN LIMITED	
SEITZ AG	
ROTEX AUTOMATION LIMITED	
OPERATED VALVES ASCO	
HABONIM VASS	
FESTO	
COMPAC NEW ZEALAND	
MICROMECANICA	
ITEM CODE /DESCRIPTION	**SPECIAL CONTROL VALVES**
VENDOR NAME	REMARK
FISHER ROSEMOUNT SIGAPORE PTE. LTD.	
FLOWSERVE PTE. LTD. (FORMERLY DURIRON)	
HOPKINSONS LIMITED	
METSO AUTOMATION PTE LTD. (FORMERLY NELES)	
NUOVO PIGNONE SPA (ITALY)	
SPX VALVES & CONTROLS (FORMERLY DEXURIK)	
COMPAC IND. LTD. NZL	
ITEM CODE /DESCRIPTION	**REGULATORS**
VENDOR NAME	REMARK
COMPAC IND. LTD.	
FISHER ROSEMOUNT SIGAPORE PTE. LTD.	
FLOWSERVE PTE. LTD. (FORMERLY DURIRON)	
ITEM CODE /DESCRIPTION	**TWO WAY / THREE WAY VALVES**
VENDOR NAME	REMARK
SWAGELOK	
PARKER	
COMPAC	
HAMLET	
HYLOK	
SEALEXCEL	
OASIS	
VOSS	
SSP	
ITEM CODE /DESCRIPTION	**SS FITTINGS**
VENDOR NAME	REMARK
SWAGELOK	
PARKER	
HAMLET	
HYLOK	
VOSS	
SSP	
ITEM CODE /DESCRIPTION	**SS TUBING**
VENDOR NAME	REMARK
SANDVIK	
FAE	
TUBACEX (SCHOELLER-BLECKMNN)	
RATNAMANI	
ITEM CODE /DESCRIPTION	**HOSES**
VENDOR NAME	REMARK
PARKER	
SWAGELOK	

EATON	
ITEM CODE /DESCRIPTION	**BREAKAWAY COUPLING**
VENDOR NAME	REMARK
OPW	
STAUBLI	
WEH	
ITEM CODE /DESCRIPTION	**FLAMEPROOF GLANDS**
VENDOR NAME	REMARK
COMET/OEM Make	
ITEM CODE /DESCRIPTION	**SURGE PROTECTOR**
VENDOR NAME	REMARK
MEGGITT AVIONICS	
GENERAL MONITORS/ MSA	
SPECTREX	
DETRONICS	
HONEYWELL	
NET SAFETY	
CROW ON	
SIEGER	
ISOLATORS	
BARRIERS	
ESP	
PHOENIX	
P&F	
MTL	
ASPRO	
ITEM CODE /DESCRIPTION	**NGV NOZZLES**
VENDOR NAME	REMARK
OPW	
WEH	
STAUBLI	
ITEM CODE /DESCRIPTION	**CABLES**
VENDOR NAME	REMARK
CORDS CABLES INDUSTRIES	
ASSOCIATED CABLES	
INCAB	
UNIVERSAL CABLES LTS/OEM Cables	
ASEAN	
CCI	
FORT GLOSTER	
FINOLEX	
KEI	
POLYCAB	
HAVELLS	

Note:

- Above vendor list is indicative only and any other vendor(s) apart from as mentioned above may be accepted subject to approval by Owner/Owners representative based on their past track record / credentials. However, no relaxation or advantage in delivery period will be given to the successful bidder on account of this approval.
- For the vendors of items not covered in above vendor list, but required for completion of project successfully, supplier shall take approval form Owner/Owners representative for the same during project execution. Bidder shall submit the required certifications, documents, PTR and Performance letters from clients for the same.

ANNEXURE-2: VENDOR DATA REQUIREMENT (DISPENSER)

1.0 DRAWING AND DATA REQUIREMENT

1.1 The following data and information marked "X" shall be furnished by the vendor for Car Dispenser:

S. No.	Description	With Bid	After Job Award		
			For Review	For Information	Final in Book Form
1	2	3	4	5	6
1.0	GENERAL				
1.1	Filled in Material Requisition Compliance Schedule.	X			
1.2	Filled in Deviation Schedule.	X			
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 Qualification of vendor, Accordingly vendor to furnish references of those cases which are matching with offered Dispensers.	X			
1.4	Installation manual			X	X
1.5	List of components of Dispenser with Make & Specification of components. Vendor shall also submit "Technical Catalogues" of components			X	
1.6	Start-up, operation & maintenance manual showing assembly details and critical tolerances. A copy of all certified drawings & documents to be enclosed.			X	X
1.7	Lubricant list with specification			X	X
1.8	Battery limit (interface) drawing/ information	X	X		
1.9	Drawing list and submission schedule		X		
1.10	Project implementation schedule, ordering and inspection schedule for long lead and major items		X		
1.11	Pre-commissioning & commissioning procedure		X		
1.12	Performance guarantee test procedure		X		
1.13	Weights & Measures Certificates from the country of origin for offered models of Car Dispensers unit model/mass flow meter model for dispensing specified mass flow rate at specified overall batch accuracy.	X	X		X
1.14	The "Test Certificate" for mass flow meter.		X		
1.15	Weights & Measures approval from Indian Authorities.		X		

1.16	Type approval for the offered dispenser from Petroleum & Explosive safety organization, Govt. of India		X		X
2.0	DESIGN				
2.1	Process flow diagrams (PFDs) and Piping & Instrumentation diagrams (P&IDs) of sub systems and complete system with write-up on operation		X		X
2.2	Data sheets and catalogue for PT ,PG ,Solenoid valve , actuated valve and mass flow meter of Car Dispensers duly filled up.	X	X		X
2.3	Basic design calculations for system design, equipment selection		X		X
2.4	Performance data, vendor literature for equipment selection, performance curves with duty point marked for individual equipment		X		X
2.5	Specification for piping material & valves.		X		X
2.6	Utility requirement		X		X
2.7	Detail of control wiring diagram, interlock/ shutdown/ control scheme with write up on operation. Sizing calculation for instrument items.		X		X
2.8	Dispenser communication port details and requirement information as per specification and list of signals		X		X
3.0	CONSTRUCTIONAL FEATURES				
3.1	G.A. drawing of Dispensers showing maintenance clearances required.	X	X		X
3.2	Cross section drawings of individual equipment/ skid, material & parts list.			X	X
3.3	Termination & Wiring Diagrams			X	X
4.0	SPARES				
4.1	List of spares for two years normal operation per Car Dispenser.		X		
5.0	Drawings, documents, data as asked under Electrical & Instrumentation specifications of this Material Requisition.		X		

1.2 DOCUMENT DISTRIBUTION SCHEDULE

1.2.1 Documents and drawings under column no. 3 shall be submitted with each copy of the bid.

1.2.2 Documents listed under column 4 are to be submitted in 2 copies

1.2.3 Documents listed under column 5 are to be submitted in 2 copies.

1.2.4 Documents listed in column 6 are to be submitted as hard bound indexed book containing the following details in Two (2) copies to be submitted within 2 weeks of release note/dispatch of materials/ equipment from vendor's works.

1.3 DETAILS TO BE INCLUDED IN FINAL DOCUMENTS BOOKS

1.3.1 Copy of P.O. and all amendments.

1.3.2 Copy of Purchase Requisition and all amendments.

1.3.3 Manufacturing Data Book containing all test certificates of components, raw materials, stage manufacturing tests and inspections, final tests & inspection documents including welders' qualification & welding procedure qualification, repairs & reworking carried out in shops. All raw material test certificates must be correlated to the P.O. Item No. & component to which they relate by clear stating on the certificates.

1.3.4 Spares details including assembly drawings, part numbers, delivery, prices and ordering information.

1.3.5 All design calculations carried out by the vendor.

1.3.6 Final Drawing Index and all as-built drawings reduced to A3/ A4 size and wherever reduction is not possible, full size copies duly folded and placed in plastic pockets.

1.3.7 Catalogues/leaflets of sub-vendors/suppliers of various bought out components highlighting the components actually supplied correlated to P.O. Item Numbers.

1.3.8 Operating and maintenance instructions including lubrication schedules with details of suppliers for procurement by OWNER for subsequent needs.

1.3.9 Release Note and Packing List.

1.3.10 Any other documents asked for in the Purchase Requisition.

1.3.11 All final drawings shall also be given to purchaser in digitized form on CD-ROM compatible to AUTOCAD software.

1.4 SPECIAL INSTRUCTIONS FOR SUBMISSION OF DWGS./DOCUMENTS:

1.4.1 Fold all prints to 216 MM x 279 MM size & roll transparencies.

1.4.2 Vendor to forward the drawings and documentation to CLIENT (Attention vendor prints control department) clearly specifying purchasers Job no. & Req. No.

1.4.3 The drawing/Document no. with Rev. No. is essential. The number may be upto a maximum of 28 characters in length.

1.4.4 Each Drawing/Document submitted to CLIENT must be checked and signed/stamped by vendor before it is submitted to CLIENT.

1.4.5 Revision number must change during subsequent submission of vendor document.

1.4.6 Multi-sheet documents other than drawings must be submitted in their entirety in the event of a re-submission even if only a few sheets are revised.

1.4.7 Final submission in bound volumes shall necessarily have a cover page giving project title, Item name, P.O.No. Particulars of owner & vendor and an index giving list of drawings & documents included (with revision no.).

1.4.8 All vendor drawings to be provided with a blank space measuring 75 mm W x 38 mm H for marking of review codes etc. by CLIENT.

1.4.9 The review of the vendor drawings shall be done by CLIENT, as applicable, under the following review codes:

Review Code 1/A	No comments.
Review Code 2/B	Proceed with manufacture/fabrication as per commented drawings. Revise drawings required
Review Code 3/C	Document does not conform to basic requirements.

1.4.10 Review of vendor drawings by CLIENT would be only to check compatibility with basic designs & concepts & would in no way absolve the contractor/vendor of his responsibility to meet applicable codes, specifications & statutory rules/regulations.

1.4.11 Vendor shall submit within 10 days after placement of FOI, the complete list of drawings/ documents with submission dates against each. Critical drawings, only, the list of which will be agreed during kick-off meeting shall be reviewed jointly at CLIENT's office.

ANNEXURE- 3: DELETED

ANNEXURE-4: VENDOR DATA REQUIREMENT (INSTRUMENTATION)

S.No.	Description	Document Category		
		Inf.	Review	As built
1	*2*	*3*	*4*	*5*
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		*	*
6.	Utility requirements	*		
7.	Level Sketches	*		
8.	Material requisition		*	
9.	Purchase Requisition	*		*
10.	Functional schematic	*		*
11.	Logic diagrams		*	*
12.	Instrument loop drawings	*		*
13.	Control room layout		*	*
14.	Panel front arrangement		*	*
15.	Power Supply Distribution		*	*
16.	Wiring diagram for panels	*		*
17.	Configuration diagram		*	*
18.	I/O assignment	*		*
19	Details of OPC, configuration port, signals details etc		*	*
20.	Instrument Duct/Tray layout	*		*
21	Instrument Cable schedule	*		*
22	Instrument location plans	*		*
23	Instrument installation drawings	*		*
24	Bill of material for installation items	*		*
25	Spare part list for			
	(a) 2 years operation			*
	(b) Start up and commissioning			*
	(C) Spare instruments (10%)		*	*
26	Inspection and test procedures	*	*	
27	Complete catalogues with part list for all vendor supplied instruments, controls etc	*		*
28	Installation, operation and maintenance manuals			*

Note: This list indicates the minimum drawings and document requirements. However vendor shall submit a complete list of document 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 along with their number and expected date of submission.

ANNEXURE - 5

QUALITY ASSURANCE PLAN : DISPENSER

CODING STRUCTURE						Manufacturer
Codes for Extent of Inspection, Tests & Test Certificates				Codes for Documents		
Code	Description	Code	Description	Code	Description	
1	Visual	12	Power failure	D1	Approved GA Drawing	
2	Dimensional	13	Failure of metering	D2	Approved P&ID	
3	Fitment & Alignment	14	Failure of totaliser	D3	Approved data sheet	
4	Physical Test	15	Calibration	D4	Approved Bill of material	
5	Chemical Test	16	Pressure test	D5	Purchase requisition	Customer's Information
6	Running Test	17	Noise & vibration	D6	W&M Certificate from country of origin	Customer: M/s Central U.P. Gas Limited Consultant : None LOA No.: CLIENT/ND/ dated Item : CNG Car Dispensers
7	Leak Test	18	Enclosure protection test	D7	Calibration certificate of all measuring test / instruments and gauges	
8	Dispenser should automatically stop in case of failure of totaliser	19	Paint shade verification			
9	Check for single bank system	20	Test certificate for bought out components			
10	Check for manual shut off	21	Flow capacity test			
11	Batch accuracy test					

DETAILED INSPECTION AND TEST PLAN

EQUIPMENT DETAILS		INSPECTION AND TESTS				SCOPE OF INSPECTION AND TESTS		
Sr. No	**Description**	**RAW MATERIAL AND Stage Inspection**		**FINAL INSPECTION**		**Documents for submission to CLIENT/PMC/TPI**	**Acceptance Criteria**	**Activity by CLIENT/PMC/TPI**
		MFR	**CLIENT/ PMC/TPI**	**MFR**	**CLIENT/PMC/ TPI**			
1	Dispenser Frame	1.2.3.4.5		1.2.3.	1.2.3	D1,D2,D3,D4	Tech. Specs in PO	Review of documents
2	Mass Flow Meter	1.2.3.4.5.15		1.2.3.15	1.2.3.15	D1,D2,D3,D4,D7	D7 & Tech Specs in PO	Review of documents
3	Actuator Valves	1.2.3.4.5.6.7		1.2.3.6.7	1.2.3.6.7	D1,D2,D3,D4,D7	D7 & Tech Specs in PO	Review of documents
4	Filling hose	1.2.3.4.5.16		1.2.3.16	1.2.3.16	D1,D2,D3,D4	Tech. Specs in PO	Review of documents
5	Totaliser	1.2.3.8		1.2.3.8	1.2.3.8	D1,D2,D3,D4,D7	D7 & Tech Specs in PO	Review of documents
6	Software	9		9	9	D3	Tech. Specs in PO	Witness
7	Pressure Gauge	1.2.3.4.5.15		1.2.3.15	1.2.3.15	D1,D2,D3,D4,D7	D7 & Tech Specs in PO	Review of documents
8	Pressure Transducer	1.2.3.4.5.15		1.2.3.15	1.2.3.15	D1,D2,D3,D4,D7	D7 & Tech Specs in PO	Review of documents
9	Shut off valves	1.2.3.4.5.10		1.2.3.10	1.2.3.10	D1,D2,D3,D4,D7	D7 & Tech Specs in PO	Review of documents
10	Performance Test (using CNG)	11.21		11.21	11.21	D3,D7	D6, D7 & Tech Specs in PO	Witness
11	Dispenser response	12.13.14.17.19 .20		12.13.14.1 7.19.20	12.13.14.17.19.20	D3,D7	D7 & Tech Specs in PO	Witness

Note:

1. The Above Testing and acceptance criteria are minimum requirements, however, manufacturer shall ensure that the product shall also comply to the additional requirements as per Particular Technical specifications(PTS)
2. Owner/Owner representative shall review/approve all the documents related to QAP/Quality manuals/Drawings etc. submitted by supplier.
3. All reference Codes/ Standards, Documents, P.O. Copies shall be arranged by vendor / supplier for reference of TPIA/CLIENT at the time of Inspection
4. At the time of delivery of material in stores, vendor will submit copy of all related document of inspection along with release note & MTC.

At the helm of the Energy Transition, Tractebel provides a full range of engineering and advisory services throughout the life cycle of its clients' projects, including design and project management. As one of the world's leading engineering and advisory companies and with more than 150 years of experience, it's our mission to actively shape the world of tomorrow. With about 5,000 experts and presence in more than 70 countries, we are able to offer our customers multidisciplinary solutions in energy, water and urban.

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