



GAIL GAS LTD

(A wholly owned subsidiary of GAIL (India) Limited)

CNG AND CITY GAS DISTRIBUTION PROJECT

BID DOCUMENT FOR CNG CASCADE VOLUME – II OF II (TECHNICAL)

(BID DOCUMENT NO: 110304/WGI/GAIL GAS/09-R0)

**LIMITED DOMESTIC COMPETITIVE BIDDING
E – TENDER NO - 6000000050**



DELIVERS. EVOLVES.

WHOLE LIFE SOLUTIONS FOR PIPELINE AND SUBSEA SYSTEMS

ISSUED BY





GAIL GAS LIMITED
CITY GAS DISTRIBUTION PROJECT



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1.0 INTRODUCTION

GAIL Gas limited (GAIL GAS LTD.) is in the process of installing refueling outlets in and around Vadodara City. These outlets shall have facilities to fill stationery & mobile cascade.

This specification along with drawings/documents attached herewith covers requirements for design, engineering, procurement, fabrication/manufacture, assembly, inspection, testing at works and supply, erection, testing & commissioning at site, CNG storage cascades.

2.0 SCOPE

This document covers minimum requirement for design, engineering, procurement, fabrication / manufacture, assembly, inspection, testing at works and supply at site CNG storage cascades.

3.0 AMBIENT CONDITIONS

- The climatic conditions to be considered for selection, design and derating of equipment shall be as indicated below:
- Design Amb temp min/max degree C : 4.7 °C / 47 °C
- Design relative humidity : 94 %
- Design Temp : 50 °C
- 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 industrial conditions and shall be rendered proof against rodents.

4.0 INSTRUCTIONS TO VENDORS

- This specification describes the technical specification of the equipment to be supplied and/or installed for CNG stations of GAIL GAS LTD..
- 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 to be extent 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 have included in the offer.

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- The drawings and reference information mentioned elsewhere in this specification shall be considered as part of this document. Anything specified in this specification but not clearly shown in the drawings, or vice versa shall be treated as indicated in both specification and drawings.
- Vendor may contact GAIL GAS LTD./WGI India and obtain clarifications required, if any, at any stage, before submission of offer.
- 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.
- 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.
- The Vendor, free of cost and without affecting agreed milestones, shall carry out modifications suggested by the statutory bodies.
- The Vendor shall be deemed to have inspected the site area and access and ascertained all conditions affecting the contract. The Vendor shall be deemed to be fully conversant with the complete requirements of the work.
- 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 from 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 drawings only.
- The Vendor shall complete and fulfill all formalities with the statutory authorities having jurisdiction in the area. Vendor shall also arrange for inspection and approval of installation.



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- 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 decisions related to the Contract.
- The progress report shall be submitted by Vendor in duplicate on weekly basis. The reports shall clearly define all major activities completed during the previous period and identify manning levels, programs etc. The report format shall be provided by/ finalized after discussion with the consultant for adherence by the Vendor.
- The Vendor shall correct all project original drawings with "As Built" information and shall on completion of erection of the equipment submit originals of all finalized drawings to the Owner.
- All expenses for all the above activities shall be done and borne by the Vendor. The responsibility of Owner shall be limited to the extent of reimbursement of inspection fee charged by any statutory authority.
- 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.

5.0 GAS COMPOSITION

Component Name	Mole Percent (%)
Methane	85-93
Ethane	4-7
Propane	0.8-3.8
Butane	0.04-1.4
Pentane	0.2-0.3
Hexane	0-0.2
Heptane	0
Nitrogen	0.05-0.15
Carbon Dioxide	3.0-4.0
Total	100

Oxygen : Not more than 0.5 mole%

Total Non Hydrocarbon : Note more than 2.0 mole%



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Total Sulphur including H₂S : Not more than 10 ppm by weight expected H₂S content not more than 4 ppm by volume

Water Content : 112-144 Kg per MMSCM

Specific Gravity (SG) : 0.62 - 0.63

Gross Calorific Value : > 8500 Kcal/SCM

The gas to be supplied shall be preferably at ambient temperature. However the actual temperature shall be in the range of 20 degree C to 45 degree C.

6.0 CODES AND STANDARDS TO BE FOLLOWED

- IS - 7285 Part II : 2004 Standard
- IS 3224 : 2004 Standard
- OIL INDUSTRY SAFETY DIRECTORATE (OISD) - 179
- GAS CYLINDER RULES – latest edition
- INDIAN EXPLOSIVES ACT.

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. and shall be of latest edition. The vendor shall obtain from concerned authorities all necessary statutory approvals.

7.0 EXTENT OF SUPPLY AND SERVICES

7.1. SUPPLY

Supply of CNG storage cascades of 3000 & 4500 water liter capacity at 15 °C with following minimum details:

- Cylinders
- Each cylinder equipped with cylinder shut -off valve and fusible burst disc.
- Steel cascade frame with canopy.
- Interconnecting SS tubing / piping, fitting, valves.
- Non return valves (NRVs) as required for three-bank operation.

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- Glycerin filled Pressure gauges on each bank.
- Supply of anchor bolts and nuts.
- Mounting Plate
- Any other item required for completing the cascade assembly.

7.2 SERVICES

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

- Preparation and submission of documents/ drawings as per schedule.
- Obtaining approvals from concerned departments/ agencies/ authorities.
- Procurement of raw materials, bought out components, fabrication, shop assembly.
- Shop inspection and testing including third party inspection and statutory approvals.
- Testing at site.
- Packaging, crating, dispatch of cascades.
- Installation, testing & commissioning at site

8.0 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, enhanced reliability, optimization may be accepted subjected to GAIL GAS LTD.'s approval. The Vendor may submit their bid for any alternative design as optional item which may be indicated separately describing all advantages. 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.

8.1 CASCADE

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



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The water storage capacity of each cascade shall be 3000 & 4500 (-0%/+5%) water liters at 15⁰C for Online / Daughter Stations (Stationary & mobile).

- Cascade storage dimension

For 3000 WL Capacity (Stationary & mobile Horizontal Cascade)

The overall dimensions, shall not exceed
Length – 4500 mm, Width – 1850 mm. and Height - 1650 mm

For 4500 WL Capacity (Stationary)

The overall dimensions, shall not exceed
Length – 5500 mm, Width – 1850 mm. and Height - 1650 mm

- The water liter capacity of any individual cylinder in-group of cylinders forming cascades shall not exceed 250 liters at 15 degree C.
- The design of cylinder shall be as per IS 7285 – Part II: 2004 Standard and approved by Chief Controller of Explosives (CCoE), Government of India for use in India for specified conditions.
- Working Pressure of cascade cylinder shall be minimum 255barg at 15 degree C.
- Cylinder material shall be seamless alloy steel (Cr-Mo) as per design approval by Chief Controller of Explosives (CCoE), Government of India.
- Cylinder neck threading shall be as per IS 3224- 2004 or as per design approved by Chief Controller of Explosive (CCoE) Government of India.
- In case cascades with 50 liters cylinders are offered, vendor shall observe minimum neck threads size of dia 25.04 mm standard. Type 4 threads with a taper of 1 in 8 on diameter confirming to IS-3224 (2004) or equivalent.
- The cylinder shut-off valve shall be with fusible burst disc confirming to requirements of IS: 3224 (2004) or as per design approved by Chief Controller of Explosives (CCoE), Government 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 manifolded 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 100 kg/min from each bank at pressure of 255 bar g. Vendor to furnish necessary calculations indicating overall pressure drop for each bank, Coefficient of flow (Cv) values, valve 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

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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 50 bar g and 28-bar g in case of booster compressor at daughter station.

- 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 as indicated in Schedule of Rates.
- Full bore ball valves for isolation shall be provided at inlet of each fill line and at each bank outlet line.
- The interconnecting tube work shall be minimum of 3/4" 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.
- Cylinders in the cascade may be vertically or horizontally placed. In case of horizontal configuration, minimum 30mm cylinder to cylinder gap shall be provided.
- All cylinders in cascade shall be identical (capacity).

8.2 Cascade frame

- The frame shall not allow lateral and rotational movement of cylinders during regular road transport under any circumstances. Vendors shall take into account the rough patches / bumps on roads.
- Frame shall be free standing and have facility for lifting by crane and forklift the complete assembled cascade. Bottom and top of frame shall be reinforced to prevent any twisting or strain to inter-connections among cascade cylinders during lifting by crane, forklift and during the transport.
- Frame structure of each cascade shall be capable of withstanding 4g impact (four times gravity) from any direction without any distortion. Vendor to test one frame for satisfactory performance, strength and stability. Test results and report shall be submitted to GAIL GAS LTD..
- All items used in the frame shall be weatherproof.
- Supplier shall submit structural drawing of the frame including canopy giving details of the steel, welding procedure, corrosion protection for approval of GAIL GAS LTD. before commencing fabrication work.

8.3 Piping / Tubing / Fitting/ Pressure gauges

- Materials used for the piping shall be stainless steel 316 fully annealed seamless conforming to ASTM A269 with maximum hardness of Rb80 or less and suitable for bending and flaring. OD tolerance shall not exceed 0.005%. The piping/ tubing material shall be as per approved vendor list.



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- All fittings including valves shall be as per approved vendor list. Material shall be SS 316 conforming to ASTM A269. Open ends on fittings and vents shall be provided with caps.
- Liquid filled (glycerin) pressure gauges 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 for quick release coupling, pressure gauges, valves and fittings of cascade shall be within tamper proof, wire cage enclosure. These shall be on one side of cascade for ease of operation. After opening the doors only, flexible hose quick release coupling connections to the cascade are authorized.
- For Mobile Cascade the tubing end connection shall be located at center of Cascade side wise and 300 mm above from bottom of cascade with provision of quick coupling connection for loading / unloading operation, fitted with pressure gauges, valves, fittings, etc.
- Material of vent tubing shall be Copper.
- Liquid filled (glycerin) temperature gauge of diameter 4" on each bank shall be used.
- A pressure relief safety valve on each bank shall be used, to release of excess pressure set at a rating 5% less than the pressure rating for fusible burst disc.

8.4 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 ten years. The exterior surface is required to be corrosion free for ten years and to have fade free life without oxidation of paint surface for five years in an environment of bright sun light with an intense UV content.

8.5 MANDATORY SPARES

- Vendor shall quote unit price for following mandatory spares for following total mandatory spares for all cascades:-

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S.No	Description of part	Total Quantity in numbers
1	Cylinder valve with end tube fitting	Refer SOR
2	Isolation valve	
3	Check Valve	
4	Tube Pig tail	
5	Burst disc with washer	
6	Pressure Gauge- low Bank	
7	Pressure Gauge- medium bank	
8	Pressure Gauge- High bank	
9	Temperature Gauge	
10	Pressure Relief Valve	

All the mandatory spare parts shall be wrapped and packaged for prolonged storage so that they will be preserved in original as new condition.

- The spare parts shall be properly tagged and coded so as to facilitate easy identification of parts.
- Spares shall be packaged separately and clearly marked spare parts and shipped at same time as the main equipment.
- The cost of the mandatory spares shall be added to the total cost for bid evaluation purpose. The offer not including the quote for mandatory spares shall be considered incomplete offer and shall be liable for rejection.

9.0 INSPECTION AND TESTING

- Vendor shall carryout 4-G static calculation of one complete assembled cascade with all the cylinders mounted and filled and submit the same for Owner/ Consultant's review.
- Vendor shall carryout cylinder burst test of one cylinder from the entire batch produced for supply to GAIL GAS LTD. in case offered cylinders are of new design. 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.



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- Vendor shall carry out all standard shop tests / QA/QC, hydrotest, pneumatic tests etc. as per recommendation of manufacturer/ Chief Controller of Explosives requirements & Gas Cylinder Rules. Copies of the testing / inspection carried out shall be furnished to GAIL GAS LTD.
- Vendor shall furnish record of storage capacity check of each cylinder in a cascade and the same need to be demonstrated to Owner/ Consultant 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.
- The vendor shall depute his representative at site for successful demonstration of operability of cascade storage system within specified parameters for a period of 4 hours. There shall not be any back flow between any two banks with all valves open. Defects noticed, if any, shall be repaired/ replaced and test shall be repeated to the satisfaction of GAIL GAS LTD./WGL without any additional cost implications.

10.0 PROTECTION DURING SHIPPING

The cascade shall be packaged to withstand rough handling during ocean shipment and inland journey. It shall be vendor's responsibility to make good any deterioration and that occurs during shipment. Sling points shall be clearly indicated on crates.

11.0 WARRANTY

- Vendor shall warranty all material and equipment to be free from defects in design, material and workmanship for a period specified elsewhere in the bid document.
- Vendor shall warranty all cylinders satisfying the requirement of intended use.
- Replacement of any defective item / equipment found damaged by Owner or their authorized representative at the time of delivery.
- Assume responsibility for obtaining manufacturer's warranty of all bought out items.
- Maintenance & Replacement of any part found not performing to the specified requirements within the warranty period (Specified elsewhere in the bid document) from the date of successful commissioning.



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Annexure – I

APPROVED VENDOR LIST

Sr.No.	Particulars	Make
1	Steel Tubing	Sandvik, Parker, Tubacex
2	Valves (Ball, check, Relief)	Swagelok, Parker, Hylok, SSP, Hamlet

Note :The products from the above vendors shall be used for the particular product type mentioned and shall not be mixed.



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