



Bhagyanagar Gas
Limited

**SUPPLY OF CNG STORAGE CASCADE ON ARC BASIS FOR A
PERIOD OF 12 MONTHS IN OF BHAGYANAGAR GAS LIMITED
FOR HYDERABAD, VIJAYAWADA & KAKINADA GA'S.
Bid Document No. BGL/699/2025-26**

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II



Bhagyanagar Gas Ltd.

**BHAGYANAGAR GAS LIMITED
(A Joint Venture of GAIL & HPCL)**

**BID DOCUMENTS FOR
SUPPLY OF CNG STORAGE CASCADE ON ARC BASIS FOR A
PERIOD OF 12 MONTHS IN GAS OF BHAGYANAGAR GAS
LIMITED**

**UNDER OPEN DOMESTIC COMPETITIVE BIDDING
Bid Document No.: BGL/699/2025-26**

VOLUME- II of II TECHNICAL



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**SECTION-7
MATERIAL REQUISITION FOR
CNG STATIONARY CASCADE**



SUPPLY OF CNG STATIONARY CASCADE ON ARC BASIS FOR A PERIOD OF 12 MONTHS IN GAS OF BHAGYANAGAR GAS LIMITED FOR HYDERABAD, VIJAYAWADA & KAKINADA GA'S.
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MATERIAL REQUISITION

Sr. No	Description	Unit	Qty
A	Design, Engineering, Manufacturing, Assembly, Supply, Inspection and Testing at works, loading, unloading at BGL store/site in Hyderabad GA including foundation bolts of CNG Storage Cascade with three banking configuration of minimum 4500 WL capacity of sum of total cylinders proposed at 15°C, for filling and storing of CNG at 255 bar (g) at 20 to 48°C as specified in Technical Specification inclusive of services as stipulated in the tender document. The inlet/outlet connections & Gauge Panel of the cascade shall be provided at the width side of the cascade frame.		
A.1	a) Hyderabad	No.	09
	Mandatory Spares: A set of mandatory spares consisting of one each of the following for Cascade specified in Sr. no. A & B above: i) Pressure Gauge Range (0-400) kg/cm2(g) ii) Cylinder Valve with end tube fitting iii) Isolation Valve iv) Check Valve v) Tube Pig Tail vi) Burst Disc with Washer vii) Spindle & Handles for Cylinder Valves viii) Safety Relief Device ix) Bleed Valve		
A.2	a) Hyderabad	Sets	03
B	Design, Engineering, Manufacturing, Assembly, Supply, Inspection and Testing at works, loading, unloading at BGL store/site in Hyderabad, Vijayawada and Kakinada GAS including foundation bolts of CNG Storage Cascade with three banking configuration of minimum 3000 WL capacity of sum of total cylinders proposed at 15°C, for filling and storing of CNG at 255 bar (g) at 20 to 48°C as specified in Technical Specification inclusive of services as stipulated in the tender document. The inlet/outlet connections & Gauge Panel of the cascade shall be provided at the width side of the cascade frame.		
B.1	a) Hyderabad	No	36
B.2	b) Vijayawada	No	1
B.3	c)Kakinada	No	2
	Mandatory Spares: A set of mandatory spares consisting of one each of the following for Cascade specified in Sr. no. A & B above: i) Pressure Gauge Range (0-400) kg/cm2(g) ii) Cylinder Valve with end tube fitting		



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	iii) Isolation Valve iv) Check Valve v) Tube Pig Tail vi) Burst Disc with Washer vii) Spindle & Handles for Cylinder Valves viii) Safety Relief Device ix) Bleed Valve		
B.4	a) Hyderabad	Sets	10
B.5	b) Vijayawada	Sets	1
B.6	c) Kakinada	Sets	1



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SECTION-8

TECHNICAL SPECIFICATION FOR CNG STATIONARY/ MOBILE CASCADE



**SUPPLY OF CNG STATIONARY CASCADE ON ARC BASIS FOR A PERIOD OF 12 MONTHS IN GAS OF BHAGYANAGAR GAS LIMITED FOR HYDERABAD, VIJAYAWADA & KAKINADA GA'S.
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1.0 GENERAL

1.1 M/s Bhagyanagar Gas Limited, a joint venture of GAIL (India) Limited, and HPCL is engaged in development of CNG (Compressed Natural Gas) as fuel to commercial & private vehicles through filling stations in the automobile sector & PNG (piped Natural Gas) to Industrial, household, commercial sector through City Gas Distribution Networks (CGDN) at different Geographical Areas in the country. PNGRB has awarded to BGL the work of development of City Gas Distribution Network for Hyderabad, Vijayawada & Kakinada Geographical Area. Presently, Bhagyanagar Gas Limited is planning to implement CNG & City Gas Distribution Network (CGDN) to supply Natural Gas to domestic, commercial, industrial and automobile consumers distributed over the Geographical Area (GA) of Hyderabad, Vijayawada & Kakinada Geographical Area.

1.2 SCOPE OF WORK & SERVICES

This specification along with applicable codes as referred, describe the minimum requirements for design, engineering, procurement, manufacturing, assembly & testing at manufacturer's works, packaging, supply including forwarding, transit insurance, handling and unloading at Purchaser's store / site in Hyderabad, Vijayawada & Kakinada GA as applicable as per price schedule / special conditions of contract, of the 3000 WL and 4500 WL capacity CNG Stationary Cascades for filling and storing of CNG at 255 bar(g) and as required for dispensing CNG to vehicles at various locations in Hyderabad, Vijayawada & Kakinada Geographical Areas.

Any additional work or technical requirement not mentioned in the specification but required to make the offered system complete in accordance with the specification and for safe and proper operation, shall be deemed to be included in the scope of work by the Bidder.

The quantities of CNG Stationary Cascade required shall be as per SOR (Schedule of Rates) cited elsewhere in the tender document.

Bidder to note that these cascades supplied to useful for both stationary and mobile cascade applications.

2.0 FEED GAS SPECIFICATION

➤ Gas Composition (INDICATIVE ONLY)

The expected gas composition of the feed gas to the CNG Storage Cascade is given below:

S · N o ·	Component	AVG. GAS COMPOSITION (mol%)
1	Nitrogen	0.3505
2	Methane	94.6591
3	CO2	0.5502
4	Ethane	2.3547
5	Propane	1.0458
6	i-Pentane	0.2135
7	n-Butane	0.3223
8	i-Pentane	0.1427
9	n-Pentane	0.1414
10	n-Hexane	0.2199
11	GCV	9721.00
12	NCV	8775.00
13	Specific Gravity	0.59 - 0.625

➤ **GAS STORAGE PRESSURE**

Fill Pressure: - 255 bar (g)

Gas Delivery Temperature: - 55°C Max. (dependent on ambient temperature)

➤ **CNG SPECIFICATION**

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

The proposed specification of the CNG is as follows:

Gas Temperature : 0 Degree Celsius to +55 Degree Celsius Pressure dew-point :
- 25 Degree Celsius

Particulate matter : Less than 5 microns Odorant (Mercaptan) : 2 to 7 mg/SCM

➤ **CLIMATIC CONDITIONS**

A. HYDERABAD

- Minimum ambient temperature: 5 Deg.C
- Maximum ambient temperature: 50 Deg.C
- Relative Humidity: 94% Max.
- Altitude above mean sea level: 100-601 m
- Wind velocity: NA

B. VIJAYAWADA AND KAKINADA

- Minimum ambient temperature: 5 Deg.C
- Maximum ambient temperature: 45 Deg.C
- Relative Humidity: 95% Max., Non condensing
- Altitude above mean sea level: 2-100 m
- Wind velocity: 120 km/hr

➤ **DESIGN PHILOSOPHY**

Storage fulfils the following functions:

ONE - It allows more vehicles to fill than the compressor could fill directly one after the other during peak time.

TWO - It allows the vehicle to fill at a faster rate than if directly from the compressor.

THREE -It prevents the compressor from stopping and starting too often. FOUR- The Combine storage capacity is compartmentalized into three banks. Each bank is separated with check valves and the direction of flow should be from highest volume to lowest volume and provided with pressure relief valve for each of the bank separately.

It is anticipated that the natural gas feed composition, flow rate and pressure will be fluctuating. Hence, Supplier should design the CNG storage facilities with optimum degree of flexibility, reliability, operability to accommodate the varying composition of feed Gas, other unexpected contaminants, flow rate and pressure fluctuation etc.

The CNG storage facilities should consist of standardized modules, which are assembled

into a complete system. Each system should be designed in standardized modular frames bundled together. The modular approach allows the CNG Stationary storage and mobile storage facilities to be easily installed there by reducing installation time. The individual cylinders shall be interconnected using SS-316 tubes and fittings of appropriate pressure and temperature rating and suitable for CNG service.

The design life of the CNG storage facilities should be not less than 20 years.

In the Mother Stations, the compressed natural gas would be directly filled into stationary storage cascades and mobile cascades.

➤ **DESIGN BASIS**

The Supplier should prepare the design basis required to meet the demands mentioned in items 1.0 & 2.0 and submit the designed documents for approval from Consultant/Client before start of manufacturing.

➤ **APPLICABLE STANDARDS AND CODES**

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 or International standards, Gas Cylinder Rule 1981, Indian Explosives Act- 1884, Stationary and Mobile Pressure Vessels (Unfired) Rules (SMPV) 1981, CNG Cylinder Design Code, IS:7285,2004(part-2), CNG Cylinder Valves, IS:3224 1979 (Amendments 1983,84,85,86,89,92,98), Hydrostatic Stretch Test, IS: 5844 - 1970, Safety Devices of Gas Cylinders, IS : 5903 -1970, Regulations of Insurance Association of India and Factories Act while carrying out work as per this 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



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inspection, if any.

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

- i) NFPA 52 Standards for CNG vehicular fuel systems and CNG cylinder code "IS:7285- 2004(PART-2)
- ii) OISD 179 Safety requirements for compression, storage, handling and refueling of CNG for use in automotive sector.
- iii) GAS CYLINDER RULE 2004 Standards for CNG Storage and Gas Cylinder Rules.
- iv) STATIC AND MOBILE PRESSURE VESSELS (UNFIRED) RULES (SMPV) (Latest Edition)
- v) CNG CYLINDER DESIGN CODE IS: 7285 2004 (Part-2)
- vi) CNG CYLINDER VALVES, IS: 3224 (Latest Edition)
- vii) HYDROSTATIC STRETCH TEST IS: 5844 (Latest Edition)
- viii) SAFETY DEVICES OF GAS CYLINDERS IS: 5903 (Latest Edition)-Regulations of Insurance Association
- ix) INDIAN EXPLOSIVES ACT
- x) ANSI, ASTM, NEC, NEMA, ASNZ

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

**3.0 SCOPE OF SUPPLY - STATIONARY CNG STORAGE CASCADES:
SUPPLY :**

Supply of CNG storage cascades along with Interconnecting tubing / piping, fitting, valves of water liter capacity as specified in Schedule of rates (SOR) with following minimum details:

3.1.1 Cylinders

3.1.2 Each cylinder equipped with cylinder shut -off valve and fusible burst disc.

3.1.3 Cascade frame shall be MS welded; shot blasted and epoxy painted instead of Galvanized.

3.1.4 Non return valves (NRVs) as required for three-bank operation.



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- 3.1.5 Pressure gauge on each bank.
- 3.1.6 Supply of anchor bolts and nuts.
- 3.1.7 Canopy
- 3.1.8 Safety Relief Valve and Pressure Relief Valve.
- 3.1.9 Any other item required for completing the cascade assembly.
- 3.1.10 Cylinders and their fittings for CNG use shall be designed, manufactured, tested including hydrostatic stretch test at a pressure in full conformity to IS 7285-1, IS 7285-2, ISO 11119-1, ISO 11119-2, ISO 11119-3, ISO 11120, EN 12245, EN 12247 or other national/international standards having approval from statutory authority under Gas Cylinder rules 2016 i.e. PESO considering the maximum allowable operating pressure of 255 Kg/cm² (g).

SERVICES :

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

- 3.2.1 Preparation and submission of documents/ drawings as per schedule.
- 3.2.2 Obtaining approvals from concerned departments/ agencies/ statutory authorities.
- 3.2.3 Procurement of raw materials bought out components, fabrication of cylinders and shop assembly.
- 3.2.4 Shop inspection and testing including third party inspection and statutory approvals.
- 3.2.5 Testing at site, if required.
- 3.2.6 Supervision during trial runs, if required.
- 3.2.7 Packaging, crating, dispatch of cascades

Technical specifications:

The following specification is intended 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 subject to approval from owner/consultant. The vendor shall bid in their main offer items according to the technical specifications outlined below:

➤ **CYLINDERS**

Supply of CNG storage cascades of water liter capacity as specified at clause no. 1.2, permissible tolerance of -0% or +5% at 15°C with the following minimum details:

- 1. Cascade shall be a group of 75 WL cylinders of capacity required to meet the specified total water capacity, dimensional and weight limitations. The cascades shall also be provided with structural frame having facility of lifting and placement.
- 2. Cascade shall be protected from the effects of the weather by a canopy designed to facilitate



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- the dispersion of free or escaped gas and shall not permit gas to be trapped.
3. All cylinders should be designed, constructed and tested in accordance with the Indian Standard 7285, as amended from time to time, IS:7285 or B 55045: Part 1 or (US) D.O.T 3AA or similar such other standard code approved by the Chief Controller of Explosives.
 4. Cylinder material shall be seamless alloy steel (Cr-Mo) or as per design approval by Chief Controller of Explosives. The neck threading shall be as per IS: 3224 or as per design approval by Chief Controller of Explosives. The thread size of Dia. 25.04 mm standards, type 4 threads with taper of 1 in 8 on diameter confirming to IS: 3224 or equivalent is recommended. The shut off valve shall be fusible burst disc confirming to requirements of IS: 3224 or as per design approval by Chief Controller of Explosives.
 5. The required Test certificates and Inspection certificates issued by the manufacturer of the cylinder shall be duly countersigned by an Inspector/TPI that the Cylinder meets the requirements of the standard or code referred above submitted to & approved by the Chief Controller of Explosives shall be provided to the Purchaser.
 6. All cylinders should be new and unused. Re-certified cylinders are not acceptable. Before dispatching, using or refilling the cylinder which has to be made gas-free, air contained therein shall be purged by N₂ gas. Cylinder of 75 liter water capacity at 15°C are only envisaged. All cylinders in a cascade shall be of same capacity.
 7. Total storage volume with no negative tolerance should be designed to meet storage patterns sizes for storage:
 - i. Stationary Storage/ mobile cascade- 4500 WLC at 15°C
 - ii. Stationary Storage /mobile cascade- 3000 WLC at 15°C
 8. The storage facilities in which cylinders are in a horizontal position, a) the storage unit should be limited to a height of 1.6 M, a length of 4.0 M and a width equal to the length of one cylinder up to 2m for 3000 WLC stationary cascades and b) the storage unit should be limited to a height of 1.6 M, a length of 5.5 M and a width equal to the length of one cylinder up to 2m for 4500 WLC stationary cascades. To ensure ready access, all cylinder fittings should be arranged to face one direction in each unit. Each such storage

- unit should be separated from other unit by a distance of not less than 2m. Where horizontal units are placed parallel to each other, cylinder fittings should be arranged so that they do not face cylinder fittings of other units.
9. The cylinder shut-off valve shall be with fusible burst disc confirming to requirements of IS: 3224 or as per design approved by CCOE, Govt. of India.
 10. 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.
 11. The cylinder shut-off valve orifice shall be designed for high flow to permit the combined flow of 100 kg/min for each bank at a pressure of 255 bar (g). Vendor to furnish necessary calculation indicating overall pressure drop of each bank, coefficient of flow (Cv) values, valve orifice size etc.
 12. Number of cylinders in the cascade shall be divided into three independent banks for low, medium & high pressure of different storage pressure. Vendor shall optimize the number of cylinder in each bank for maximizing the recovery from the storage cascade and submit the calculations along with the bid, indicative ratio of Low : Medium : High is 5:3:2 by volume.
 13. The interconnecting tube work of cylinder manifold in configuration suitable for priority filling and sequential dispensing system by the electronic CNG dispensers.
 14. Full bore 3/4" ball valves for isolation shall be provided at inlet/outlet of each line/ banks.
 15. Pressure gauge of appropriate range suitable for CNG service shall be provided in each bank at the common manifold point with enclosure having transparent panel for visibility of the gages. One common temperature gauge of the range 0-100°C should also be provided.
 16. Inter-Connecting tube work shall be maximum of 3/4" OD SS-316 tubing. The sizing of connecting tubing between each outlet and its associated cylinder shall be such that where they join the total incoming flow areas shall not be less than the total outgoing area. The loops in the tube work shall be provided for absorbing contraction, expansion and vibration. Piping/ tubing shall be suitably clamped to the frame structure.



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17. There shall not be any back flow between any two banks with all valves open.
18. Cylinders installed horizontally should be separated from one another in each storage unit by a distance of not less than 30mm. The material used to separate the cylinders should be sufficiently strong enough and should not absorb moisture and anti-static material. Special precautions should be taken to avoid corrosion at the point of contact.
19. 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.
20. All cylinders is to be hydrostatically tested and approved by third party certification body. Test certificates shall be duly endorsed by approving body and issued before delivery.
21. The location of inlet/outlet tube manifold and pressure/temperature gauges shall be at the first width side of the cascades taking anti-clockwise from the side of the common cylinders valves.
22. The cascade cylinder shall be purged with N₂ and maintain 1 bar (g) pressure before dispatch.
23. Cascade canopy design to be maintained to protect the CNG cylinders from direct sunlight.
24. Doors for cascade manifold gauge panel shall be provided with sufficient and proper hinges to avoid breaking of doors during operation.
25. Vent lines shall be provided at a height of 3.0M from operating platform.
 - i. The vent tubing connecting the cylinders and manifold upto the vent header shall be of SS 316 material, conforming to ASTM A 269. The vertical vent header may be constructed from CS/MS with a minimum diameter of 2" and shall extend to a minimum height of 3 meters above the working level. The sizing of tubes and piping shall be in accordance with statutory provisions and tender specifications, ensuring adequate flow capacity and compliance with all safety requirements.
 - ii. Cascade venting tubes (SS 316 conforming to ASTM A 269) shall not be with welded connection. It shall be with nut ferrule connection.

26. 3 nos. PG, 3 nos. PSV, & 1 No. TG shall be incorporated in each unit.
27. All cylinder valves shall be of $\frac{1}{4}$ turn type for ease of operation.
28. $\frac{3}{4}$ " Full bore ball valves for isolation shall be provided at inlet of each fill line and at each bank outlet line.
29. The interconnecting tube (SS 316 conforming to ASTM A 269) work shall be maximum of $\frac{3}{4}$ " OD. 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.
- i. Except pressure gauge with $\frac{1}{4}$ " OD SS tube, at the other inter connecting tube shall be min of $\frac{3}{4}$ " OD tube for pressure piping. For operating the pressure gauge $\frac{1}{4}$ " OD tube is sufficient. However, steep ($\frac{3}{4}$ " to $\frac{1}{4}$ " or similar) reduction of tube size shall be avoided.
30. Owner/Consultant or its representative/third party or both shall have access for stage-wise and final inspection to those parts or areas of the plant where work or testing of the equipment is being performed, including packaging items.
31. All cylinders shall be new and unused. Re-certified cylinders are not acceptable. Before dispatch, using or refilling the cylinder has to be made gas-free, air contained therein shall be purged by N₂ gas. All cylinders in a cascade shall be of same capacity

➤ **MARKING ON THE CYLINDERS**

- a. Every Gas cylinder shall be clearly and permanently marked in accordance with the PESO guidelines amended if any, other applicable guidelines following conditions by stamping, engraving or similar process;
- i) On the shoulder of the cylinder which shall be enforced by forging or other means, or
- ii) On such a part which is inseparably bound with the cylinder and which is not or only negligibly affected by the stresses due to the gas pressure within it.
- b. The name plate shall not be affixed to the cylinder by soldering, if there is risk of corrosion.
- c. In conjunction with the original marking, space shall be provided for stamping the test date obtained at the periodic inspection.

- d. Markings shall be as carried out and the letters and numerals used shall be of such shape and size that the marking is clear and easily readable and does not give place for misreading.
- e. All cylinders must be permanently stamped with the word CNG together with the following information:
 - i) Manufacturers, owners and inspectors marking and rotation number;
 - ii) Specifying that the cylinder has been manufactured for “CNG only”
 - iii) A symbol to indicate the nature of heat treatment (such as normalizing, quenching, or tempering) given to the cylinder during manufacture.
 - iv) The date of the hydrostatic stretch test, as the case may be, with the code mark of recognized testing station where the test was carried out. The code mark shall be registered with the Chief Controller of Explosives.
 - v) Working pressure and test pressure;
 - vi) Tare weight
 - vii) Water capacity.
- f. All the markings, except the manufacturers marking, which may be on the base, shall be stamped on the neck end of the cylinder.

➤ **MARKING ON THE VALVES**

Valves fitted to the cylinder shall be clearly and durably marked in accordance with the following provisions by stamping, engraving or similar process:

- i) The specification of the valves;
- ii) Year and quarter of manufacture;
- iii) Manufacturers symbol;
- iv) Working pressure;
- v) The name or chemical symbol of the gas for which the valve is to be used;

vi) The type of screw threads on the outlet namely left handed (L.H) or right handed (R.H);

vii) Inspectors stamp;

- Identification Colors

Every cylinder is painted with the appropriate identification colours specified in IS: 4379 for Industrial cylinders.

Color of the Cylinder shell --- White (Total DFT: 75 micron min. / As per process data sheet / approved drawing / as per code)

Color of band at neck end of cylinder--- Red (IS Standard Colour No. 537)

Color of the Frame --- Yellow (Total DFT: 75 micron min. / As per process data sheet / approved drawing / as per code)

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 faded free life without oxidation of paint surface for five years in an environment of bright sun light with an intense UV content.

- Labeling of cylinders

i) Every cylinder shall be labeled with the name "CNG ONLY" with letter of at least 25mm high in contrasting color and the name and address of the Purchaser by whom the cylinder was filled with gas.

ii) A warning in the following terms shall be attached to every cascade containing Compressed Natural Gas namely:

a. Do not change the color of the cylinder

b. This cylinder should not be filled with any gas other than CNG.

c. No flammable material should be stored in the immediate vicinity of this cylinder or in the same place in which it is kept.

d. No oil or similar lubricant should be used on the valves or other fittings of this



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cylinder.

- e. Please look for the next date of test, which is marked on a metal ring inserted between the valve and the neck of the cylinder, and if this date is over, do not accept the cylinder.

- All storage system should be supplied in three banks arrangement:-Low Bank-50% by volume of the total capacity

Medium Bank- 30% by volume of the total capacity High Bank- 20% by volume of the total capacity

➤ **PRESSURE RELIEF DEVICES**

- Each bank (All the three banks) used for the storage of CNG should be equipped with a suitable pressure relieving device and a suitable isolating valve which should be readily accessible when installed in the storage bank. The isolating valve should not be capable of closing off the pressure relieving device.
- Relief devices should be positioned in such a way as to avoid discharge of high pressure gas to the operator or persons in close vicinity and suitably extended.

➤ **SAFETY RELIEF DEVICES FOR CYLINDER STORAGE**

- Cylinders manufactured in India, if fitted with safety relief devices in their bodies, shall have such safety devices manufactured and maintained in accordance with IS:5903.
- Piping and gas storage systems should be protected against overpressure by safety relief devices fitted in each bank. Relief devices installed to protect the storage systems should have sufficient capacity to vent the maximum flow produced by the compressor and should be set to open at a pressure not exceeding 20% above the maximum allowable working pressure of the system or the pressure which produces a hoop stress of 75% of the specified minimum yield strength, whichever is lower.
- A combination burst disc/fusible alloy assembly should be incorporated in the cylinder valves. Burst disc should yield at a pressure not less than 1.5 times manufacturer's



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recommended operating pressure of the cylinder, and not more than test pressure. The disc should relieve pressures in excess of 30 MPA.

- In addition to 3.3.2 a mechanical pressure relief valve which opens at a predetermined pressure should be used. This should not be part of the cylinder valve.
- Safety relief valves should be provided with means to seal to prevent tampering by unauthorized persons.
- Minimum required rate of discharge from the safety valve should be at least equal to any input from the system whether stored or being compressed.
- Each safety relief valve should be clearly marked by the manufacturer.
- The maximum pressure in the storage system should not exceed 255 bar (g)
- The cascade cylinders should be supplied with impact test certification.

➤ **CORROSION PROTECTION**

- Pressure vessels which are made of materials that are subject to corrosion by atmospheric conditions should be protected by painting or other equivalent means necessary to prevent corrosion.

➤ **VALVES**

- All Valves fitted to gas cylinders shall comply in all respects with the following Specifications namely:
 - i) In respect of VALVE FITTINGS FOR COMPRESSED GAS CYLINDERS, IS: 3224
 - ii) Valves for cylinders shall be hand wheel operated.
- Each gas storage unit should have a quick action gas storage isolation valve installed in the steel supply pipe immediately adjacent to its gas storage unit to enable individual shut off and isolation of each unit. These valves will be within fence enclosure.
- Separate common valve system to be supplied for each storage bank complete with non return valve.



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➤ **RIGID PIPING**

- All rigid piping, tubing and other components on the storage system should be designed for the full range of pressures, temperatures and loadings to which they may be subjected with the factor of safety of at least 4 based on the tensile strength at 20°C. Any materials used including gaskets and packing should be compatible with natural gas and its service conditions.
- All piping should be designed in accordance with engineering calculations based on the requirements of ASME B31.3 in conjunction with EEMUA supplement to ASME B31.3 or equivalent design standards. Standards used should be used in total.
- All welding piping should be fabricated and tested in accordance with ANSI/ASME B31.3, API 1104, ASME SEC.IX. Whichever standard is chosen for use, it should be used in total.
- All piping to be tested after assembly to a pressure equal to that of the pressure relief device setting and proved leak free.
- Cylinders to be connected in stainless steel tubing 316 (Stainless Steel Tubing Specifications ASTM A269, ultimate tensile 517 MPA, or equivalent) incorporating stress reducing hoops. Only approved manufacturers of high pressure fittings are to be used. All fitting should be of fractional dimension in Inch unit.

➤ **PRESSURE & TEMPERATURE GAUGES**

- Every CNG storage unit including each manifold group or bulk storage tank should be provided with a suitable pressure gauge for each bank. The pressure gauge should be directly connected to the bank or storage system. The gauge should be dial graduated to read approximately double the operating pressure. Pressure gauge should be equipped with 3-way relief/isolation valve. Similarly one surface contact type Temperature gauge should be provided at a suitable location representing the equivalent temperature of the whole cascade.
- A good quality industrial pressure gauge should be used with a dial face of at least 63mm or larger. Gauges should be built to requirements of BS 1780 or ANSI/ASME B40.1



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or equivalent.

➤ **PIPE WORK, VALVES AND FITTINGS**

Pipe work should be designed, tested and installed to ensure its safe operation at the worst conceivable conditions of flow, pressure and temperature.

All pipe work should be ASTM 316 stainless steel tube. Fittings shall be of SS 316 of approved make. The system should be “go-no-go” gaugable to demonstrate that fittings are properly tightened. Wherever, possible valves and control devices should incorporate the same end connector system. The number of fittings used should be minimized. The Supplier should ensure that personnel assembling the pipe work should be competent in the system employed. Valves & Fittings shall be of PARKER / SWAGELOK make and SS tubing shall be of SANDVIK

/ RATNAMANI / MITSUBISHI / FAE / SUMITOMO / PARKER make. Vendor to ensure that only one make, out of the specified makes of SS Tubes, Valves & fittings shall be used in a cascade and no mixing of makes shall be permitted.

The preferred valve types for isolation are ¼” turn full ball valves. Such valves have similar material to the tube they are attached to. Ball valves must be of good quality and be appropriately selected frequency of use. Ball seats must be suitable for natural gas operation of the gas composition indicated.

Valves and fittings subject to corrosion must be either inherently resistant, or be coated with a corrosion inhibiting paint or surface treatment.

The gas inlet connection of each bank shall be terminated with ¾“union after the isolation valve.

➤ **CYLINDER FRAME**

- Cascade storage system to be skid mounted and complete with removable metal frames and non-metal / non-sparking spacer material.
- Cascade and spacer frame to be painted with anti-rust and etching primer under coat. Importance should be drawn to avoiding corrosion which can limit the working life of a cylinder and affect the fatigue characteristics in serious cases. The implementation of

good periodic maintenance anti-corrosion procedures is strongly recommended.

- Each storage system should be supplied with suitable lifting lugs. Bottom and top of frame shall be reinforced to prevent any twisting or strain to inter connections among cascade cylinders during lifting by crane, forklift and during transport
- All cylinder tubing, manual isolation valves and pressure relief valves should be protected from knocking by any moving object and should not protrude outside the metal frame or brackets.
- The frame shall not allow lateral and rotational movement of cylinders during regular road transport under circumstances.
- The frame structure of each cascade shall be capable of withstanding 4g impact (four times gravity) impact from any direction without any distortion. Calculations for the same to be signed by TPI and to be submitted to Owner/Consultant after award of contract
- All fixing/supporting items used in the frame shall be of weather proof type.
- Supplier shall submit structural drawing of the frame (not Mandatory) giving details of the steel design calculation, welding procedure, corrosion protection etc. for approval before commencement of fabrication work.
- Cascade Assembly to be protected from elements by a roof canopy supported on cylinder frame. Roof sheeting to be precoated galvanized iron or approved equivalent.

➤ **PROTECTION OF VALVES AND ACCESSORIES**

- All valves and accessories shall be safeguarded against accidental damage or interference.
- Valves and accessories shall be mounted and protected in such a way that risk of accidental rupture of the branch to which the valve or accessory is connected is minimized.
- Valves and accessories situated at the rear of a vehicle shall be protected by the rear cross member of the frame of the vehicle against damage.



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➤ **EQUIPMENT**

• Piping, Fittings and meters:

i) All piping, fittings and meters mounted on the Cascade shall be designed to withstand the most severe combined stresses imposed by the following, namely:

- a. The maximum design pressure of the vessel
- b. The super imposed pumping pressure of the shock loading caused by road movements;

ii) The materials used for vessel equipment shall be sufficient ductile to withstand rough usage and accidental damage. Brittle materials such as cast iron shall not be used.

• Protection of piping and equipment:

i) All piping and equipment shall be adequately protected to minimize accidental damage which may be caused by rough usage, collision or over-turning;

ii) Any equipment or section of piping in which liquid may be trapped shall be protected against excessive pressure caused by thermal expansion of the contents.

• Marketing of connections-

All connections on the vehicle which require manipulation by the operator of the vehicle should be clearly marked to prevent incorrect operation. The form of this marking should correspond with the operating procedure laid down for the vehicle.

4.0 CALIBRATIONS, TEST CERTIFICATES AND THIRD-PARTY CERTIFICATION

➤ Every Cylinder should be carried with Hydrostatic or Hydrostatic stretch test and a certificate should be provided.

➤ Leak test should be carried for each cylinder or cascades with all tubing, valves and a certificate should be furnished to the Owner.

➤ All Instrument gauges, Valves, Pressure gauges, safety relief devices, shut off valves



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tubing and piping etc. should be Pressure tested, calibrated and such test, calibration certificates.

- If any of the test certificates is not in order, the Suppliers should replace the affected equipment with valid certificate at Supplier cost.
- Calculation shall be carried out for 4G Static of one complete cascade with all cylinders mounted and filled and the same should be submitted for review of the Owner.
- Burst test of one cylinder from the entire supplies shall be produced and in case offered once are new design the schedule for the test should be informed prior to enable the Owner or their authorized representative to depute their personnel for witnessing the test.
- All standards shop tests / QA / QC as per the recommendation of the manufacturer / Chief Controller of Explosives to be carried out and a copy of such certificates shall be furnished to the Owner.
- Record of storage capacity check of each cylinder in a cascade shall be furnished and same shall be demonstrated.
- Third Party Inspection

All the above quality system implementation, witness and verification of requisite documents shall be independently check, verified and certified by any one of the approved Third Party Inspection Agencies(TPIA) like M/s Bureau Veritas, M/s SGS, M/s LRIS or any other PNGRB Approved firms after the cascades have been assembled to complete finish condition before dispatch. Vendors shall inform the Name of the appointed Agency along with contact details.

Third Party Inspection is in the scope of bidder. Third Party shall be PNGRB Approved.

Vendors shall notify BGL well in advance (minimum 10 days) of such inspections so as to enable BGL provides clearance for conducting the inspections and also to depute BGL's official to witness the same.

Note: The manufacturer of the Cylinders and the Cascades shall have adequate facilities for

shop testing & quality assurances.

5.0 PROTECTION DURING SHIPPING

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

6.0 EXPERIENCE RECORD PROFORMA FOR CASCADE (TABLE-1)

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

TABLE-1

Sl. No.	Parameter	Information On offered model	Information on existing Cascade (Location)		
			1	2	3
1	No. of units				
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				



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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				
20	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	Design case gas composition				
28	Approved Manufacturer License certificate from PESO				
29	Dimensions of the Total package				
30	Warranty certificates				
31	Dimension of package max.				
32	Calibration certificates for all instrument gauges etc of package				
33	Test certificates of all instruments with cylinder, tubing's, fittings of total package				
34	Date of commissioning of cascade				



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35	Approval from PESO Nagpur				
36	Dimensions of package Max.				
37	Date of commissioning of cascade				
38	Where cascades are located: Address and fax/ telephone no. of				
39	Major problems encountered, if any				

7.0 CHECK LIST FOR SCOPE OF SUPPLY (TABLE-2)

- Vendor shall furnish all the equipment of Storage / mobile Cascade System instruments and gauges and safety devices as per the enquiry document. Anything required over and above what is specified, for safe and satisfactory operation of the equipment package shall be included by the Vendor in his scope.
- Vendor to write YES/NO against each item. Vendor is required to include complete scope, as such 'NO' is not warranted. However, in case for any of the items if supplier's reply is 'NO', supplier should give reason for the same:
- Vendor's scope of supply shall include but not limited to the following :

TABLE-2

Sr. No.	Description	Specified by Purchaser	Included by Vendor YES / NO	Remarks
1.0	Each Storage cascade Package complete with:			
1.1	Specification - Indian Standard 2825, as amended time to time, IS : 7285 similar such other standard code approved by PESO	YES		
1.2	Cylinder material - Seamless alloy steel (Cr-Mo) or standard code approved by the Chief Controller of Explosives.	YES		
1.3	All the fittings, Valves, Safety devices, gauges are as per IS 3224 or standard code approved by the Chief Controller of Explosives.	YES		
1.4	Tubing's are of rigid type ASTM 316 stainless steel tube.	YES		
1.5	All cylinders are Hydrostatic Tested	YES		



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1.6	Water capacity of single cylinder used in cascade not less than 75 Ltrs.	YES		
1.7	Nos. of banks in cascade- three bank system for Stationary Cascade	YES		
1.8	One Cylinder should be for burst test	YES		
1.9	4-G Stationary calculation for one complete assembled package is done	YES		
1.10	Working Pressure of Cascade min. 250-255 bar(g)	YES		
1.11	Pressure test for Leakage on cylinders with assembled condition	YES		
1.12	Isolation Valve complete with venting line valve and end plug installed on the inlet of the cylinder	YES		
1.13	Copy of Calibration certificates for all instrument gauges etc. of Cascade package, Test certificates of all instruments with cylinder, tubing's, fittings of total package	YES		
1.14	BOQ with weight of each component	YES		
1.15	Drawing of cylinder of specified parameters approved by CCOE	YES		
1.16	Drawing of cascade frame	YES		
1.17	Storage cascade with frame assembly is shipped in fully and assembled condition only to be mounted on anchored bolts laid at site.	YES		
1.18	GA drawing of the cascade	YES		
1.19	Warranty for a period of 12 months is provided from the date of final site acceptance of CNG facilities by the Company's.	YES		
1.20	Make of bought out items	YES		
1.21	Detailed time schedule for supply indicating time periods required for cylinder manufacturing, cascade frame fabrication, shop testing, dispatch of material from works at delivery site	YES		
2.0	Spares			
2.1	Mandatory spares as specified in the "Material Requisition / SOR" (Indicate separate price for each item)	YES		
3.0	Inspection and Testing			
3.1	As specified on the Inspection and testing clauses	YES		
4.0	Supplier Data and drawings			



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4.1	All data & drawings as required per VDR format as per Material Requisition.	YES		
5.0	Supervision during the Trial Run if required at site of the CNG storage cascade system			
5.1	Additional Items not specified by purchaser but recommended by bidder for safe smooth and normal operation. (Bidder shall indicate separate list of such items in his proposal)	YES		
6.0	Technical Parameters to be confirmed by supplier			
6.1	Pressure range: 19 bar(g) to 255 bar(g) at 15°C	YES		
6.2	Fill Pressure: 200 bar(g)	YES		
6.3	Operating Temperature range: 20°C to 65°C	YES		
6.4	Design Code: IS-2825, IS-7285, IS-3224 or as per Applicable standard Codes or approved by CCOE	YES		
6.5	Calibration traceability: NABL as per ISO 17025	YES		
6.6	Enclosure weather proof: IP65, NENA4x	YES		
6.7	Process Temperature effect: $\pm 0.01\%$ of nominal Flow rate/degree C on zero offset	YES		
6.8	All valves as per IS-3224 or as Applicable standard code or approved by CCOE	YES		
6.9	Safety relief devices as per IS-5903 or Applicable standard code or approved by PESO	YES		

8.0 WARRANTY SERVICING AND SPARE PARTS

- All necessary spare parts to sustain the operations and maintenance of the CNG Stationary storage facilities should be supplied and stock at the Supplier workshop / warehouse located in India for immediate replacement of parts. The costs to stock these spare parts should be at supplier cost. However, once the parts are replaced in the CNG mother and daughter Cascades, the Company's should compensate the Suppliers accordingly provided that the warranty period has expired.



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- The suppliers should provide a warranty period of 12 months from the date of final site acceptance of CNG facilities by the Company.
- All the material and equipment to be free from defects in design, manufacture, material and workmanship.
- Replacement shall be made if any defective items found damaged or not performing to the specified requirements of any part of cylinder for at least 24 months from the date of delivery or 12 months from the date of successful commissioning whichever is later.
- In case any problem or abnormality found /occurs in cascade during commissioning or warranty period, bidder has to get it solved within 24 hours of lodging of complaint by owner

9.0 SERVICES

- Preparation of submission of document drawing.
- Obtaining approvals from statutory authorities.
- Bidder to submit foundation and other drawings indicating requirement of work to be Carried out by Owner within one month of placement of order.
- Supervision during trial runs if required.

10.0 DATA AND DRAWING DETAIL

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

Along with the technical bid the following information is to be provided.

- i) Process and instrument diagram along with Bill of Material. The Bill of Material should indicate all items, quantity of all items installed per storage system, their part nos. and make.
- ii) Process and instrument diagram along with Bill of Materials for all major components



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within the tender.

- iii) General arrangement drawing of the storage system giving overall dimensions and erection shipping weight.
- iv) Technical data sheet of storage system.
- v) Typical cross-sectional drawing and literature to fully describe the details of all major components such as Cylinders, valve, gauges piping etc. Data sheet indicating material of tube, tube size etc., piping and instrument diagram.
- vi) The supplier shall have to provide a comprehensive list of mandatory spares required per each type of the storage system and other auxiliary equipment, if any. Itemized rate shall have to be given in price bid.
- vii) The supplier shall have to provide, in addition to those mentioned above, for 2 years normal operation & maintenance per each type of storage system.
- viii) The supplier shall have to provide, a list of commissioning spares, if any, per each type of storage system.
- ix) The supplier shall have to provide, a list of special tools & tackles required for installation & maintenance per each type of storage system.
- x) Leaflets, catalogues for all major items & bought out items.
- xi) Shop test procedure.
- xii) Maintenance schedule of the storage system along with list of Spares for O&M during warranty period.
- xiii) A complete zonal drawing of the Storage Cascade (complete package), all certification for all components used within the hazardous areas should be provided.
- xiv) Reference list of similar / identical storage system supplied in last 7 years of CNG application.
- xv) Deviation sheet (if any).



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Within one month from date of P.O.

- xvi) General arrangement drawing, schematic of cascade piping, drawing of cascade frame the storage system giving overall dimension and erection / shipping weight.
- xvii) Detailed foundation drawing of the storage system for casting foundation giving load pattern etc.
- xviii) Details of inlet gas termination to the storage system including X, Y, Z co-ordinates with respect to center of storage system skid or any reference.
- xix) Detailed time schedule for supply indicating time periods required for cylinder manufacturing, cascade frame fabrication, shop testing, dispatch of material from works and delivery at site.
- xx) Operation and maintenance manuals - 3 sets all in original for each Storage Cascade. The instruction manual should describe in details the construction and recommended procedure for maintaining, operating and troubleshooting of the storage. System should also include cross-sectional drawings, exploded views of all spare parts along with part nos., quantity installed per storage unit. The manual should provide detailed catalogues of all bought out items.
- xxi) Test certificates of all major components like cylinders, shutoff valves, pressure relief valves tubing / pipe work etc.
- xxii) Calibration certificates for all measuring and protection devices.
- xxiii) In case of foreign supply, the bidder should get all certificates endorsed by office of Chief Controller of Explosives (CCOE), Govt of India within one month of delivery of cascades at site.
- xxiv) The bidder can submit (not Mandatory) draft QAP / Data Sheet / GA Drawing along with the Bid.



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LIST OF RECOMMENDED THIRD PARTY INSPECTION AGENCY (TPIA)

SL. NO	NAME OF TPI	ADDRESS	PHONE NO	FAX NO
1	Tata Projects Ltd.	22, Sarvodaya Society, Nizampura, Baroda-390002	0265-2392863	0265-2785952
2	Bax counsel Insepection Bureau Pvt. Ltd.	303, Madhava,Bandra Kurla Complex, Bandra(E),Mumbai-400051	022-26591526,022-26590236	022-26591526
3	Germanischer Lloyd	4th Floor, Dakshna Building, Sec-11, Plot NO.2, CBD Belapur, Navi Mumbai 400 614	022-4078 1000	022-4024 2935
4	ABS Industrial Verification Ltd., Mumbai	404, Mayuresh Chambers, Sector-11, CBD Belapur(E), Navi Mumbai-400614	022-27578780 /1 /2	022-27578784 / 5
5	Certification Engineers International Ltd.	EIL Bhavan,5th floor,1,Bhikaji Camma Place,New Delhi-110066	011-26167539,26102121	011-26101419
6	Dalal Mott MacDonald	501, Sakar -II, Ellisbridge,Ahemedabad-380006	079-26575550	079-6575558
7	International Certification Systems	E-7,Chand Society, Juhu Road, Juhu, Mumbai-400049	022-26245747	022-226248167
8	SGS	SGS India Pvt. Ltd.,SGS House,4B,A.S.Marg,Vikhroli(W), Mumbai-400083	022-25798421 to 28	022-25798431 to 33
9	Intertek Moody	9th Floor, Kanchenjunga Building, 18-Barakhamba Road, New Delhi-110001	011-4713 3900	011-4713 3999
10	TUV SUD South Asia	C-153/1, Okhla Industrial Ara, Phase-1, New Delhi-110020	011-3088 9611/9797	011-3088 9598
11	TUV Rheinland (India) Pvt. Ltd.	F-51, Kailash Complex GF, Veer Savarkar Marg, Vikhroli Park Site, Vikhroli(W), Mumbai-400079	022-4215 5435	022-4215 5434
12	Vincott International India Assessment Service Pvt. Ltd.	C-301, Mangalya Premises Cooperative Soc. Ltd, Off. Marol Maroshi Road, Andheri(E), Mumbai-400959	022-4247 4100	022-4247 4101
13	Meenar Global Consultants	Mr. Nitin Taneja (Project Manager)	M: +91-9711212783 T: +91-129-4072836	Web : www.meenaar.in Email : nitin.taneja@meenaar.in
14	VCS Quality Services Pvt. Ltd.	505, 5th floor, 360 Degree Business Park, Next to R-Mall, L.B.S. Marg, Mulund West, Mumbai 400080	Tel: 91 22 21649720	091 22 21646392



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Sr. No.	OPERARATION / PARAMETER	CHARACTERISIC S / PARAMETERS	ACCEPTANCE CRITERIA & CERTIFICATION	INSPECTION FREQUENCY	VENDOR	TPAI	CLIENT / PMC	REMARKS
1	Raw Material	Chemical Composition	Chrome Moly Steel, Grade-DS-202/IS: 7285-2004 ci. 5.2 Table-1	One sample per heat No.	P	R	R	Verification of RMT certificate Received from RM supplier.
IN PROCESS								
2	Raw Material Cutting (seamless Tube)	Length	As per process heat	4-5 jobs during setting approval & every two hour.	P	W/R	R	
		Thickness						
		Outside Diameter						
		Surface Flaws						
		Ultrasonic Examination						
3	Bottom Forming	Bottom Thickness	1.5 T min (where T is wall thickness)	4-5 jobs during setting approval & every four hour.	P	W/R	R	
		Centre of Bottom	IS: 7285 : 2004					
		Side of Bottom Forting	Free from crack, excess metal, pin	4-5 jobs during setting approval & every two hour.				
		Visual Inspection						
Ultrasonic examination	IS: 7285 : 2004	Each cylinder						
		Solid Neck Length	As per Approved Drawing	4-5 Jobs during setting approval & every two hour.				
		Neck Diameter	As per Approved Drawing	4-5 jobs during setting approval & every two hour.				



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4	Neck Forming	Surface finish, defects	Free from crack, excess metal, pin hole, ball formation, roller mark and other surface defects.	4-5 jobs during setting approval & every two hour.	P	W/R	R	
		Ultrasonic Examination	IS: 7285 : 2004	Each cylinder				
5	Heat Treatment	Hardness	As per approved drawing	Every cylinder	P	W	R	
		(As Tempered)	IS: 7285 : 2004					
		Mechanical Properties Tensile Strength	As per IS: 7285 : 2004	One random cylinder will be selected from Heat Treatment Batch conforming the mechanical properties like tensile test, impact test, bend test etc, in presence of inspecting officer.				
		Yield Strength	IS: 7285 : 2004					
		% Elongation						
		Impact test (at-20°C)	IS: 7285 : 2004					
		Bend Test	IS: 7285 : 2004					
Burst Test	IS: 7285 : 2004							
6	Ultrasonic testing	Crank deduction	As per IS: 7285 : 2004	Every cylinder	P	W	R	
		Wall Thickness measurement	As per approved drg. IS: 7285-2004					
7	Neck cutting & threading	Neck Length	As per approved drawing	Audit check by Q.A staff	P	W	R	
		Machined neck step diameter	As per approved drawing	Audit check by Q.A staff				
		Neck thread configuration	As per approved drawing	Every cylinder				



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		Visual inspection thread finish	Free from crack blow hole excess metal at inside neck, thread damage ,flat threads etc.	Every cylinder				
8	Water capacity checking & hydrostatic strength testing.	Measurement of water capacity. Total Expansion and permanent expansion at test pressure.	Tolerance on water capacity +5 % IS-7285: 2004	Every cylinder	P	W	R	

		Holding Time = 30 sec min.	Permanent expansion shall not exceed 10% of total expansion. IS : 7285:2004	Audit check by Q.A staff				
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	
10	Bursting Test	The value of hoop stress shall be not less than 0.95 of the minimum specified tensile strength of the cylinder material.	IS-7285-2004	One Cylinder of the first batch.	P	W	R	



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11	Steam cleaning & Air Drying	Examination of Oil residue, Moisture etc.	Free from Oil , Moisture etc when Cylinder is exposed to steam jet at steam temp. 160-180°C for period minimum 5-6 minutes.	Audit check by Q.A staff	P	R	R	
12	Internal blasting	Scale free surface	Inner surface should be free from scales, metallic particles etc	Audit Check by Q.A staff	P	R	R	
13	External blasting	Scale free surface	Cylinders 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 stamping	Data 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, dust etc 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	P	W	R	
18	Painting (primer & finish painting)	Paint coating thickness	As per process data sheet / approved drawing / as per code	Audit check by Q.A staff	P	R	R	
19	Marking		IS: 7285 : 2004	Each cylinder	P	R	R	
20	Colour identification		IS: 7285 : 2004	Each cylinder	P	R	R	



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21	Cascade frame fabrication painting cascade frame complete	Visual (Welding etc) Dimensional Physical Test Chemical Test	Approved Drawing/Manufacturers standard. Owner's specification approved drawing	100%	P	R	R	
22	polyurethane/ Epoxy paint	Chemical properties	Approved Make / Owner's Specification		P	W	R	
23	SS Tubes	Physical Test Chemical Test Visual (Welding etc) Dimensional Fitment & Alignment	Approved Drawing, Manufacture Test certificate for bought out items.	As per tender / Owner's instruction.	P	R	R	
24	Fittings	Visual Dimensional pressure Test Fitment & Alignment	Approved Drawing / Manufactures standard	As per tender / Owner's instructions	P	R	P	
25	Valves 2 way	Visual dimensional fitment & Alignment	Approved Drawing/Manufacturer Test Certificate for bought out items.	As per tender/owner's instruction	P	R	P	
26	CNG Cascade Assembly	Visual (Welding etc) Dimensional Fitment & Alignment	Approved drawing/Manufacturer std.	Owner's specification/instruction	P	W	R	
27	CU Tubes for vending of Burst Disc separator	Visual (welding etc) Dimensional pressure test leakage Fitment & Alignment	Approved Drawing /Manufacturer std.	Owner's specification/instruction	P	W	R	



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28	Cylinder valves		As per approved CCOE Drawing, Bill of Material.	Owner's specification/instruction	P	100 % W	R	
29	Gauge	Visual Dimensional Fitment & Alignment	Approved Drawing. Bill of Material.	Owner's specification/instruction	P	100 % W	R	
30	Final Inspection of Finished Cylinders:		IS: 7285-2004	Each cylinder	P	100 % W		
	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.							

LEGENDS: W=witness; H=Hold; M=Monitoring; P=Perform; R=Review of documents; R/M=Random Check; A=Approved; TPAI=Third Party Inspection Agency

Notes:

1. The above testing and acceptance criteria are minimum requirements; however, manufacturer shall ensure that the product shall also comply to the additional requirements as per particular Technical Specification (PTS) and Data Sheet.
2. The supplier shall submit their own detailed QAP prepared on the basis of above / Technical specification for approval of Owner/Owner's representative.
3. Supplier shall submit calibration certificates of all instruments/Equipment to be used for inspection and Testing to TPIA with relevant procedures and updated standards for TPIA review/Approval. All reference codes / documents shall be arranged by vendor for reference of TPIA at the time of inspection.
4. Owner / Owner's representative include TPIA will have the right to inspect activity of manufacturing at any time.
5. TPIA along with Owner / Owner's representative shall review/approval all the documents related to QAP/Quality manuals/Drawings etc. submitted by supplier.
6. Contractor shall in coordination with supplier/sub vendor shall issue detailed production and inspection schedule indicating the dates and the location of facilities Owner/Owner's representative and TPIA to organise inspection.
7. Special manufacturing procedure have to be specially approved or only previously approved procedures have to be used ,in case of conflict between specification more stringent condition shall be applicable.
8. All reference codes/standards, Documents; P.O. Copies shall be arranged by vendor/Supplier for reference of TPIA/VCS at the time of inspection.
9. Certification requirement shall comply with European standard EN 10204-3.2 (Latest edition)



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SECTION-8

SPECIAL CONDITIONS OF CONTRACT (SCC)



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SPECIAL CONDITIONS OF CONTRACT (SCC)

1. GENERAL DEFINITIONS

1.1. In addition to meaning ascribed to certain capitalized terms in Section III "GCC – GOODS / WORKS", following initial capitalized terms shall have the meaning as ascribed to such term hereunder. In case any term defined hereunder is also defined in Section III "GCC – GOODS / WORKS", the meaning ascribed to such term hereunder shall prevail:

1.1.1 Definitions

Effective date: shall mean the date on which Contractor's obligations will commence and that will be date of issuance of Fax of Acceptance

Commissioning: shall mean completion of erection, installation, hook- up & site acceptance of Field Trial Run test of **various types of CNG Storage CASCADE packages** to Owner / Consultant as defined in bid documents. CNG storage cascade means stationary CNG cylinder cascade or mobile CNG cylinder cascade (i.e. for transportation purposes also).

1.2. Special Conditions of Contract shall be read in Conjunction with the General conditions of Contract, specification of work, Drawings and any other documents forming part of this Contract wherever the context so requires.

1.3. Notwithstanding the sub-division of the contract documents into separate sections and volumes, every part of each shall be deemed to be supplementary to and Complementary of every other part and shall be read with and into the Contract so far as it may be practicable to do so.

1.4. Where any portion of the General Condition of Contract is repugnant to or at variance with any provisions of the Special Conditions of Contract, unless at different intention appears, the provisions of the Special Conditions of Contract shall be deemed to override the provisions of the General Conditions of Contract and shall to the extent of such repugnancy, or variations, prevail.

1.5. Wherever it is mentioned in the specifications that the Contractor shall perform certain work or provide certain facilities, it is understood that the Contractor shall do so at his cost and the value of contract shall be deemed to have included cost of such performance and provisions, so mentioned.

1.6. The material, design, and workmanship shall satisfy the relevant Indian Standards, the Job Specifications contained herein and Codes referred to. Where the job specification

stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied.

- 1.7. In case of an irreconcilable conflict between Indian or other applicable standards, General Conditions of Contract, Special Conditions of Contract, Specifications, Drawings or Schedule of Rates, the following shall prevail to the extent of such irreconcilable conflict in order of precedence:
- i) Letter of Acceptance along with Statement of Agreed Variations, if any
 - ii) Fax of Intent
 - iii) Schedule of Rates as enclosures to Fax of Acceptance (If applicable)
 - iv) Job Particular Specifications
 - v) Drawings
 - vi) Technical Material Specifications
 - vii) Instruction to Bidders
 - viii) Special Conditions of Contract
 - ix) General Conditions of Contract
 - x) Applicable Standards as specified
 - x) Indian Standards
 - xi) Other applicable Standards
- 1.8. It will be the Contractors responsibility to bring to the notice of Engineer-in- Charge any irreconcilable conflict in the contract documents before starting the work(s) or making the supply with reference which the conflict exists.
- 1.9. In the absence of any Specifications covering any material, design of work (s) the same shall be performed/ supplies/ executed in accordance with Standard Engineering Practice as per the instructions directions of the Engineer-in-Charge, which will be binding on the Contractor.
- 2.0 **SCOPE OF WORK & SCOPE OF SUPPLY**
- 2.1 The detailed scope of work shall be as specified in Technical Volume & tender / addendum / corrigendum document.
- 3.0 **CONSTRUCTION WATER AND POWER SUPPLY**
- 3.1 No water and power will be provided by the owner. It should be the responsibilities of the contractor to arrange water and power at his own cost.
- 4.0 **COMPLETION SCHEDULE (DOMESTIC & FOREIGN BIDDERS)**
- 4.1 The time schedule envisaged for 4500 WL and 3000 WL Capacity CNG Storage Cascades shall be as under:

CONTRACT PERIOD: 01 Years Rate Contract from the date of placement of FOA/LOA with a provision of extendable up to 06 months.

DELIVERY SCHEDULE: 10 Weeks from the date of Letter of Intimation for each lot.

Group No.	Capacity of CNG Storage Cascade	Qty.	FOR DELIVERY
PART-A (Hyderabad)	Part-A: Sr. No. A.1 (For Hyderabad) - 4500 WLC CNG Storage Cascade	Sr. No. A.1 (For Hyderabad): Total = 09 Nos.	i) For Part-A & Part-B (Details mentioned in SOR): a) First lot of requirements will be given along with FOA. b) remaining quantities shall be delivered after intimation by EIC within Delivery Schedule of 10 weeks from the date of intimation.
PART-B (Hyderabad, Vijayawada and Kakinada)	Part-B: Sr. No. B.1 (For Hyderabad) - 3000 WLC CNG Storage Cascade Sr. No. B.2 (For Vijayawada) - 3000 WLC CNG Storage Cascade Sr. No. B.3 (For Kakinada) - 3000 WLC CNG Storage Cascade	Sr. No. B.1 (For Hyderabad): Total = 36 Nos. Sr. No. B.2 (For Vijayawada): Total = 01 No. Sr. No. B.3 (For Kakinada): Total = 02 No.	
Spares (Hyderabad, Vijayawada and Kakinada)	Sr. No. C.1 (For Hyderabad) - Mandatory spares Sr. No. C.2 (For Vijayawada) - Mandatory spares Sr. No. C.3 (For Kakinada)- Mandatory spares	Sr. No. C.1 (For Hyderabad): Total = 13 Nos. Sr. No. C.2 (For Vijayawada): Total = 01 No. Sr. No. C.3 (For Kakinada): Total = 01 No.	

The basis of delivery will be FOT site, Hyderabad, Vijayawada & Kakinada basis.

However, BGL reserves the right to increase/decrease the quantity of each item for actual requirement and delivery location at the time of dispatch to site within the 3 cities during execution at the discretion of EIC.

5.0 COMPLIANCE WITH LAWS

5.1 The Contractor shall abide by all applicable rules, regulations, statutes, laws governing the performance of works in India.



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6.0 GOVERNMENT OF INDIA NOT LIABLE

6.1 It is expressly understood and agreed by and between the Contractor and the Owner / Consultant that the Owner Consultant is entering into this agreement solely on its own behalf and not on behalf of any other person or entity. In particular, it is expressly understood and agreed that the Government of India is not a party to this agreement and has no liabilities, obligations or rights there under. It is expressly understood and agreed that the Owner Consultant is an independent legal entity with power and authority to enter into contract, solely in its own behalf under the applicable laws of India and general principal of Contract Law. The Contractor expressly agrees, acknowledges and understands that the Owner / Consultant are not an agent, representative or delegate of Govt. of India. It is further understood and agreed that the Govt. of India is not and shall not be liable for any acts, omissions, commissions, breaches or other wrongs arising out of the contract. Accordingly, contractor hereby expressly waives, releases and foregoes any and all actions or claims including cross claims, impleader claims or counter claim against the Govt. of India arising out of this contract and covenants not to sue to Govt. of India in any manner, claim, and cause of action or thing whatsoever arising out of or under this agreement.

7.0 LIMITATION OF LIABILITY

7.1 The final payment by the Owner / Consultant in pursuance of the Contract terms shall not mean release of the Contractor from all of his liabilities under the Contract. The Contractor shall be liable and committed under this contract to fulfill all his liabilities and responsibilities, till the time of release of contract performance guarantee by the Owner / Consultant.

7.2 Notwithstanding anything contrary contained herein, the aggregate total liability of Contractor under the Contract or otherwise shall be limited to 100% of Contract value. However, neither party shall be liable to the other party for any indirect and consequential damages, loss of profit or loss of production.

8. ISSUE OF ESSENTIALITY CERTIFICATE

No essentiality certificate shall be issued by Bhagyanagar Gas Limited.

9. WITHHOLDING, ACCOUNTING AND TAX REQUIREMENTS

9.1 Contractor agrees for withholding from wages and salaries of its agents servants or employees all sums required to be withheld by the laws of Republic of India or any other agency having jurisdiction over the area where Contractor is conducting operations and to pay the same promptly and directly when due to the proper authority. Contractor further agrees to comply with all accounting and reporting requirements of any Nation having jurisdiction over the subject matter hereof and to conform to such laws and regulations and to pay the cost of such compliance. If requested, Contractor will furnish the evidence of payment of applicable taxes, in the



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country (ies) of the Contractor's and his sub-contractor (s) and expatriate employees.

10. **FIRM PRICE**

10.1 The quoted prices shall be firm and shall not be subject to price escalation till the work is completed in all respects.

11. **WORKS CONTRACT**

11.1 The work covered under this contract shall be treated as "Works Contract".

12. **PROVIDENT FUND ACT (FOR INDIAN BIDDERS AS WELL AS INDIAN ASSOCIATE OF FOREIGN BIDDER)**

12.1 The Contractor shall strictly comply with the provisions of Employees Provident Fund Act and register them with RPFC before commencing work. The Contractor shall deposit Employees and Employers contributions to the RPFC every month. The Contractor shall furnish along with each running bill, the challan receipt for the payment made to RPFC for the preceding months.

13. **PAYMENT TERMS AND MODE OF PAYMENT**

13.1 The terms and mode of payment shall be as per SECTION – III D hereto.

14. **ADDITIONAL WORKS/EXTRA WORKS**

OWNER reserves their right to execute any additional works / extra works, during the execution of work, either by themselves or by appointing any other agency even though such works are incidental to and necessary for the completion of works awarded to the contractor. In the event of such decisions taken by OWNER, contractor is required to extend necessary cooperation, and act as per the instructions of Engineer-in-Charge.

15. **SITE HANDOVER AND PERMITS: DELETED**

16.0 **STATUTORY APPROVALS**

16.1 The package supplier shall give necessary documents for obtaining approval from CCOE and any other concerned authority as required by the client.

17.0 **TESTS AND INSPECTION**

17.1 The Contractor shall carry out the various tests as enumerated in the technical specifications of this bid document and the technical documents that have been part of bidding document and will be furnished to him during the performance of the work & no separate payment shall be made unless otherwise specified in Price Schedule.

18.0 PRICE REDUCTION SCHEDULE (PRS)

Pursuant to cl. no. 26.1 of GCC - Work, the Price reduction schedule shall be modified to the following extent:-

- 18.1 Price Reduction Schedule shall be separately applicable for lots/ individual CNG Storage Cascade, as required to be delivered/ commissioned as per order/ intimation given by BGL @1/2 (half)% of the Contract Value of respective parts i.e., Part-A for Supply (on FOT site basis) & Part-B for Installation, Testing & Commissioning as indicated in FOA, per complete week of delay or part thereof:

Further, Price Reduction Schedule for delay in completion will be applicable separately for:

- i) Part A: Supply on FOT site basis
- ii) Part B: Installation, Testing & Commissioning

- 18.2 Price reduction schedule for supply shall be applicable @1/2 (half)% on the value of undelivered/ incomplete delivered CNG Storage Cascade package unit(s) as per complete week of delay or part thereof.

Note: CNG Storage Cascade package shall be considered delivered only after receipt of CNG Storage Cascade unit on FOT site, complete in all respect with all required parts & accessories. Supply value of complete CNG Storage Cascade unit shall be considered for PRS purpose.

- 18.3 Similarly, Price Reduction Schedule for Installation, Testing & Commissioning shall be applicable @1/2 (half)% on Commissioning value of incomplete CNG Storage Cascade package unit(s) as per complete week of delay or part thereof.

- 18.4 The maximum value of PRS shall be limited to 5% (five percent) of total contract price as per Price Schedule excluding amount pertaining AMC (O&M charges), if any. For PRS purpose, the above mentioned contract price shall be excluding taxes and duties.

- 18.5 The deduction of PRS is not limited to the invoice value submitted for processing at any time.

19.0 BONUS FOR EARLY COMPLETION

- 19.1 Clause No. 27.3 of GCC-Works shall not be applicable for this tender.

20.0 ORIGIN OF GOODS

- 20.1 A certificate issued by relevant Chamber of Commerce to this effect shall form part of shipping document.



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21.0 **LIEN**

21.1 Contractor shall ensure that the Scope of Supply supplied under the Contract shall be free from any claims of title / liens from any third party. In the event of such claims by any party, Contractor shall at his own cost defend, indemnify and hold harmless Owner or its authorized representative from such disputes of title/liens, costs, consequences etc.

22.0 **GOVERNING LAW**

22.1 Laws of India will govern the Contract and courts in respective location of Hyderabad / Vijayawada / Kakinada will have exclusive jurisdiction or all matters related to Contract.

23.0 **DEFECT LIABILITY PERIOD**

23.1 The defect liability period shall be as per clause 80.0 of GCC-Works. The sub clause no. 80.1 of GCC Works shall stand modified as under:

23.2 The BIDDER / SUPPLIER shall guarantee the installation / WORK for a period of 12 months from the date of completion of WORK as certified by the ENGINEER IN CHARGE which is indicated in the Completion Certificate or 24 months from the date of last supply (on FOT basis), whichever is earlier. Any damage or defect that may arise or lie undiscovered at the time of issue of Completion Certificate, connected in any way with the equipment or materials supplied by him or in the workmanship, shall be rectified or replaced by the BIDDER at his own expense as deemed necessary by the ENGINEER IN CHARGE or in default, the ENGINEER IN CHARGE may carry out such works by other work and deduct actual cost incurred towards labour, supervision and materials consumables or otherwise plus 100% towards overheads (of which the certificate of ENGINEER IN CHARGE shall be final) from any sums that may then be or at any time thereafter, become due to the BIDDER or from his Contract Performance Security, or the proceeds of sale thereof or a sufficient part on thereof.

24.0 **INSPECTION OF SUPPLY ITEMS**

24.1 All inspection and tests on bought out items shall be made as per the specifications forming part of this contract. Various stages of inspection and testing are indicated in the bidding document and shall also be identified after receipt of Quality Assurance Programme from the Contractor / Manufacturer.

24.2 The contractor / sub-contractor shall provide all instruments, tools, necessary testing and other inspection facilities to inspection engineer of Owner / Consultant free of cost for carrying out inspection.

24.3 Vendor shall advise Owner / Consultant in writing at least 10 days in advance of the date of final inspection/tests. Manufactures inspection or testing certificates for equipment and materials supplied, may be considered for acceptance at the discretion of



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Owner / Consultant. All costs towards testing etc. shall be borne by the Vendor within their quoted rates. All inspection of various items shall be carried out based on Quality Assurance Plan, which will be submitted by the Vendor and duly approved by Owner / Consultant.

25.0 SITE CLEANING

25.1 The Contractor shall clean and keep clean the work site from time to time to the satisfaction of the Engineer- in-Charge for easy access to work site and to ensure safe passage, movement and working.

26.0 COORDINATION WITH OTHER AGENCIES

26.1 Work shall be carried out in such a manner that the work of other agencies operating at the site is not hampered due to any action of the Contractor. Proper coordination with other agencies will be Contractors responsibility. In case of any dispute, the decision of Engineer-in-Charge shall be final and binding on the Contractor.

27.0 EXTENDED STAY COMPENSATION

27.1 The Extended Stay Compensation (ECS) is not applicable in the instant tender.

29.0 INSURANCE

29.1 Insurance for free issue material

All supplies at FOB Seaport for Foreign bidder and FOT site for Indian bidder shall be considered free issue material to contractor.

Bidder shall at his own expense arrange, secure and maintain insurance cover of value not less than the supply value (including custom duty, CVD, Special Duty, Cess etc. as applicable) upto 15 days beyond commercial operation by purchaser or 14 months from the date of supply on FOT site basis, whichever is earlier. Contractor's quoted price shall be inclusive of all costs on account of insurance liabilities covered under the Contract. Bidder to note that the beneficiary of insurance cover shall be the Owner.

Indemnity Bond to be executed by the supplier while taking custody of all supplies from owner at the time of custom clearance and transporting to site for completion his scope of work.

29.2 Insurance in India

29.2.1 In addition to the insurance covers specified in the General Conditions of Contract to be obtained and maintained by the contractor, Contractor shall at his own expense arrange secure and maintain insurance with reputable insurance companies to the satisfaction of the Owner / Consultant as may be necessary and to its full value for all



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- 29.2.2 such amounts to project the works in progress from time to time and the interest of Owner / Consultant against all risks as detailed herein. The form and the limit of such insurance as defined against all risks as detailed herein. The form and the limit of such insurance as defined herein together with the under writer works thereof in each case should be as acceptable to the Owner / Consultant. However, irrespective of work acceptance, the responsibility to maintain adequate insurance coverage at all times during the period of contract till completion of installation, testing & commissioning including PG tests shall be that of contractor alone. Contractor's failure in this regard shall not relieve him of any of his responsibilities and obligations under contractor.
- 29.2.3 Any loss or damage to the equipment during ocean transportation, port / custom clearance, inland and port handling, inland transportation, storage, erection and commissioning till such time the work is taken over by Owner / Consultant, shall be to the account of contractor. Contractor shall be responsible for preferring of all claims and make good for the damage or loss by way of repairs and / or replacement of the parts of the work damaged or lost. Contractor shall provide the Owner / Consultant with a copy of all insurance policies and documents taken out by him in pursuance of the contract. Such copies of documents shall be submitted to the Owner / Consultant immediately upon the contractor having taken such insurance coverage. Contractor shall also inform the Owner / Consultant at least 60 (sixty) days in advance regarding the expiry cancellation and / or changes in any of such documents and ensure revalidation / renewal etc. as may be necessary well in time.
- 29.2.4 The risks that are to be covered under the insurances shall include, but not be limited to the loss or damage in handling, transit, theft, pilferage, riot, civil commotion, weather conditions, accidents of all kinds, fire, war risk (during ocean transportation only) etc. The Scope of such insurance shall cover the entire value of supplies of equipments, plants and materials.
- 29.2.5 All costs on account of insurance liabilities covered under this contract will be to contractor's account and will be Contract Price. However Owner / Consultant may from time to time, during the currency of the contract, ask the contractor in writing to limit the insurance coverage risk and in such a case, the parties to the contract will agree for a mutual settlement, for reduction in value of contract to the extent of reduced premium amounts.
- 29.2.6 Contractor as far as possible shall cover insurance with Indian Insurance companies, including marine insurance during ocean transportation.
- 29.2.7 Owner will be co-insured in the policy.
- 29.2.8 Contractor will be required to submit documentary proof for the transit insurance before dispatch.



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30.0 TRAINING OF PURCHASER'S PERSONNEL

Contractors shall train Purchaser's personnel as per the scope define in the particular Job Specifications, technical specification, Price Schedule.

Bidder's quoted price shall include all expenses towards their personnel's travel, transportation, boarding, loading, living and personnel expenses, etc. for on-site training.

Travel, transportation, venue, boarding, lodging & personnel expenses of Purchaser's personnel shall be borne by Purchaser.

31.0 QUALITY ASSURANCE / QUALITY CONTROL PROGRAMME

31.1 Bidder shall include in his offer the Quality assurances Programme containing the overall quality management and procedures which is required to be adhered to during the execution of Vendor.

After the award of the contract detailed quality assurance programme to be followed for the execution of contract under various divisions of work will be mutually discussed and agreed to.

31.2 The Vendor shall establish document and maintain an effective quality assurance system as outlines in recognized codes.

31.3 Quality Assurance system plans / procedures of the Vendor shall be furnished in the form of a QA manual. This document should cover details of the personnel responsible for the Quality Assurance, plans or procedures to be followed for quality control in respect of design, Engineering, Procurement, Supply, Installation, Testing and Commissioning. The quality assurance system should indicate organizational approach for quality control and quality assurance of the construction activities, at all stages of work at site as well as the manufacture's works and dispatch of materials.

31.4 The Owner / Consultant or their representative reserve the right to inspect witness, review any or all stages of work at shop / site as deemed necessary for quality assurance.

32.0 ERECTION AND INSTALLATION

The CONTRACTOR shall carry out required supervision and inspection as per quality Assurance plan and furnish all assistance required by the OWNER in carrying out inspection work during this phase. The OWNER will have engineers, inspectors or other authorised representatives present who are to have free access to the WORK at all times. If an OWNER's representative notifies the CONTRACTOR's authorised representative not lower than a Foreman of any deficiency, or recommends action regarding compliance with the SPECIFICATIONS, the CONTRACTOR shall make every effort to carry out such instructions to complete the WORK conforming to the SPECIFICATIONS and approved DRAWINGS in the fullest degree consistent with best industry practice. CONTRACTOR has to deliver the material / CNG storage cascade at

site as per EIC instructions.

33.0 **FIELD INSPECTION**

CONTRACTOR shall have at all times during the performance of the WORK, a Competent Superintendent on the premises. Any instruction given to such superintendent shall be construed as having been given to the CONTRACTOR.

34.0 **PROJECT SCHEDULING & MONITORING**

The following schedules / documents / reports shall be prepared and submitted by the Bidder / Contractor for review / approval at various stages of the contract.

35.1 ALONGWITH BID

a) Time Schedule

The Completion Time Schedule for the work (including mobilization period) as per Invitation for bid, Section-I of Tender in all respect, from the date of issue of Fax of Acceptance.

The Bidder is required to submit a Project Time Schedule in Bar Chart Form, along with the Bid. The Schedule shall cover all aspects like sub-ordering, manufacturing and delivery, indicated in the Bid Document. The Owner interface activities shall be clearly identified with their latest required dates. Owner reserves the right to disqualify the Bidder if the above Schedule submitted by the Bidder is not in line with the overall Project requirement.

b) Scheduling & Monitoring System

The Bidders should describe their system of Project Scheduling and monitoring, the extent of computerization, level of detailing, tracing methodology etc. with the name of computer package and sample outputs.

35.2 **AFTER THE AWARD OF CONTRACT**

a) Overall Project Schedule

The Contractor shall submit within 1 week of Fax of Acceptance, a sufficiently detailed overall Project Schedule in the activity network form, clearly indicating the major milestones, interrelationship / interdependence between various activities together with analysis of critical path and floats.

The network will be reviewed and approved by Engineer-in-Charge and the comments if any shall be incorporated in the network before issuing the same for implementation. The network thus finalised shall form part of the contract document and the same shall

not be revised without the prior permission from Engineer-in-Charge during the entire period of contract.

b) Progress Measurement Methodology

The contractor is required to submit within 1 week of award of WORK, the methodology of progress measurement of sub-ordering, manufacturing / delivery, sub-contracting construction and commissioning works and the basis of computation of overall services / physical progress informed. Owner reserves the right to modify the methodology in part or in full.

c) Functional Schedules

The contractor should prepare detailed functional schedules in line with network for functional monitoring and control and submit scheduled progress covers for each function viz. ordering, delivery and construction.

36.0 **COMPLETION OF THE FACILITIES**

36.1 Purchaser will take over the Work on its Completion.

37.0 **STORAGE AND PRESERVATION**

37.1 Contractor shall be fully responsible for safe custody, storage and preservation for all the supplies and materials / equipments required for carrying out the work until handing over of the complete facility to the Purchaser at no extra cost.

In case of delay in availability of site, supplies may be stored at BGL's store and during the tenure of supplies in BGL store, responsibility for safe custody, storage and preservation shall be BGL, however, all loading / un-loading shall be in bidder's scope. Thereafter, beyond the point of receiving supplies from BGL's store and till handing over of complete facility to the purchaser, responsibility of safe custody, storage and preservation shall be of bidder.

38.0 **HEALTH, SAFETY AND ENVIRONMENT (HSE)**

38.1 The Contractor will strictly adhere to HSE requirements as per Technical Specifications.

39.0 **Instruction to Bidder**

This enquiry envisages total responsibility for complete work from design, engineering, manufacture, supply / shipment, port handing, clearance at port of entry in India, inland transportation within India upto the designated Project Sites, all taxes, duties, levies, fees etc. as applicable and payable by the bidders under the Contract in India, all insurance, handling of goods at all stages, loading and unloading facilities at designated storage of client, re-transportation of the package from the store to the actual site / station including transit insurance, other associated works including materials, tools / tackles etc., and civil works (limited to grouting of package) prior to



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start of work at sites till the time of installation, testing, commissioning, performance test, Site Acceptance Test, Trial Run and handing over at site to the Owner and Operation and Maintenance Work as specified in technical parts for the items stated in Price Schedule and in Technical Part.

However in case of foreign bidders, after supplying on FOB / CFR basis, bidder shall receive CNG Storage Cascade packages from Owner's designated store for site activities & shall handle the material on complete responsibility basis till completion of work & acceptance by owner.

39.1 In case of Foreign Bidder, Custom clearance, port handling & Inland forwarding of supplies from port of entry to designated stores shall be arranged by Bhagyanagar Gas.

39.2 The Supplier, wherever applicable shall after proper painting, pack and crate all goods for sea / air / road / rail transportation in a manner suitable to tropical humid climatic region in accordance with the internationally accepted practices and in such a manner so as to protect it from damage and deterioration, in transit by sea or air or road or rail and during storage at the storehouse till the time of issuance to erection contractor. The Seller shall be held responsible for all damages due to improper packing. The Seller shall insure sizing for packing of all oversized consignments in such a way that availability of carrier and/or road / rail route is properly taken in to consideration. Supplier shall follow the packing, marketing and shipping instructions as per tender.

39.3 The quoted price shall be deemed to be inclusive of all applicable taxes & duties including GST, import duty and other levies etc. till the complete execution of the order as applicable in India under this contract and the bidder shall not be eligible for any compensation on this account.

Both Indian and Foreign Bidders shall not be eligible for compensation by the Owner for any variations whatsoever in the aforesaid taxes / duties / levies, etc. as included in the total price except for statutory variation as provided under tender document. Non-compliance to the provisions of this Article as aforesaid shall lead to rejection of offer.

39.4 All Bidders are requested to indicate positively the division of work

- (a) To be directly undertaken by the Bidder
- (b) Envisaged to be undertaken by Bidder's Sub-contractor under Bidder's shall Overall responsibility.
- (c) A copy of MOU (Memorandum of Understanding) shall be furnished along with the offer.

41.0 **LOCAL CONDITION**

It will be imperative for each bidder to fully inform himself of all local conditions and factors which may have any effect on the execution of the works covered under these documents and specifications. In their own interest the Bidders are requested to familiarize themselves with the Income Tax Act. 1961, the Companies Act 1956,

Custom Act 1962 and other related Acts and Laws prevalent in India. The Owners shall not entertain any request for clarification from the Bidders, regarding such local conditions.

- 41.1 It must be understood and agreed that such factors may have properly been Investigated and considered while submitting the bids. No claim for financial Adjustment to the Contract awarded under these specifications and documents will be entertained by the Owner. Neither any Change in the time schedule of the Contract nor any financial adjustment arising therefore shall be permitted by the Owner which are based on the lack of such clear information to its effect, the cost or time schedule.
- 41.2 The activities listed in the scope of proposal in this document as well as in the price break-up shall be only broad categories and shall in no way absolve the Bidder in executing and completing of the turnkeys philosophy of the Owner within the quoted Lumpsum price. Any item / equipment / services / activities / taxes / duties, if not specifically identified in the Bid document or in the offer but is necessary for the completion of work, shall be deemed to be included in the quoted Lumpsum price and no extra charges are payable by the Owner.
- 41.3 The Purchaser / Consultant will not provide any power and water connection and The Contractor shall obtain necessary power and water connection from relevant authority and will pay its uses charges. Purchaser will not own the responsibility for providing the land.
- 42.0 Other terms and condition will be applicable as specified elsewhere in **General Condition of Contract and Instruction to bidder.**
- 43.0 **CUSTOM CLEARANCE ETC. For FOREIGN BIDDERS – NOT APPLICABLE , IT IS SOLELY RESPONSIBILITY OF THE BIDDER. BGL SHALL NOT PAY ANY ADDITIONAL AMOUNT.**
- 44.0 **INDEMNITY BOND**

After award of work, bidder has to furnish legal indemnity bond to owner equivalent to total price of delivered items / equipment before Owner hands over such equipment to them for the purpose of further action as per scope of work in the format attached. The Indemnity Bond shall be valid from the date of receipt of 1st consignment at site & remain valid upto 06 (six) months from date of the receipt of last consignment at site. In case of Indian bidder & from the date of receipt of 1st consignment at Indian Port & to remain valid upto six months from the date of receipt of last consignment at port.

Indemnity Bond to be executed by the supplier latest by prior to taking custody of all supplies at the time of custom clearance and transporting to site in case of foreign bidder however, in case of Indian bidder latest by the time of dispatch of supply as per format attached to General Conditions of Contract.



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45.0 **RULES, REGULATIONS AND PROCEDURES**

45.1 CONTRACTOR shall observe in addition to Codes specified in respective specification, all National and Local Laws, Ordinances, Rules and Regulations and requirements pertaining to the WORK and shall be responsible for extra costs arising from violations of the same.

45.2 Various procedures and method statements to be adopted by CONTRACTOR during the construction as required in the respective specifications shall be submitted to OWNER in due time for APPROVAL. No such construction activity shall commence unless approved by OWNER in writing.

46.0 **ORDER OF WORKS / PERMISSIONS / RIGHT OF ENTRY/ CARE OF EXISTING SERVICES**

The order in which the WORK shall be carried out shall be subject to the approval of the Engineer-in-charge and shall be so as to suit the detailed method of construction adopted by the CONTRACTOR, as well as the agreed joint programme. The WORK shall be carried out in a manner so as to enable the other contractors, if any, to work concurrently.

OWNER reserves right to fix up priorities which will be conveyed by Engineer-in-Charge and the CONTRACTOR shall plan and execute work accordingly.

47.0 **DEDUCTION FROM CONTRACT PRICE**

All costs, damages or expenses which the OWNER may have paid, for which under the CONTRACT the CONTRACTOR is liable, shall be cleared by the OWNER. All such claims shall be billed by the OWNER to the CONTRACTOR, regularly as and when they fall due. Such bills shall be supported by appropriate and certified vouchers or explanations, to enable the CONTRACTOR to properly identify such claims. Such claims shall be paid by the CONTRACTOR within fifteen (15) days of the receipt of corresponding bills and if not paid by the CONTRACTOR within the said period, the OWNER may then deduct the amount, from any amount due or becoming due by OWNER to the CONTRACTOR under the Contract may be recovered by actions of law or otherwise, if the CONTRACTOR fails to satisfy the OWNER of such claims.

48.0 **CONSTRUCTION AIDS, EQUIPMENT, TOOLS & TACKLES**

CONTRACTOR shall be solely responsible for making available for executing the work, all requisite Construction Equipments, Special Aids, Cranes, and Tools, Tackles and testing equipments and appliances. Such construction equipments etc. shall be subject to examination by owner and approval for the same being in first

class operating condition. Any discrepancies pointed out by OWNER shall be immediately got rectified, repaired or the equipment replaced altogether, by CONTRACTOR. OWNER shall not in any way be responsible for providing any such equipment, machinery, tools and tackles.

The OWNER reserves the right to rearrange such deployment depending upon the progress and priority of work in various sections.

49.0 **MAKE OF MATERIAL / BOUGHT OUT ITEMS**

An annexure of approved vendors for various major items is enclosed with this tender specification. The bidder shall consider such names only as indicated in the aforesaid list and clearly indicate in the bid the name(s) as selected against these items. However, for any other item not covered in the list enclosed with this tender document, prior approval shall be obtained by the contractor for its make / supplier's name.

50.0 **DOCUMENTATION**

Following documents shall be submitted with the offer (Technical Bid):

50.1.1 Drawing of cylinder of specified parameters and proposed to be used in offered cascades, approved from Chief Controller of Explosives/ Petroleum and Explosives Safety Organization (PESO), Government of India.

50..1.2 Schematic of cascade piping

50..1.3 Drawing of cascade frame and assembly.

50..1.4 Bill of quantities with weight of each component

50..1.5 Make of bought out items.

50..1.6 Detailed time schedule for supply indicating time period required for cylinder manufacturing, cascade frame fabrication, shop testing, dispatch of material from works and delivery at its site.

50..1.7 Dimensions & schematic drawings of cascades offered.

50..2 Following documents shall be submitted after release of order:

50..2.1 Cylinders to be manufactured and tested as per IS 7285 (Part 2), approved by CCOE under BIS certification marks scheme. The approval for same to be enclosed.

50..2.2 Schematic of cascade piping, drawing of cascade frame and bill of quantities with weight of each component and make for Owner/ Consultant's review and approval.

50..2.3 The supplied cylinders shall have the certification from CCOE, Government of India for suitability of each cylinder for filling and storage of CNG up to 255 Kg/ cm² (g) at 15°C in India.

50..2.4 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.

50..2.5 QA/QC report for manufacture of cylinder and testing shall be furnished

50.2.6 Bidder shall furnish "As built" drawing of each CNG cascade with serial number indicating schematic, structural dimensions and bill of material with shipment.

50.1 "AS BUILT" DRAWINGS

Notwithstanding the provisions contained in standard specifications, upon completion of WORK, the CONTRACTOR shall complete all of the related drawings to the "AS BUILT" stage and provide the OWNER, the following:-

- a) Deleted.
- b) Deleted. c)
Deleted.
- d) Two complete sets of all original drawings including design calculations in hard and soft copy.
- e) Deleted.
- f) Deleted.
- g) Two complete sets, in the form of hand bound volumes, of the manufacturer's data book for all the equipments, instruments etc. including certified prints and data. Data books shall be completed with index as to tag numbers associated with manufacturer's data shown, Equipment data shall include as a minimum requirement the principle and descriptions of operations, installation and maintenance instructions, drawings and dimensions, parts list and priced purchase orders including those of major sub-vendors and suppliers. Requirements pertaining to "VENDOR DATA REQUIREMENT" attached with standard specifications for the documents to be included in the Data Book for each equipment, instruments etc. shall also be complied with.
- h) Two copies each of the Spare Parts Data Books and the Lubricants Inventory Schedule.

50.2 Completion Document

The following documents shall be submitted in hard binder by the CONTRACTOR in THREE sets, as a part of completion documents: -

- a) Test results and reports.
- b) Pre-commissioning/commissioning check list.
- c) Performance certificate
- d) Completion Certificate issued by Owner's Site Engineer.
- e) No claim certificate by the Contractor.

51.0 DOCUMENTS TO BE SUBMITTED / PRODUCED ALONGWITH R.A. BILLS

- i) Computerized R.A. Bill/ Manual Bill, with IT No./ ST No./ Labour License No. Printed thereon.
- ii) ESI / EPF clearance certificates for the last month along with R.A. Bills.
- iii) Insurance Policy as per relevant clauses of Contract Agreement.



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- iv) Attendance Register and Salary Records.
- v) Photocopy of the measurement book to be attached with R.A. Bills.
- vi) Any other document required for the purpose of processing the bills.
- vii) Registration Certificate with Sales tax authorities of state concerned.

52.0 DEDUCTION AT SOURCE

Bidder may note that if any tax is deductible at source as Permanently Indian Income Tax Law, the same will be so deducted before releasing any payment of the bidders. Accordingly, bidder shall have the responsibility to check and include such provisions of taxes in their prices. Owner will release the payment to the Contractor after effecting deductions as per applicable law in force & after offsetting all dues to the Owner payable by the Contractor under the Contract.

53.0 DELIVERY BASIS

Delivery basis is to be on FOT site basis.

54.0 The statement of agreed deviations shall be prepared based on the finally retained deviations if any by the Tenderer and all correspondences and MOM's held between the OWNER and the Tenderer prior to issue of Fax of intent shall be treated as Null and Void. Any deviation or stipulations made and accepted by the owner after award of the jobs shall be treated as amendments to the contract documents as above.

55.0 The OWNER may waive any minor informality or non-conformity or irregularity in a Bid which does not constitute a material deviation, provided such waiver does not prejudice or affect the relative ranking of any Bidder.

PROTECTION DURING transportation / SHIPPING : The cascade shall be packaged to withstand rough handling during transportation and inland journey. It shall be vendor's responsibility to rectify any deterioration / damage that occurs during shipment. Sling points shall be clearly indicated on crates.

56.0 POST ORDER CORRESPONDENCE:

Refer FOA

57. DIRECT PAYMENTS TO SUB-VENDORS / SUPPORTING AGENCIES OF MAIN CONTRACTOR

Normally, the payment is to be made to vendor / contractor only as per provision of contract. During execution, in case of financial constraints, BGL may make direct payment to their sub-vendor / supporting agencies as an exception from the amounts due to the vendors / contractors from any of their bills under process upon certification by EIC subject to receipt of such request from the vendor / contractor. Further, the request



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for direct payments to the sub-vendor / sub-contractor shall be considered in performance evaluation of such vendor/ contractor.

58. Sub-letting of works

Pursuant to Clause No. 37 of GCC-Works:

The contractor shall not, save with previous consent in writing of the Engineer-in-charge, sublet, transfer or assign the contract or any part thereof or interest therein or benefit or advantage thereof in any manner whatsoever.

Provided, nevertheless, that any such consent shall not relieve the contractor from any obligation, duty or responsibility under the contract.

However, subletting of WHOLE WORKS is prohibited. Vendor / Contractor shall submit undertaking to this effect along with each invoice / bill.

59. In case of start of installation, testing & commissioning of CNG Storage Cascade package gets delayed on account of owner by more than one year from the date of delivery on site / BGL store, bidder's quoted rates (excluding service tax) towards installation, testing & commissioning of CNG Storage Cascade package(s) and operation & maintenance (O&M) shall be increased by 5% per annum on annual basis subject to maximum of 10%.
60. Also, in case of delay in installation, testing & commissioning of CNG Storage Cascade package beyond above limit of 10%, a joint inspection/assessment shall be done by BGL, LEPL & supplier to arrive at additional cost to be incurred for restoration of the package after mutual discussions.



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PAYMENT TERMS AND MODE OF PAYMENT



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1. TERMS OF PAYMENT

The following shall be read in conjunction with the relevant clauses of GCC (Goods/Works)

1.1 FOR SUPPLIES

Payments shall be released by the Owner against pre-receipted invoice, submission of a copy of valid performance guarantee and other documents complete in all respects meeting the requirement of contract document.

A) 100% of supply value including the requisite tests as applicable will be paid within 30 days against receipt of material / equipment at BGL designated site & submission of the following documents:-

- i) Invoice in triplicate (Invoice to indicate all taxes and duties separately.)
- ii) Inspection Release note / Dispatch clearance issued by inspection agency appointed by Owner.
- iii) GR/ LR
- iv) Packing List
- v) A certificate from manufacturer that all items / equipment under supply including its component or raw material used with manufacturing are new and conform to the tender requirement.
- vi) Final technical file as per Technical Specifications / Material Requisition including all test certificates, if applicable
- vii) A copy of legal Indemnity bond
- viii) Copy of Performance Bank Guarantee(s).
- ix) In case of delay in receipt of material at site the invoice value shall be reduced to take care of stipulation of PRS clause of the contract.

1.2 General Notes

- i) Invoice shall be raised on the basis of not less than one fortnight interval.
- ii) Invoice(s) in respect of items for which payment is to be made to Indian Associate of Foreign Bidder shall be raised by Foreign Bidder. In case it is raised by Indian Associate, same shall be duly certified and endorsed by Principal Bidder.
- iii) All efforts shall be made to release the payment within 30 days after receipt of relevant documents complete in all respects.
- iv) All bank charges incurred in connection with payments shall be to vendor's accounts.



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- i) The contractor shall be responsible, on completion of contract, or wherever required, to undertake customs reconciliation work with Indian customs authorities and finalise the customs assessment by furnishing the necessary technical information etc. to the said authorities.
- vi) Unless otherwise specifically stated in bid document, all payments shall be made in the currency quoted.
- vii) No interest charges for delay in payments, if any, shall be payable by Owner.
- viii) In case of Indian bidder (Contractor), statutory variation, if any, on account of customs duty on their built-in import content, as per terms of bid document, shall be claimed separately by Contractor after receipt of goods at site(s). However, any price benefits to the Owner, on account of such variation as per terms specified in the bid document, shall be passed on to the Owner along with invoicing itself. Copy of necessary documentary evidence in support of statutory variation shall be submitted along with claim / invoice.

1.3 **For Price Reduction Schedule (PRS) refer clause no. 18 of SCC.**

2.0 MODE OF PAYMENT

Payment will be released through E-payment as detailed in ITB clause 20.

3.0 DEDUCTION AT SOURCE

3.1 Purchaser will release the payment to the Seller after effecting deductions as per applicable law in force.

3.2 Purchaser will release payments to the Contractor after offsetting all dues to the Purchaser payable by the Contractor under the Contract.

4.0 Paying Authority:

In-charge (Finance)
M/s Bhagyanagar Gas Limited
2nd Floor, APIDC Building, Parishram Bhavan,
Basheer Bagh, Hyderabad – 500004



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SECTION-10

SCHEDULE OF RATES (SOR)



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SCHEDULE OF RATES (SOR) PART-A

TENDER NAME: PROCUREMENT OF CNG CASCADE FOR HYDERBAD, VIJAYAWADA & KAKINADA GA'S

TENDER NUMBER: BGL/699/25-26

NAME OF BIDDER:

Sr. No	DESCRIPTION	HSN Code	UNIT	QTY	Unit price				Amount
					Unit Ex-works Price Including Packing & Forwarding but excluding Inland Transportation upto FOT site	Unit Inland transportation charges upto FOT delivered at site including transit insurance, unloading & stacking at site etc. & other costs incidental to delivery of goods	GS T %	GST (CGST& SGST/UT GST or IGST) on the finished goods and inland transportation etc. Applicable on Col. (6 +7)	

PART-A (4500WL CAPACITY)



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A	Design, Engineering, Manufacturing, Assembly, Supply, Inspection and Testing at works, loading, unloading at BGL store/site in Hyderabad GA including foundation bolts of CNG Storage Cascade with three banking configuration of minimum 4500 WL capacity of sum of total cylinders proposed at 15°C, for filling and storing of CNG at 255 bar (g) at 20 to 48°C as specified in Technical Specification inclusive of services as stipulated in the tender document. The inlet/outlet connections & Gauge Panel of the cascade shall be provided at the width side of the cascade frame.									
A.1	Hyderabad		No.	9				-	-	-
	Mandatory Spares: A set of mandatory spares consisting of one each of the following for Cascade specified in Sr. no. A & B above: i) Pressure Gauge Range (0-400) kg/cm2(g) ii) Cylinder Valve with end tube fitting iii) Isolation Valve iv) Check Valve v) Tube Pig Tail vi) Burst Disc with Washer vii) Spindle & Handles for Cylinder Valves viii) Safety Relief Device ix) Bleed Valve							-	-	-
A.2	Hyderabad		Sets	3				-	-	-
Total Amount Including all Applicable Taxes, GST & Duties in Rs. (PART-A):										-
Total Amount Including all Applicable Taxes, GST & Duties in Rs. (PART-A) In words:										



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B.1	Hyderabad		No	36				-	-	-
B.2	Vijayawada		No	1				-	-	-
B.3	Kakinada		No	2				-	-	-
	Mandatory Spares: A set of mandatory spares consisting of one each of the following for Cascade specified in Sr. no. A & B above: i) Pressure Gauge Range (0-400) kg/cm2(g) ii) Cylinder Valve with end tube fitting iii) Isolation Valve iv) Check Valve v) Tube Pig Tail vi) Burst Disc with Washer vii) Spindle & Handles for Cylinder Valves viii) Safety Relief Device ix) Bleed Valve									
B.4	Hyderabad		Sets	10				-	-	-
B.5	Vijayawada		Sets	1				-	-	-
B.6	Kakinada		Sets	1				-	-	-
Total Amount Including all Applicable Taxes, GST & Duties in Rs. (PART-B):										-
Total Amount Including all Applicable Taxes, GST & Duties in Rs. (PART-B) In words:										