SECTION X

TECHNICAL SPECIFICATIONS FOR UNDERGROUND LPG STORAGE TANK

Scope of work, Specifications Terms and Conditions are detailed below:

I. Scope of Work:

a) Preparation of detailed Design Calculations including Man Hole Cover Thickness, Bullet Hold Fasts details and Fabrication drawings which are to be approved by HPCL and Third Party Inspection Agency and Chief Controller of Explosives, Nagpur, prior to fabrication.

b) Procurement and supply of all materials like Steel Plates, various fittings like Nozzles, Flanges etc., as required for the fabrication of Pressure Vessel in accordance with the approved specifications as per ASME Code and HPCL requirements.

c) Fabrication of entire LPG Storage Pressure Vessel.

d) Dye penetration Test on root run of all Welded Joints, 100% Radiography, 100% Stress Relieving, Hydrotesting or the Vessel at appropriate stages as per ASME code.


The scope includes appointment of Third Party Inspection Agency as well as payment for all their services / inspection / certification charges by the Contractor.

f) Erecting the Pressure Vessels.

i) Contractor will be required to furnish Six sets of final Fabrication drawings and Design calculations duly stamped by Third Party Inspection Agency and one set of reproducible tracings of Fabrication drawings and Design calculations to HPCL for their records.

Contractor will also furnish original copy of Certificates of Control issued by Third Party Inspection Agency and all other Test Certificates to HPCL.
j) Cleaning inside of Pressure Vessel.
k) External surface coating of the Pressure Vessels after Sand Blasting the surface as per attached specifications. Any touch up painting required after erection of Pressure vessels at site will also be carried out by the Contractor at no extra cost.

Contractor shall Supply and Install following fittings. These are the minimum requirement. However, Contractor is required to give details of all the fittings required for their system.

1. One No. Magnetic Float Type Gauge (Rochester Gauge) with local display and one no. Magneto Restrictive Type with two no Remote Display one at Remote Fill Point and one in Sales room.
2. One No. High Level Alarm.
3. 2 Nos. Safety Valves on each Pressure Vessel. Each Safety Valve to be provided through independent nozzle. To be supported by pipe or angle structure for bending against wind pressure.
4. One No Pressure Switch for tripping LPG pump in case of low liquid level.
5. Temperature Gauge
6. Water drain off Nozzle to be provided on the manhole cover. The water drain off pipe should be of ¾\" and should be up to just few mm above the tank bottom. The water drain pipe on top of the bullet shall be provided with two ball valves and the length of the pipe should be such that it should project outside the manhole / bullet.

CONTRACTOR TO GIVE MAKE AND DETAILS OF THESE FITTINGS ALONG WITH THEIR UNPRICED BID.

I) Preparation and submission of calibration charts. These charts should be approved by the Third Party Inspection Agency.

II. Design Parameters / Material Specifications:

1. Volumetric Water Capacity : 10 Cum or 7.5 Cum
2. Storage Capacity of LPG : Vendor to specify
3. Density of LPG : 0.52
4. Design Code : ASME Sec VIII Div. 2
5. Design pressure : 22 kg/cm² Gauge at Top
6. Design Temperature : -46°C to +55°C
7. Hydraulic test pressure : As per code.
8. Radiography : 100%
9. Corrosion Allowance : 1.5 mm
10. Stress Relieving : 100% required for the entire pressure vessel.
11. Joint Efficiency : 1
12. Inside Diameter of Pressure Vessel : VTS
13. Length of Pressure Vessel : VTS
14. Dished Ends : Torispherical

Note:

(i) Contractor should advise the Shell & Dish end thickness and also Man Hole Cover thickness with Design calculations in their Unpriced Bid.

(ii) All Openings will be of Flanged type with Nozzle Construction.

Material of specifications:

1. Shell, Dished Ends, Wear Plates, Manhole : SA 537 Class I / ASTM SA- 516 Grade 70 (Impact tested for low temperature applications)
2. Nozzles : SA 333 Gr. 6
3. Flanges/ Manhole Cover : SA 350 Gr. LF2 – ASA 300 Weld neck raised face dimensions as per ANSI 16.5
4. Couplings : SA 350 Gr. LF2  6000 lbs
5. Bolts/Nuts : SA 320 Gr. L7 or SA 194 Gr.4 / Gr. 7

(iii) Nozzles:

Following Nozzles shall be provided by the Contractor on each Pressure Vessel in addition to 2 nos. of Manhole with Cover one of 350 mm dia and another of 600 mm dia. The details of the Nozzle given below are indicative and Contractor to specify the details.

**All Nozzles should be provided with SA 350 Gr. LF2, 300 lbs. RF blind flanges.**

1. Nozzle for Liquid receipt : 1 No.
2. Nozzle for Vapour Receipt/ return : 1 No
3. Nozzle for Pump Chamber : 1 No
4. Nozzle for Pump Chamber Valve Closing Mechanism : 1 No
5. Nozzle for Pressure Equilisation : 1 No
7. Nozzle for Magneto Restrictive Type Level Gauge : 1 No.
8. Nozzle for High Level : 1 No.
9. Nozzle for Water drain line : 1 No
10. Temperature Gauge ( in a Thermowell) : 1 No
11. Two Nozzles for Safety Valves : 2 Nos
The Vessel shall have a Name Plate with following details:

a) Manufacturer’s name and identification marks.
b) The standard or code to which the vessel is constructed.
c) Official stamp of the Inspector.
d) Design Pressure in Kg/ sqcm.
e) Date of initial hydrostatic test.
f) Hydrostatic test pressure in Kg/sqcm.
g) Water capacity in litres.
h) Gas Capacity
i) Name of the gas.

Scope of Third Party inspection:-

i) Approval of fabrication drawings/design calculation.

ii) Identification of raw material w.r.t. Test certificates

iii) Verification of welding procedures and of validity of welders performance Certificate.

iv) Stage inspection during fabrication.

v) Inspection of components at Contractor’s works.

vi) Checking of forming of plates, edge preparation and mock assemblies.

vii) Approval of all weld set ups and back chipping.

viii) Examination of radiographs and supervision of repairs where necessary.

ix) Attendance to other non-destructive test and such hardness measurements, D.P. check, magnetic flux tests and ultrasonic tests where specified.

x) Inspection of assembly

xi) Final dimensional checks

xii) Attendance of hydraulic and pneumatic tests

xiii) Inspection of cleaning and painting
xiv) Approval of stress relieving.

xv) Issue of certificate of control

xvi) Issue of Inspection reports.

xvii) Any other items of Inspection not covered above but required as per Inspection Agency / Design Code / Statutory requirements / Safety requirements / Static and Mobile Pressure Vessels (Unfired) Rules, 1981 shall also form part of this scope of work and the same shall also be covered in the quoted rates.

Approval from CCOE:

Before taking up fabrication of Pressure Vessel at their works, the Contractor will be required to obtain approval of Chief Controller of Explosives, Nagpur on the design calculations and Fabrication drawings of the Pressure Vessel. Contractor shall furnish a copy of such approval to HPCL for records.

All documents of stage wise inspection of the tanks will have to be submitted to HPCL.

PARTY TO GIVE THE DEAD STORAGE OF THE LPG TANK OFFERED IN THE UN PRICED BID. THE DEAD STORAGE HAS TO BE GIVEN IN % OF ROCHESTER GAUGE READING, MM OF THE MAGNETO RESTRICTIVE GAUGE READING IN LITRES OF WATER CAPACITY OF THE BULLET AND IN KG OF AUTO LPG.

THE FOUNDATION BOLTS HAVE TO BE CASTED ALONG WITH CASTING OF RCC RAFT USING TEMPLATE,

ANTICORROSIVE PAINT HAS TO BE ONLY SIGMA MAKE. CORRECT THICKNESS OF THE ANTICORROSIVE PAINT HAS TO BE CERTIFIED BY THE TPI WHO CARRIES OUT STAGE WISE INSPECTION OF THE BULLET AND IS IN YOUR SCOPE.

BULLETS HAVE TO BE SENT TO THE SITE WRAPPED IN SUCH A WAY THAT THERE IS NO DAMAGE TO THE ANTI CORROSIVE PAINT. BULLETS HAVE TO BE UNLOADED AT THE SITE USING CRANE ONLY AND TRIPOD SHOULD NOT BE USED TO AVOID DAMAGE TO THE ANTI CORROSIVE PAINT ON THE BULLET.
SURFACE COATING AND CATHODIC PROTECTION OF UNDERGROUND LPG TANK AND LPG PIPING.

1. SURFACE COATING: For Underground LPG Tank.

Surface Preparation: Blast Clean all Steel to Sa 2.5 using copper slag or equivalent. Surface profile should be 40-70 μm after blasting. Clean all blasted surface areas using dry compressed air and following paint scheme shall be applied.

Paint Scheme:

Sigma Cover Primer (7413) 1 x 50 μm
Sigma TCN 300 Brown shade (7472) 1 x 200 μm
Sigma TCN 300 Black Shade (7472) 1 x 200 μm

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TOTAL DFT 450 μm

1. CATHODIC PROTECTION:

Sacrificial Anode type Cathodic Protection system with a minimum life of 15 years shall be provided. The Cathodic Protection shall be complimentary to the protective surface coating on the LPG Tank and the sacrificial anode shall be either a Zinc or Magnesium anode. The minimum requirement of the system shall be:

- Pre Packed Sacrificial Anodes.
- Reference Electrode.
- Monitoring Panel with Test Points.
- Cabling

The Cathodic Protection shall be as per for applicable standards:

NACE CODE – RP0285 -95
Indian Electricity Rules 1956
BS Standard – 7361
Cathodic Protection Criteria shall be:

A negative (cathodic) potential of at least 850 mV with the cathodic protection system. The potential is measured with respect to a saturated copper/copper sulphate reference electrode containing the electrolyte.

A minimum polarisation shift of (-) 100mV of cathodic polarization

The underground piping shall be provided with PYKOTE Tape to protect it.

Names of the brands/Party, to whom the jobs will be outsourced shall be furnished in tender as well as prior approval to be taken before excavation of the job.

Cathodic Protection System and surface coating shall be approved by HPCL or Third Party Inspection Agency prior to application. Party to submit QAP for Cathodic Protection/surface coating which shall be approved by HPCL/TPIA.

THE CATHODIC PROTECTION SYSTEM APPLICATION AT THE SITE SHALL BE CARRIED OUT BY THE TRAINED ENGINEERS OF THE CP SYSTEM SUPPLIER ONLY.

RULE 33 SHALL CONTAIN CERTIFICATION THAT CP SYSTEM HAD BEEN DONE PROPERLY.

PLEASE GIVE THE DETAILS OF THE MAKE OF INSULATION GASKET AND AT WHICH JOINTS IT WILL BE USED. INSULATION GASKET SHALL ALSO BE USED FOR THE FOUNDATION BOLT OF THE BULLETS TO ISOLATE THEM FROM THE TANK AND THUS TO HAVE BETTER CATHODIC PROTECTION.
CATHODIC PROTECTION

The contractor shall engage the service of OEM for design and installation of cathodic protection for underground vessel and shall obtain a written procedure giving details of the design and installation procedure from him. The competent person engaged for certification under rule 33 should verify the design, oversee the installation of CP, witness the pre-commissioning and post commissioning results and based on his observations certify the adequacy of CP in his certificate issued under rule 33 of the SMPV Rules.

The cathodic protection for Auto LPG Station should be laid down in a manner so as to meet the requirements prescribed under Nace RP-0285-95 or IS:8062 or other equivalent standards. It should basically comprise of under mentioned components.

a) Di-electric coating covering the entire surface of vessel. (Normally provided at the time of vessel fabrication)

b) Sacrificial anode sufficient to last 15 years of the life of vessel.

c) Electrical isolation of the vessel from connecting piping and other structures.

a) Di-electric coating :- Vessels should be protected by providing polyamide aductured coal tar epoxy coating having a minimum Dry Film Thickness (DFT) of 450 microns. The coating should comprise of one coat of epoxy based prefab primer for steel of minimum DFT of 50 micron with two coats of high build epoxy coating of 200 micron each per coat. The coating should be subjected to a holiday test for verification of its integrity by way of existence of air pockets or bubbles between steel and coat. The coating should be further tested for thickness using elometer. Prior to applying primer, the vessel should be externally cleaned by short blasting to the degree of cleanliness as per SA 2.5. The vessel prior to being installed at the site should be visually checked for damage to coatings and suitably repaired, if required to the satisfactory of the competent person. If any of the superior dielectric coating is to be employed by the installer on the vessel, a prior approval should be obtained from CCE after furnishing the details and the standards to which it will conform to.

THIRD PARTY INSPECTION AGENCY WITNESSING THE STAGE WISE INSPECTION OF THE VESSEL SHOULD RECORD AND MENTION THE THICKNESS AT VARIOUS PLACES FOR EACH LAYER. IN THE CERTIFICATE OF CONTROL IN A SEPARATE SHEET. VESSEL WILL BE ACCEPTED ONLY AT THE SITE IF SUCH CERTIFICATION BY TPI IS THERE.

b) Sacrificial anode system :- The design of the cathodic protection shall meet the following criteria:

(i) Negative cathodic potential of not more than (-) 850 milli volt and not less than (-) 1200 milli volt. should be maintained between vessel
surface and the electrolyte, the potential being measured with respect to standard copper / copper sulphate reference cell.

(ii) A minimum polarized shift (\(\Delta V\)) 100 milli volt should indicate adequate levels of cathodic protection for the vessel.

The quantity of sacrificial anode provided shall be adequate to last for 15 years of the life of vessel considering coating defect on 30% of vessel surface.

c) Isolation of vessel from connecting piping and other structures :- It has to be ensured that underground vessel is completely insulated from piping network. The areas of focus being (i) Piping network to and from the vessel (ii) The support holding the vessel in place with the foundation such as strap or tie rod or both. (iii) Fittings and accessories which are connected to the earth by virtue of external connection such as cables and wires. Such fittings should include ROV, level gauge, etc.

The general guidelines that should be followed regarding design, material, installation and testing of C.P. system should be as per details given below:

General guidelines for cathodic protection system are :-

A) Design :-
   i) The current requirements for cathodic protection should be determined by calculation and accordingly the size and number of anodes worked out.
   ii) Allowance should be provided for current requirements for CP to allow for deterioration of the vessel over a period of time.
   iii) All assumptions in the calculations of the total current should be documented.

B) Material :-
   i) The type of anode to be selected for the CP system, should be based on the consumption rate of the anode, its current capacity, driving voltage and efficiency.

   ii) The anode should be free from damage to affect its life in operation.

   iii) The back fill material used should have preferably following composition
       Gypsum - 75%
       Bentonite - 20%
       Sodium Sulphate - 5%

   iv) Cables used should have their current carrying capacity and temperature ratings complying with standards employed. Cables should accordingly be appropriately sized and insulated.

   v) Reference cell used should be of permanent type of copper sulphate CU/CUS04 having stability of at least +/- 10 milli volt with 3.0 micro ampere load.
vi) Insulating gasket used for insulating cathodically protected tank from piping and other accessories should be provided with Neoprene faced phenolic gasket of thickness at least 3 mm. The insulation resistance of neoprene being at least 1.4 x 109 ohm. The washer should be of a fabric base phenolic sheet of at least 3.2 mm. thick whereas the sleeves used should be 8 mm. thick woven fabric with resein coating.

C) Installation : -
   i) The cathodic cable should be connected to the tank at two locations through thermit welding. The welding should be completely covered with an epoxy coating. For this purpose, two numbers of cleats should be provided on each side of the tank.

   ii) For monitoring the structure to soil potential, the CU/CUSO4 reference electrode should be installed at two locations one on each side of the tank at a distance of at least 150 mm. from the tank surface. One end of the cable should be connected to the reference electrode and the other terminated in the CP monitoring box.

   iii) The sacrificial anode should be laid on the sides of the tank as per laid down procedure. After installation of the same, left over space shall be filled with back fill material. The anodes should be connected together and two cables drawn from them to the CP monitoring box.

D) Pre Commissioning Inspection: -
   i) Before covering the tanks, a visual inspection of the equipment should be carried out to detect any mechanical damage and for comparison and verification of the dimensions with drawings and specifications. The visual inspection should include determining correctness of location of (a) anode (b) electrodes, (c) cable routes & (d) connection to CP monitoring box.

       Further, cable insulation should be verified using meager and the correctness of termination of the cables confirmed. The continuity of the cable should also be verified. The effectiveness of the insulating flanges should be verified by determining that no leakage of CP current takes place.

E) Testing & Commissioning: -
   i) All the cables i.e. anode cables, cathode cables and the reference electrode cables should be terminated in the CP monitoring box through cable glands. The anode lead cables should be connected to the cathode through the shunts and isolating links to complete the electrical circuit.

   ii) The pipe to soil potential should be measured before energizing CP system using CU/CUSO4 reference electrode and recorded.
iii) The potential between the tank structures and reference electrode should be measured and recorded. The C.P. is to be considered adequate if the results indicate that a minimum voltage of (-) 0.85 volt across the tank with respect to CU/CUS04 reference electrode is available.

F) Documentation:-

After testing and commissioning following documents should be maintained:

i) Test reports on testing and commissioning.

ii) Tank to soil potential readings obtained during commissioning.

iii) Test certificates of material used.