ANNEXURE – 4

TECHNICAL SCOPE FOR TESTING OF SAFETY RELIEF VALVE

1. SCOPE:

This procedure describes the general requirement and steps to be followed for the Overhauling, Repair and Calibration of pressure relief valve.

2. LOCATION OF WORK:

The proposed works are to be carried out at GUJARAT ENERGY LTD premises.

3. GUJARAT ENERGY LTD. (GEL) SCOPE OF WORK:

- To provide spare SRV if available for replacement if the SRV is malfunctioning.
- To provide Electrical supply. Arrangement required for connecting power supply to the **GEL** power point is to be done by **CONTRACTOR**.
- **GEL** shall give intimation for execution of SRV calibration and maintenance.
- To give permission for any repair of replacement of Spare parts of SRV.

4. CONTRACTOR'S SCOPE OF WORK:

- The **CONTRACTOR** shall be deemed to have visited the sites and thoroughly acquainted himself with the site locations and conditions, work areas available, etc.
- **CONTRACTOR** shall bear the transit insurance of their air compressor, Test bench / calibrator set up.
- **CONTRACTOR** shall provide details of calibrator set up including the P&ID and its testing certificate.
- **CONTRACTOR** has to arrange the removal and refitting of SRV.
- The **CONTRACTOR** shall make his own arrangements for the water, Pneumatic air, Nitrogen cylinder or any other arrangements.
- **CONTRACTOR** shall be responsible for the damages during removal and refitting of SRV.
- **CONTRACTOR** shall be responsible for arrangement of tools and tackles.
- All transportation required shall be under scope of **CONTRACTOR**
- **CONTRACTOR** shall be either certified under SMPV rule or should be a competent authority certified under factories act 1948 produce necessary documents for this context. All statutory requirements should be followed.
- **CONTRACTOR** has to fulfill all HSE, Statutory & additional requirements advised by **GEL** site In-charge prior to commencement or the work.
- **CONTRACTO** to carry out the job as per **GEL** approved IMS procedures and guidelines, latest version.

5. RESPONSIBILITY:

- **CONTRACTOR** Execution Engineer / Supervisor shall be responsible for Dismantling of SRV from compressor/Dispenser/Cascade at CNG stations and at other locations as is directed by site incharge for testing / overhauling.
- QC Inspector / EIC from the **GEL** side shall be responsible for visual inspection, witnessing of test and calibration and documentation.

6. INSPECTION:

- Inspection of the works executed under the scope of this contract shall be done by EIC or his authorized representative.
- The relevant data on the nameplate of valve shall be recorded in prescribed format.
- Collected data shall be verified / matched with the given original certificate of SRV.
- Inspection of SRV for any physical deformity, condition of wire seals, sign of any tampering, condition of thread etc. It shall be recorded under remarks on Datasheet and informed to **GEL** in writing / verbal.

7. PRE TESTING ACTIVITIES:

- Co-ordination with respective CNG In charge for shutdown / availability of the machine.
- Issuance of work permit.
- Test Bench is to be barricaded by 5 ft MS sheet surrounded by three sides.
- Test bench, Hose and Operating panel should be clamped /fixed by Sand Bags or any suitable means.
- Test bench installation at Safe and ventilated space.
- Test bench must be checked for any leakage in air / gas connections.
- Perform tool box talk prior to start job.
- Stopping / Shut down of the machine.
- Isolate station by closing Suction Valve, discharge Valve (priority panel) and valves of cascade.
- Isolate Electrical supply of the machine.
- Explore possibility of using cascade gas to fill the vehicle.
- Safe venting of gas from the machine.
- Ensure no residual gas is in the package.
- Dismantle Discharge side hose of SRV from the Vent Header.
- Dismantle SRV from Equipment.

8. TESTING ACTIVITIES:

8.1 Testing and Adjusting Set Pressure:

8.1.1 (Calibration) Set Pressure Test:

- Set pressure testing must always be performed using the appropriate test fluid shown below.

Pressure Relief Valve Tests Fluid	
Service Fluid	**Test Fluid**
Air, Gas, & Vapor	Air or Gas

- Mount the valve on the test bench making a note of the set pressure and cold differential test pressure (CDTP). The valve will be set at the CDTP.
- Increase the pressure and note the pressure at which the safety relief valve starts to open.
- If necessary, reduce the test pressure 25% below the opening pressure and adjust the spring adjusting screw. Repeat this until the valve opens at the required pressure, designated as the cold differential test pressure (CDTP). The set pressure tolerance is equal to +3% of the set pressure.
- Lock the jam nut in place and pop the valve once more to ensure the set pressure adjustment was not disturbed.
- Install the cap or lever assembly and wire seal the cap and blow down ring lock screws to prevent tampering.

8.1.2 Seat Tightness Test: -

Safety relief valve seat tightness is checked as per API 527. After 3 or 4 openings, reduce the pressure to 90% of the set pressure (For safety relief valves set to 3.50 kg/cm2 g or less, the tightness test pressure will be the pressure setting minus 0.350 kg/cm2 g). Close the outlet and measure the leakage rate for at-least one minute according to the standard API 527.

8.1.3 Preferable Table:

Set Pressure		**Leakage Rate for Effective Orifice size <= 0.307 inch sq (F orifice)(bubbles/min)**	**Leakage Rate for Effective orifice size > 0.307 inch sq (F orifice) (bubbles/min)**
PSI (G)	**Kg/cm2 (G)**		
15-1000	1-70	**40**	20
1500	103	**60**	**30**
2000	135	**80**	**40**
2500	171	100	50
3000	207	100	**60**
4000	276	100	**80**
5000	385	100	100
6000	414	100	100

8.2 Acceptance Criteria with Various Test Fluid:

AIR - The valve with metal seat, the leakage rate in bubble per minute shall not exceed the appropriate value given in table below (as per table 1 of API 527). For a soft seated valve there shall be no leakage for 1 minute (0 bubbles per minute).

8.3 Disassembly of SRV

In case, where Safety Relief Valve fails in Leakage test, machine is disassembled for inspection, cleaning and lapping (depend upon condition of SRV internals/seat).

8.4 Lapping and Cleaning

First all parts be thoroughly cleaned with an appropriate solvent / CTC. Particular attention should be paid to guiding surfaces such as stems, stem retainers, and guides. These surfaces should be free of corrosion or signs of pitting. Stem should be check if they are straight.

Spread a thin coat of Lapping abrasive on the lapping tool surface and place the disc on the top. Do not apply hand pressure; the weight of the disc will be sufficient. Apply a quick motion in a figure of 8 motions. Lift the disc periodically. Apply further coats of abrasive to the lapping tool and repeat the operation until all defects have been removed. The entire contact surface must have an identical texture and appearance, with no trace of scoring. Clean the contact surfaces of the lapping set and disc, using solvent / CTC. For finishing, use a much finer grade abrasive and spread a thin coat on the lapping set. Proceed as before, in a figure of 8 motions, for about ten minutes. If the contact surface does not appear fully polished, repeat the operation but without putting on more paste, just spread the remaining paste evenly, using the finger. The lapping process is completed when the entire contact surface has no marks and is uniformly polished to a glazed / mirror finish.

Finally, carefully clean the contact surface, using solvent / CTC and a very clean white cloth, until all traces of impurity have been removed.

8.5 Assembly of SRV

After lapping is done properly, SRV is assembled with new gaskets and proper lubrication of internal parts. The lubrication used must be compatible with operating conditions. Greasing / lubrication are not allowed if service fluid is oxygen. Repeat process 4 to 5 after assembly.

9. RE-INSTALLATION OF SRV:

9.1 After completion of testing, SRV is to be removed from test bench.
9.2 Teflon will be applied to thread of inlet of SRV.
9.3 SRV will be installed and tightened properly at respective header / vessel.
9.4 Hose / pipe in discharge side connecting between SRV and Vent header will be installed.
9.5 Crack opening of Inlet valves and ensure little gas in the Equipment.
9.6 Leak checking to ensure no leakage from SRV inlet / discharge threads. If there is any leakage close the inlet valves, vent the gas follow the step 2 to 6.
9.7 After ensuring no leakage follow below steps for each SRV

a) Charge gas up to the 20% of Working pressure, leak check and ensure zero leakage from threads.
b) Charge gas up to the 40% of Working pressure, leak check and ensure zero leakage from threads.
c) Charge gas up to the 75% of Working pressure, leak check and ensure zero leakage from threads.
d) Charge gas up to the 100% of Working pressure, leak check and ensure zero leakage from threads.

9.8 Compressor system can be taken now on normal working.

10 SITE CLEARANCE AND JOB CLOSURE

- Perform site clearance by collating tools & tackles, test bench, equipment, material etc. within station area.
- Assemble all involved persons / team at one point.
- Conduct feedback / what we learnt / what went well with team
- Inform to control room / shift in charge for start of station
- Close work permit and closure of the job.

11. REFERENCE CODES AND STANDARDS

- API Standard -RP: 527 : Seat Tightness of Pressure Relief Valves
- API Standard -RP: 576 : Inspection of Pressure Reliving Devices
- API Standard -RP: 521 : Pressure Reliving and Depressurizing systems
- OISD-:132: Inspection of Pressure Reliving Devices
- ASME Sec VIII Div 1 Ed. 1989:
- ASME Sec I Ed. 1992: Boiler and Pressure Vessel code