

ANNEXURE - 3

Thickness Measurement of Pressure Vessels, above Ground Pipe Lines, Skids etc

1. **SCOPE:**
This procedure describes the general requirement and steps to be followed Thickness Measurement of Pressure Vessels, Above Ground Pipe Lines, Skids etc.
2. **LOCATION OF WORK:**

The proposed works are to be carried out at GEL CNG station and CGD Installations.
3. **GUJARAT ENERGY LTD. (GEL) SCOPE OF WORK:**
 - 3.1 **CONTRACTOR** has to fulfill all HSE, Statutory & additional requirements advised by **GEL** site In-charge prior to commencement of the work.
 - 3.2 **GEL** shall give permission for execution of Thickness Measurement work.
4. **CONTRACTOR'S SCOPE OF WORK:**
 - 4.1 The **CONTRACTOR** shall be deemed to have visited the sites and thoroughly acquainted himself with the site locations and conditions, work areas available, etc.
 - 4.2 **CONTRACTOR** shall bear the transit insurance of the Equipments that are being used in Thickness Measurement Work.
 - 4.3 **CONTRACTOR** shall provide Calibration Certificate of the testing Equipment traceable to NABL accredited Laboratory.
 - 4.4 **CONTRACTOR** shall provide PPE's Like Safety Helmets, Goggles, Earmuffs, Gloves Safety Shoes etc to personnel deployed for work execution.
 - 4.5 **CONTRACTOR** shall be responsible for arrangement of Consumables, tools and tackles.
 - 4.6 All transportation required shall be under scope of **CONTRACTOR**
 - 4.7 **CONTRACTOR** shall ensure that this assessment is carried out by certified and competent personnel – ASNT Level-II as minimum and reviewed/approved by ASNT Level-III as deemed necessary, - Competent Authority authorized by Inspector.
5. **RESPONSIBILITY:**
 - 5.1 **CONTRACTOR** Execution Engineer / Supervisor shall be responsible for performing Thickness Measurement of Pressure Vessels, Above Ground Piping and Skids installed at CNG stations and at other locations as is directed by site incharge for testing / overhauling.
 - 5.2 QC Inspector / EIC from the **GEL** side shall be responsible for visual inspection, witnessing of test and calibration and documentation.
6. **INSPECTION:**

- 6.1 Inspection of the works executed under the scope of this contract shall be done by EIC or his authorized representative.
- 6.2 The relevant data on the nameplate of Pressure Vessels, Skids etc shall be recorded in prescribed format.
- 6.3 Collected data shall be verified / matched with the given original certificate of Pressure Vessel/Skid/ Pipe.

7. PRE TESTING ACTIVITIES:

- 7.1 Co-ordination with respective CNG/PNG In charge for shutdown / availability of the machine.
- 7.2 Issuance of work permit.
- 7.3 Perform tool box talk prior to start job in line with Hazards/Risks identified during Site Specific Risk Assessment (SSRA).
- 7.4 Isolate/Stop / Shut down of the machine/installation, if required. Ensure LOTO procedure is followed.
- 7.5 Ensure all consumables, Tools and Tackles are available before execution of job.

8. TESTING ACTIVITIES:

8.1 Equipments Required: -

- i. Ultra Sonic Thickness Measurement
- ii. Battery and Charger.

8.2 Material /Consumable: -

- i. Couplant: - Oil/Water/Grease should be used as couplant.
- ii. Cleaner: - Cleaner shall be used for preparation of Surface before thickness measurement.
- iii. Paint/Permanent Marker Shall be used for marking the points which are selected for thickness measurement.

8.3 Surface Condition: -

All surfaces shall be clean and free of scale, dirt, grease, paint, spatters or any other foreign materials. Surface shall be smooth to carry out effective test.

8.4 Measurement location Selection Methodology

Typical scope of work is defined below; actual execution needs to be done as per Instruction of Site Engineer performing the job.

8.4.1 Vessels:

To locate the testing point on vessel, straight distance is measured from circumferential seam & curve distance is measured from long seam which are recorded while taking reading.

- 8.4.1.1 Select Test Location for thickness measurements of each dome on vessel and readings are taken at total 12 nos. spots on dome area, radial three (3) spots (one near center, second on knuckle area & third on straight face) on each divisional axis is made at 0°, 90°, 180° and 270° when viewed clockwise from top.

- 8.4.1.2 Select Test Location for thickness measurements on each shell on vessel and readings are taken at four (4) spots at equal distance circumferentially i.e. at 0°, 90°, 180° and 270° clockwise. (The number of circumferential measurements on

shell will depend on the shell height, minimum 2 nos. or maximum 3 nos. circumferential measurements).

- 8.4.1.3 Select Test Location for thickness measurements on each nozzle on vessel and readings are taken at four (4) spots at equal distance circumferentially i.e. at 0°, 90°, 180° and 270° clockwise.

All dimensions are in mm.

8.4.2 **Pipe:**

Select Test Location for thickness measurement at every approx. 1 meter or less distance (as per site condition) of straight pipe and readings are taken at four (4) spots at equal distance circumferentially i.e. at 0°, 90°, 180° and 270° clockwise when viewed along the flow.

All dimensions are in mm.

8.4.3 **Fittings:**

Select Test Location for thickness measurements of each elbow on pipe lines and readings are taken at four (4) spots at equal distance circumferentially i.e. at 0°, 90°, 180° and 270° clockwise when viewed along the flow as well as there are 3 nos. radial spots (i.e. at one elbow total $4 \times 3 = 12$ nos. thickness measurements recorded).

All dimensions are in mm.

8.5 **Execution Methodology:**

- 8.5.1 Thickness measurement is carried out for above-ground piping, fittings, valves & vessels.

- 8.5.2 Facing direction (Flow direction) is recorded while taking reading at four (4) spots at each location.

- 8.5.3 For reducing measurement error, near Reference is defined for future traceability of test location. All weld joints are given unique identification no. and are used as reference for traceability of test locations.

- 8.5.4 Future traceability of test points is done by permanent marking / painting of test points. Distance of test points from reference weld joints are recorded in assessment sheets.

- 8.5.5 Isometric drawings and sketches are to be referred for locating test points.

- 8.5.6 A graphical representation of thickness readings, with reduction of greater than or equal to () 1.5mm is recorded and represented as a separate section in the assessment report.

- 8.5.7 All linear dimensions for location of test location on pipe and valve are taken straight.

- 8.5.8 All linear dimensions for location of test spot on elbow are taken curve distance.

- 8.5.9 All personnel deployed are NDT Level II (UT) in accordance with ASNT document ASNT-TC-1A. Copies of UT Level II Certificate of all personnel engaged are attached with this ultrasonic thickness survey report.

- 8.5.10 Considering integrity aspects, removal of coating to be avoided.

For particular item, out of all Recorded thickness measurement observations "**Bold underline Marked**" record indicates "**Minimum thickness**" & "*Italic*

underline Marked" indicates "*Maximum thickness*". "**Bold marked with ***" records indicate **reduction of recorded thickness measurement 1.5mm** and above in comparison to last recorded thickness measurement.

8.6 Procedure for Thickness Measurement: -

Sr. No.	Activity	Responsibility
8.6.1	Thickness measurement for existing above-ground installations (City Gate Stations, Pressure Regulation Installation, Metering Regulating Stations, etc. – as applicable) is planned in accordance to frequency defined in planned maintenance schedule	Owner along with Testing Agency
8.6.2	A 'Work Authorization" approval is obtained and Site In Charge is informed before initiation of job.	Testing Agency
8.6.3	Site Specific Risk Assessment (SSRA), Tool Box Talks, PPE, fitness of equipments are ensured before initiation of job	Testing Agency
8.6.4	Ensure selection of thickness measurement point as per Measurement location Selection Methodology mentioned in Section 8.4.	Testing Agency
8.6.5	Check whether Equipment/installation/machine needs to stopped/isolated before execution of work. If required isolate/stop the Equipment/installation/machine.	Owner along with Testing Agency
8.6.6	Ensure execution of thickness measurement as per the Execution Methodology mentioned in Section 8.5.	Testing Agency
8.6.7	Appropriate marking of measurement point (either by paint, stickers, etc.) is ensured for future traceability	Testing Agency
8.6.8	The thickness measurement report submitted is reviewed	Testing Agency
8.6.9	The measurement results to be compared with original test certificate of the equipment, and those results in which reduction in thickness is either within limits as specified in the test certificate or less than 1.5mm of the original thickness than it shall be considered in acceptance criteria.	Owner
8.6.10	All measurement results in which reduction in thickness is either more than the limits as specified in the test certificate or 1.5mm of the original thickness (whichever is more) than the results are to be re-verified at site, along with ASNT Level II personnel and Asset Integrity. In the re-verification process If the reduction in thickness still is more than the limits as specified above than it shall be considered for rejection, mitigation / replacement plan is devised in consultancy with Asset Integrity, Technical Department.	Owner along with Testing Agency
8.6.11	Case-1:- If the results of thickness measurement are within limit when compared to the original test certificate of equipment or less than 1.5 mm of the original thickness. Yearly Monitoring as per Annual Maintenance Plan.	Owner & Testing Agency

Case-2:- If the reduction in thickness is either more than the limits as specified in the test certificate or 1.5mm of the original thickness (whichever is more) of the equipment than

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| <ul style="list-style-type: none">- Detailed re-assessment of the said spool in consultation with ASNT Level III expert (O&M & Asset Integrity).- Action plan to be prepared jointly with Asset Integrity and Technical Department |
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Note:- If at any time it is felt that the internal of pipeline, valve or any fittings (valve neck, PRV internals, etc.) are to be measured or checked, which may result in system shutdown or supply discontinuity, then a detailed Permit to Work is prepared and approval sought from owner/ stakeholders.

CONTRACTOR to follow **GEL** approved IMS procedure and guideline, latest version to carry out Thickness assessment.

9. SITE CLEARANCE AND JOB CLOSURE

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