



M/s. GIRISH CHANDRA GHOSH & G.G.S.

Tank Settlement Survey, Roundness Test
in INDIA & ABROAD



TANK SETTLEMENT SURVEY & INSPECTION



Corp Off : 40/2, B. T. Road, Sonajhuri Apartment, Block-B
Ground Floor, Kolkata - 700 002
Regd Off : 39A, B. T. Road, Katakhal, Kolkata - 700 002
West Bengal India
Mob. : 91 9830081365
Tel / Fax : 033-25589089
e-mail : gcg.ggs.kol@gmail.com
gcg_ggs@rediffmail.com



An ISO 9001:2008 certified Company

NSIC-MSME registered Unit
NSIC-ONICRA credit rated Co.

www.girishcalibration.com
www.storage-tank-calibration.in

Approved by Office of Zonal Director General
of Foreign Trade Certificate of Importer-
Exporter Code (IEC) No: 0216925703 and
the Registered member of EEPC
(Engineering Export Promotion Council)
India, Reg. No-301/M28655



The scope of the described project includes:

Ground Access:

1. Visual inspection of tank supports, assemblies and conduits.
2. Tank Settlement survey-Ovality, Verticality & Roundness
3. Bottom Profile survey of Tank
4. Magnetic Particle Inspection on weld joint of shell to annular plate.

Above Ground Access:

1. Ultrasonic Thickness Gauging on shell and roof plates through ladder or Scrap holding.
2. Visual Inspection of supports, assemblies and conduits in work at height locations.

Quality Controls:

GCG endeavors to ensure a high quality deliverable. The following measures will be taken:

- Only technically qualified and experienced staff will be utilised
- Only trade experienced staff will be utilised for the respective project tasks
- All Inspection processed will follow standard procedure
- All client and GCG specific procedures to be closely adhered to

CLIENT QC Requirement:

- All staff Biodata, including CV and certificates shall be submitted to client for review and approval
- NDT technician for ECI shall be ASNT-TC-1A qualified
- Final dossier for all jobs executed by contractor. Signed off report for all jobs to be submitted by contractor.

Equipment Preparation

1	GCG equipment shipped to site. Storage location established and equipment made safe.
2	Completion of GCG pre work site access equipment inspection. Preparation of equipment movement onto work site.
3	Movement of RA and inspection equipment near to Tank Location
4	Establish adequate exclusion zone as required. Barricade work zones and potential hazards accordingly.
5	Establish communication requirements between client and Company staff. Allocation of radio communication as required
6	Allocation of rescue specific rigging and equipment

Project Work Sequence & Processes:

Visual, NDT Inspection & Survey of Storage Tank INTERNAL TANK INSPECTION – Ground

1.0 Visual Inspection on Tank Supports, conduits and assemblies	
a	Carry out visual inspection on bottom plate, support structures, foundation, floor to shell weld internal, pressure valves, Nozzles and all applicable apparatus.
b	Photographs to be taken for findings recorded in the report.
2.0 Tank Settlement Survey	
a	To find the centre of tank by using survey equipment's and fix the total station.
b	Make sure hard barricade has to be placed around the station to avoid lost of station level.
c	Perform Out of Roundness, Verticality & shell Settlement respectively.
d	Perform profile survey and calibration once initial survey is completed.
3.0 Tank Bottom plate Thickness Gauging	
a	Surface cleaning /preparation as per the standard procedure.
b	Five location in each section has to perform UTG in Bottom Plate.
4.0 Magnetic Particle Inspection/Eddy Current Inspection on weld joint of shell to annular plate	
a	Surface cleaning /preparation as per the standard procedure.
b	Perform Magnetic Particle inspection /ECI on weld joint of shell to annular plate.

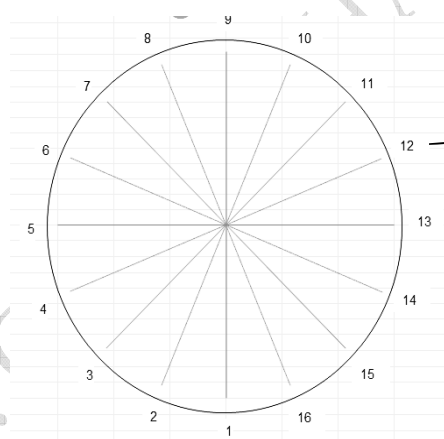
EXTERNAL TANK INSPECTION

5.0 Ultrasonic Thickness Gauging on each shell by Rope Access/Scrap holding	
a	Carry out visual inspection on bottom plate, support structures, foundation, floor to shell weld internal, pressure valves, Nozzles and all applicable apparatus.
b	Photographs to be taken for findings recorded in the report.
6.0 Tank Roof Plate Thickness Gauging	
a	Surface cleaning /preparation as per the standard procedure.
b	Five location in each section has to perform UTG in Bottom Plate
7.0 Visual Inspection on Tank Supports, conduits and assemblies	
a	Carry out visual inspection on top plate, support floor to shell weld external, roof structure, pressure valves, Nozzles and all applicable apparatus.
b	Photographs to be taken for findings recorded in the report.

Survey of Cylindrical Vertical Tanks as per API 653 latest edition.

Shell Edge Settlement

- ❖ Initial visual inspection is performed with an insight of reference points on the tank shell and corresponding positioning of Total Station.
- ❖ Reference shell (1st course) circumference shall be measured along the horizontal plane to find the mean outer diameter of the tank at bottom course (Figure 1).
- ❖ The total survey point shall be a minimum eight (8) in numbers.
- ❖ The number of survey points may be increased for more accuracy as per Owner's recommendations. **Spacing between the survey points shall not exceed a circumferential distance of 10 meter** (Figure 2).
- ❖ The Total Station is positioned radially along gauge point, which is considered as Position 1.
- ❖ From Position 1, the elevation of Total station View Finder is measured and recorded.
- ❖ The view finder is aligned to the tank bottom course edge, to give SHV readings (Slope, Horizontal & Vertical). The Vertical measurement with reference to the elevation from all points would determine the tank shell settlement.
- ❖ Adjacent positions shall be viewed through the Total Station to determine the elevation, before moving from Position 1 to next.
- ❖ SHV readings will be taken, from each station around the circumference, with high precision optical laser Total Stations and laser Distance Meter.



Maximum spacing of 10 meter around circumference.

Maximum spacing of 32 ft around circumference.

Figure 2

Tank Tilt or Verticality:

- ❖ Tank verticality check shall be performed to find out maximum out-of plumpness of the top shell to the bottom shell. The same settlement measurement point will be used for tank verticality check.
- ❖ All station points are positioned equally around the circumference, from where Laser Total Station is used to obtain vertical measurement readings at two heights for each strake (measured with optical equipment along 8 stations around the tank exterior).
- ❖ Measurements shall be taken at maximum / minimum liquid level or at any level as recommended by the Owner.
- ❖ These measurements are extensively analysed to output various data required for determining tank tilt, offset GCGaphs for adjacent and opposite stations (Figure 3).

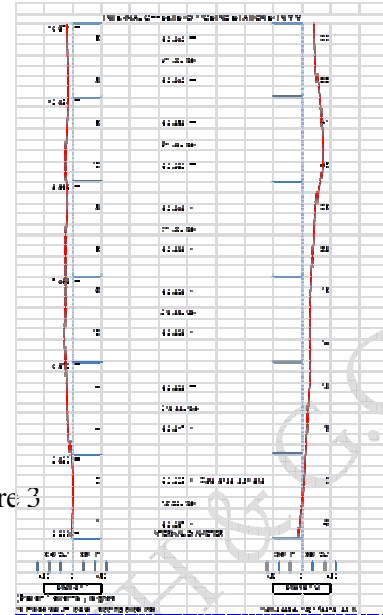


Figure 3

Tank Ovality or Roundness Survey:

- ❖ Initially, a visual inspection is performed with an insight of reference points on the tank shell and corresponding positioning of Total Station.
- ❖ Reference shell (1st course) circumference will be measured as per API MPMS 2.2A along the horizontal plane to give a mean outer diameter for the bottom course and centre, for an on-stream tank. If the tank is at Off-stream, internal radii are determined using “Disto” Laser, ranging (offset) measurements taken from a fixed point to each station around the upper section of 1st Course.
- ❖ The total survey points shall not be less than eight (8), **with spacing between the survey points not exceeding a circumferential distance of 10 meter.** The internal radii at each survey point, 300 mm above the base of the tank shell, shall be determined.
- ❖ Each course will be surveyed for roundness at two levels, each level will being at a distance $1/4$ th – $1/5$ th of the course height, from upper or lower horizontal weld.
- ❖ To provide a roundness report of the tank shell, radii readings and shell roundness measurements are considered to give equivalent radii at 300 mm above the tank base
Figure 4.

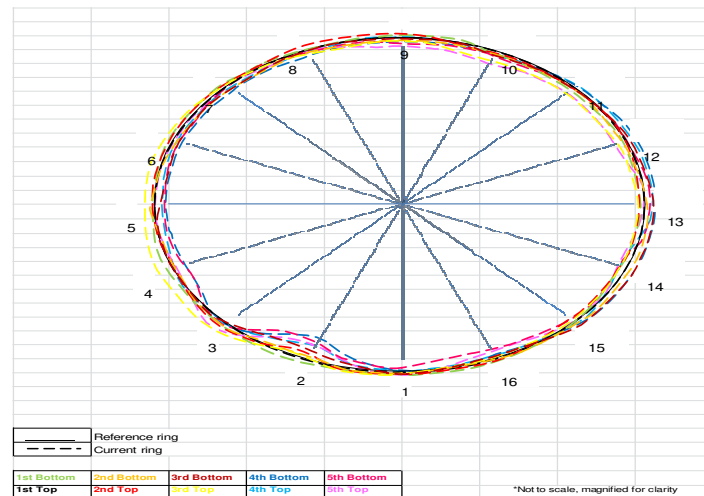


Figure 4

Evaluation of Survey Data

All analysis of surveyed data will be done in accordance with API 653 appendix B latest edition

Shell Settlement Evaluation

Maximum and Minimum out-of-plane settlement of shell will be found in accordance with API 653 latest edition.

Maximum out-of-plane deflection will be found in accordance with Fig. B-3 of API 653 and compared with maximum permissible value as given by the formula in B-3.2 of API 653 latest Edition.

$$S_{\max}, \text{ ft} = \frac{(L^2 \times Y \times 11)}{2[(E \times H)]}$$

Where

- S_{\max} , ft is Permissible out-of-plane settlement, in feet (ft).
- L is Arc Length between measurement points, in feet (ft).
- Y is Yield Strength of the shell material, in pound force per square inch (lbf/in.2).
- E is Young's Modulus, in pound force per square inch (lbf/in.2).
- H is Tank Height, in feet (ft).

Bottom Settlement Evaluation

This method is only applicable to tanks out of service. The permissible bulge or depression is given in API 653 latest edition appendix B.3.3 by the following formula.

$$B_B = 0.37R$$

Where

- B_B = maximum height of bulge or depth of depression, in inches.
- R = radius of inscribed circle in bulged or depression, in feet.

Readings will be taken at a maximum spacing of 10ft across the diameter and there will be at least 8 diameter readings and at suspicious /other location as per Client / Owner advise.

The data obtained will be used to evaluate the bottom for settlement. Additional settlement readings may be required to define local bulges or depressions.

Tank Tilt or Verticality Evaluation

The maximum out-of-plumpness of the top of the shell with respect to bottom of the shell will not exceed 1/100th of the total tank height, with a maximum of 5 inches. The 1/100 criteria, with a maximum of 5 inches, shall also apply to fixed roof columns. For tanks with internal floating roofs, we will apply the criteria of this section or API 650, Appendix H, whichever is more stringent.

Tank Roundness or Ovality Evaluation

Radii measured at 1 ft. above the shell-to-bottom weld shall not exceed the tolerances shown in API 653 Table 10.2.

Radius tolerances measured higher than one foot above the shell-to-bottom weld shall not exceed three times the tolerances given in API 653 Table 10.2 which we mentioned below.

Tank Diameter (Feet)	Radius Tolerance (Inches) at 1 ft above the shell bottom *
< 40	± 1/2 " (12.7 mm)
40 to < 150	± 3/4 " (19 mm)
150 to < 250	± 1 " (25.4 mm)
> 250	± 1 1/4 " (31.75mm)

Reporting

After tank inspection & survey, draft report will be submit within 4 days of measurement.

Thus one bound reports approved by an API 653 Tank Inspector for subject tank will be submitted within 10 days after completion of total project.

SURVEY & CALIBRATION TEAM		
TEAM MEMBER	QUALIFICATIONS	ROLE
SURVEYOR (ONE)	Bachelor in Engineering, 5 years' Experience in similar work	Responsible for carrying Calibration with the Digital total station, equipment's handling, report making, daily HSE site reporting, QA/QC administration and main focal point of site information to GCGI HQ.
ASST.SURVEYOR (ONE)	Diploma in Engineering, 3 years' Experience in similar work	Assistance to Site Surveyor to establish safe means of work at site, collecting field data.
Technical Clerk (ONE)	Diploma in Engineering, Experience in similar work	Computing field data in the software to generate report (Office Based)

Inspection Equipment

All required materials and equipment's, not specifically provided by the client, are referenced in the Company Equipment Manifest Form (EQM) for this particular project.

Remedial Repairs Equipment

All required materials and equipment's, not specifically provided by the client, are referenced in the Company Equipment Manifest Form (EQM) for this particular project.

Personal Protective Equipment

Throughout the project standard and task specific personal protective equipment (PPE) will be used:

- Standard category I and II PPE (helmet; appropriate eye protection; working gloves; long sleeve, fire retardant fluorescent work coveralls; ear protection; and steel capped boots
- Task specific PPE may also be required for hot works, blasting etc.
- Work at Height specific category III PPE where required

PPE use will remain the responsibility of each individual technician. The Company Site Supervisor will establish a PPE assessment and will enforce the use of complete use PPE where required. The site specific PPE assessment can be reviewed for further details.

COMMUNICATIONS

An efficient communication system shall be established between all rope access technicians, site management, and where necessary, to third parties (e.g. sentries or the client control room). This shall be agreed and set up before work starts and should remain effective for the whole period of work. The Site Supervisor is to establish what is required, and advise the staff of the communication systems to be utilised on the project, including any emergency numbers. Please reference the project Toolbox Talk for further details.

As a standard operating procedure the IRATA level III Safety Supervisor and the staff in his/her charge must be able to maintain uninterrupted communication with each other at all times during the series of work tasks. It is ideal to maintain both direct verbal and direct visual contact throughout all rope access work. Communication channels should be via clear instructions, either verbally, or via radio or established hand signals. Company technicians will typically employ standard rigging hand signals throughout the operations.

It is the responsibility of the level III Site Supervisor to establish and maintain adequate communications and ensure that the system of communication is understood by all parties involved. Initial communication standards are typically taught to staff during in house training sessions. Potential problems, such as noise, radio interference, other work teams' communication systems, weather etc., should be taken into account. Should other established methods of communication fail, and then an alternative method shall be established before the works begin, i.e. by sign or signal, to enable the rope access technician to summon assistance. In some cases pre-arranged hand signals are used because other methods, such as a helmet microphone, are unsuitable when blasting, due to the noise. A common and effective technique to attract the blaster's attention is for the Ground technicians to cut off the air supply.

Establishing and maintaining effective communications between facility management, Company Site Supervisors and Company technicians will be required to:

- Alert facility control room of Company technicians entering the work zones
- Alert Company technicians of any planned and unplanned simultaneous operations
- Alert Company Technicians of any unsuitable isolation or unsafe control of vehicular traffic
- Relay security alarm scenario information and response as advised by military escort

QUALITY ASSURANCE

The Company aims to provide service quality that meets or exceeds requirements in a cost effective and professional manner. The Company's Quality Manual has been established to achieve and maintain this quality assurance and to ensure adherence to the governing requirements for safe and efficient operations.

Thanking you
Yours faithfully



MR. SUPRIYO GHOSH (098300 81365 / 080132 76564)
(MANAGING PARTNER)
For, M/s. GIRISH CHANDRA GHOSH & GGS

For Any Site Enquiry You May Contact
Technical Head
Mr. Mahadi Hossain (+91 8336984786)

Our beloved customers



M/s. G.G.S.

G.G.S.