ACCURACY FOR YOUR INVENTORIES/VESSSEL LOAD AND DISCHARGE

Cost-effective using the latest technology for storage tank strapping

intertek.com/petroleum/metering/tank-calibration/
Large storage tanks are not perfect cylinders. There are many variables that change the shape during construction and as the tank ages. For example, heat input during welding can create distortions at the weld seams and tank settlement can cause various changes to the shape of the bottom shell and can tilt the tank in certain circumstances. Tank strapping or calibration is the process of gathering accurate measurements for the purpose of producing tank capacity tables. The tables express the volume measurement for a specific product height in the storage tank. These are tied to the strike point and serve as the reference for all elevations within the tables. The strike point is positioned on the tank bottom plates below the gauge pole or under a roof mounted gauge point. It is also tied to the floating roof and serves to establish when the roof is fully floating in product. Volumetric strapping and the capacity tables derived from these measurements are the most economical and accurate way of determining the true volume of a containment system in relation to the liquid level. The only way that any gauging system can accurately measure the amount of product in a containment system is to calibrate that system with accurate capacity tables. Inaccurate or out of date tables may negate even the most accurate tank level gauging systems. With today’s high commodity prices, the potential costs of out of date or inaccurate capacity tables can add up to significant losses. A small error in the diameter of the tank can add up to a significant amount of money every month, especially if the tank is frequently cycled.

Our Capabilities for Tank calibration are available for any site with a tank farm including:
- Independent storage facilities
- Small distribution depots
- Large fuel terminals
- Oil refineries
- Power plants

We have the ability to provide volumetric capacity tables in gallons and barrels
- Vertical Tanks
- Horizontal Tanks
- Cylindrical Tanks
- Double-wall Tanks
- Spherical Tanks
- Truck Tanks
- Fixed Roof Tanks
- Floating Roof Tanks
- Domed Roof Tanks
- Conical Roof Tanks
- LNG storage Tanks
- Rail Cars

Inaccurate or out of date storage tank strapping charts negatively impact the most accurate inspection and sophisticated tank gauging systems and cost the Terminal thousands of dollars every month, such as: large discrepancy between vessel discharge and storage tank received quantity; discrepancy between bill of lading (BOL) and shore tank received; day to day inventory discrepancy during pipe line transfer/trucks/rail car Load. Don’t you want every gallon of product accounted for as precisely as possible?
A = Application
The American Petroleum Institute (API) Committee on Petroleum Measurement Standards issues and oversees the Manual of Petroleum Measurement Standards (MPMS). These are the measurement standards used by the petroleum industry. API Chapter 2 - Tank Calibration contains the procedures used to calibrate closed storage vessels.

In order to determine the volume of product delivered or received during a transfer, the storage tank must be calibrated and have a certified strapping chart.

To calibrate a tank, procedures for measurements for vertical wall roundness, shape, roof, floor and deadwood are performed. Tank capacity tables also known as strapping charts are calculated using these measurements. The tables express the volume measurement for a specific product height in the storage tank.

M = Methods
Intertek Calibration Services personnel have many years of experience doing physical calibration of all types of storage tanks. They use the procedures in API Chapter 2, specifically 2.2C and 2.2D, laser distance techniques. Laser distance technology is more precise (accuracy of 1/16” at 600 feet) and safer than traditional methods 2.2a and 2.2b (no scaffolding required).

API Chapter 2.2A Circumferences of Tanks/Strapping Method
This method involves using a calibration tape and taking circumferences with a tape that encircles the entire tank. The measurements are taken at approximately 20% and 80% of each ring. After the ground measurements are taken, the tape is pushed up the tank to the next position by using poles.

This method is very time consuming. There are also safety concerns in reading the tape at higher levels. It requires ladders or hanging over the side of a tank in a boson’s chair.

API Chapter 2.2B Optical Reference Line Method
This method involves taking a circumference reading at approximately 80% height of the first ring, which will be the reference circumference. The determination of the circumferences of the other rings are done using a trolley and a millimeter scale. Poles with a pulley or a person on the top of the tank will raise and lower the trolley to approximately 20% and 80% of each ring. This determines the deviation from the reference circumference. The measurements are calculated to derive the circumferences of the other rings. The number of stations to measure depends upon the diameter of the tank.

API Chapter 2.2C Optical Reference Line Method
This method involves using a digital theodolite to determine the deviation of the shell plates. A circumference is taken at approximately 80% of the first ring. Triangulation readings are then taken at 80% of the first ring and then at 20% and 80% of each of the following rings. The measurements are calculated to derive the circumferences of the other rings. The number of stations to measure depends upon the diameter of the tank.

API Chapter 2.2D Optical Reference Line Method
This method involves using a ‘total station’ to take radius measurements from inside the tank. The equipment is set up in the center of the tank. Two readings are taken on each ring at approximately 20% and 80% of height. The number of stations is dependent upon the size of the tank. The radius results are used to determine the diameter of the tank of each ring.
Tank Internals

Deadwood
Is any piping, channels, etc. that take up or add volume in a tank. All deadwood is recorded as size, length, height, and type (i.e. channel, open pipe, closed pipe, etc.) for deduction from the charts in the area that it is at.

Tank bottom
Is measured by setting up a floor laser in the center of the tank. The readings start at the shell by the gauge point and are taken at intervals as prescribed by the API standard. Everything regarding height of the floating roof, overflow points, shell height as per gauging, etc. is based upon the reading taken on this point.

Tank Externals
All deadwood such as piping to the valves, manways, clean out hatches, etc. are documented.

Recalibration of tanks according to API 2.2A.19.10.2, “should be in any case re-measured and calibrated under the following conditions:

• When restored to service after being disconnected or abandoned.
• When disassembled and re-erected or when moved bodily.
• When deadwood is changed, when concrete or other material is placed on the tank bottom or on the shell of the tank, or when the tank is changed in any manner which would affect the incremental or total volume.”

API also states for recalibration in Appendix A of Chapter 2.2A, Section A.6.3, “Tanks do change with time and service, and volume changes may not be readily identified by visual inspection or preceding verification procedures. Because of that, it is considered justifiable practice to recalibrate tanks on a periodic basis to reassure good measurement accuracy. A total recalibration at 15-year intervals for tanks in custody transfer service and at 15-20 years for others is reasonable.”

A.6.1 states that for custody transfer service, verification of the bottom course diameter, bottom course thickness and tank tilt is suggested to be performed every five years. If any exceed the criteria for a predetermined variation in volume, a total recalibration should be considered.

Loss Control Suggestion: If you see a significant variation, the terminal or loss control should verify that the latest strapping chart is being used. If an outdated chart is found, remove it and note it as obsolete. In the case of computerized systems, check to see if there was a data entry error from when the original hard copy chart was entered into the computer system.
Intertek is a leading Total Quality Assurance provider to industries worldwide. Our network of more than 1,000 laboratories and offices and over 46,000 people in more than 100 countries, delivers innovative and bespoke Assurance, Testing, Inspection and Certification solutions for our customers’ operations and supply chains. Intertek Total Quality Assurance expertise, delivered consistently with precision, pace and passion, enabling our customers to power ahead safely.