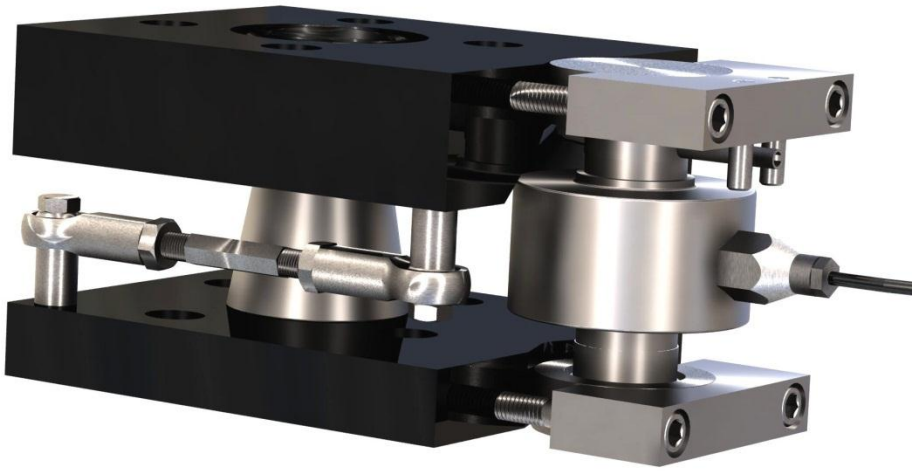
Group Four Transducers Inc

Pioneering | Measured | Solutions

INSTALLATION GUIDE

RC-WM (5000WM3) | WEIGH MODULE



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Content

Important

Group Four Transducers recommends that the user read this manual completely prior to starting installation as each successive step depends upon satisfactory completion of all prior procedures. The installation should be planned by a qualified structural engineer. Each installation is unique, and this manual is meant to serve only as a general guideline for installation.

Safety information/instructions

- Do not drop the load cell.
- Protect the load cells from shock loading.
- Do not carry the load cell by the cable.
- Do not damage the cable.
- As long as the installation work on the scale structure is not completed, replace the load cells with dummy load cells, to avoid damage to the load cell.

Group Four Transducers reserves the right to revise this manual at any time and to make changes in the contents hereof without obligation to notify any person of such revision or changes.

Call (800) 419 1444 for Group four sales services.

1. Introduction

The type RC-WM is a self-aligning weigh module with superior load introduction. Capacity range is from 5 to 50 ton. This design includes integral uplift protection and check link (Stay rod). RC-WM compression canister loads cells are compatible for use in the RC-WM weigh module. All construction of the load cell is stainless steel, complete hermetically sealed and rated for 200% maximum overload.

Specifications:

Refer RC-WM weigh module datasheet for weigh module specifications.
Refer RC-WM load cell datasheet for load cell technical specifications.

Uplift protection:
Uplift protection is important to prevent the tank from lifting off due to wind forces. It is required in the case of lightweight containers and tall, outdoor silos.

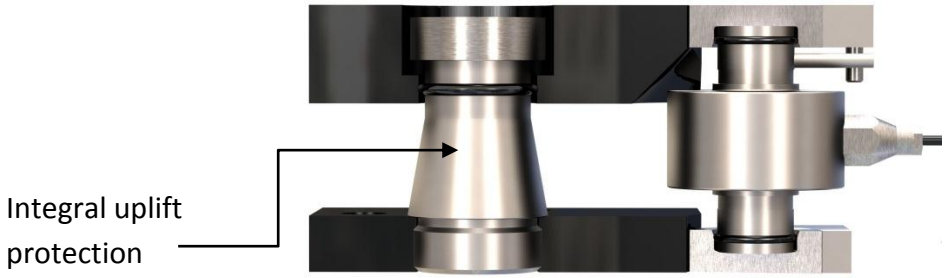


Fig 01: RC-WM weigh module(section view)- Integral uplift protection

Integral check link (Stay rods):
The Integral check links (stay rods) absorb side forces limit vessel oscillation or vibration while allowing for minor thermal expansion and contraction of vessel. The Integral check links are used to,

- Protect piping from fatigue failure due to constant vessel movement.
- Ensure the stability of tall slender vessels or vessels with heavy eccentrically-mounted equipment.
- Ensure the stability of vessels against wind, seismic forces or threat from vehicular traffic.
- Hold a vessel in place when mounted on canister cells. These cells have very little tolerance of side forces and must be loaded in the vertical direction only.

Fig 02: RC-WM weigh module- Integral check link

The weigh module will be shipped completely pre-assembled, ready for installation by welding or bolting.

Optional top and bottom mounting plates are provided on request. Size of mounting plate can be customized according to application requirement.

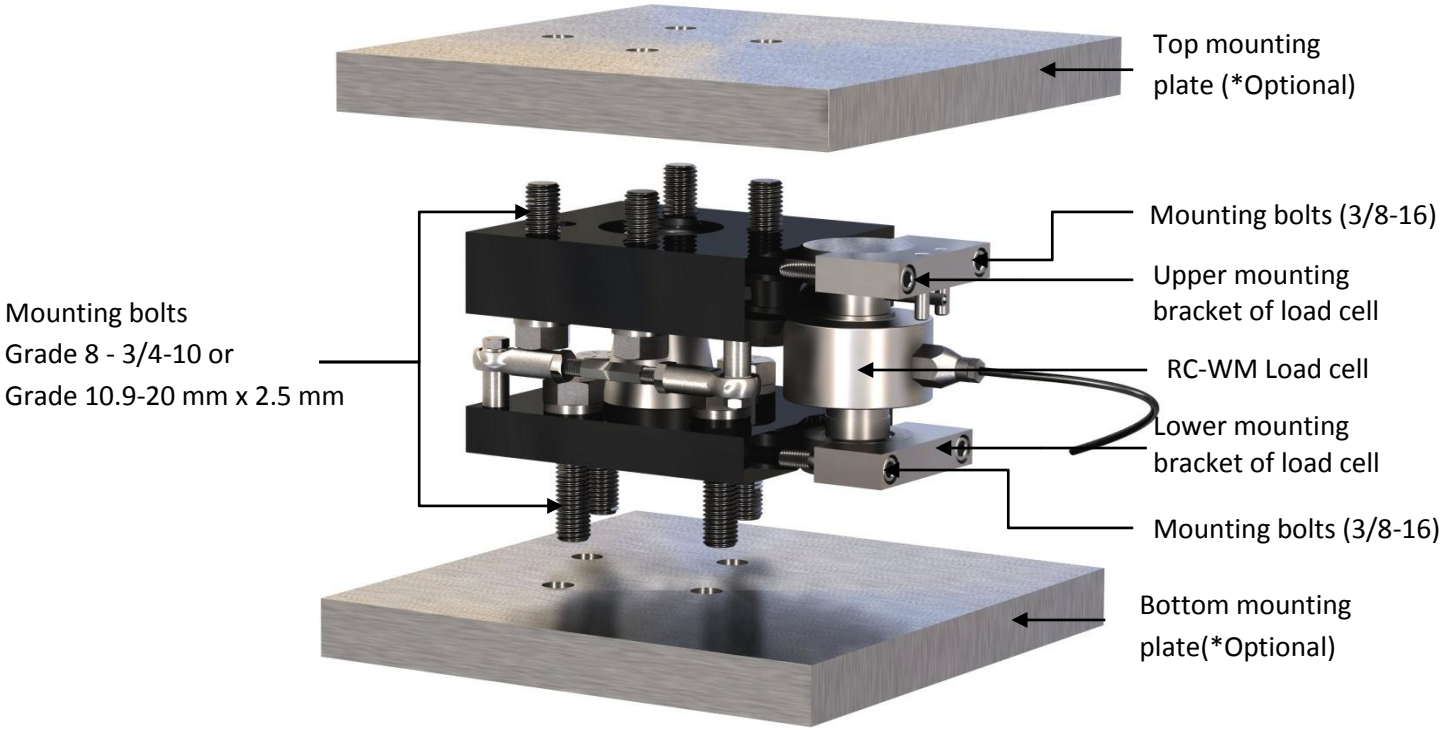


Fig 03: RC-WM weigh module-Exploded view with mounting plates

2. Configuration of Weighing System

Determining number of weigh modules

For an existing installation, the number of weigh modules is determined by the number of existing supports of the tank. If a tank has four legs, you will need to use four weigh modules.

Compression mounting systems use three, four, or more mounts. More than eight-module systems should be avoided as even weight distribution becomes extremely difficult to achieve.

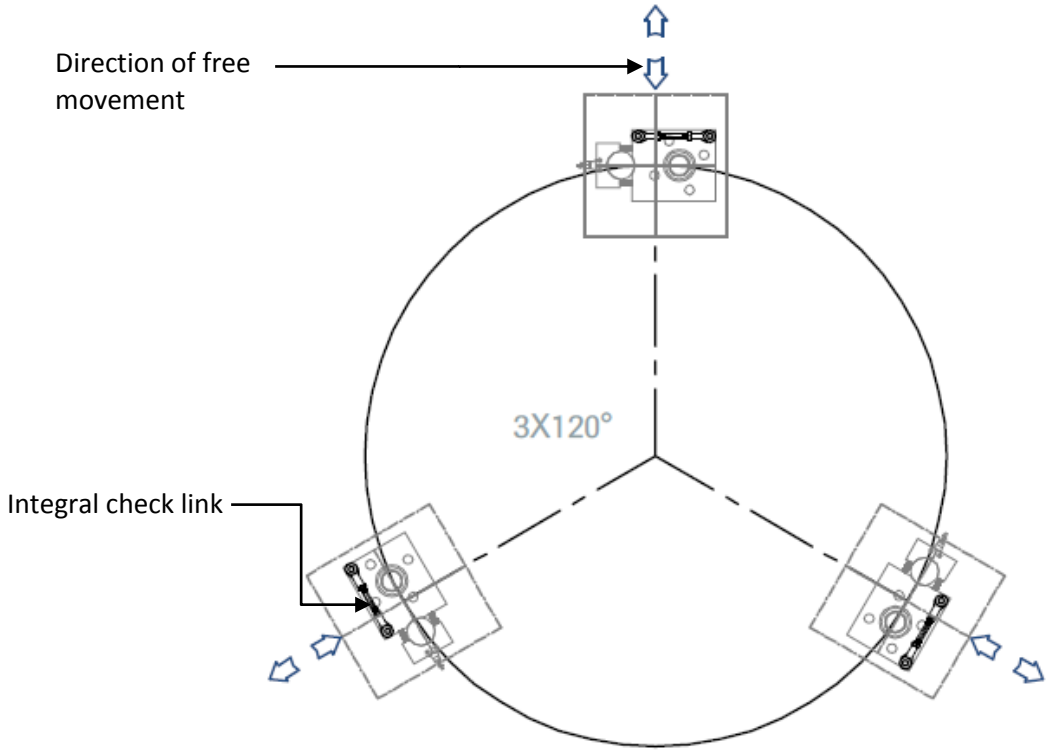
Determining capacity of weigh module

To calculate required capacity of weigh module, divide the gross capacity of system by number of supports (Or Number of weigh modules). A safety factor should be applied to the gross capacity in case the weigh is underestimated or distributed unevenly.

Recommended mounting configuration

Figure 04 and 05 illustrate different type of vessels and recommended mounting configurations for weigh modules with Integral check links.

When a tank is supported by four weigh modules, one load module should be installed without Integral check link (Stay Rod) to avoid restricting compensating movements and to avoid damage to the modules.(See figure 05).



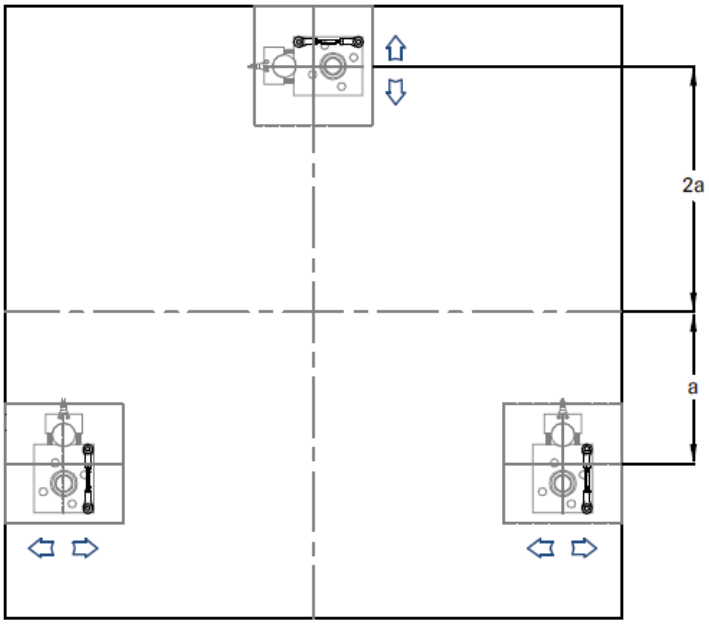
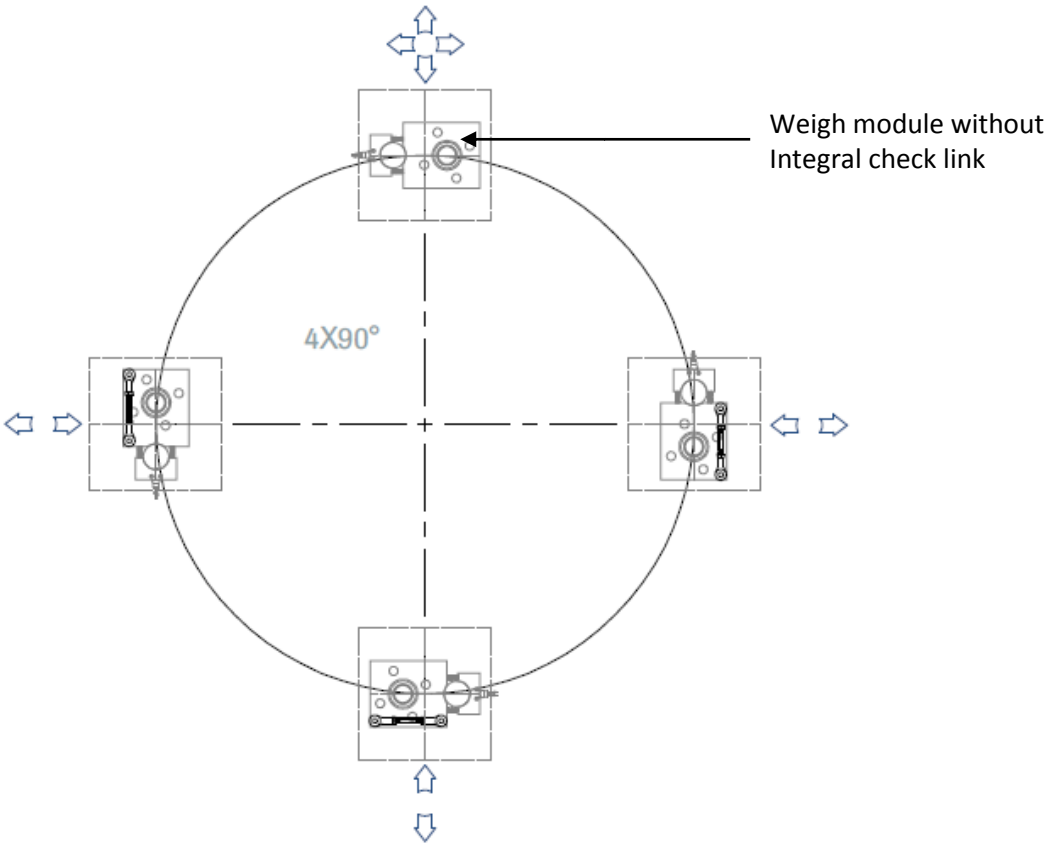


Figure 04: Mounting configurations, when tank is supported by three points.



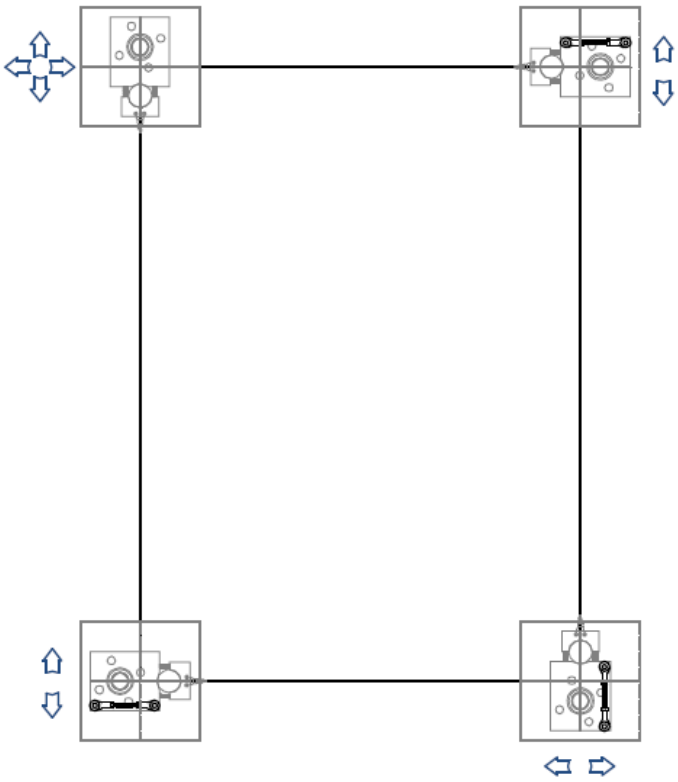


Figure 05 : Mounting configurations, when tank is supported by four points.

3. Considerations Prior to Installation

The foundation of weighing system

The foundation for the weigh module can be a concrete pier or Structural Beam Foundation. The foundation should be flat within 1/8" (3mm), rigid, level, and should support the weight of the vessel plus the load that will be applied to it. The mounting location of each weigh module must be level to 0.5° on the foundation (see figure 06).

Figure 06 : Foundation for weighing module installation.

Deflection of structural support system

Deflections in a tank scale's structural support system can affect the weight indicated by the scale. Excessive or non-uniform deflection will introduce unwanted non-vertical forces at the load cells, reducing the system's accuracy and repeatability. When designing a weigh module support structure, you should follow below guidelines:

• The support brackets for the weigh modules should not deflect more than 0.5° degree out of level at full capacity(See figure 07).

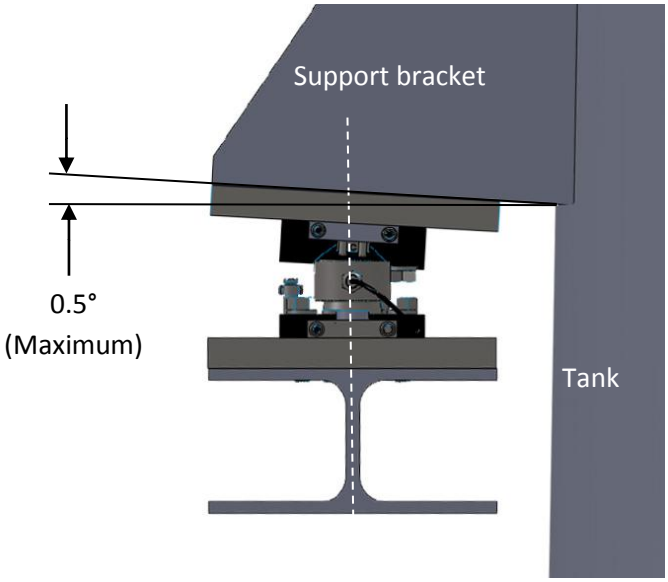


Figure 07 : Deflection limits of support brackets

• The base support structure for the weigh modules should not twist or deflect more than 0.5°degree out of level at full capacity(See figure 08).

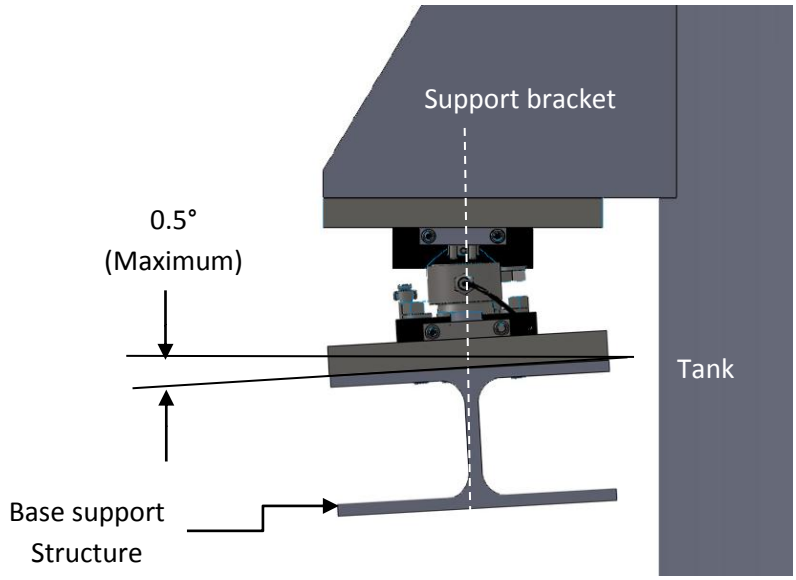


Figure 08 : Deflection limits of base support

• The base support structure for the weigh modules should deflect uniformly.

A tank scale's support structure should deflect as little as possible, and any deflection should be uniform at all support points (see figure 09). Excessive deflection can cause inlet and outlet piping to bind, creating linearity errors. When deflection is not uniform, it can cause repeatability errors and zero return errors.

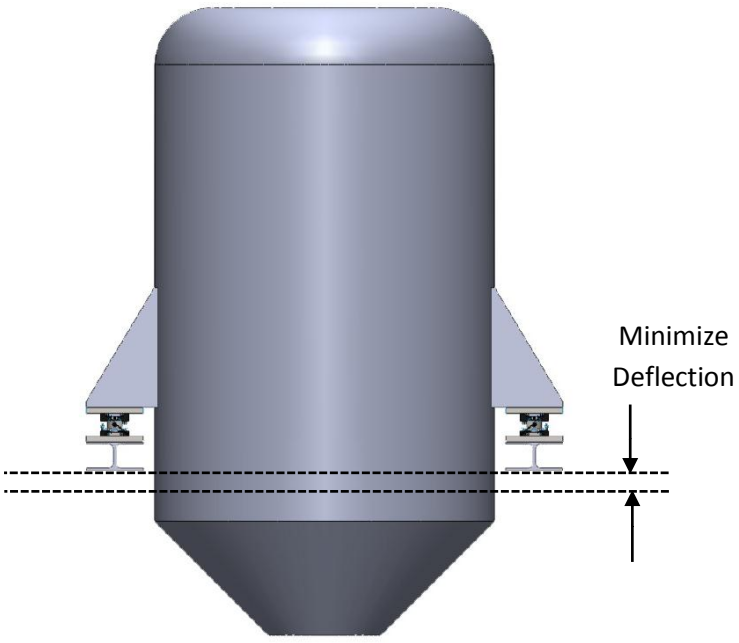


Figure 09 : Deflection limits of base support

In some cases, a tank's legs will deflect under the weight of the tank. If the deflection is great enough to affect weight readings, you should brace the legs to keep them rigid (see figure 10).

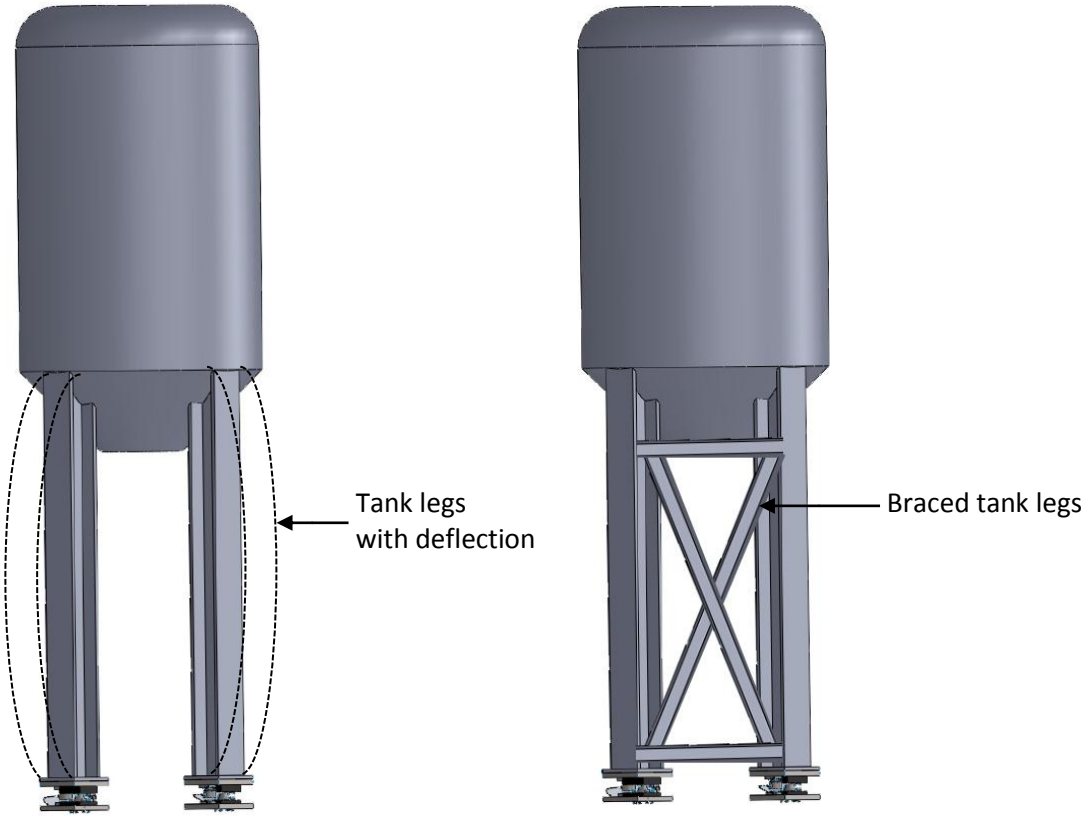


Figure 10 : Braced tank legs to make tank legs rigid

• Weigh Module and Support Beam Alignment

The center line of load application on a load cell should align with the center line of the weigh module's support beam. (see figure 11)

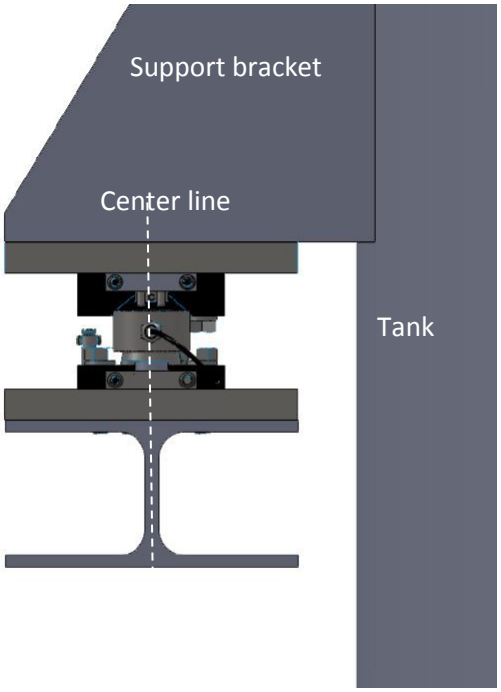


Figure 11 : Weigh Module alignment on support beam

Metal support structures tend to bend or deflect as the amount of weight placed on them increases. Too much deflection can affect the accuracy of a tank scale. The greatest potential for deflection occurs when a weigh module is mounted at the middle of the support beam's span. (see figure 12)

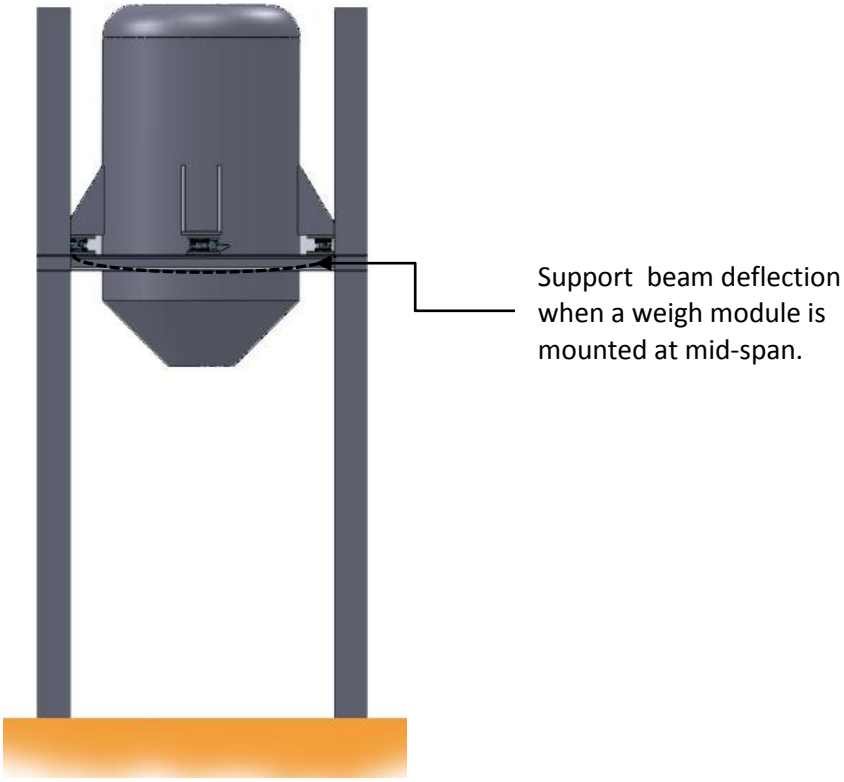


Figure 12 : Support beam deflection when a weigh module is mounted at mid-span.

A better way to reduce deflection is to mount weigh modules at the bottom of the vertical columns instead of at the center of horizontal support beams.

If horizontal support beam type of arrangement cannot be avoided, you should reinforce the support beams to minimize deflection. (see figure 13)

Figure 13 : Typical reinforcement methods for support beams

Be sure to support all weigh modules with the same size structural beams to prevent differential deflection, which can cause non-repeatability or zero-return problems.

Another recommendation for this kind of arrangement is installation of weigh modules near vertical beams. (see figure 14)

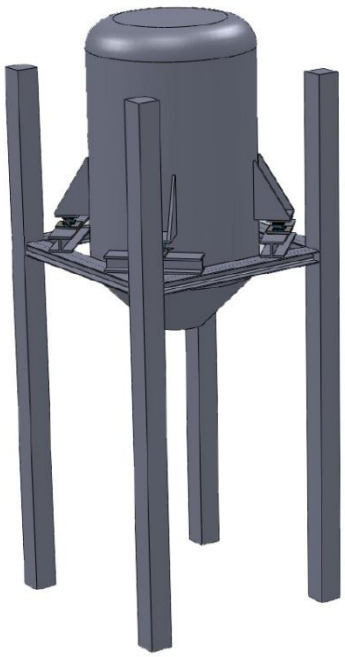


Figure 14 : Installation of weigh modules near vertical beams

Piping Design

Any time that piping is connected to a tank scale (a live-to-dead connection), there is a potential for mechanical binding. If piping is not installed properly, it can cause weighing errors by pushing or pulling on the tank. The best way to avoid these problems are to design piping so that it does not exert unwanted forces on a tank. Here are some general guidelines you should follow when designing a piping system. (see figure 15).

• Make sure the tank's support structure deflects as little as possible. That will decrease the amount of deflection in the piping.
• Run all pipes horizontally from the tank so that the tank is not suspended by the piping.
• Locate the first rigid support for the piping as far away from the tank as possible. That will make the piping more flexible.
• Use pipe with the smallest diameter and lightest gauge possible. That will make the piping more flexible.
• Use flexible piping or connections whenever possible.

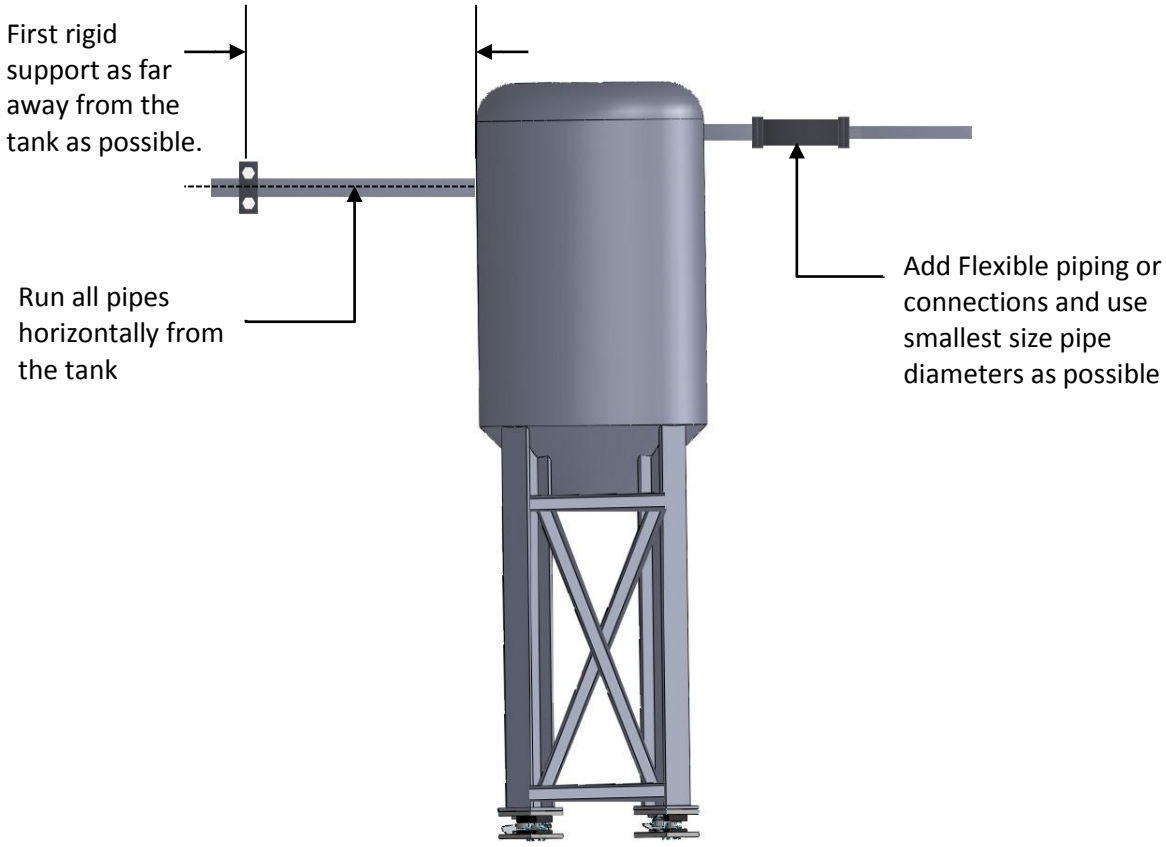


Figure 15 : Installation of weigh modules near vertical beams

It is crucial that all piping or conduit be horizontal and flexible. If flexible piping is not used, make sure the distance from the vessel to the first pipe support is 20-30 times the pipe diameter. In smaller, lower capacity tanks and hoppers, isolating the resultant forces becomes extremely critical.

Environmental consideration

Wind loading

When sizing weigh modules for an outdoor system, you should always consider the local wind speeds.

Seismic loading

Seismic forces, movement caused by earthquakes and other shifts of the earth, are among the strongest external forces that can affect a tank scale. Seismic forces should be analyzed in much the same way as wind forces.

Vibration

Constant scale vibration will make it difficult to capture an accurate weight reading. Group Four indicators have built-in filtering systems that can eliminate most of the effects of vibration. When installing a weigh module system, you should take steps to reduce any **external** or **internal** vibrations.

External Vibration: A scale can be affected by vibration from its foundation or from the surrounding environment. We recommend finding the source of the vibration and correcting it to eliminate its effect on the scale. Cutting the floor slab or separating the scale support frame from surrounding structures can also prevent external vibration from affecting a scale's stability.

Internal Vibration: Vibrations produced inside a tank are normally caused by sloshing liquid or agitation. In large tanks, sloshing can produce low-frequency vibrations that are difficult to eliminate at the scale indicator. You can reduce sloshing by installing baffles in a tank. If an agitator and its drive motor are permanently attached to a scale, you might need to incorporate isolation pads in the mounting of the weigh modules to minimize the internal vibration.

Temperature effect

Temperature changes will cause the structural supports to expand and contract. As a tank expands and contracts, it pushes or pulls on attached piping. If the piping connections are rigid, this will cause weighing errors. It is also important to avoid temperature gradients. Temperature gradients occur when the material in the tank is at a temperature that is greater or less than the temperature of the ground. The gradient will cause heat to flow through the load cell and result in measurement instability. It is recommended that thermal isolators be used in these cases.

Moisture and corrosion

Moisture or corrosive material on a weigh module can affect the life of the load cells. Debris, such as leaves and dirt, accumulated in and around weigh modules can also cause problems. Preventive actions should be taken to minimize the potential for moisture and corrosion problems.

Lighting and high voltage surge protection

The grounding cable is used to protect the load cells from undesired currents and voltage surges such as below

- A lightning strike nearby
- Welding work
- Static charge

The grounding cables in the compact installation units are made up of fine-core flexible copper wires. The flexible copper wires are tin-coated to additionally protect the copper from corrosion.(see figure 16)

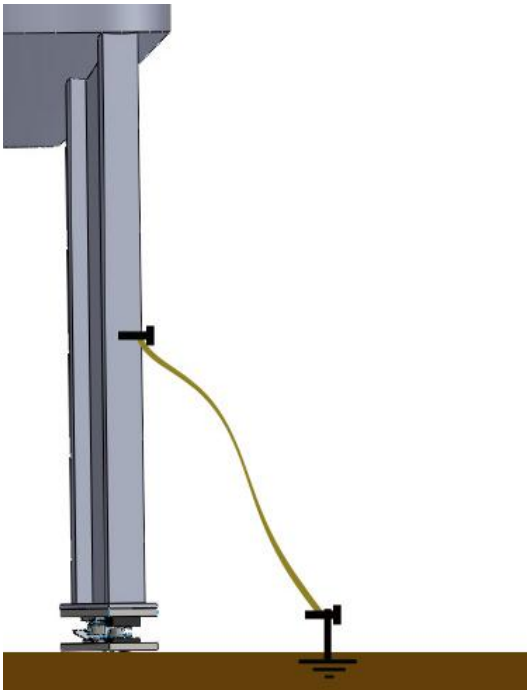


Figure 16 : Grounding cable for lighting and high voltage surge protection

4. Mechanical Installation

Importance of using dummy load cell

It is recommended to use a dummy load cell with the weigh module during mechanical installation to protect the load cell.

If the actual load cells are used during installation of the weigh module, extreme care must be taken to prevent overload damage. A tank or hopper weighing several tons can exert huge forces when dropped only a fraction of an inch.

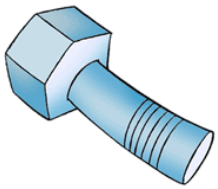
Actual load cells should not be installed in the modules until all welding is completed. The welding current passing through a load cell can damage internal components of load cell.

Instruments and materials necessary

- Bubble level

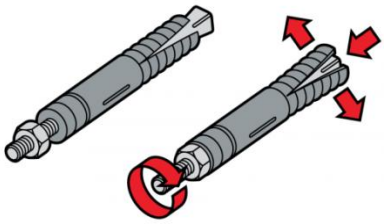
- Welder / Welding machine

- Bolts for mounting (Grade 8.8 or stronger studs or bolts must be used)

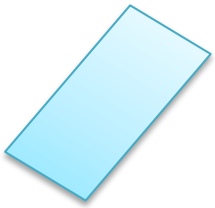


- Torque wrench

● Anchors (if necessary)

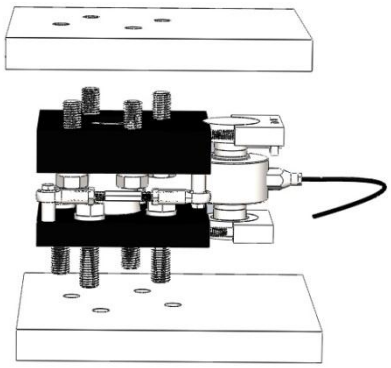


● Shims for leveling

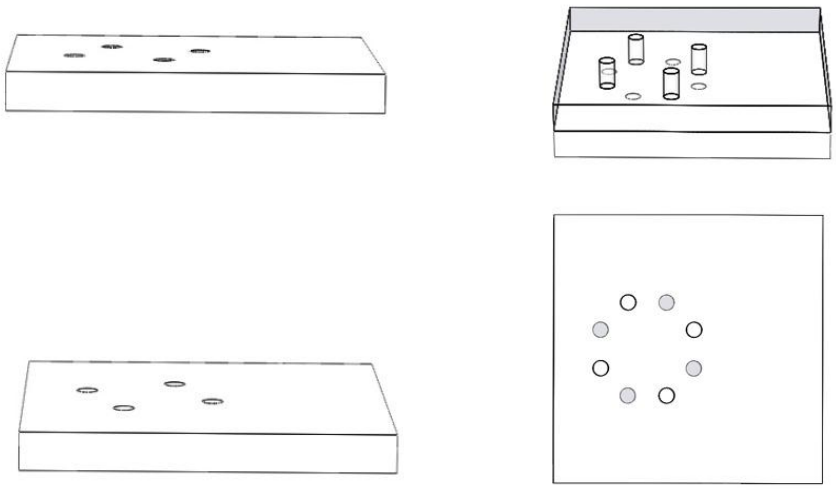


General installation procedure

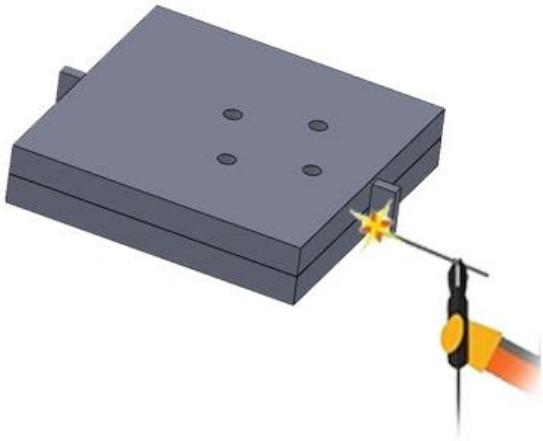
Step 1: If optional mounting plates are used for installation, first understand how top and bottom mounting plates are connected to each side of weigh module.



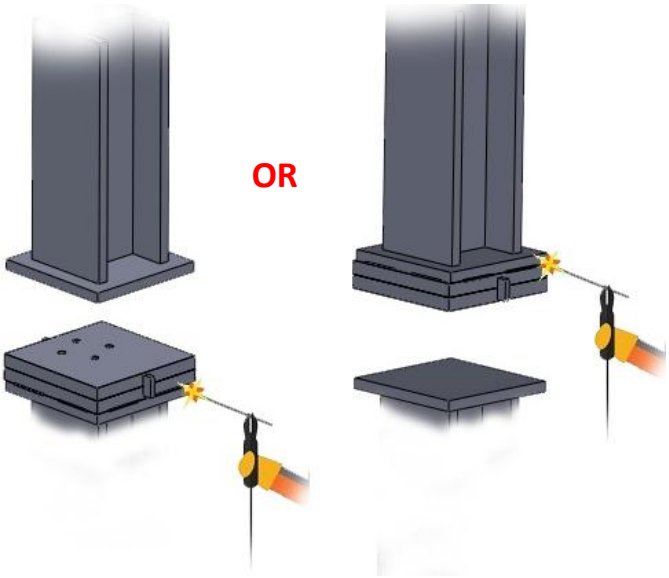
Step 2: Place top mounting plate on bottom mounting plate ensuring proper alignment with weigh module mounting.



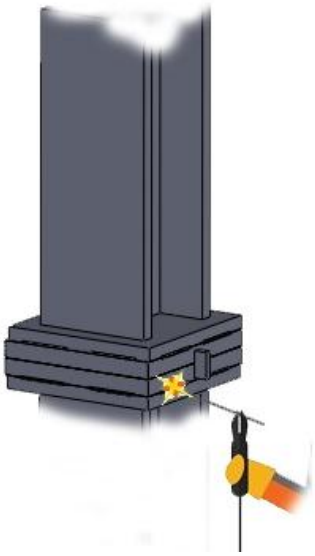
Step 3: Join top and bottom mounting plates using joining bar. Use easy removal tack welds on one side of joining bars to join this temporality.



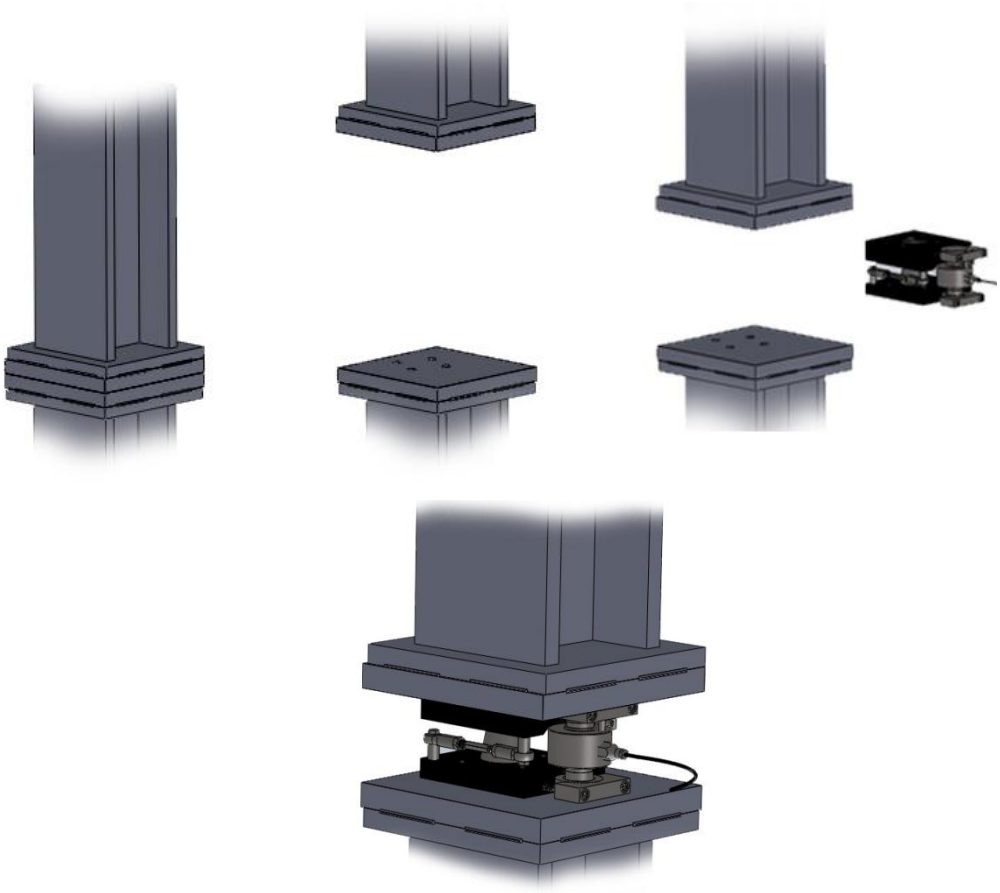
Step 4 : Raise the vessel (vessel legs/gussets) using proper lifting device. And, Bolt or weld the top plate or bottom mounting plate on tank leg or foundation (concrete slab or support beam). For welding use a 3/8-inch fillet, 1 inch long on 3-inch centers.



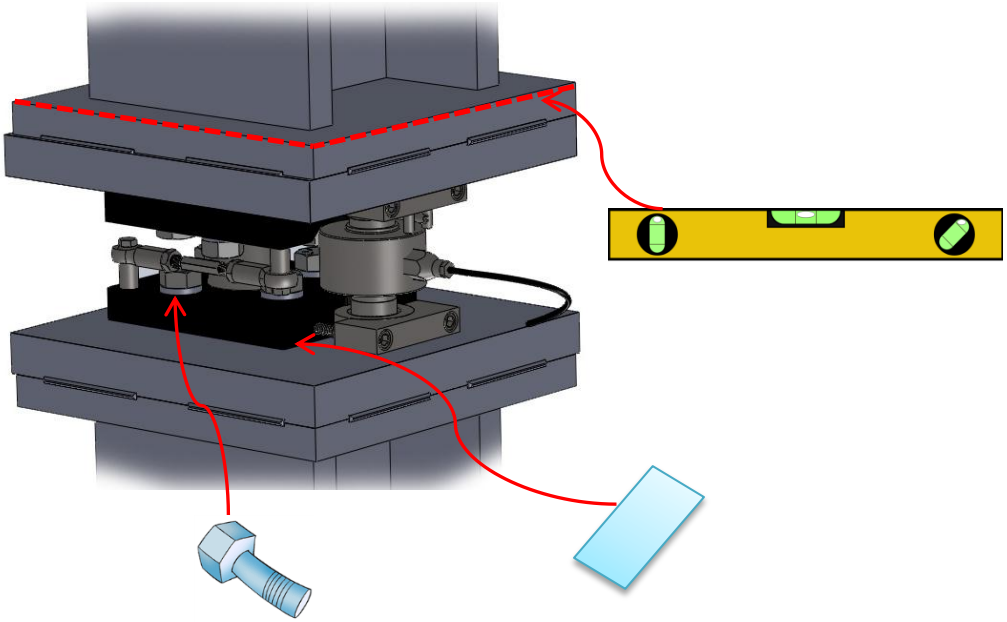
Step 5: Lower the tank on to the support foundation and weld mounting plate which is not welded. And remove the temporally fixed joining bar



Step 6: Raise the vessel again and position the weigh module under each of the tank's support legs or mounting lugs, and slowly lower the tank onto the weigh modules.



Step 7: Check the level of top and bottom plates. The top and bottom plates must be level within ±0.5°. The load on each module should vary by no more than 20%. During installation, Shims and or grout may be used to level the mount. And install the weigh module using bolts.



Shimming Notes:

Top Plates

• Use full-size shims (equal to the top plate dimensions) to redistribute weight or eliminate rocking across corners.

• Use partial-plate shims or stainless steel shim kits to fill voids between the top plate and tank leg / mounting lug.

Base Plates

• Use an injectable grout (such as Hilti HIT HY 150) to fill large voids between the base plate and foundation when using expansion anchor bolts

Step 8: Apply the bolt torque as per table 01 using suitable torque wrench.

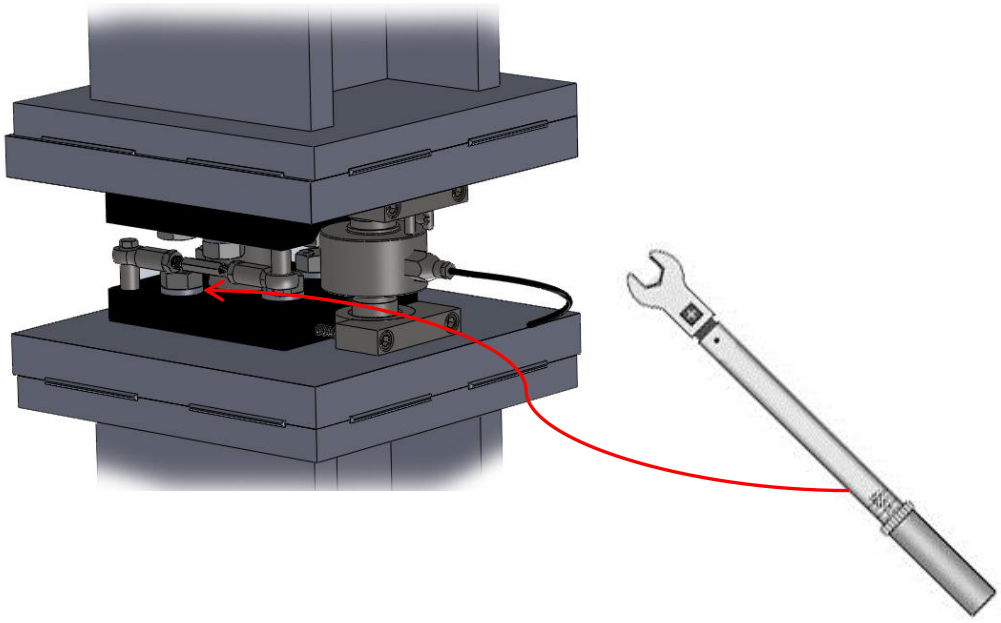


Table 01: Recommended torque values for bolt sizes

Bolt type	Recommended Torque in ft/lbs
3/8-16UNC	35
3/4- 10UNC	280

Wiring of weighing system

A weigh module system requires two types of wiring connections. Those are,

1. Connection of all load cell cables to the junction box.
2. Connection the home run cable from the junction box to scale indicator.

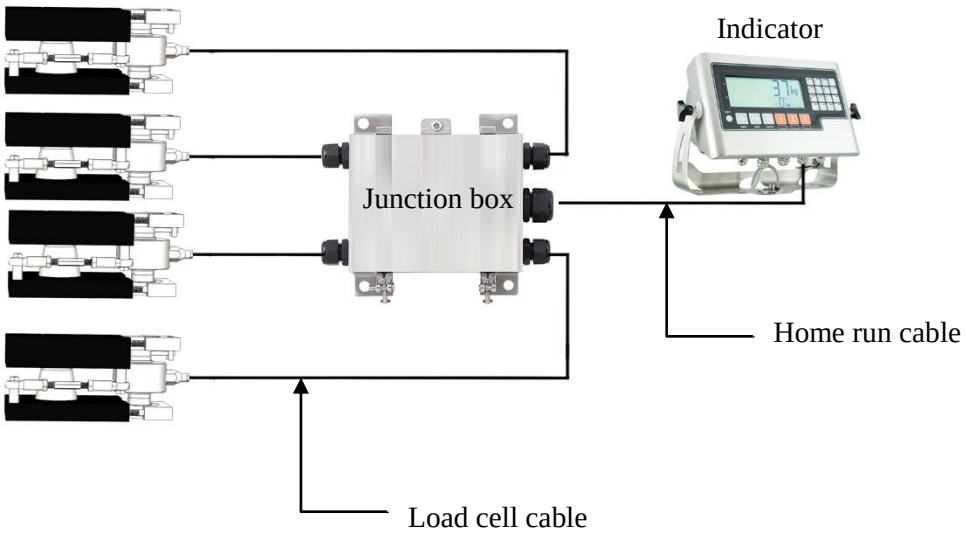


Figure 17 : Weigh module wiring diagram

Connection of all load cell cables to the junction box

Mount the junction box in a location where the load cell cables can be properly terminated in the junction box. Do not mount the junction box on the scale.
Then, connect the load cell cables to the junction box and terminate the wires according to installation guide for junction box.

Each load cell is supplied with a standard length of cable. Do not lengthen or shorten load cell cables in the field! Changing the length of a load cell cable will affect the output signal from the load cell. If a cable is too long, simply coil the excess cable and place it in or near the junction box. Nonstandard lengths of cable can be ordered for applications that require them.

Provide a drip loop in all cables so that water or other liquids will not run directly down the cables onto either the load cells or the junction box. Attach load cell cable to the dead structure, not the vessel.

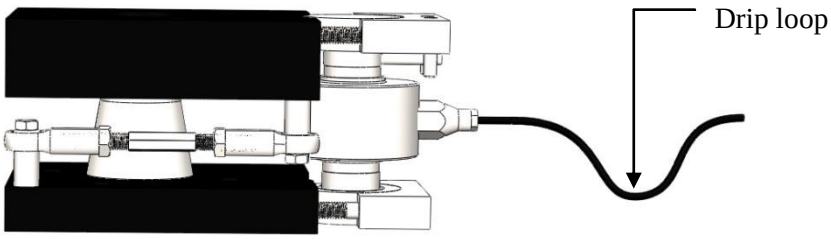


Figure 18 : Drip loop - near load cell

If conduit protection is necessary against mechanical or rodent damage to the load cell cables, use flexible conduit and conduit adapters at the load cells.

Connection the home run cable from the junction box to scale indicator

Connect the home run cable from the scale indicator to the junction box. If the wiring run from the junction box to the indicator is longer than 25 feet, use positive and negative remote sense lines for better performance. Refer to Junction Box manual for trimming details.

Request indicator manual from G4 sales team for calibration of weighing system.

5. Calibration

When a weigh module system is installed, it must be calibrated so that the readings on the indicator accurately reflect the amount of weight placed on the scale.

Group Four Transducers recommends calibrating a scale using test weights equal to the scale's full capacity. Specific instructions for calibration can be found in the technical manual for the digital indicator that will be used with the weigh modules.

The design or size of a tank scale might make it impossible to hang test weights equal to the scale's full capacity. For those applications, there are several other calibration methods as per below,

- Calibration with test weights and material substitution
- Calibration with material transfer
- Electronic calibration

Contact sales representative from Group four transducers if any future details required for calibration.

6. Maintenance, Troubleshooting and Warranty

Maintenance

Cleaning:

Avoid damaging to load cells during cleaning operations.

Calibration verification:

Calibration should be checked whenever the beam is thought to have been overloaded beyond its safe overload rating. Any weighing modules with calibration error should be returned to Group four for service.

System calibration instructions are included in the digital indicator/transmitter operator's manual.

Troubleshooting

If the system powers up and gives some type of stable digital readout that varies with the load on the system, any system problems are probably caused by factors other than the load cells. All too often, the load cells are blamed for a malfunctioning system, but 90% of the time, the problem lies elsewhere. Look for mechanical causes for your problem first.

If the system can be calibrated but doesn't return to zero, loses calibration, or demonstrates non-linearity or non-repeatability, see the following chart for possible causes and refer to the following list of checks.

Symptom	Possible Cause
No return to zero	Mechanical binding or debris in seals; may have lost system calibration
Non-linearity	Thermal expansion or deflection under load causing binding or side load
Non-repeatability	Loose load cell mount, Drifting caused by moisture, Load cell overload or shock damage, Mechanical binding
Lost calibration	Out of level or plumb, moisture problem, mechanical binding
Drifting readout	Moisture in junction box, cables or load cell, mechanical binding

1. Check load cell mount for debris restricting load cell movement or debris between scale and structure. Check any overload stops for proper clearance.
2. Check that tank/vessel and mounts are plumb, level, and square at critical areas.
3. Check all piping and conduit for connections which restrict vessel movement.
4. If stay rods are used, loosen all connections to finger tight only for testing.
5. Check load cell cables for physical or water damage.
6. Check all electrical connections, especially in the junction box.

If the problem still is not found:

7. Check possible indicator malfunction by using a load cell simulator to input a known good signal into the indicator.

8. Disconnect each load cell's signal leads at the junction box and check individual load cell outputs with a multimeter. Then check input/output impedances for comparison with load cell manufacturer's specifications.

If after all these checks the problem still cannot be isolated, reconnect all but one load cell. Replace the load cell with a load cell simulator. Alternate so that each load cell is individually disconnected and replaced with a simulator. If there is a problem with a particular load cell, the symptom should disappear when that load cell is disconnected and replaced with the simulator.

Resistance readings other than those listed in the specifications indicate a failure within the unit. DO NOT attempt to repair; faulty modules require factory service. Contact the local sales office of group four transducers for RETURN AUTHORIZATION. Upon examination of the module at the factory, a full report on the condition with a quotation on repair cost and delivery will be submitted to the customer.

Warranty

Refer warranty and repair policy from group four transducers web site.