

Modern Weigh Modules

No Compromise on Safety – Right the First Time

Designed specifically for easy, safe and professional installation every time.

Introduction

Weigh modules are used across many industries when unique scales such as tanks, hoppers and conveyors are required. Weigh module users, like many businesses, are under increasing pressure to improve efficiency, quality, safety and regulatory compliance. In addition, weigh modules today are often installed by sub-contractors who may not understand how a scale works, let alone appreciate the finer points regarding installation. In response, a new generation of weigh modules has been designed to greatly improve performance, safety and ease of selection, installation and commissioning, helping businesses to get the installation right the first time. This white paper explains the key features of modern weigh modules.



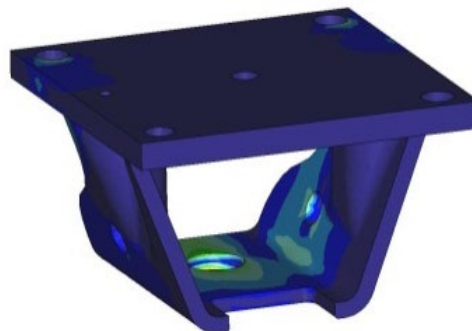
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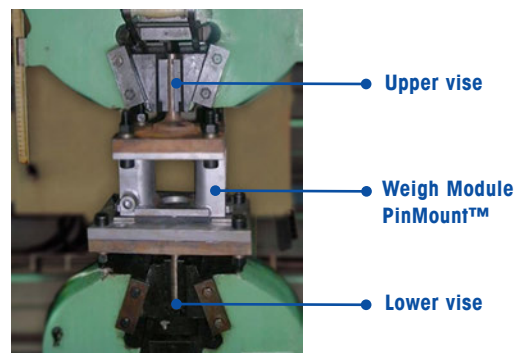
2 Design Integrity and Safety Requirements

When purchasing a weigh module, it is important to consider the following design integrity and product safety requirements.

1) Weigh modules not only weigh the scale, they also become an integral part of its support structure and, in many cases, provide the only restraint available to, for example, prevent tipping. Weigh modules should be designed and optimized using finite element analysis (FEA). In addition, prototypes should undergo a complete set of physical and metrology testing to verify the computer model and to ensure performance requirements are met. The manufacturer's load ratings should be fully documented in datasheets; this along with drawings in various formats will ensure safe and easy integration into the overall scale design.



FEA of optimized top plate assembly.



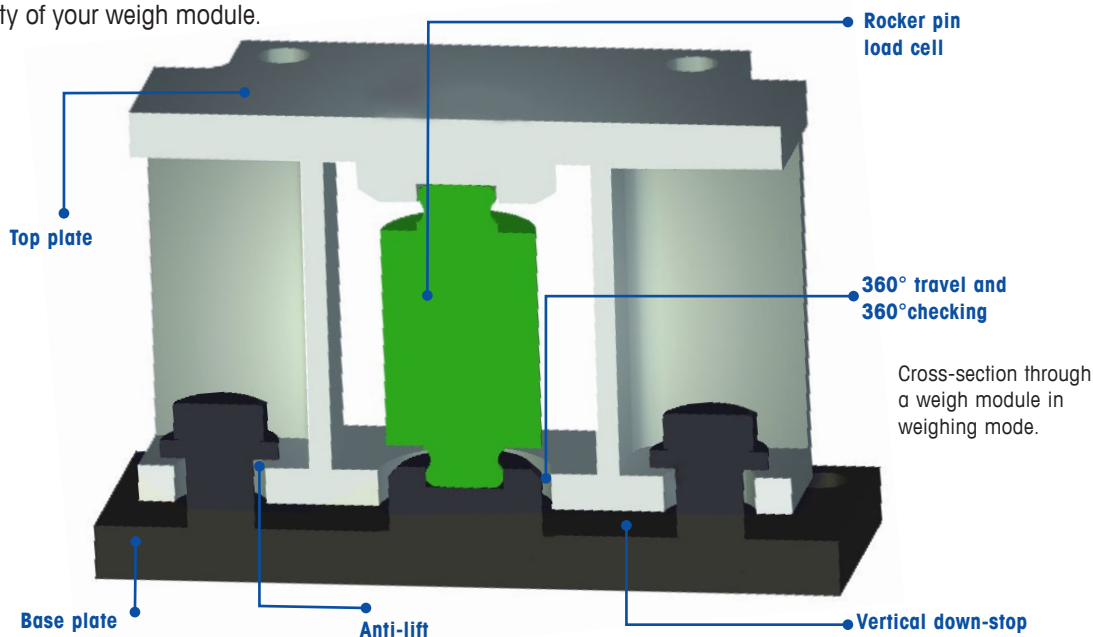
Testing the integrity of the anti-lift protection.

2) For installations in hazardous areas, the load cells must have approvals such as FM and ATEX. In addition in Europe, the weigh module hardware must comply with the requirements of EN 13463-1, "Non-Electrical Equipment for use in Potentially Explosive Atmospheres ...". This standard considers the mechanical aspects of equipment, for example, its ability to create mechanical sparks, heat or static discharges. Compliance should be demonstrated by availability of, for example, an Attestation of Conformity issued by a Notified Body.



3 Key Design Considerations

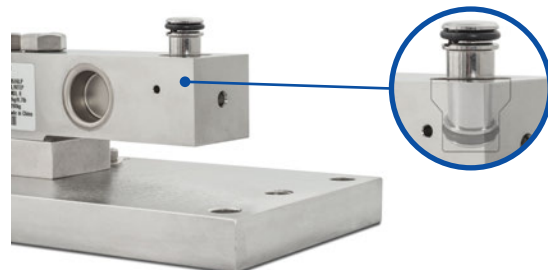
Weigh modules are not all created equal. Here are several important considerations that impact the accuracy and safety of your weigh module.



1) The weigh module should use a load cell with the proven self-aligning **rocker pin** suspension or a load cell that is itself a rocker pin. The rocker pin has spherical surfaces top and bottom and rocks to allow free thermal expansion/contraction of the scale and to move to absorb side impacts. This minimizes the side forces applied to the load cells and the performance degradation that would result. In addition, the self-aligning feature always returns the scale to the ideal weighing position, ensuring best repeatability and accuracy. Further, the load cells should be high performance cells with NTEP and OIML approvals as standard, allowing them to be used in legal-for-trade applications if required.

2) To take full advantage of the **rocker pin**, a weigh module's top plate should not be constrained. It should have **360° travel**, meaning it should move freely in all horizontal directions to allow thermal expansion and contraction of the scale — up to a point of course. A weigh module should also have **360° checking**, that is, it should stop the scale in all directions when travel is excessive. These features combine to ensure high performance and safety, regardless of how the weigh modules are oriented during installation. That is an important distinguishing feature of modern weigh modules.

Because of **360° travel**, there is no right or wrong orientation for installation; performance is not dependent on orientation. More importantly, **360° checking** ensures that the installation is safe regardless of weigh module orientation. These are ways in which modern weigh modules have made installation much easier.

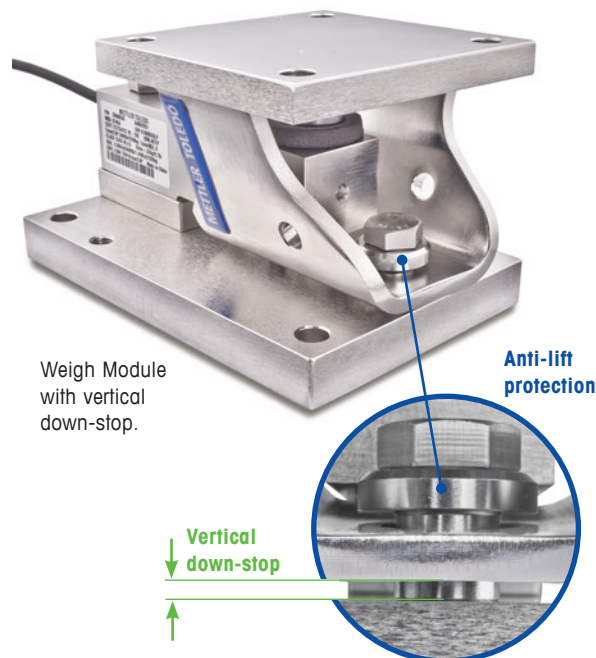


Load cell with rocker pin suspension.

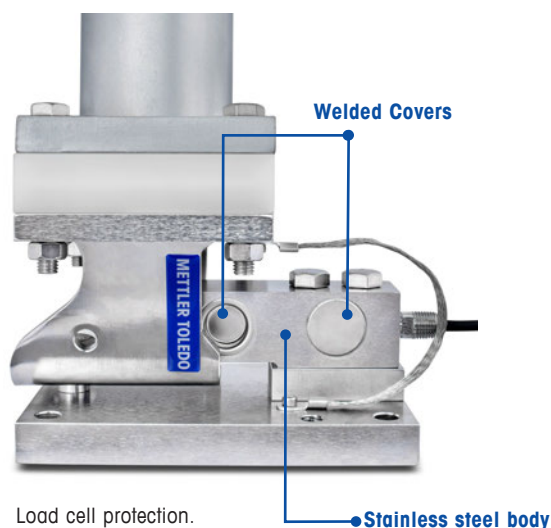


Rocker pin load cell.

- 3) Weigh modules should have **anti-lift** protection as a standard feature, not a field-installed option that may get lost or forgotten about on site. This, for example, protects the scale from tipping in windy conditions. Anti-lift forces should not be transmitted through the load cell so the feature functions even without a load cell installed.
- 4) A weigh module should have a **vertical down-stop** to prevent tipping of a scale in case of load cell or suspension failure. This is unlikely to happen but the feature provides peace of mind. A **down-stop** is inherent to the design of the weigh module shown here, in which the top plate assembly sits down firmly on the base plate after approximately 5 mm of downward travel.
- 5) The load cell should be suitable for all environments with a **stainless steel body** and **welded covers** conforming to IP68/NEMA 6/6P as standard, to protect the electronics and ensure long life and excellent performance.
- 6) The same basic weigh module should be available in various materials and with options to cope with difficult operating environments, such as dynamic or in-motion weighing, shock loading and heat conduction.



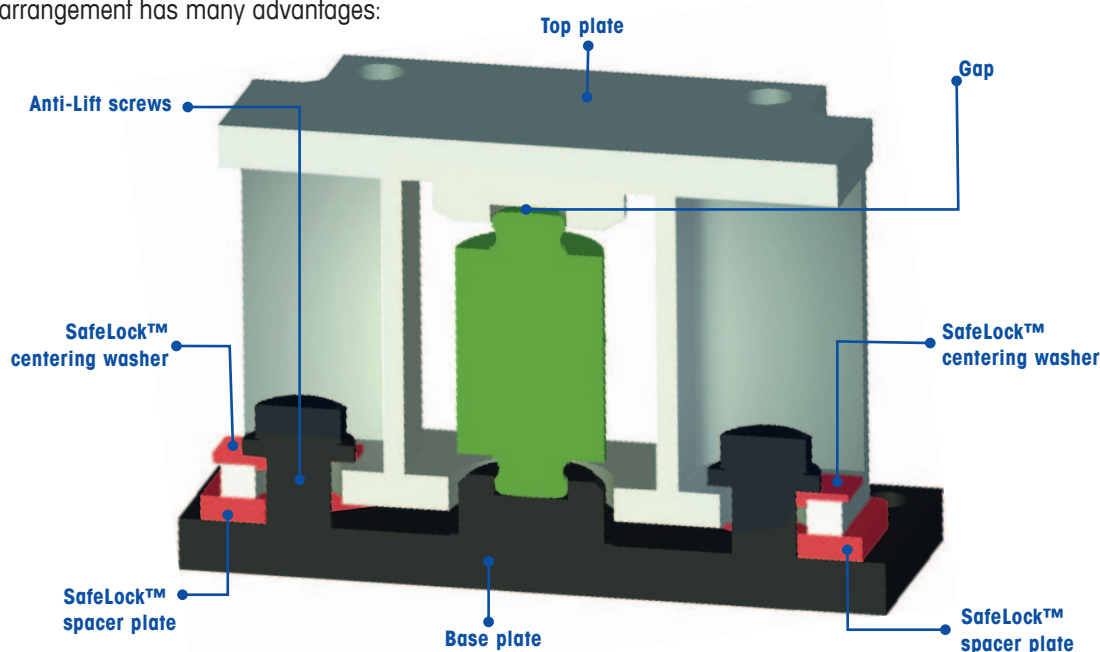
Weigh Module with vertical down-stop.



Load cell protection.

4 Shipping and Installation Considerations

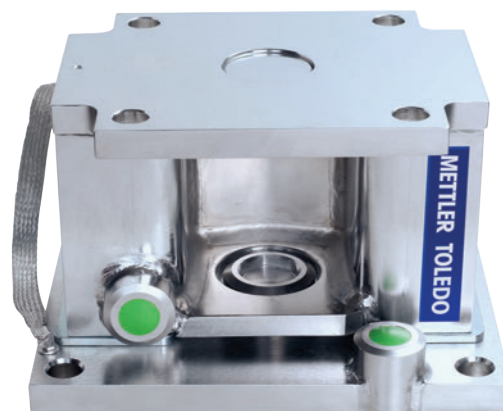
Modern weigh modules have improved greatly in regard to ease and safety of installation. The last section described how **360° travel** and **360° checking** make installation simpler and safer. But that is only the beginning, there are several other enhancements designed to simplify installation. This illustration shows a modern weigh module in the shipping/installation mode. Its top plate is supported directly from the base plate by the insertion of **SafeLock™ spacer plates**. The **SafeLock™ centering washers** locate the top and base plates horizontally and then the weigh module is locked into a rigid block by tightening down on the **anti-lift screws**. This arrangement has many advantages:



Cross-section through a weigh module in shipping/installation mode.

- 1) All components are locked in their ideal initial positions, ensuring perfect load introduction and equal top plate travel in all directions. Also, the top and base plates are locked parallel when viewed from the side; during installation, when you level one plate, the other is then automatically level.
- 2) The **SafeLock™ spacer plate** thickness is chosen to create a **gap** above the load cell, making it impossible to damage by shock or overload during shipping and installation.
- 3) The alignment and rigidity does not depend on the load cell so the installation can be done equally well without the load cell installed. Customers can take advantage of this by installing the weigh modules without load cells and only at the last minute inserting the load cells in preparation for calibration. This eliminates any possibility of damage to

the load cell and its cable, including damage from welding on the scale structure, an all too common occurrence. This is especially important on large construction sites with sometimes many sub-contractors working on the scales over the course of months or years.

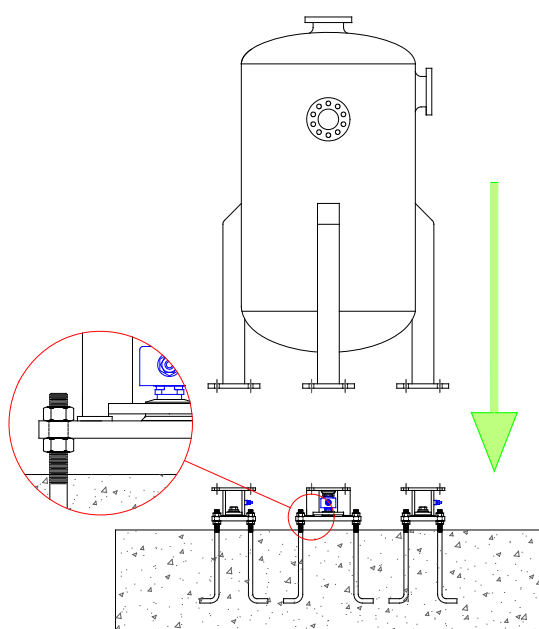


Weigh module without load cell ready for installation.

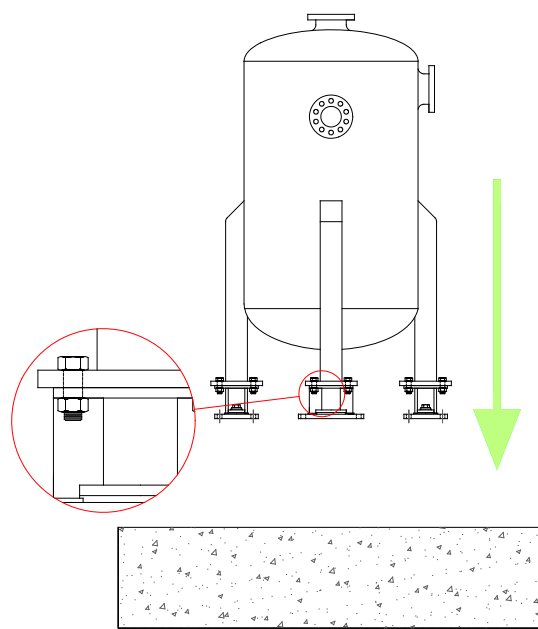
4) Because the weigh modules are essentially rigid blocks, they can be installed safely in different ways as illustrated below. With or without the load cells installed, the weigh modules can be fixed to the foundation before the tank is lowered into place or they can be fixed to the tank as it is lowered onto

the foundation or while sitting on its side. Indeed they can be fitted to the tank before being shipped to site. This is a good example of a situation in which you would want to put the load cells away for safe keeping until you are ready for calibration.

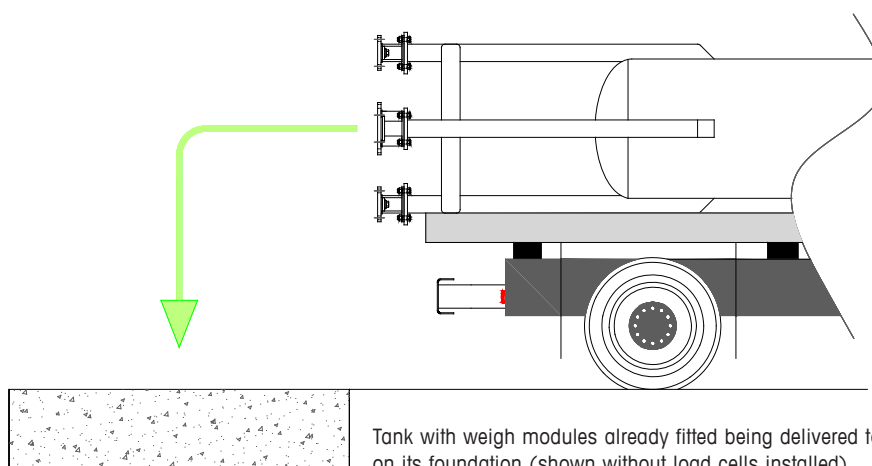
Safe and Easy Installation Methods for Modern Weigh Modules



Weigh modules leveled on foundation before the tank is lowered into place (shown with load cells already fitted).



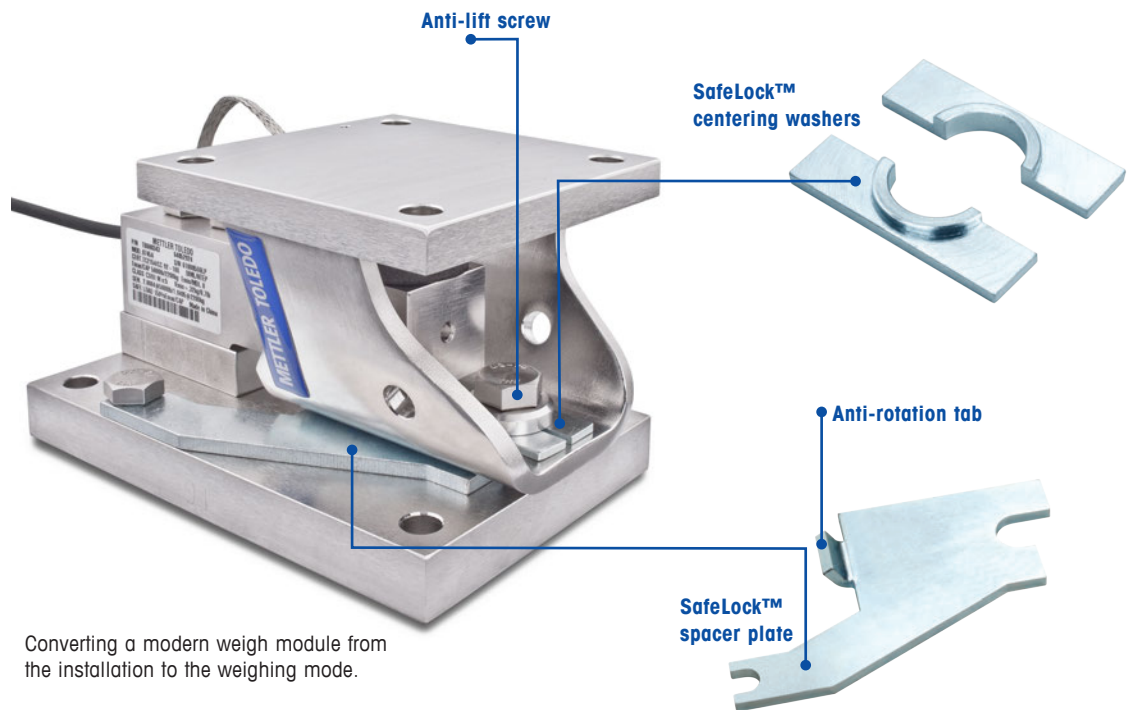
Weigh modules fitted to tank as it is lowered onto its foundation (shown without load cells installed).



Tank with weigh modules already fitted being delivered to site ready for erection on its foundation (shown without load cells installed).

5) After installation is complete, it's easy to convert the weigh modules from the shipping/installation mode to the weighing mode in preparation for calibration. Simply relieve the tank weight with a jack, loosen the **anti-lift screw**, remove the **SafeLock™ centering washers** and remove the **SafeLock™ spacer**

plate. Then remove the jack and retighten the **anti-lift screw**. Do this in turn for each weigh module and the scale is ready for calibration and weighing with the assurance that everything has remained perfectly aligned through the installation phase.



Converting a modern weigh module from the installation to the weighing mode.



5 Summary

A weigh module as described here is a very versatile and feature-rich product capable of being used in all applications, including those requiring higher accuracy. At the same time the task of specifying, purchasing and installing the product safely has been greatly simplified. In other words, you can expect your installation to be right the first time. The PinMount™ and MultiMount™ weigh modules from METTLER TOLEDO encompass all features described in this White Paper, ranging in capacity from 5kg to 100t.

For free design guidance and information about METTLER TOLEDO's state-of-the-art weigh modules, visit

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