



Compliance
Sustainability
Productivity

Guide Book

Tips for SOLAS Compliance Productivity at Ports

METTLER TOLEDO

Purpose

This guide offers valuable insights for people at any experience level, from those just beginning to learn about weights and measures to operational experts.

SOLAS is a set of regulations aimed at keeping transport via the seas safe and compliant. Primarily, SOLAS helps to regulate the loading of ships to avoid safety hazards associated with uneven loading.

These regulations require you to provide a verified gross mass for all shipping containers. Although they list two general methods for determining verified gross weight, they do not provide specific guidelines about the type of weighing equipment or the procedures you could use.

This guide explains the options available for determining the weight of your containers and identifying the option that will best fit your business.

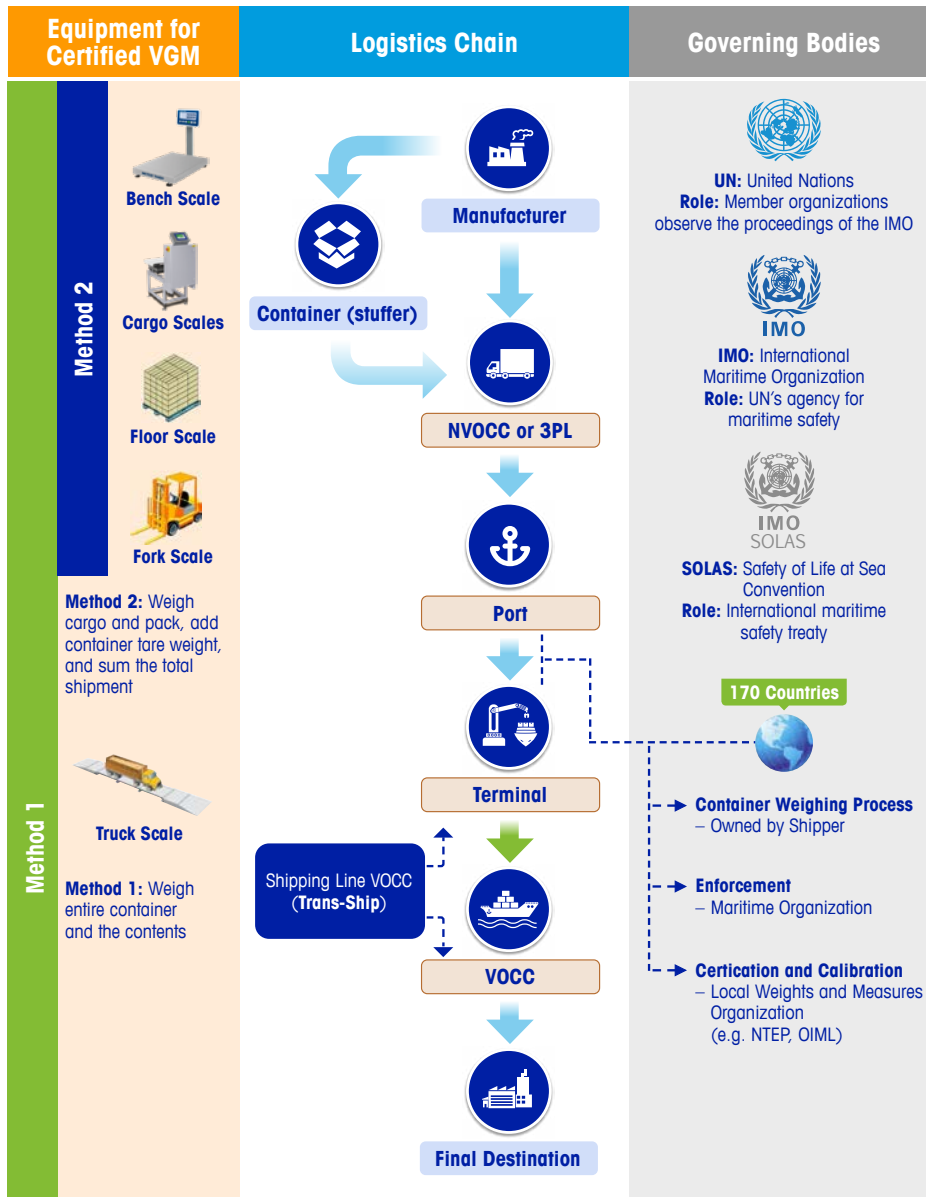


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Certified VGM required before containers can be shipped beginning July 1, 2016.

VGM = Verified Gross Mass (weight)



SOLAS Infographic: Logistics Chain

This visual representation of the SOLAS logistics chain overviews the impact of the law on each stakeholder and what solutions are available to support compliance depending on the business.

► www.mt.com/veh-solas

NVOCC = Non Vessel Operating Common Carrier
 ■ **Role:** freight forwarder, consolidator, books space on VOCC

3PL = 3rd Party Planning Logistics
 ■ **Role:** Manage shipping, logistics operations

VOCC = Vessel Operating Common carrier
 ■ **Role:** Ship and/or carrier

Port = Physical dock facility

■ **Role:** Rent or operate terminals

Terminal = Loading/unloading operation

■ **Role:** Container transfer

VGM Required or else container can be refused!



Want to learn more about SOLAS? Read the FAQs:

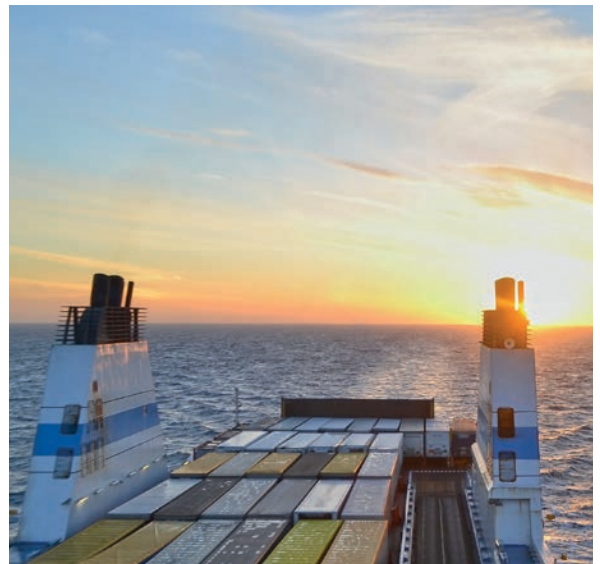
► www.mt.com/veh-solas

Chapter 1 – Introduction

SOLAS Regulations Overview

Declaration of shipping weights has been required for a long time. Verification of shipping weights has not. Verification is now mandatory because misdeclared weights have caused unsafe conditions at sea for vessels and crew.

According to the SOLAS maritime regulations, shippers whose names appear on the bill of lading must verify the gross mass of all containers before they are accepted at a shipping terminal for loading onto an ocean-going vessel. No cargo will be allowed at sea without proof of verified gross mass of shipped containers. Shippers can be held responsible for loading any container without verified gross mass.



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1 What is SOLAS?

The International Convention for the Safety of Life at Sea (SOLAS) is an international maritime safety treaty from the maritime arm of the United Nations known as the International Maritime Organization (IMO). It regulates safety of life at sea, which includes any ocean-going vessels. The IMO, in 2015, issued guidelines regarding verified weight of all containers shipped at sea.

This is a significant procedural change for most shippers. While declaration of shipping weights has been required for a long time, actual verification of those weights has not. This verification is now mandatory because discrepancies between declared and actual weights have repeatedly caused unsafe conditions at sea for vessels, crew and marine life. The SOLAS regulations are intended to help prevent future maritime disasters, such as stack collapses, lost containers and damage to ships or the environment.

How is SOLAS being enforced?

In general, enforcement is the responsibility of the maritime organization of each country. The party listed on the bill of lading as the shipper will ultimately be responsible for providing the verified gross weight. That may be the shipper of original origin, or it can be a non-vessel operating common carrier (NVOCC) or freight forwarder. Any business within the logistics chain that declares itself the shipper is essentially the responsible party.

According to the rule, if shipments are found to be non-compliant, containers will not be loaded onto the waiting vessel. This will require shippers to take back shipments and either return them to their destinations of origin or weigh and re-load, resulting in lost time and additional costs. Both the terminal and the shipper can be held responsible for any sanctions or fines that result from regulatory non-compliance.

2 Compliance verification methods

With Method 1, the entire container, contents and packing must be weighed. The straightforward approach to using method 1 involves using a weighbridge (truck scale). It can be used to weigh a single shipping company's freight prior to loading or be provided as a paid service to other shippers awaiting load-in at terminals. Either way, easy electronic data interchange transfer of verified gross mass (VGM) can be accomplished through most scale indicators that comply with Method 1.

Method 2 requires that contents be weighed separately, adding the packing material and the container tare weight to compute the declared weight. This requires smaller weighing devices, such as floor scales, pallet scales, bench scales and forklift scales. While generally less expensive than truck-scale systems individually, the cost of the entire system should be taken into account before implementation. Total weights, including packing materials, can be aggregated using an enterprise resource planning (ERP) system for compliance with Method 2.

Compliant equipment and regulatory timing

While SOLAS enforcement will vary from country to country, one thing all countries have in common is the acceptance of a globally recognized set of standards and approvals that confirms a system or weighing components as meeting a minimum set of requirements. Those are generally termed “legal for trade.” Legal-for-trade programs test and certify equipment to a standard accepted at the enforcement level of trade activities.

Examples of organizations that help in the setting and enforcement of such programs include the International Organization for Legal Metrology (OIML) and the National Type Evaluation Program (NTEP). Under the new rules, local Weights and Measures organizations operating within the oversight of such enforcement agencies will be responsible for ensuring certification and calibration of weighing equipment used to verify gross mass. This makes legal-for-trade equipment a must when complying with SOLAS in all 170 countries covered by the treaty.

In this guide

This guide is part of METTLER TOLEDO’s overall effort to ensure all shippers have what they need to easily manage weighing data and comply with the SOLAS regulations. In it, we will cover details surrounding:

- Why they were created and who is affected
- Compliance: Method 1 detail
- Compliance: Method 2 detail
- How METTLER TOLEDO weighing solutions can help

As one of the world's largest manufacturers of weighing equipment, METTLER TOLEDO offers legal-for-trade solutions for every step of the process, whether you choose to use Method 1 or Method 2. Our long-lasting scales’ legal-for-trade status applies everywhere you weigh, and our network of more than 5,000 service professionals worldwide are ready to deploy our weighing solutions immediately anywhere along your logistics chain.

Terms to know

Terms	Description
SOLAS	Safety of Life at Sea - international maritime safety treaty
IMO	International Maritime Organization specialized agency of the United Nations responsible for regulation of sea vessel shipping
WIM	Weigh-in-motion
VGM	Verified Gross Mass - a weight reading provided by a certified scale that indicates the total weight of the container loaded
OIML	Weights and measures authority recognized by many European and Asian countries
NTEP (or NIST)	Weights and measures authority recognized by the United States and others
Handbook 44	Set of weighing equipment regulations used by NTEP/NIST in the United States
Metrology	The scientific study of measurement
Legal for Trade	A term describing a scale that is used for business transactions and that meets certain performance guidelines
Gross Weight	When referencing a truck scale, the weight of the loaded truck; meaning the truck and the load combined
Tare Weight	When referencing a truck scale, the weight of the unloaded truck
Net Weight	When referencing a truck scale, the weight of the load by itself, minus the weight of the truck. Net weight is often calculated as: gross – tare = net

Chapter 2 – Method 1:

Compliance with a Single Weighment

“Method 1, which requires weighing the container after it has been packed”

World Shipping Council: Partners in Trade, The SOLAS Container Weight Verification Requirement, January 2015

“Method 1” involves determining the weight of the container and its contents. This task is most easily accomplished by using a truck scale.

Benefits of method 1:

- A simplified process
- Requires only one or two weighments instead of dozens of small weighments and summation
- Less time and effort required to achieve VGM



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1 Basics of a truck scale

Gross weight: the weight of the loaded truck

Tare weight: the weight of the unloaded truck

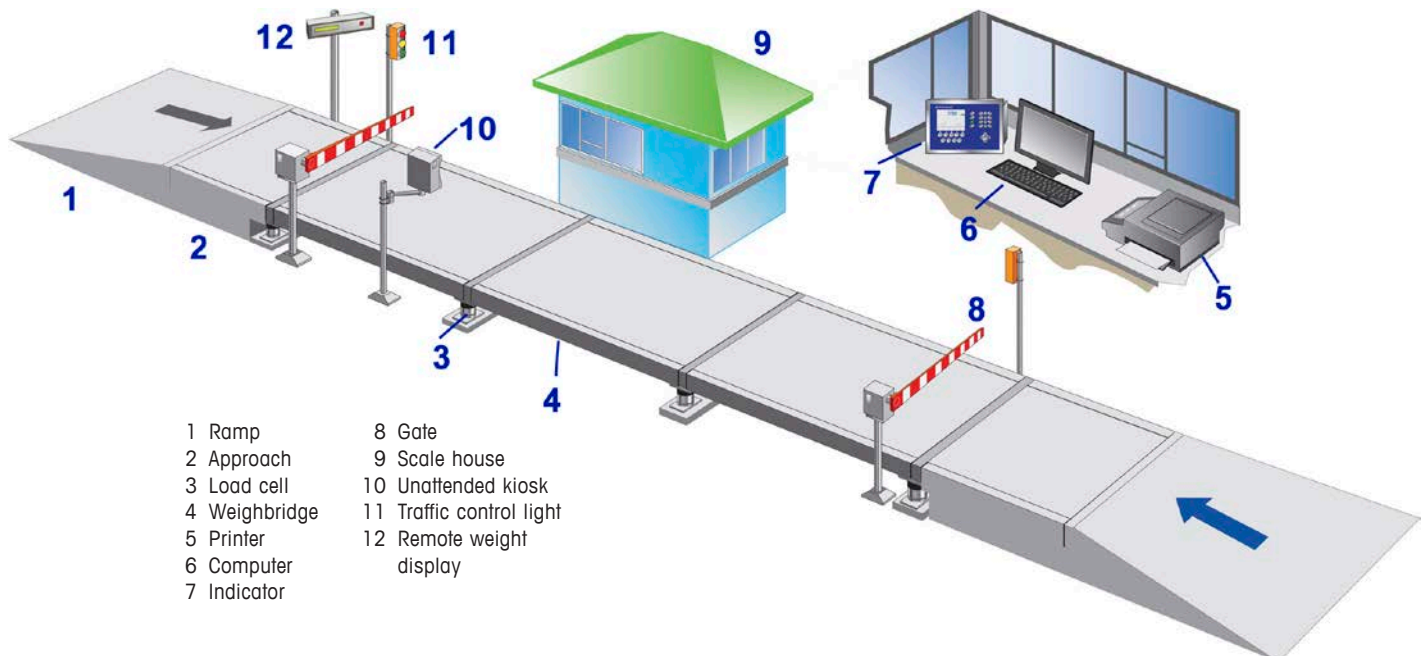
Net weight = Gross - Tare

For compliance:

Whether buying goods, selling goods, recording inventory, or checking for compliance, the information from the truck scale is critical. It is used for transaction pricing, profit margins, quality control, inventory management, legal compliance, and more.

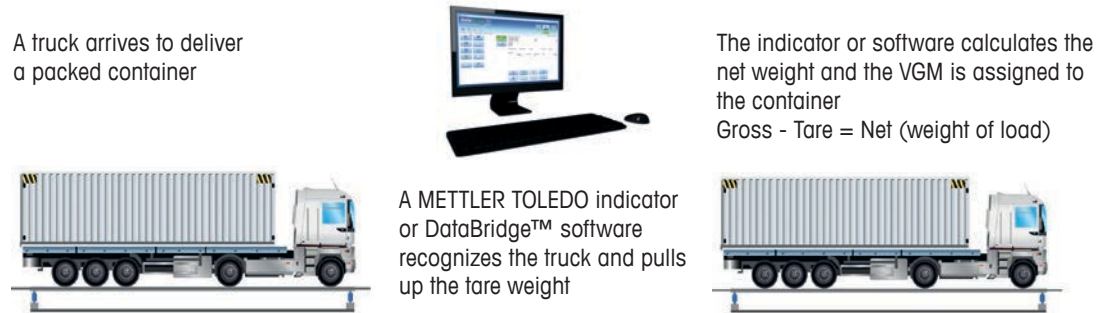
For more information download a free copy of the Truck Scale Buying Guide:

► www.mt.com/truckscaleguide



2 One-pass transactions

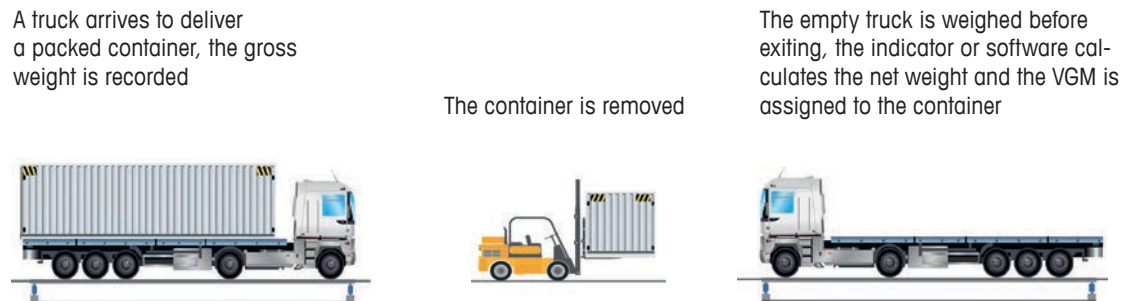
The first way to determine verified gross mass weight is to make one pass over a truck scale and subtract a stored tare weight. To use this method, you must weigh each empty truck and store its weight (tare weight) in the scale indicator or DataBridge™ software. Benefits of indicators and METTLER TOLEDO's DataBridge™ software include tamper-proof ticketing, inventory control, reporting and more.



The main benefit of this option is increased throughput and continual traffic flow. The entire transaction can be completed within minutes.

3 Two-pass transactions

The second way to determine verified gross-mass weight is to make two passes over a truck scale.



This method of weight measurement is used globally to determine the weight of a product bought and sold, track inventory, confirm compliance and more. All METTLER TOLEDO truck scale models are certified legal for trade and fall within the expected accuracy tolerance threshold for SOLAS compliance.

4 Specialized vehicle scale solutions

In some cases, SOLAS compliance may require a customized solution. Weigh-in-motion (WIM) truck scales are available for applications where high traffic volumes could cause backups at the scale. Full scale galvanization can be beneficial for businesses located close to the ocean, where salt can wear on traditional scales at an accelerated rate. Rail scale solutions also can be incorporated into existing rail yards.

5 Custom solutions and alternatives

While there is little debate that weighing a container on a vehicle scale is the most accurate method of obtaining the VGM, customers often are constrained by real estate or non-weighing processes. In the case of container terminals, crane or vehicle-mounted weighing devices often make the most sense. If the volume of containers is low, it may not make financial sense to purchase large equipment. In that case, a container jack weigher may provide the best solution.

Many processes may require a tailored solution: for example, filling containers with bulk goods. It makes sense, in that case, to design a system to weigh the entire container in-process and monitor the fill status at the same time inventory relief is recorded. That may require the use of custom-built platforms and load-cell kits or weigh modules. In cases where standard weighing equipment is not sufficient METTLER TOLEDO provides weighing components such as load cells, weigh modules and indicators to build the best suitable solution. These components are integrated into mechanical structures and convert them to scales.

With all weighing devices, considerations must be made for the accuracy required and whether other commerce is based on the weightment. Legal-for-trade devices will provide the most accurate weighing in most cases and have a greater probability acceptance by Weights and Measures officials. Contact your supplier to determine whether the device is to be used for weighing as a paid service or the product is to be sold by weight. They should be able to direct you to an appropriate solution for your process.



Chapter 3 – Method 2:

Compliance by Summation of Weighments

“Method 2, which requires weighing all cargo and contents of the container and adding those weights to the container’s tare weight as indicated on the door end of the container”

World Shipping Council: Partners in Trade, The SOLAS Container Weight Verification Requirement, January 2015

“Method 2” involves weighing all contents to be shipped, from a pallet of product to a box, adding the weight of any packaging, and finally the tare weight of the container – to determine the total summed weight of the container and all contents.

Benefits of method 2:

- Smaller equipment is ideal for businesses with spacial constraints
- Can be easily integrated in to current internal processes
- Less permanent solution for businesses that lease their workspace; ability to take equipment with you in case of a move



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1 Forklift scales

Forklift scales offer an efficient way to weigh individual pallets before combining the weight of several shipments to declare the total weight of a container. The scales can be added to existing forklift scales, provided they are ISO2328 compliant. An ISO2328-compliant forklift truck has a fork that is hung, rather than welded, onto the carriage so that it can be easily removed. It is then as simple as removing the forks, adding the scale as you would any other forklift accessory, and then re-hanging the forks.

The main benefit of using a forklift scale for weighing pallets is that it eliminates the need to transport the load to a dedicated weighing station, saving both time and energy. In peak hours when many shipments need to be made ready for transport at once, having to wait for a timeslot to weigh can cause bottlenecks and slow down operations.



Addition of several pallets of product weighed by forklift scale, plus tare weight of the empty container, equals the verified gross mass weight reading required by SOLAS

METTLER TOLEDO forklift scales are designed with both reliability and safety in mind for use in what are typically quite rough and fast-paced environments. The unique three-point suspension holds the scale's calibration for up to 12 months. Accuracy is maintained even if the scale gets knocked around. Similarly, the scale provides reliable, legal-for-trade results when the forks are uneven, if the load is unevenly balanced or if the forklift is exposed to bad weather or bumpy surfaces.

Safety features include an extra-large viewing window in the center of the scale carriage, which provides full visibility for the driver when positioning, loading and transporting pallets; a safety lock, which prevents the scale from dropping if something fails; and 150 percent overload capacity, which prevents the scale from damage in the case of overloading.

The sum of many shipments can be calculated either using the scale indicator's software or with the shipper's own smart PC or PDA. The weight of packing materials and the container tare weight can then be added to calculate the total declaration weight.

METTLER TOLEDO forklift scales are approved for legal-for-trade weighing in all regions of the world.



2 Floor and bench scales

SOLAS compliance using Method 2 involves summing multiple weighments of goods as they are loaded into a container. This can involve weighing discrete items on a scale such as a bench scale, forklift scale, or floor scale. It can also include weighing bulk materials into an intermediate bulk container (IBC).

Weighing indicators are capable of summing individual item weights via either a semi-automated or manual process. Here's how it works: The operator places the item on the scale and either uses an "auto-print" function to capture the item weight when the scale is above a pre-defined weight threshold, or the operator can manually press a function key on the weighing indicator HMI to accumulate the weight of multiple items.

Sub-totals can be calculated for an entire pallet, and grand totals can be calculated for multiple pallets that are loaded into a single container. The accumulated weights can then be sent to a local printer, or they can be sent to a PC application via a serial or Ethernet TCP/IP connection. Once the totals have been recorded, the operator clears the accumulated weights from the indicator memory and the process starts again. A counter tracks the number of items weighed for the sub-total and grand total weights, so a check against the shipping manifest can be made to confirm that the correct number of items are included in the totaled weight values.



Addition of several pallets of product weighed by floor scale, or small boxes weighed by bench scales, plus tare weight of an empty container, equals the verified gross mass weight reading required by SOLAS



Weight Summing Procedure

For IBC filling it is possible to record the tare (empty) weight of the IBC plus the filled material weight that is dispensed either from a hopper with weigh modules or onto a floor scale on which the IBC is resting. Similar to the previous process, it is possible to accumulate weights from multiple IBCs and print or transmit to a PC the summed weight of multiple IBCs that may be loaded into a single container.

You can also use more advanced weighing solutions that provide the VGM summed weight in a custom data format that can easily integrate with Warehouse Management Software or Transportation Management software. Such solutions can be created with a programmable weighing indicator that provides the ability to have an advanced internal database that can integrate data directly with the database of PC software using a SQL data structure.

Programmable Indicators

A programmable indicator facilitates purpose-designed operator workflows, using the weighing indicator's custom prompts to guide the user through each step of data collection during the weighing process. That could include data entry via a variety of input methods, such as barcode scanners, alphanumeric keyboards, RFID scanners, or validity check discrete I/O inputs from quality check devices.

Finally, when an automation system is involved in the container-loading process, it is possible for the weighing indicator to interface directly to a programmable controller (PLC) sending individual packages, pallets, or IBC weight information to the PLC. In that case, the software logic for accumulation of weights can be contained within the PLC software, or for some weighing indicators, the accumulated weight can be communicated to the PLC.



Chapter 4 – Weigh-in-Motion

Productivity and Emissions Reduction

Enhance productivity, safety and sustainability with a weigh-in-motion (WIM) truck scale, all while complying with SOLAS regulations. Choose from two variations of WIM technology, depending on the needs of your operation.

METTLER TOLEDO offers a variety of weigh-in-motion solutions including AxlePass, AxleMate IIJ and TruckPass. With our diverse portfolio of WIM solutions, it's easy to find the right solution for you.



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1 AxlePass and AxleMate IIJ

AxlePass and AxleMate IIJ capture axle weights and use them to calculate a vehicle's gross weight within a 2% weighing tolerance.

Depending on where you are in the world, one of our axle scales could be a fit for your port operation. These scales offer a smaller footprint, making them easy and quick to integrate into an existing process flow while achieving compliance with SOLAS regulations.

Ideal for: Operations that currently do not have a truck scale and are looking to implement a simple, cost-effective solution.



Reduce Bottlenecks

By weighing vehicles while they are in motion, AxlePass and AxleMate IIJ maximize throughput and reduce the risk of bottlenecks at the scale. If you need to implement inbound or outbound checkweighing, these solutions offer little disruption to the existing process flow.



Control Costs

With much smaller footprints than full-length scales and minimal foundation work required, AxlePass and AxleMate IIJ have lower initial costs for installation. The compact units also help you to minimize ongoing maintenance costs.



Weigh with Confidence

The designs for AxlePass and AxleMate IIJ were tested at weights above the legal tolerance for over 2 million cycles. In addition, both models have been extensively tested in the field to verify durability in real-world environments. You can be sure you have a product built to last.

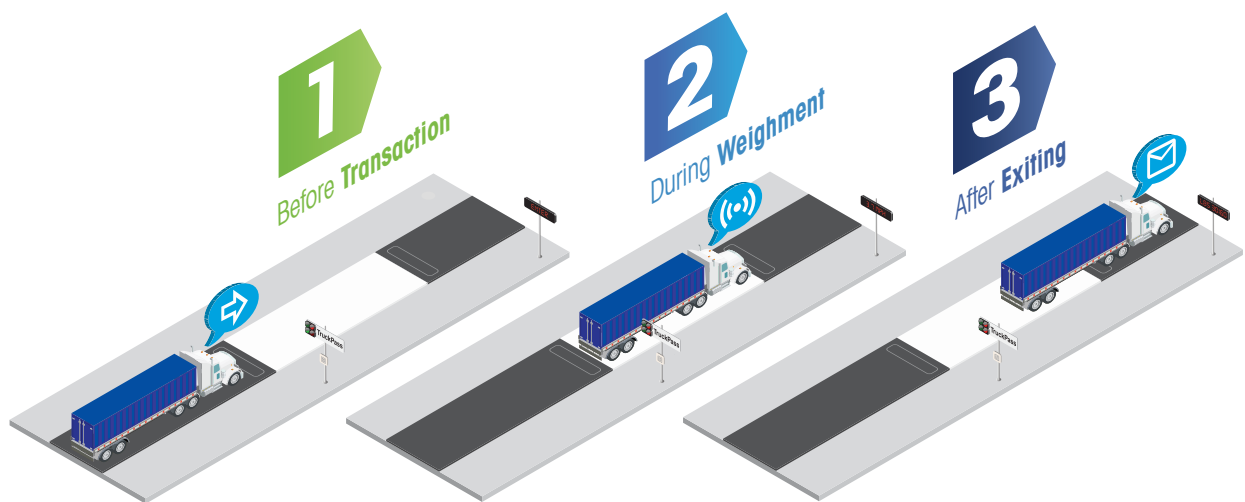


2 TruckPass

TruckPass is a full-length weigh-in-motion truck scale solution. With TruckPass, operations can capture axle, axle group and gross weights of trucks moving at speeds up to 5 miles (8 kilometers) per hour.

By eliminating the need to stop each truck, TruckPass can handle the same truck traffic as several scales in a fraction of the time, while significantly reducing harmful emissions and safety risks. TruckPass is currently approved for legal-for-trade accuracy levels in the US, with the global approvals in progress.

Ideal for: Operations that already have full-length truck scales onsite and want to convert to a more efficient and sustainable solution. Also ideal for operations that are ready to purchase additional scales to expand capacity, as WIM can increase capacity with existing scales.



3X Higher Productivity

Weighing in motion helps to maximize daily throughput potential while reducing long lines at the scale.

Reduced Emissions

Reduce or even eliminate truck idling time to lower overall emissions and meet sustainability targets.

Automated Processing

Automated truck identification and data management eliminates the risk of manual errors in data handling.

Enhanced Safety

TruckPass weighments are completed automatically, eliminating the need for a driver to exit the cab.



Benefit of Weigh-in-Motion for Ports

With AxlePass, AxleMate IIJ and TruckPass, METTLER TOLEDO offers a comprehensive portfolio of WIM truck scales. If your operation wants to maximize space at your facility or if you do not currently have a full-length truck scale onsite, AxlePass and AxleMate IIJ are ideal weigh-in-motion solutions. If your site has an existing truck scale onsite or processes legal-for-trade transactions, TruckPass is ideal.

Port operations often see large volumes of trucks every day, often leading to backups at the truck scale or entry point. With the extra throughput enabled by WIM, your operation can combat spatial constraints while ensuring quality weighing results. To keep up with demand and maximize profits, it might be time for your operation to invest in weigh-in-motion technology.

For more information about how WIM can reduce emissions at the truck scale, visit the page:

► www.mt.com/veh-emissions-roi

Chapter 5 – Service:

Basics of Servicing and Scale Compliance

We serve global customers with one of the largest sales and service networks in our industry – over 5,000 sales and service specialists strong.

With routine scale calibration and adjustment, you can measure safely, ensure compliance and avoid the costs of inaccurate measurements. Achieve and maintain compliance through consistent procedures and adhere to local and global regulations and standards.



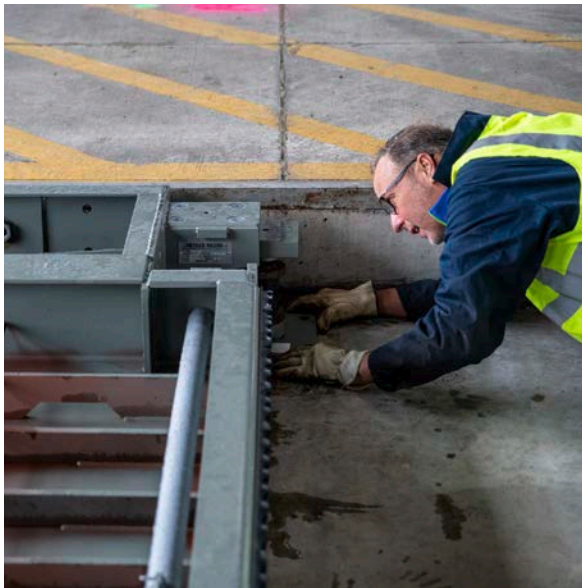
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1 Specifying services for SOLAS

Accuracy and compliance reassurance

Selecting the right weighing equipment is an important first step to ensuring that your weighing processes achieve SOLAS compliance. Specifying the right services for the equipment is the next step to make sure that your project is a success and that you maintain compliance while you maximize your return on investment over the life of the equipment.



Installation and start-up

Proper installation of weighing equipment can be as simple as removing it from its shipping carton, setting it in place and plugging it in – to as complex as setting advanced operational parameters, loading an application database, or configuring and testing for network integration.

A successful installation begins with an assessment of the environment where it will be used and an evaluation of how equipment capabilities can be matched to process requirements and operational procedures. Next, the equipment must be properly installed, wired, adjusted, configured, integrated and tested.



Calibration and certification

It is easy to erroneously assume that the weight value displayed is the exact weight of the object or material on the scale. However, this is not true; every measurement has an uncertainty associated with the measurement device's capabilities, the environmental conditions of the measurement and the weighing process.

The only way to determine the suitability of a measurement for meeting your process specifications, or for delivering acceptable cost and revenue impact, is to calibrate the measurement device with a traceable reference standard and to determine accuracy. Additionally, to have traceability for your process, you must document calibration results and certify that measurements meet quality and regulatory requirements.



Maintenance, training and support

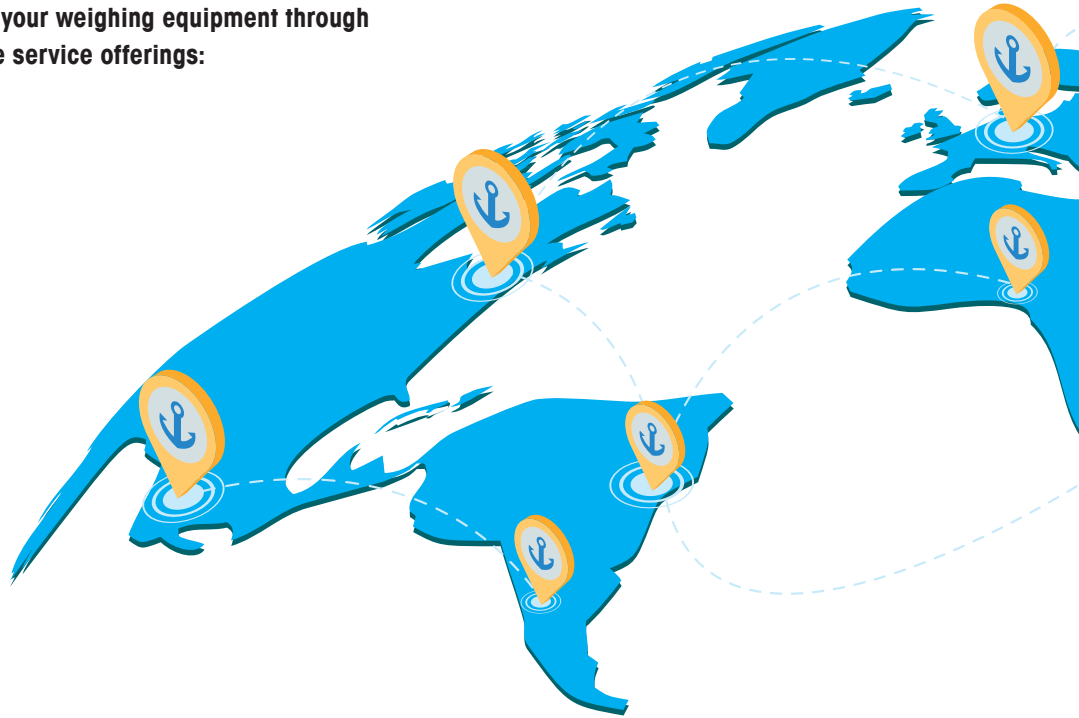
Proper maintenance according to factory specifications will significantly improve weighing equipment uptime and performance and extend its life. Preventive maintenance should be periodically performed with a frequency appropriate to the type of equipment, application, environment, regularity of use and criticality of the equipment to your process, product quality and downtime costs.

Additionally, planned maintenance can make your costs more predictable. You should also have a training plan to ensure an effective start-up of any new weighing process and to provide for the onboarding of new employees. Finally, make sure that you have a support plan and processes that provide access to the expertise that you need when you need it.

2 Your global service provider

Local SOLAS compliance support

Contact METTLER TOLEDO to ensure your method for verifying gross mass on all shipping containers complies with SOLAS – from installation and beyond. Our technicians have the advanced skill set to safeguard the life of your weighing equipment through these comprehensive service offerings:



Installation and start-up

Achieve proper installation in the working environment, setup and configuration for optimal operator efficiency, and interface to peripherals, data collection or automation systems.



Calibration and certification

Gain confidence in your measurements with calibration and certificate services that only METTLER TOLEDO can provide. Our market-leading technology and expertise will bring you peace of mind and keep you compliant.



METTLER TOLEDO will assist you in determining the key requirements before defining a service program:

- How important is maximizing uptime to your process and business?
- What measurement accuracy will ensure required quality and profitability?
- What are your regulatory, quality and customer compliance requirements?
- How should your equipment be integrated into your process and systems?
- What is the optimal equipment configuration for your process and operation?
- Can your staff safely and productively operate and maintain your equipment?

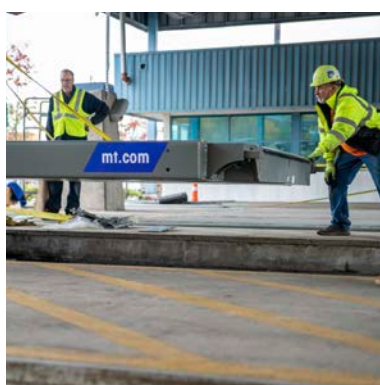
Benefits of using METTLER TOLEDO service:

- Consultation for an optimal service plan to achieve SOLAS compliance
- A global network of factory-trained technicians delivering exceptional service
- A field-service force backed by local and global support personnel to provide ideal solutions
- Proprietary service tools to realize and maintain the best performance for your equipment
- Factory maintenance procedures to maximum your return on investment
- Consistent procedures to ensure measurement results that lower costs and increase revenues
- Certification solutions that are compliant with local and global regulations and standards
- Calibration services that are ISO17025 accredited, giving third-party credibility to results



Maintenance agreements

From BasicCare to ComprehensiveCare, METTLER TOLEDO's Care packages ensure that your equipment is always operating at peak performance and measurement results comply with SOLAS requirements, while keeping your budget under control.



Lifecycle management

Leveraging METTLER TOLEDO as your service partner addresses the complete lifecycle of your equipment, ensuring optimal uptime through preventive maintenance, repairs, upgrades, and equipment-performance reporting.

Chapter 6 – Conclusion: Partner with Global Experts

METTLER TOLEDO is the world's largest manufacturer of weighing equipment, an industry leader in quality and innovation, and your trusted partner for compliance with the new SOLAS convention guidelines.

Our reliable scales and systems have global approvals that cover your weighing applications needs, no matter where you are in the world.



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1 Compliance and more with METTLER TOLEDO

With our comprehensive product portfolio we are equipped to meet your unique needs. We understand that this new law can be viewed as disruptive to some who are now tasked with modifying their logistics chain to meet VGM compliance standards. However, it is our goal to ensure a smooth integration process no matter the current structure of your operation. If desired, the addition of our weighing equipment and systems can have an impact beyond simply providing compliance for SOLAS. Data analysis and reporting, inventory tracking, and improved efficiency are just a handful of the benefits that come with integrating weighing systems into your current structure.

2 Solutions for Every Business

Whether you simply want to ensure you have the right equipment to comply with the new regulations or you want to be able to analyze all your weighing data easily, we can help. METTLER TOLEDO offers solutions for every step of your process, helping you comply with the new SOLAS regulations, from production to shipping.

Ports and Terminals:

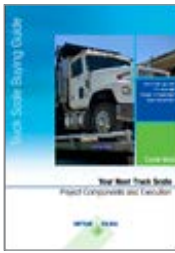


Logistics Companies:



Manufacturing:

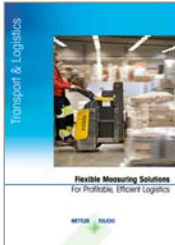




Truck Scale Buying Guide

This guide is designed to help you make an informed decision when buying a new truck scale. Whether you need help getting started, or want to better understand technology and specification options, this guide will be useful.

► www.mt.com/truckscaleguide



Transport and Logistics Competency Brochure

Our Transport and Logistics Competence Brochure will help you to simplify the logistics process and increase financial and operational productivity. Includes 'Know How' on topics such as: speeding up production, ensuring consistent high data quality for load planning, pricing, sorting and tracking, invoicing and customer communication.

► www.mt.com/TandL-competency



Emissions ROI Calculator

By reducing idling time in line and on the scale, you can expect to see an overall reduction in truck emissions at your site.

► www.mt.com/veh-emissions-roi

www.mt.com/veh-solas

For more information

METTLER TOLEDO Group

Industrial Division

Local contact: www.mt.com/contacts

Subject to technical changes

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MarCom Industrial