Installation Guide

Load Cell Installation Guidelines

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Original manual

Contents

1) Introduction

An Alfa Laval load cell is a unique capacitive transducer that is used to measure weight or force.

When the weight (force) is applied to the load cell, it causes a distance change inside the load cell, which a non-contacting capacitive sensor measures very accurately. This capacitive measurement results in a digital value, which is proportional to the force applied to the load cell.

The load cells may only be used for the weighing applications for which they were designed. The dimensions of all mounting and structural components must be calculated to ensure sufficient overload capacity.

Installation and repair work should only be carried out by qualified personnel.

2) Electrical Installation

The power needed for each weighing system is 24 VDC, min. 2A unless otherwise specified.

Don't ever carry a load cell by the cable!

For applications in hazardous ATEX (Ex) rated area, load cell modules and instrumentation must be installed outside the hazardous zone. Furthermore, only ATEX certified load cells, instrumentation and power supply are allowed for use in ATEX applications.

The load cells should be installed so that the load cell cable will not be cut or otherwise damaged during installation or use.

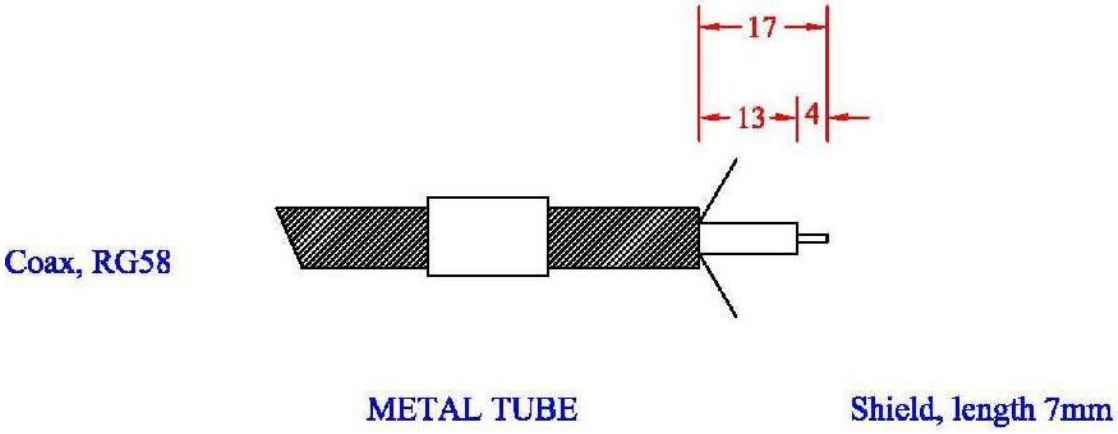
Always keep the open end of the load cell cable protected against humidity.

If you want to extend the cable, we recommend that you buy a longer cable from Alfa Laval. Alternatively, you can use a male-female connector pair that is protected from moisture ingress.

If welding is performed on the installation, remember to disconnect the load cells from the instrumentation.

Please follow these instructions for mounting the BNC connector on the load cell cable (we recommend using the crimp tool from Weidmüller type HTG 58/59 or similar):

1. The load cell cable is put through the metal tube
2. The insulation is removed and the shield is folded out and backwards
3. The Gold pin is crimped on the center wire (check tightness of crimp with a light pull)
4. Load cell cable with gold pin is pushed into BNC connector until it is locked (a small "click")
5. The shield is folded around the neck of the BNC connector
6. The metal tube is drawn over the shield
7. Excess shield is cut of and metal tube is crimped tight

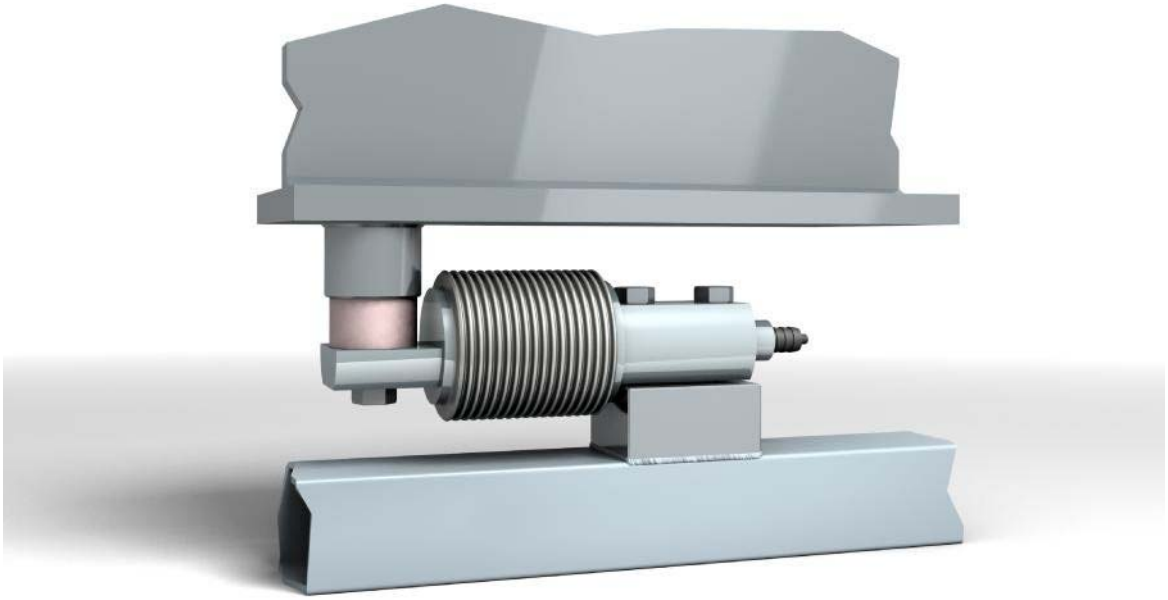


For further information on electrical installation, please consult the documentation following the instrumentation.

3) Mechanical Installation – General Information

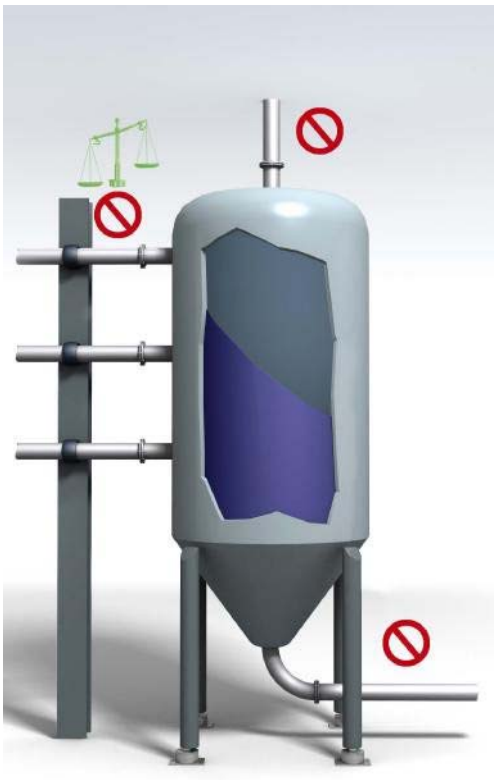
The mechanical installation of an Alfa Laval load cell is very simple and easy as sideload and overload protection devices are most often not necessary since the non-contacting capacitive measuring principle allows for high overloads and sideloads.

When mounting the load cell, it is placed between the force introducing structure and the base, which ideally are two parallel surfaces.

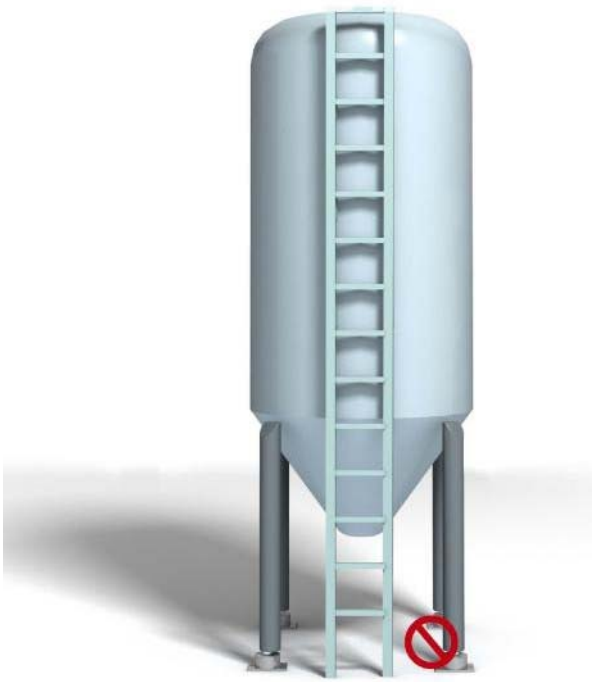


For highest accuracy, please ensure that the force is applied vertically on the loading surface (load point) of the load cell. The force should not be applied to the load cell outside the loading surface (load point).

Please notice that rigid process tubing will cause errors and should be considered when designing the installation:



To prevent force shunts, all connections from the weighing system to the surrounding construction (pipes, cables, bellows) must be as flexible as possible.



Any component or part causing resistance to vertical movement of the load, the parts to be weighed and the load cells will induce accuracy errors.

Determine if any vibration or influence on the weighing system is caused by other systems operating close by. If possible, do try to minimize the vibrations on the load cells in order to achieve the best weighing performance.

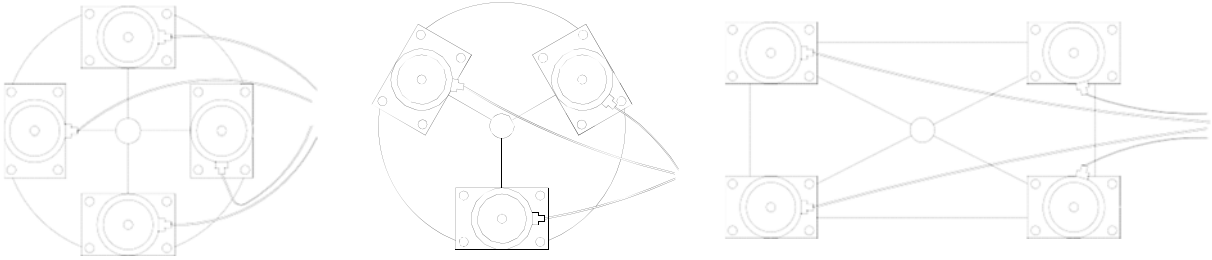
4) Mechanical installation of compression load cells for tanks

General Installation of compression load cells

Preferably, the load cell is placed directly on an even and hard surface.

In environments with rough or uneven surfaces it is recommended that the load cell is placed on a base plate to ensure a proper foundation.

The following positioning of the load cells is recommended for vessels with 3 or 4 legs - always balance the forces equally on the load cells if possible:



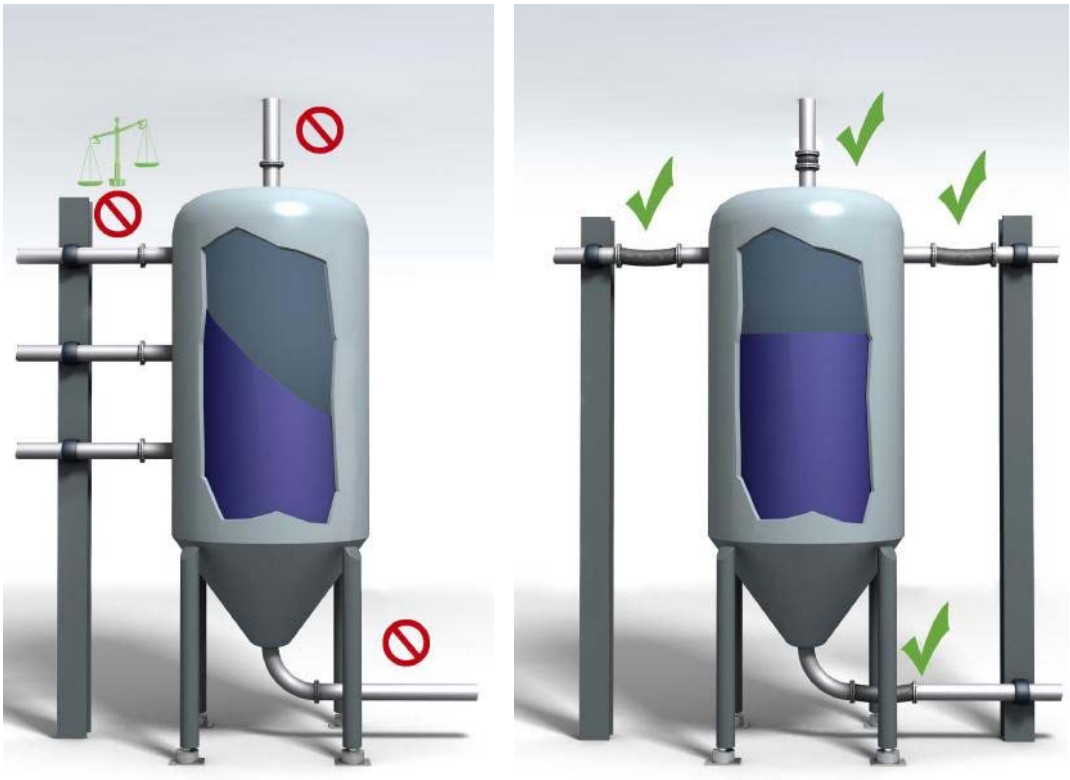
For process installations with process tubing/piping, the process tubing/piping should have the highest possible flexibility to vertical movements by having the longest possible free horizontal length.

The error from the process piping is equal to the force that is required to deflect the piping 0.2 mm (equivalent to the deflection of the load cells at rated capacity). However, the stiffness of the process piping may to a certain degree be calibrated out by changing the slope (calibration factor) of the output.

Remember to tighten all process connections before calibration.

We recommend flexible connections to optimize accuracy and the process piping should be balanced around the vessel. Avoid rigid cabling to mixers and agitators. Where possible, agitators should be balanced and positioned at the centre of the vessel.

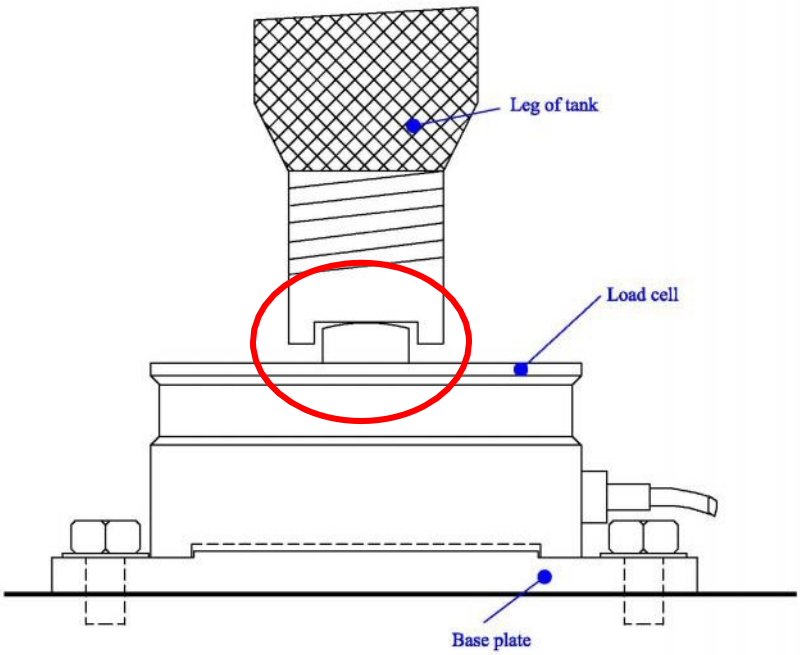
When multiple pipes are connected to a weighing vessel, then the connections should preferably be flexible and made as symmetrical as possible.

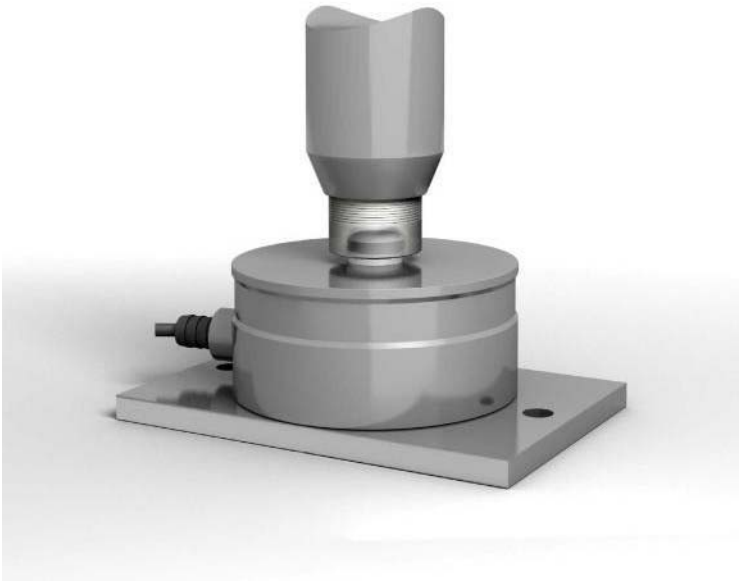


After mechanical installation, check if there is any contact between the tank and other structures as this is the number one cause of inaccuracy in a weighing installation:

For installations where all the legs of the tank are supported by load cells, horizontal forces will only cause minimal weighing errors as the load will be shifted from one load cell to another, but the sum of the load on the load cells will remain constant.

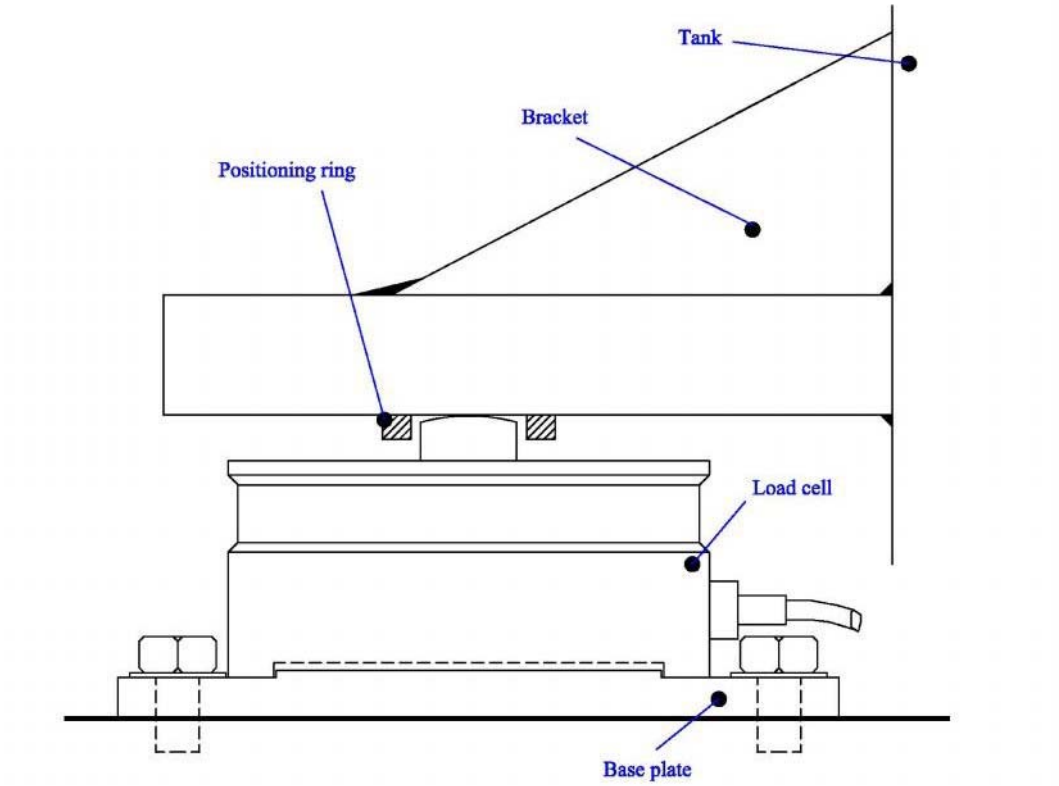
Remember to allow some air around the loading point of the compression load cells to allow the structure of the tank, silo or vessel to expand and contract during temperature changes (thermal expansion) as shown below:

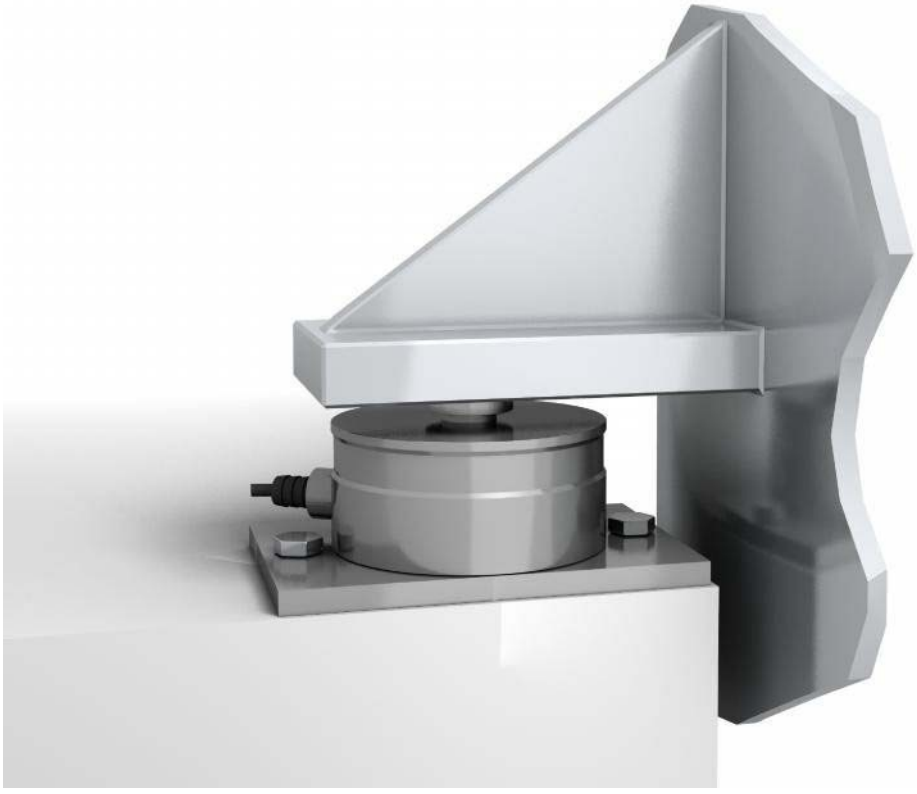




Installations for vessels with lugs/brackets

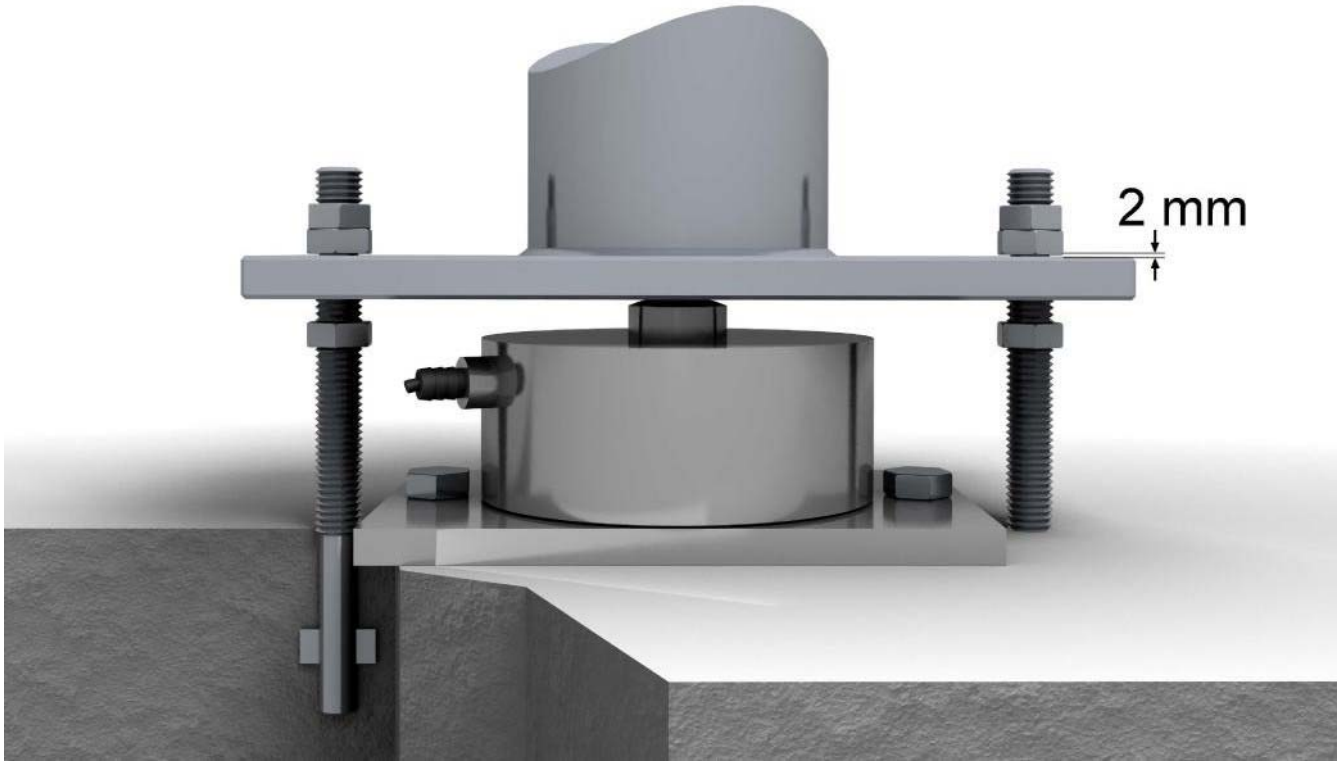
This installation method is very similar to the installation with tank legs. Alfa Laval can provide the positioning ring if required:





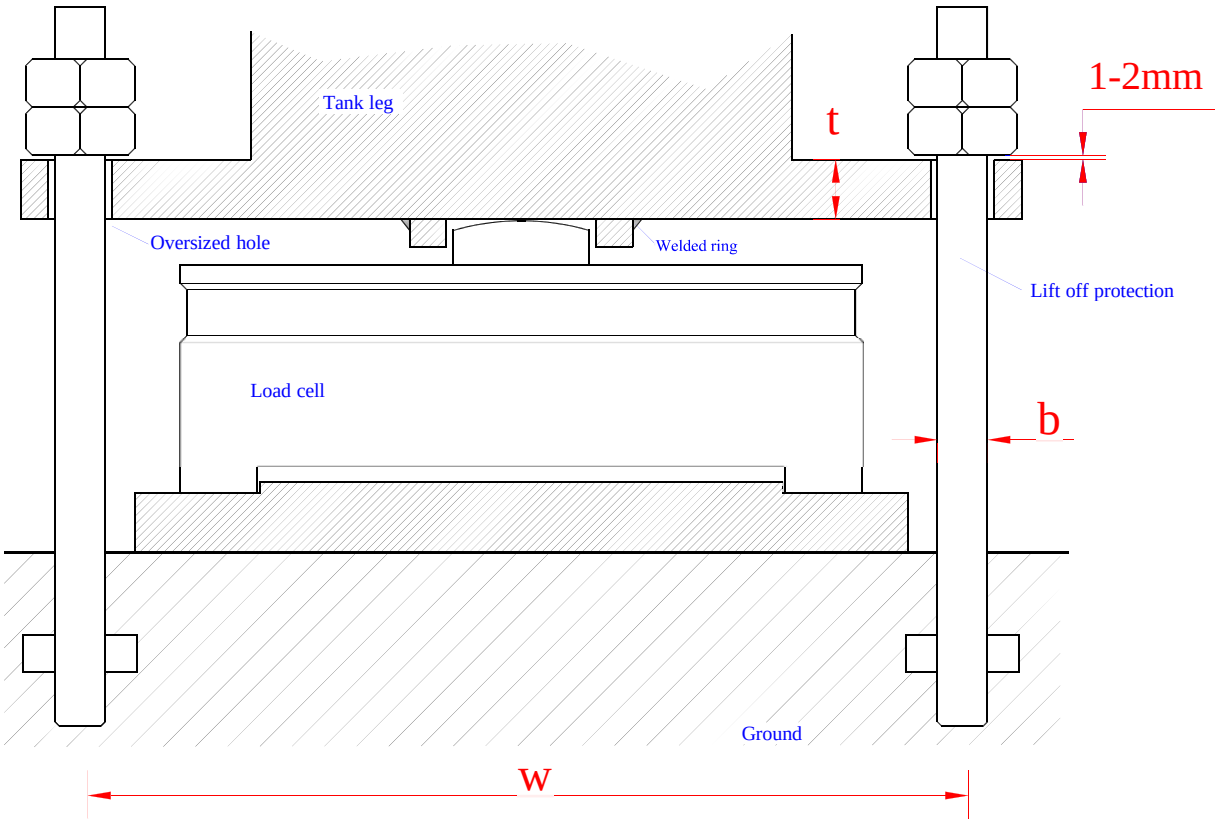
Installations requiring lift-off protection

If the installation is placed outdoor subjected to wind loading, or seismic activity or indoor with a risk of tilting, a lift-off protection must be used.



The lift-off protection can be used on one or both sides of each load cell depending on the size of the silo and the local conditions. Lift-off bolts must restrain the maximum upward movement.

A clearance should be provided to prevent the bolts from mechanically interfering with the silo during normal use as this will cause weighing errors.



Installations requiring lift-off protection (indoor)

The following table is only to be used as a **guideline** for **indoor installations** (Dimensioning of the lift-off protection **must** be calculated individually for each installation!):

W (mm)	Load cell type	Load cell capacity (ton)	No. of tank legs	Top plate (t in mm)	Top plate material	Bolt (b)	Bolt break force (kN)	Bolt material
150	MD/DL/DLA/ CL/CL-Ex	0-1,5	3	12	St37/ AISI304	M12	65	Class 8.8
150	MD/DL/DLA/ CL/CL-Ex	0-1,5	4	12	St37/ AISI304	M12	65	Class 8.8
150	MD/DL/DLA/ CL/CL-Ex	2-5	3	15	St37/ AISI304	M16	120	Class 8.8
150	MD/DL/DLA/ CL/CL-Ex	2-5	4	15	St37/ AISI304	M16	120	Class 8.8
200	FD/DM/DMA/ CM/CM-Ex	6-15	3	40	St37/ AISI304	M20	200	Class 8.8
200	FD/DM/DMA/ CM/CM-Ex	6-15	4	40	St37/ AISI304	M20	200	Class 8.8
200	FD/DM/DMA/ CM/CM-Ex	20-50	3	50	St37/ AISI304	M24	290	Class 8.8
200	FD/DM/DMA/ CM/CM-Ex	20-50	4	50	St37/ AISI304	M24	290	Class 8.8

Installations requiring lift-off protection (outdoor)

The following table is only to be used as a **guideline** for **outdoor installations** (Dimensioning of the lift-off protection **must** be calculated individually for each installation!).

If the height is greater (>) than 2 times the diameter of the silo, special pre-cautions must be taken and dimensioning of the lift-off protection must be carefully calculated for the installation!

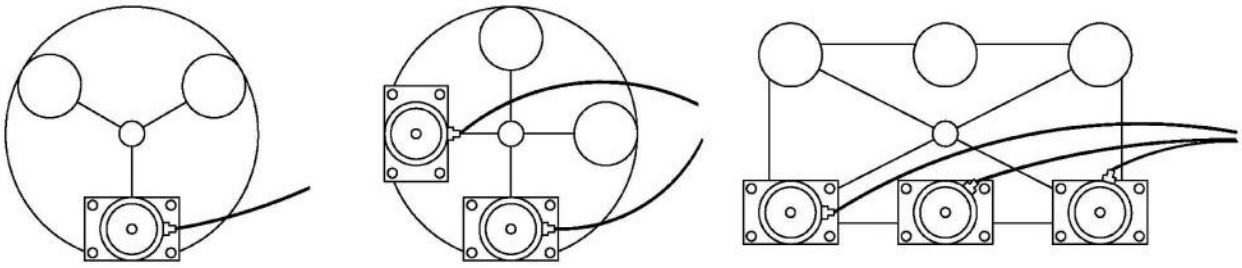
W (mm)	Load cell type	Load cell capacity (ton)	No. of tank legs	Top plate (t in mm)	Top plate material	Bolt (b)	Bolt break force (kN)	Bolt material
150	MD/DL/DLA/ CL/CL-Ex	0-1,5	3	20	St37/ AISI304	M20	200	Class 8.8
150	MD/DL/DLA/ CL/CL-Ex	0-1,5	4	20	St37/ AISI304	M16	120	Class 8.8
150	MD/DL/DLA/ CL/CL-Ex	2-5	3	40	St37/ AISI304	M24	290	Class 8.8
150	MD/DL/DLA/ CL/CL-Ex	2-5	4	30	St37/ AISI304	M20	200	Class 8.8
200	FD/DM/DMA/ CM/CM-Ex	6-15	3	40	St37/ AISI304	M30	450	Class 8.8
200	FD/DM/DMA/ CM/CM-Ex	6-15	4	40	St37/ AISI304	M30	450	Class 8.8
200	FD/DM/DMA/ CM/CM-Ex	20-50	3	60	St37/ AISI304	M42	950	Class 8.8
200	FD/DM/DMA/ CM/CM-Ex	20-50	4	60	St37/ AISI304	M42	950	Class 8.8

4.1 Gravimetric Level Measurement - Positioning of the load cells

You can achieve the highest accuracy by using load cells under all legs of the vessel. However, a simple and cost-effective solution for gravimetric level measurement is achieved by only using load cells under some of the legs (supporting points).

Using gravimetric level measurement, you can expect about 1-2% accuracy if the installation is performed with a bit of care, and the vessel is mechanically stable.

The following drawings show the positioning of the load cells for different no. of legs on the vessel when you don't use load cells under all the legs:



A further benefit of using load cells for level measurement is that you can always upgrade the accuracy by installing load cells under all the legs.

For installations where not all the legs of the vessel are supported by load cells, the process piping should have a high flexibility also to horizontal movements.

Otherwise, the piping, especially if there are connections at the top of the tank, will be able to shift the load to or from the vessel leg(s) with the load cell(s) and thus cause weighing errors.

One of the further advantages of using load cells for gravimetric level measurement is that the proper operation of the system may easily be confirmed by applying a known load on the system.

For other advantages of using load cells for gravimetric level measurement, please visit our homepage (http://www.Alfa Laval.com/weighing-solutions/).

4.2 Recommendations - Process Connections

This document describes our recommendations regarding connections of pipes and tubes for process weighing applications.

Ideally, the tank should be able to move freely in the vertical direction so the process connections should have the highest possible vertical flexibility.

Therefore, flexible connections mounted horizontally to allow for vertical movements should be considered.

For sanitary applications or where it is not feasible to use flexible connections, the following free horizontal length of the piping is recommended:

Diameter / wall thickness	Recommendation
Piping up to max. 16 mm/1 mm	>500 + 500 mm (or >400 + 600 mm etc.) free horizontal length with at least one 90 degree horizontal bend
Piping up to max. 25 mm/1-1,5 mm	>800 + 800 mm (or >400 + 1200 mm etc.) free horizontal length with at least one 90 degree horizontal bend
Piping up to max. 50 mm/2 mm	>1000 + 1000 + 1000 mm (or >600 + 1200 + 1200 mm etc.) free horizontal length with at least two 90 degree horizontal bends
Piping diameter > 50 mm	The actual situation should be treated individually

It is always preferable to have the bends in three dimensions.

When the above mentioned rules have been followed, the influence from the process connections can be removed by a calibration.

Theoretically, if a load cell has no deflection at all, the influence from process connections during loading of the weighing system will be zero. So the smaller the deflection of the load cell is, the smaller is the influence from process connections.

As a general rule, the Alfa Laval capacitive load cells only have a deflection of about 0,10 mm at full capacity, contrary to other types of load cells which typically has a deflection of more than 0,20 mm at full capacity.

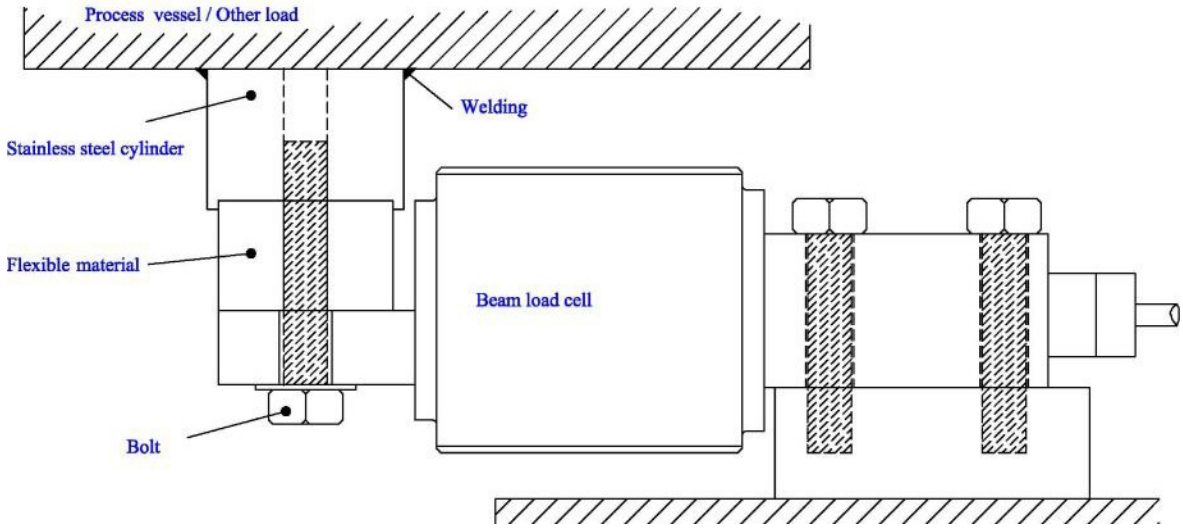
When using load cells under all supporting points, horizontal forces will be compensated because the horizontal forces will only shift the load between the load cells.

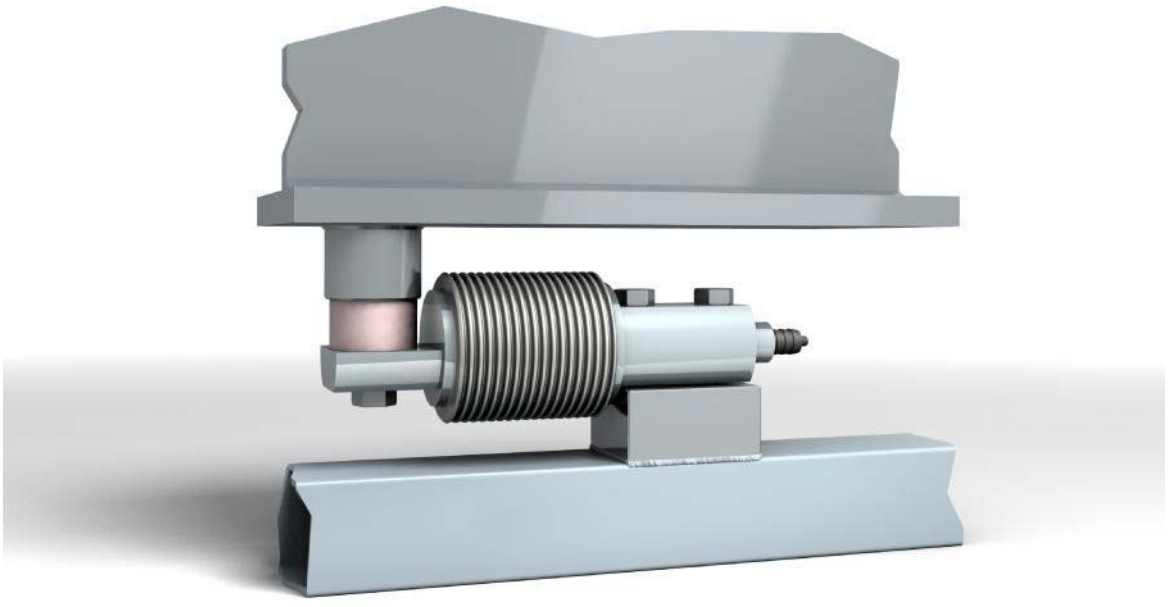
We will be happy to give advice on process connections if drawings (2D/3D) are provided. The information will be treated as confidential.

5) Mechanical mounting of beam load cells

5.1 General installation of beam load cells

We recommend using a flexible mounting part when installing beam load cells in mechanical structures that are not perfectly aligned. This prevents torque on the load cells caused by the mechanical mounting of the load cells when the mounting bolts are tightened:

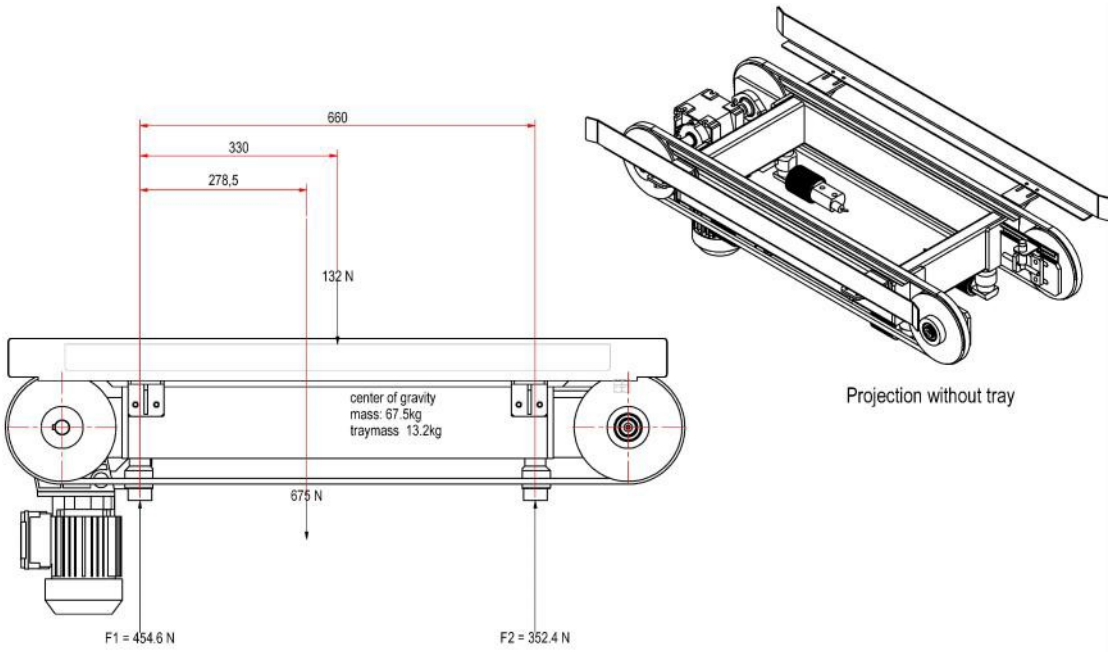




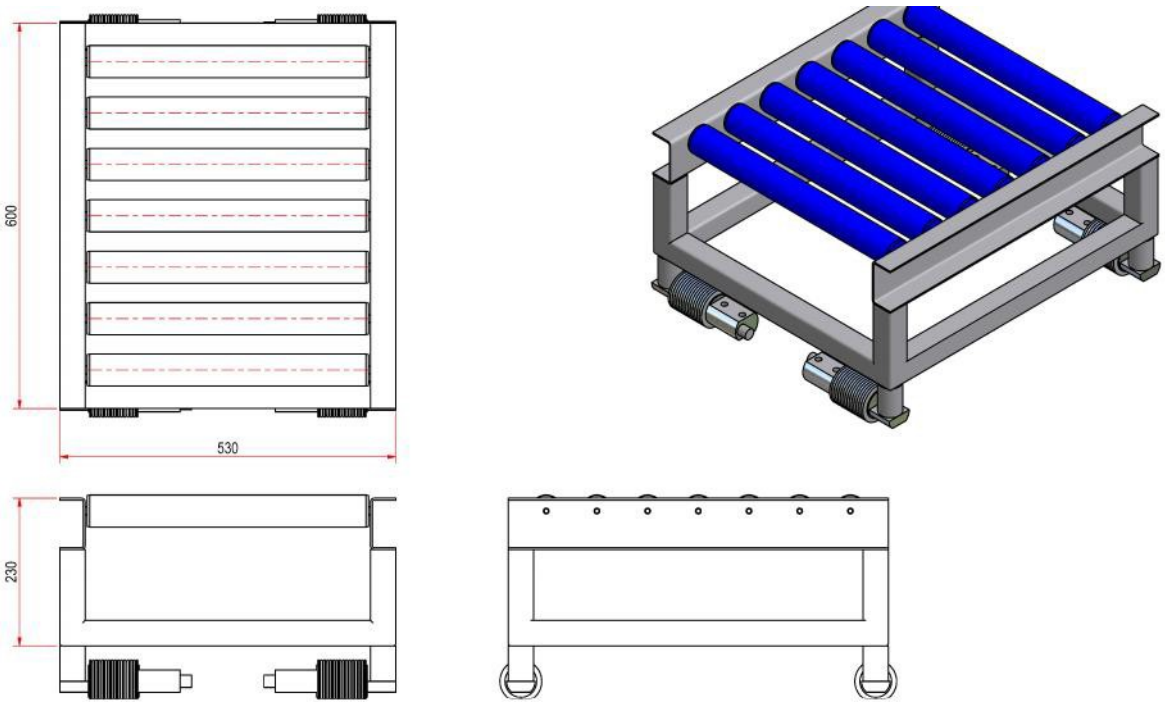
5.2 Installation of beam load cells for conveyer belts and belt scales

When installing beam load cells for conveyers and belt scales, it is important that the load cells are installed in the direction along the movement of the product or items to be weighed:

CORRECT



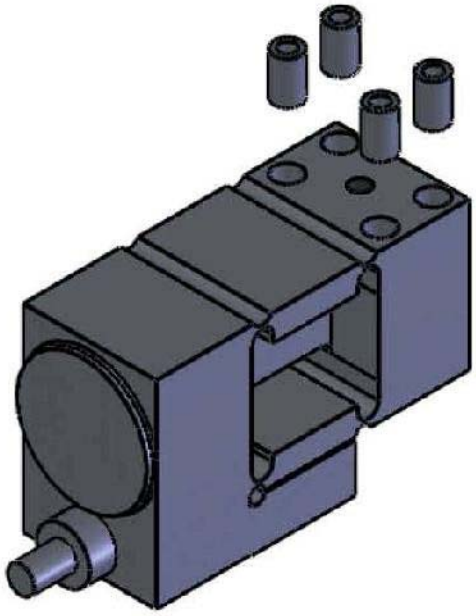
NOT CORRECT!



6) Mechanical mounting of Alfa Laval single point load cells

Remember to use the four (4) cylinders supplied with the single point load cells.

These cylinders will make sure that there is only contact with the load at the correct load points of the load cell. Also, the cylinders eliminate the need to specify the torque used for the mounting bolts.



7) Calibration

The Alfa Laval digital load cells are supplied pre-calibrated i.e. the load cells transmit the weight (force) directly in grams, kilograms or tons.

However, if the measurement is interfered by mechanical factors like heavy process piping, gears etc. then it can be necessary to perform a calibration of the complete system.

For more specific calibration guideline, please follow the calibration instruction for the supplied instrumentation.

8) How to contact Alfa Laval Kolding A/S

For further information please feel free to contact:

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