

# CALIBRATION GUIDE FOR TANKS

There are various calibrating methods. In this note, we describe the most common ones in tanks or high capacity systems as silos.

## General recommendations

The following recommendations apply to all the calibrating methods disregards the method used.

- If the scales are to be used for commercial transactions, check with the Weight and Measures Authorities for the legal local requirements.
- The weighing electronic indicator must have been operating for 20 minutes prior to its calibration, or some other length of time according to the specifications of the manufacturer.
- The weighing system must be exercised several times before calibration by means of successive loads and unloads. This ensures that everything is fitted in its position.
- At the same time that the weighing system is exercised, verify the return to zero each time the system is unloaded. Make sure that any Auto-Zero device from the electronic indicator is off. If the zero return is poor, verify the complete mechanical system before going on to the calibration.
- For a better precision load of calibration, between 70% and 100% of the weighing capacity of the system is used.

## Calibration by means of a certified mass

More exact calibrations are achieved with this method. Due to the fact that, at times, it is very difficult to apply the certified mass inside the tank or on the tank, it may be fitted with additional anchoring, chains or platforms for the placing of the mass.

1. Remove all the weights from the tank. Leave the additional anchoring in case it is necessary for the later application of the mass.
2. Carry out the zero calibration following the instructions of the manufacturer.
3. Place the certified mass in the tank up to 70%-100% of its capacity distributed evenly.
4. Adjust the indicator for the applied load according to the instructions of the manufacturer.
5. Remove the certified mass and verify the zero return.
6. Apply the certified mass once again in order to verify the calibration carried out.
7. Remove the additional anchoring and recalibrate the zero.

This method can only be used with systems in which all the supporting points feature active load cells, as it would be practically impossible to place the certified mass in the centre of gravity of the real load.

## Calibration using the previously weighed material

This calibrating procedure is the same as the one described for the calibrations using certified mass, but instead of using certified mass, a previously weighed material of a known value is used. It normally uses the same one to be stored, water or sand. This material is usually loaded on a truck of a known tare, weighed on a truck for weighing trucks and transported to the site of calibration. Care must be taken not to lose the load in transport and to unload the total amount of material into the tank. The system of weighing the truck before and after delivery can also be used to know the value of the material unloaded into the tank.

## Calibration using substitution material

This method is used to calibrate in an accurate way high capacity weighing systems when there is only a partial amount of certified mass available. A certified mass is applied and then substituted in steps until the final load is reached.

1. Remove all the weights from the tank. Leave the additional anchoring in case it is needed for the later application of the mass.
2. Carry out the zero calibration following the instructions of the manufacturer.
3. Place the certified mass into the tank up to a minimum of 10% of the capacity of the weighing system.
4. Adjust the indicator to read the value of the applied load.
5. Remove the certified mass and substitute it with substitution material until the indicator shows again the same value as with the certified mass.
6. Place once more the certified mass into the deposit loaded with the substitution material.
7. Remove once more the certified mass and substitute with more substitution material until the indicator shows again the last one as with the certified mass.
8. Place once more the certified mass into the deposit loaded with the substitution material.
9. Repeat this process until the total applied load (pattern mass and substitution material) is in 80% to 100% of the capacity of the system.
10. The total weight on the system is the weight of the certified mass plus the addition of the substitution material batches. For example, if the certified mass is 5000 kg heavy and 4 substitutions have been carried out with material, the final weight is  $5000 + (4 \times 5000) = 25000$  kg.

To carry out a correct substitution, it is recommended to use the maximum possible resolution in the weighing indicator.

This method can only be used with systems in which all the supporting points are fitted with active load cells, as it would be practically impossible to place the certified mass in the centre of gravity of the real load.

## Calibration in mV/V, without using mass

Some modern weighing electronics allows a mathematical calibration by using mV/V of the load cells, without the need of using masses.

This technology consist in introducing into the indicator the main parameters of the load cells used as number of load cells, nominal capacity in kg and nominal sensitivity output in mV/V. Then the indicator can calculate the relation between load cell outputs in mV and kg to put in the display or to be send to the plc or PC.

The load cells should have a good factory calibration and they have to be delivered with the real nominal sensitivity in mV/V data. Utilcell deliver the nominal sensitivity with each load cell indicated in its label. Additionally the indicator should have a good factory calibration of the internal amplifiers and analog to digital converters using voltage references. Utilcell indicators have been calibrated by using voltage references at level of decimals of microvolts.

It should be noted that this type of calibration cannot substitute the calibration by using mases, necessary in some countries for legal for trading scales, or cannot predict influences of frictions, piping, structural deflections that can appear in real loading conditions. However if necessary a mass official can be done additionally when the system is in operation if required.

The calibration by using mV/V of the load cells is a very helpful method because it allows to put the system in operation in very few time. The calibration can take less than 1 minute. It will help on the test of the control system, in/out operative, setpoints and alarms. It will also help in testing of weighing repeatability and zero returns to detect frictions and some mechanical problems by seeing display in real kg values, with an accuracy around 0,1% F.S. (equivalent to weighing 1000 divisions), which in the majority of applications of large tanks and silos is more than acceptable.

From Utilcell hope this technical note can be of help to make a tank installation, only as a guideline and not serve as a contractual specification. We reserve the right to change the content of this technical note at any time without notice.

Remaining at your disposal for any further information.