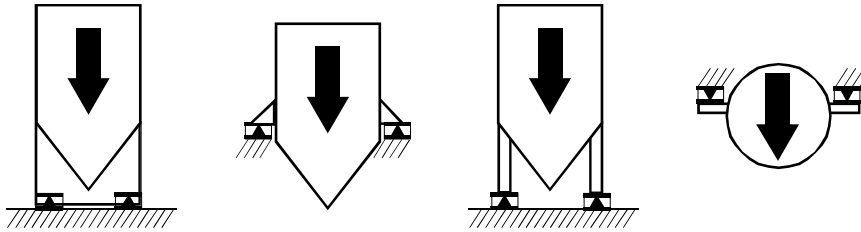


Silos and Tanks weighing systems

Choice guide of load cells



TeleMetrix



The measurement of the container, whether liquid, solid or powder in a tank, silo, hopper is realised by weighing. This technique allows to obtain in a reliable way a great precision on condition of respecting some rules which you will find in this document :

- **Determination of load cells :**
Compression, Tension, Shearing.
Number of load cells and support points.
Weighing extension and load cell capacity.
Accuracy.
- **Operating and functional mode :**
Easy installation and maintenance.
Signal transmission.
Calibration
- **Environmental conditions:**
Climate, Wind.
Temperature.
Influence of rigid connections.
Vibration
- **Risk control:**
Seismic risk.
Risk of explosion.



Série 300



Série 400



Série 600

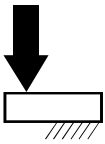
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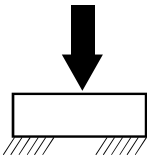
Silos and Tanks weighing systems

➤ Determination of load cell type:



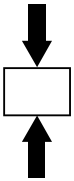
Bending beam load cell – shear beam load cell (10 to 5 000 kg serie 300) :

- + Easy installation
- + Integrated security
- + Accuracy (< 0,05%)
- Limited in maximal capacity



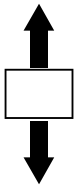
Double shear load cell (5 to 100 t serie 400) :

- + Easy installation: effort is distributed and centered
- + Integrated security
- + Mechanical reliability (double support)
- Accuracy (< 0.1%)



Compression load cell (15 to 300 t serie 700) :

- + Used for heavy loads (> 100 t)
- + Selfcentering column simplifies the design of supports.
- Very sensitive to misalignment of supports
- No security integrated in load cell



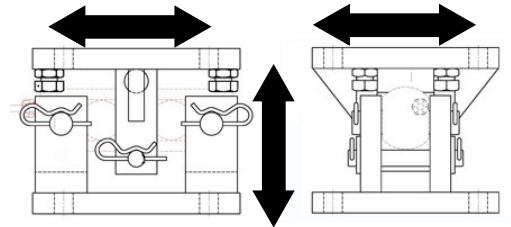
Tension load cell (0.1 to 5 t serie 600) :

- + Self-centering of forces
- + Good accuracy (< 0,1 %)
- Complicated implantation
- No security integrated in the load cell, anticipate the security in case of damage



➤ Load cell bracket

Each load cell is equipped with a bracket facilitating installation and ensuring the mechanical safety of the silo and load cell. Series 300 et 400 have jack screws to make a system secured during assembly or maintenance. Our brackets are calculated and tested to resist parasitic forces in the 3 plans (refer to the technical sheet of each bracket)

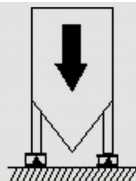
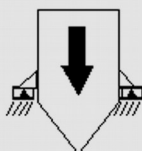
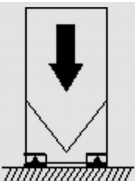


➤ Number of load cells and support points

Make sure that the silo / hopper rests only on stable and horizontal support points. For supports on a metal frame, this implies having a maximum bending of 2/1000. Ducts, sheats and all intermediate parts must be equipped with elastic bellows. Nevertheless, we can accept to leave fixed parts depending on the level of accuracy sought. Be careful to position the bellows in such a way that there are no products loading.

- Best accuracy (<0.5%) is obtained when the number of load cells is equal to the number of support points.
- In the case of a symmetrical tank containing liquid or very fluid products it is possible to equip only partially the support point with a load cells.

Ex : 4 support points and 2 load cells, the accuracy can't be better than +- 2 % and depends on the case.



Choice of the unit capacity of the load cell

1 / Calculator of TOTAL load (CT) in the silo :

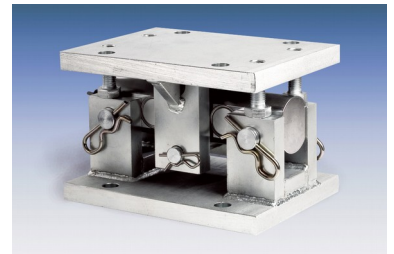
$$CT = \text{Empty weight (t)} + \text{max capacity (t)}$$

2 / Calculate load by support point (CP) :

$$CP = CT / \text{Number of support points (t)}$$

3 / Capacity of the load cell should be at **minimum** :

- Silo of 3 support points: **CPx1.5**, Another type of 4 to x support points (hyper static): **CPx1.7**



EXAMPLE :

FOR ONE SILO: 50 M3 D=1 IS 50 T NET, EMPTY WEIGHT: 10t, 4 SUPPORT POINTS

$$CT = 60 \text{ t} , CP = 15 \text{ t}$$

SO CHOOSE 4 LOAD CELLS OF MAX NOMINAL LOAD > 1,7 x 15 t

MAX LOAD CELL = 30 T

Accuracy

Weighing accuracy is the measurement error for a load, do not confuse with the display rung (multiple of 1.2,5). The accuracy depends on several factors:

- Error of load cell (< 0,01%).
- Calibration error (automatic calibration of the indicator 0.1% or with standard masses < 0.01%).
- Mechanical error (mechanical problem of the ducts, bridge, cone supports ...) can go up to 1 t in reality.

$$\text{Combined load cell error} : E = N \times E_{\text{capteur}}$$

With $E_{\text{capteur}} = \text{MAX load cell} / 10\ 000$

Numbers of load cells	1	2	3	4	6	8
N	1	1,4	1,7	2,0	2,5	2,8

EXAMPLE :

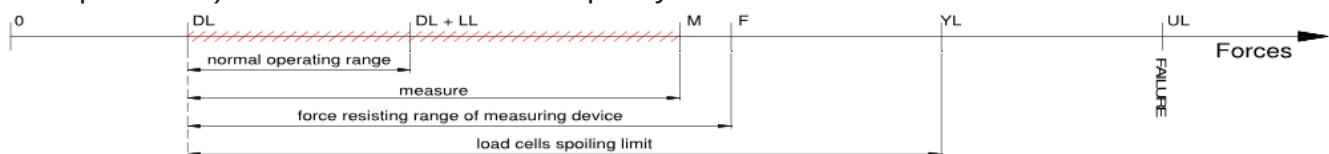
FOR 4 LOAD CELLS WITH MAX LOAD CELL = 20 000 kg

ERROR LOAD CELLS = 4 KG

This result is insignificant. In reality we oversize the MAX LOAD CELL to resist to disturbances (wind risk, seismic)

Environmental constraint

The designer of the silo must calculate the constraints : mechanical (inclined support), climatic (wind), seismic, vibrations (mixer)... after the calculation we can have a diagram (please watch the example below) to determine the max. capacity of the load cell:




DL : Normal operating range	LL : Measure	AL : Charge accidentelle	Elx, Ely, Elz : Seisme
WL : Wind	F : Force resisting range of measuring device	YL : Load cells spoiling limit	UL : Failure
M = DL+LL+AL	F= MAX(DL+or.LL;DL+LL+AL)	YL = MAX (Co max:F)	



➤ Anti-explosion protection ATEX IECEx

1 / All of our load cells are certified ATEX Zone 0-1-2 (GAS) and 20-21-22 (DUST).

Zone marking : **II 1 GD EEx ia T6 (-20°C < Ta < +40°C) ATEX** 



2 / Although it is up to the user to determine the type of zone, the commonly used zones for load cells are:

ZONE 1 for GAS and LIQUID

ZONE 21 / 22 for DUST.

Two types of protection are possible (ia , low energy) or Adf (explosion-proof).

When complete weighing system is demanded by client, we study the compatibility between the different modules (load cell, cable, junction box, indicator). We provide an indicative calculation note at the end of this study.

➤ Display and signal transmission

- The LOCAL display allows signal processing and conditioning as close as possible to the source. Moreover, the display is very practical for maintenance and diagnosis.

- Generally it is equipped with an analog output (4-20mA) or digital output (ETHERNET, PROFINET, PROFIBUS, MODBUS...).



Analog signal accuracy 4-20 mA

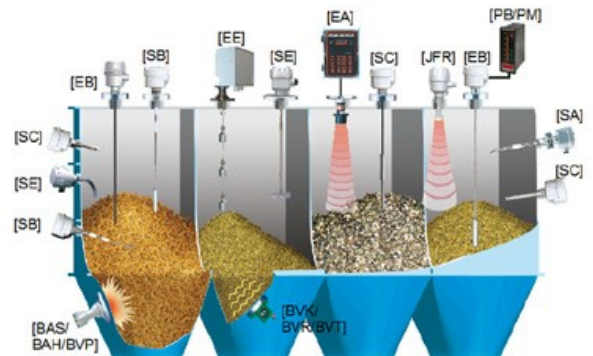
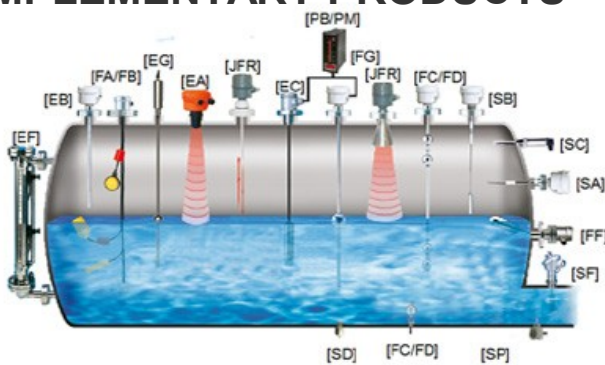
- Analog transmission involves a loss of signal quality. For this reason, we recommend that an additional error of +/- 0.1% be taken into account when using this technology.

➤ Calibration

- Our weighing transmitters and indicators are specially designed for the field of tank and silo weighing:

- Automatic calibration based on the characteristics of each load cell.
- Simplified zero and scale adjustment even when the silo is loaded!
- Load cell diagnostic functions
- Level alarms

COMPLEMENTARY PRODUCTS



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