General guideline for application of the H8C load cell in hospital beds

1 General

The sensing or spring element of the H8C is the main structural component of the load cell. The element is designed in such a way that it develops a strain, directly proportional to the load applied. The sensing element is made of high strength alloy steel (nickel plated for environmental protection). By bonding strain gages to the precisely machined element, the force applied can be identified in terms of resistance change. The four strain gages are connected into a Wheatstone bridge configuration in order to convert the very small change in resistance into a usable electrical signal. Passive components such as resistors and temperature depending wires are used to compensate and calibrate the bridge output signal.
Sensing elements which are subjected to beam load cell types are widely used, in many configurations, for commercial transducers. Shear beams, such as the H8C, offer high strain levels at relatively low forces, which makes them ideal for high accuracy load cells.

2 Design

The installation of load cells into a hospital bed application requires careful attention if the system is to be safe and accurate. The performance of a load cell depends primarily on its ability to deflect repeatedly under conditions when load is applied or removed. It is a misconception that a load cell can be considered as a solid piece of metal on which hospital beds can be supported. Furthermore, if more than one load cell is used then the deflection and output of each individual cell should be similar on each load point.
To satisfy the above requirements, load cells are mainly used in conjunction with special mounting systems rather than being mounted rigidly between application and foundation. Load cell supports should be designed to avoid the following effects to the load cell:

- Lateral forces
- Bending moments
- Torsion moments
- Off centre loading to the cell
- Vibration to the load cell

These effects not only compromise the performance of the load cell, but they can also lead to permanent damage.
Preferably the load cell should be mounted on a stiff base that will not deflect while the system is loaded. The load cell should be supported by a hardened plate with the following specifications:

- length 54.2 mm
- thickness 4 mm
- hardness 50 to 53 Rc
- surface roughness Ra 1.6 micron

Determination of the correct capacity of the load cell:
The factors that contribute to the load on the load cells are:

- Pre-load (the weight of the entire construction built on top of the load cells)
- Maximum scale capacity
- Shock loading
- Dynamic influences (reanimation, transportation)
- Off centre loading to the scale
- The possibility of an overload weight

To choose the best capacity of the load cell, calculate the maximum possible load divided by the number of load cells. Choose the closest higher capacity from the capacity range available. For that chosen capacity check the minimum interval (V_{min}) meets your requirements for accuracy. If V_{min} does not meet the requirements a lower capacity can be chosen but the possibility of overloading the individual load cell must be avoided.
Both static and dynamic overload can result in a change of zero balance.

- Avoid force shunts between the base and the bed as much as possible.
- Keep clearance around the bed and sufficient clearance between the base and bed.
- Avoid impact forces as much as possible.
- Locate the load cells as good as possible to the outer perimeter, so the centre of gravity will always be within the supporting load cells.
- Locate the load cells preferably there were the force-introduction is constant.
- Locate the load cells preferably there were side-forces will not occur during measurement.
- Mount the load cell with the correct (see datasheet) torque.
- Mount the load cells horizontal and in the same level.
- Take care that the bed is put in the horizontal position during measurement (to avoid side forces causing inaccurate measurements).

3 The installation

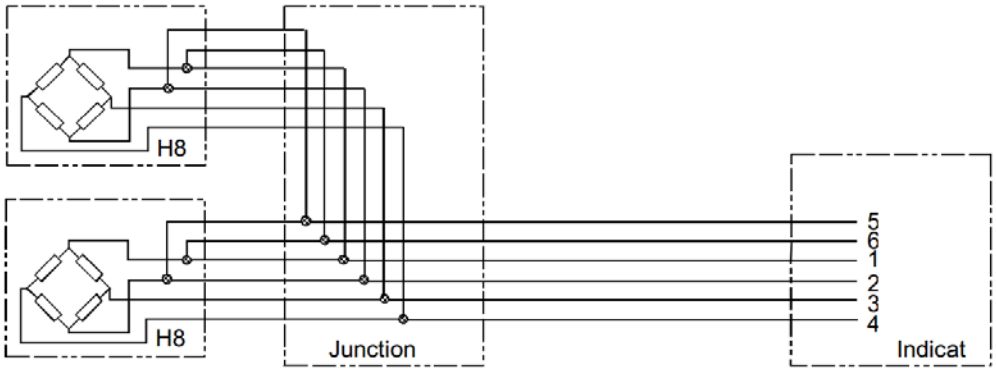
3.1 Mechanical

To prevent load cells from being damaged during installation, load cells should be handled with care, especially those with a low rated capacity.
Single ended beam load cells are subjected to a momentum and require high quality bolts for safe operation.
The amount of torque on these bolts is specified and should be met to achieve the maximum performance.
Special attention should be paid in preventing the load cell cable from being damaged during and after installation. Never carry load cells at their cables and provide dripping loops to prevent water from running directly into the cable entry.
Avoid electric welding after installation of the load cells. If welding is necessary and the load cells cannot be removed then disconnect each individual load cell cable from the junction box or measuring device. Place the earth clamp of the welding apparatus in the close proximity of the weld to avoid a current path through the load cells.

3.2 Electrical

The 6-wire cable is not part of the temperature compensating system of the load cell. The sense lines are connected to the sense terminals of the indicator, to feed back the actual voltage at the load cells. The indicator either adjusts its output voltage or adjusts its amplifier to compensate for any resistance change in the cable. The advantage of using this "active" system is the possibility to cut (or extend) the 6-wire load cell cable to any length. If a 4-wire connection is offered by the indicator the Sense + wire should best be connected to the Excitation + wire, consequently the Sense - wire to the Excitation – wire.

Load cells are always connected in parallel. Always review the load cells attached calibration certificate to see the correct wiring colours and to correctly connect the load cells to indicating device. A junction box is used to connect load cells in parallel.



Wiring Code:

Input(+)	Red
Sense(+)	Blue
Input (-)	Black
Sense(-)	Brown
Output(+)	Green
Output(-)	White

Depending on the application the junction box should be protected to at least IP54 (DIN.40.050), but for wash down purposes we strongly recommend a junction box protected to IP65. The degree of protection can only be achieved if the junction box is installed correctly:

- Select the right location based on the environmental conditions, NOT on the ease of installation.
- Preferably locate cable entries so that no water will come in the vicinity of cable glands.
- Put on the cover-screws according to the manufacturer's specifications.
- Place the cable-entries downwards and provide a dripping-loop in the cable.
- Avoid moisture during the installation, also ensure that no moisture enters the load cell cable before and during installation.
- Mount cable glands correctly to avoid water entering the junction box.

Moisture could decrease the insulation resistance of the circuit and might cause unstable readings. A bag with drying agent (silica gel) should be enclosed to absorb condensation. This bag should never make contact with any not-insulated wiring in the junction box.

4 Use

A load cell will perform within specifications until the safe load limit or safe side load limit is passed. Beyond this point, even for a very short period of time, the load cell will be permanently damaged. The load cell may physically break at the ultimate load limit.

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LOAD CELL SELECTION AND DESIGN

Do select the right load cell for the application in terms of type and environmental compatibility.
Do choose the right capacity.
Do consider all environmental aspects before making the final choice (whether they are always or occasionally present at the place(s) the load cells will operate).
Do provide for any additional environmental protection at the design stage.
Do design-in adequate over/under load protection as well as protection from other mechanical damage (e.g. physical abuse, rodent problems).

Don't make the choice based only on price - cost of ownership is more important.
Don't allow load cells to operate above their rated capacity.
Don't over specify - look at overall system limitations on accuracy (e.g. shock, vibration etc.).
Don't ignore accidental overloads once every 2 or 3 years.
Don't build-in water / debris traps.
Don't assume "it" will never happen and never use the load cell as a mechanical fuse.
Don't forget to provide adequate protection for the load cell cable, near the load cell if possible.

INSTALLATION AND FITTING

Do use dummy load cells prior to installation.
Do store and handle load cells carefully prior to and during installation, and try to keep copies of the Certificate of Calibration in a safe place. Check load cells before fitting for correct model, capacity, thread combination, etc.
Do check that any threaded fittings screw smoothly into the load cell before final assembly.
Do use high quality bolts with the recommended torque.
Do check that adequate and accurately fitted mounting surfaces are provided.
Do use care when tightening mounting bolts.
Do use lock nuts appropriate on threaded fittings, especially if vibration is present.
Do check cable colour code for load cell prior to connection.
Do use good quality connecting terminals / Junction Boxes.

Don't carry out electric welding near load cells if possible.
Don't forget to check specific storage and operating temperature ranges for the load cells.
Don't ever carry load cells by their cables !
Don't force bolts or other threaded assemblies.
Don't use mounting bolts to pull uneven surfaces together - use shims as appropriate.
Don't use excessive force when fitting / tightening mounting bolts or hardware, especially on low capacity cells.
Don't cut load cell cables unless necessary, performance may be effected.
Don't allow moisture to get at any interconnections.
Don't allow load cell to be the electrical link between ground and metal weigh structure.

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MAINTENANCE

Do regularly inspect load cells and weigh system especially after extreme conditions (hosing down, heavy shocks, etc.).
Do check for corrosion damage to the load cell and mounting hardware. If practical, carry out cleaning and any remedial work (paint or other protective coating) before it is too late.
Do give special care and attention to critical areas of the load cell such as metal bellows, seals etc. Those features are important in the operation and performance of the product.

Don't allow build-up of dirt, debris tec. around load cell or mounts. Don't allow any drains to become blocked with leaves or other debris.
Don't disconnect and just re-calibrate one or more load cells in a system if they cease to function. Mechanical failure may have catastrophic effects.

FINALLY

Do remove load cell with care and attach a label with comments relating to the problem or mode of failure.
Do return a copy of the Certificate of Calibration with the load cell if available.

Don't cut cable at the gland to facilitate removal - please - we cannot test load cells without cables!