About load cells

Load cells are transducers that measure mechanical force and output a linear change in voltage proportional to that force. Load cells are rated in units of weight (grams, kilograms or tonnes).

A load cell will measure from zero to the stated capacity. The accuracy of the load cell is generally stated as a percentage of the overall capacity. For example, if a 100kg load cell has an overall accuracy of ±0.03%, then that load cell will measure weight from zero to 100kg to a worst case accuracy of ±30 grams. This applies whether it is weighing a load of 5kg or 95kg.

A load cell data sheet will provide other important information about the load cell:

Capacity

The overall capacity of the load cell.

Overload

The maximum percentage of full load that the load cell can handle before damage occurs.

Accuracy

This may be expressed in terms of linearity, hysteresis, repeatability and creep. These figures are all expressed as a percentage of the overall capacity of the load cell.

Sensitivity

The sensitivity of the load cell determines the actual voltage output you will get when you place the full load on the load cell. These figures are all expressed in mV/V.

Thermal Sensitivity

This tells you how much the output will change with change in temperature. It is usually expressed in percent of full load/°C.

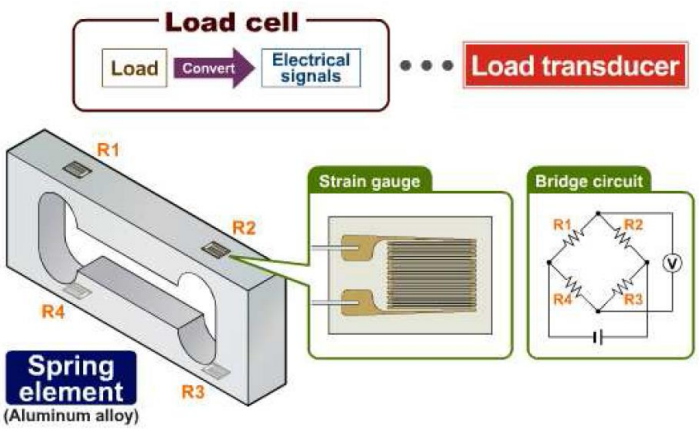
Strain gauges and load cells

Load cells are blocks of metal that have been machined in such a way that specific areas are put under high strain when weight is applied to them. These areas have strain gauges attached to them with a high strength adhesive. The materials used to manufacture load cells are Aluminium, Steel Alloy, and Stainless steel.

Strain gauges themselves consist of thin foil elements that are glued to the load cell body. Strain gauges are cunningly shaped so that even very small movements or "stretching" of the gauge results in comparatively large changes in resistance.

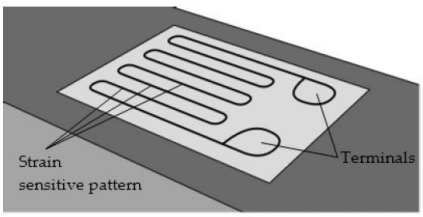
The relationship between strain and change in resistance is almost perfectly linear. Accuracies between ±0.01% and ±0.02% are not uncommon for a high accuracy load cell.

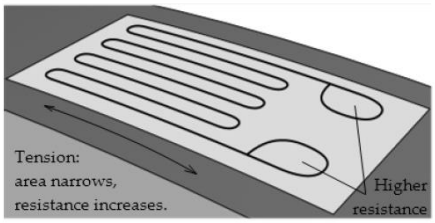
***Load cell capacities can range from a few grams to hundreds of tonnes**.*

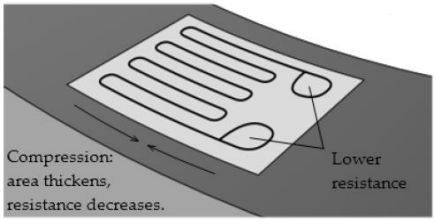


Wheatstone Bridge circuit

The strain gages, usually four or a multiple of four, are connected into a Wheatstone bridge configuration in order to convert the very small change in resistance into a usable electrical signal.
Load cells usually have 4 or 6 wires coming out of them. Two of these wires are to power the load cell. This is called "excitation". Two of the other wires return a signal to the weight indicator. These are called "signal" wires. If the load cell has a 6-wire connection, the extra 2 wires are called "sense" wires. These are used by the weight indicator to compensate for voltage drop in the excitation over long distances. The sense wires are connected to the same point as the excitation wires.



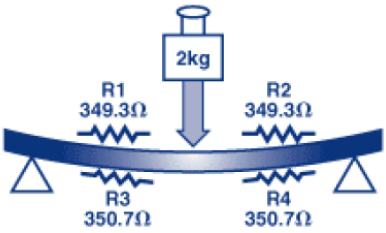


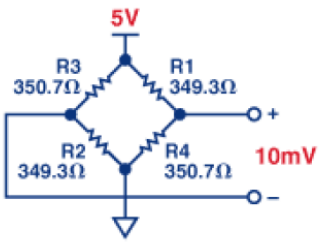


If the gages within a load cell are connected in a balanced Wheatstone Bridge circuit, and are excited by a source of AC or DC voltage, the transducer will produce an electrical output which is a direct linear function of the excitation voltage.

Load cells usually have an excitation voltage of between 3 and 15 Volts DC. The signal output of the load cell depends on the load cell itself, but it is usually in the range of 0 to 50 mV.

The signal output of the load cells is expressed in milli-Volts per Volt (mV/V). What this means is that for every Volt of excitation applied to the load cell, it will output so many milli-Volts at full scale. This value is called the load cell's ***sensitivity****. Typical sensitivity ranges are from 1mV/V to 3 mV/V.*





In this example:

· *A load cell has a capacity of 2kg and a sensitivity of 2mV/V.*
· *The weight indicator has an excitation voltage of 5Vdc.*
· *The output signal when a 2 kg weight is applied on the load cell is 10mV.*

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