# Electrical Resistance Type Load Cells

## Applications

**The Model 3000 Electrical Resistance Strain Gage Type Load Cells are used for…**

- **Monitoring loads in tie-backs and rock bolts in the walls of excavations**
- **Monitoring loads in steel arch tunnel supports**
- **Monitoring loads in cross lot struts**
- **Measurement of loads during pile testing**

*Closeup of cable insertion showing Kellems® wire mesh grip.*

*Model GK-502 Readout for use with the Model 3000 Series Load Cells.*

*Model 3000 Series Load Cells.*

## Operating Principle

The Model 3000 Load Cell is designed primarily for use on tiebacks and rockbolts. They may also be used during pile load tests and for monitoring loads in crosslot struts and tunnel supports, etc.

In most situations, the Model 3000 is used in conjunction with bearing plates, positioned on either side of the load cell.

Where load cells are used to check the load as determined by the hydraulic pressure applied to the jack, during proof-testing on tiebacks, rockbolts, etc., the user should be aware that, due to the annular design and the many variables in load distribution, the agreement cannot be guaranteed better than ±15%.

In use, load cells are positioned so that the tensile load in the tieback or rockbolt produces a compressive load in the load cell. This is done by trapping the load cell between bearing plates positioned between the jack and the structure, either below the anchor plate for permanent installations or above the anchor plate for proof-testing.

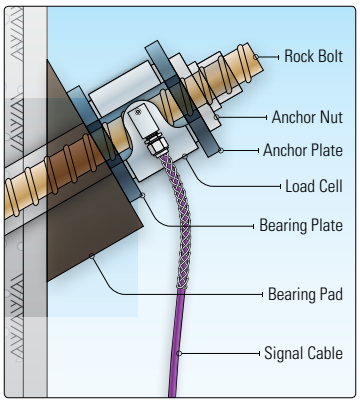
## Advantages and Limitations

The Model 3000 Load Cell is made from an annulus of high strength steel or aluminum. Electrical resistance strain gages are cemented around the outside of the annulus and connected in a Wheatstone Bridge circuit so that there is a single mV/V output. Remote sensing techniques are used to minimize cable effects. Solid load cells are also available.

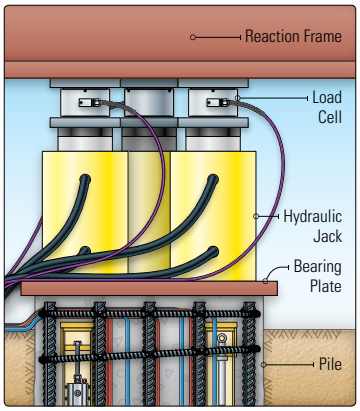
An outer shell protects the gages from damage and 'O'-rings on either side of the gages ensure that the load cell is fully waterproof.

The cable is attached to the cell through a waterproof gland. A strain relief, in the form of a Kellem's grip, prevents the cable from being pulled out of the cell. Cables have thick PVC jackets and can be terminated in a 10 pin connector to mate with the GK-502 Readout.

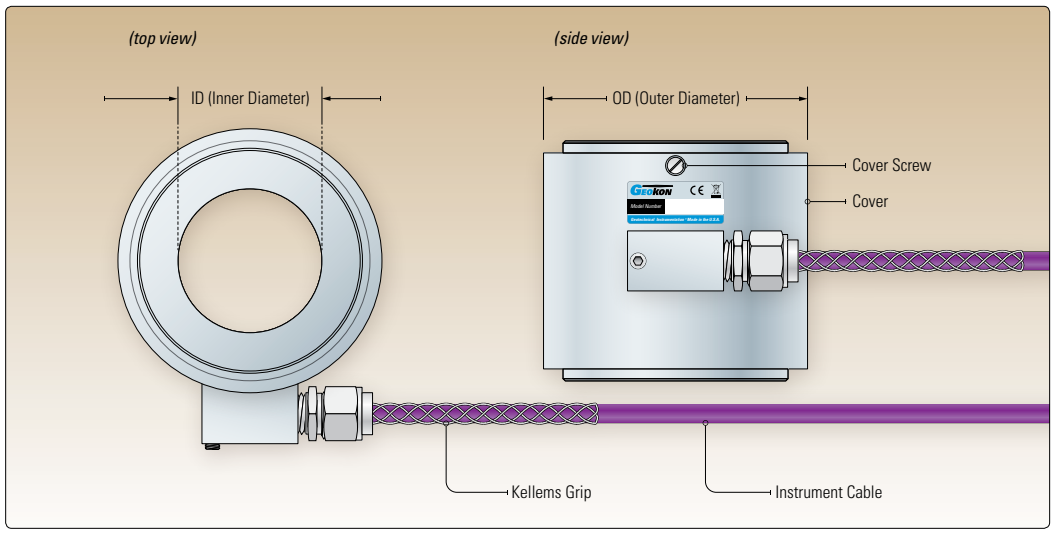
The calibration of annular shaped load cells is very dependent on the end loading conditions, i.e. on the flatness and thickness of the bearing surfaces and on any mismatch in size between the load cell and the hydraulic ram which could cause bearing plates to bend. Calibration variations of as much as 15% have been observed. For best accuracy, calibrations should be performed while duplicating or simulating actual field conditions.




● *Load cell used to monitor performance of tie-back in excavation.*




● *Load cells used in pile test.*




● *Model 3000 Series Load Cell components.*

## System Components

Signals from the load cell are transmitted to the readout location by means of a multi-conductor shielded cable, which may be armored for extra protection. Kellems grips prevent the cable from being pulled from the load cell. Larger size load cells are supplied with lifting lugs.

To minimize eccentric and uneven loading, the use of the thick machined-flat bearing plates and centralizer bushings (where necessary) are recommended.

Bearing plates should be machined flat and large enough to totally cover the load bearing surface of the load cell. The thickness is related to the load cell/hydraulic jack size mismatch: the greater the size disparity the thicker the bearing plate. Typical thickness ranges from 25 to 75 mm.

If the size of the tie-back or rock bolt is more than 20 mm smaller than the internal diameter of the load cell, then centralizer bushings are recommended.

Readout of the Model 3000 Load Cells is achieved using the Model GK-502 Readout or with the Micro-800/1000 Dataloggers.

## Technical Specifications

| | |
|---|---|
| Rated Capacities[1] | 100 to 10,000 kN |
| Over Range[2] | 150% F.S. |
| Resolution | 0.025% F.S. |
| Accuracy[3] | ±0.5% F.S. |
| Output | 1.5 to 2.5 mV/V @ F.S. |
| Temperature Range[4] | –20°C to +80°C |
| Cables | Multi-conductor shielded pairs with PVC outer jacket |
| Internal Diameters[1] | solid, 25, 50, 75, 100, 125, 150, 200, 250 mm |

*[1]Other capacities and diameters available on request. Calibrations that exceed Geokon's NIST traceable capacity of approximately 10,675 kN are subcontracted to an accredited testing laboratory.*
*[2]With no calibration shift.*
*[3]Established under laboratory conditions. System accuracy depends on end loading conditions.*
*[4]Other ranges available on request.*

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