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Notes on the use of product

For safe and efficient use of the product, please read carefully the following instructions before starting any operation.

Any use of the product other than the one described in this manual shall be considered the user’s full responsibility. The same applies for any unauthorized modifications. In addition to the hereby listed standards, the user must comply with the provisions of the current legislation regarding personal safety and health together with all other persons in the workplace.

SISGE is not responsible for any accident, breakdown or other problems due to lack of knowledge and/or non-compliance with the requirements contained in this manual. Check that the product has not been damaged during the transport. Verify that the package includes all items as well as any requested optional accessories; if anything is missing, please promptly contact SISGE.

The user must strictly follow all the operations described in this manual. Maintenance or repair of the device is permitted only by authorized operators. These operators must be physically and intellectually suitable.

For information about instrument or to order spare parts, always specify the product information which can be found on the identification label. When replacing parts, always use ORIGINAL SPARE PARTS.

The manufacturer reserves the right to make either technical and/or commercial changes without prior notice.

It is our policy to keep manuals continuously updated.

Symbols

Pay particular attention to the following instruction.

Identification

Instruments can be identified

- From a production lot number (written on the Compliance Certificate)
- From a serial number (s/n) engraved indelibly on the instrument
- From a label on the instrument
- From a label on the cable
Introduction

Anchor load cells are used in tiebacks and rock bolts, in tunnels and retaining walls. Sisgeo offers a wide range of models, and the central hole with different dimensions can satisfy most needs. If necessary they can be used to measure the loads on piles heads both during load tests and work. Another application is for measuring of the load passed from the decks on the pier cap.

SISGEO manufactures 3 kinds of anchor load cells:
- electric;
- hydraulic;
- electric-hydraulic.

Description

Electric Anchor Load Cells

Electric anchor load cells consists of:
1. a solid stainless steel body with toroidal shape, with extensometers connected in Wheatstone bridge. Sensors number changes according to the model and in this way the instrument is not very sensitive to eccentric loads;
2. an electric cable to connect the instrument to the readout;
3. (optional) a steel load distribution plate allows an uniform load distribution on the whole body of the cell.

Under load, the load cell endured a deformation read from the extensometers.

The output signal is proportional to the applied load; is ratiometric (mV/V) and proportional to supply voltage.

The cable has 6 conductors, 2 of them (sensing) are used to compensate the voltage drop due to cable length.

On request is possible to have the cells with 4-20mA current loop output.
HYDRAULIC AND ELECTRIC-HYDRAULIC ANCHOR LOAD CELLS

Hydraulic and electric-hydraulic anchor load cells consist of:
1. A solid stainless steel toroidal body, with an internal suitable pressure chamber filled with de-aired oil;
2. a manometer to read the load directly in kN, or
3. an electric pressure transducer with 4-20mA output+electric cable for the connection to readout;
4. (optional) a steel load distribution plate allows an uniform load distribution on the whole body of the cell.

The load applied on the cell deforms the pressure chamber volume bringing pressure to the oil.
The pressure is measured from the manometer or the electric transducer.

PRELIMINARY CHECKS

Before the installation we recommend to take a control reading with a readout, for the electric models, or from the manometer, for the hydraulic model.

For the electric models, the difference between the value read and the one on the Calibration Certificate supplied with the instrument must not be higher than 1% of full scale.
For the models with manometer, the needle must point zero.

The anchor load cells are finished products so is not required to have special tools for the installation, apart from those needed for the tiebacks or the rockbolt.
The toroidal anchor load cells have to be installed carefully.
Please take special care for the surfaces in contact with the cell, that have to be flat and underformable: only in this way the load will be transferred correctly to the cell.
If the contact surface with the lower part of the cell is not flat enough, and does not guarantees enough rigidity of the system, it is possible to lay the cell on an additional steel plate (not supplied).
This plate must have the same thickness of the distribution plate and a diameter higher than the cell of at least of 20mm.
SISGEO supplies, upon request, a load distribution plate, with 30mm thickness, to be put between the cell and the anchor head.
The electric anchor load cells works for “flesion” (see next picture).
For this reason we recommend to install them correctly to avoid irreparable breakings.

The special construction, both of the electric and the hydraulic cells, makes them little sensitive to eccentric loads.
If necessary, and only for the hydraulic and electric-hydraulic cells, the distribution plate can be used in contact with the lower cell’s surface.
Before the load cell’s installation, that has to be carried out along the tieback tensioning, be sure that:

- the contact surface around the hole prepared for the tie-rod is regular and smooth, removing the bigger roughness;
- if necessary, spread a light layer (1-2cm) of cement to guarantee the surface flatness and wait until it reaches a suitable maturation;
- lay the load cell with the distribution plate (if available) on the prepared surface;
- take a control reading of the load cell, directly on the manometer or with the readout;
- begin the stretching of the tieback and at the same time read the instrument;
- check if the cell position has to be changed in order to guarantee the perfect flatness and load distribution;
- proceed with the stretching up to the expected project value is reached.
Scheme and installation example:

Please note:
- during the wedging you can have a decrease in the maximum value reached of about 5%;
- at the end of stretching, during the first days of work, you can have a settlement of the whole system and a decrease in the load value;
- if necessary, protect the cable from mechanical damages and to avoid water and humidity seepages, protect the final part;
- avoid moving or carrying the cells holding them by the cable, the manometer or the pressure transducer.

We point out once more that, for the cell correct functioning, you must install it between two steel plates more rigid than the cell. Moreover you must avoid plates with central holes much smaller than the cell to avoid the bending of the cell under load. At the same time the support plate must not be thinner than the cell, and if it is assembled cantilevered on tubes, shall guarantee the suitable rigidity of the system. So, the load cell must be the most deformable element of the set head/tieback.
The cells supplied with manometer can be read directly and immediately.
Manual readings are taken connecting the conductors to a datalogger according to the following scheme:

<table>
<thead>
<tr>
<th>4-20 mA current loop</th>
<th>Red</th>
<th>+ Loop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td></td>
<td>- Loop</td>
</tr>
<tr>
<td>Shield</td>
<td></td>
<td>Shield</td>
</tr>
<tr>
<td>Ratiometric signal mV/V</td>
<td>Red</td>
<td>+ Vcc</td>
</tr>
<tr>
<td>Black</td>
<td></td>
<td>GND</td>
</tr>
<tr>
<td>Blue</td>
<td></td>
<td>+ Sensing</td>
</tr>
<tr>
<td>Green</td>
<td></td>
<td>- Sensing</td>
</tr>
<tr>
<td>Yellow</td>
<td></td>
<td>+ Out</td>
</tr>
<tr>
<td>White</td>
<td></td>
<td>- Out</td>
</tr>
<tr>
<td>Shield</td>
<td></td>
<td>Shield</td>
</tr>
</tbody>
</table>

To obtain reliable measurements, with mA instruments, we recommend a warm up time not less than 5-10 seconds.
For automatic measurements, connect the instrument to a datalogger.

For the hydraulic load cell the values are not required to be processed because the reading is direct on the manometer.
For the electric load cells, the following formulas allow to convert the electrical measures into engineering values:

Linear factor: \( L_{\text{eng}} = \frac{L_{\text{ele}}}{S} \) \text{[kN]}

Polynomial factors: \( L_{\text{eng}} = (L_{\text{ele}}^2 \times A) + (L_{\text{ele}} \times B) + C \) \text{[kN]}

\( L_{\text{eng}} \) = engineering reading  
\( L_{\text{ele}} \) = electric reading  
\( S \) = sensitivity factor  
\( A, B, C \) = polynomial conversion factors

\( S, A, B, C \) factors are stated on Calibration Report  
The excercise readings refer to the initial reading (zero reading).

\[ \Delta kN = L_i - L_0 \]

\( L_0 \) = Zero reading (kN)  
\( L_i \) = Excercise reading (kN)

Zero reading shall be taken carefully once the installation is ended and the instrument is in operating conditions.
**AN chor Load Cells**

**Troubleshooting**

**Cells with 4-20 mA current loop signal**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unstable measure</td>
<td>Wiring not connect</td>
<td>Make proper wiring</td>
</tr>
<tr>
<td>0mA measure</td>
<td>Wiring not connect</td>
<td>Make proper wiring</td>
</tr>
<tr>
<td></td>
<td>Lack of power</td>
<td>Check readout powering</td>
</tr>
<tr>
<td>Overrange measure</td>
<td>Wiring not connect</td>
<td>Make proper wiring</td>
</tr>
<tr>
<td></td>
<td>Cable cut or damaged</td>
<td>Repair the cable. Cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>splicing kit available at Sisgeo.</td>
</tr>
</tbody>
</table>

**Cells with mV/V ratiometric signal**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unstable measure</td>
<td>Wiring not connect. Measure the resistance between Red&amp;Black, Blue&amp;Green, Yellow&amp;White conductors: it must be approximately 14000Ω. Consider cable length. The single conductor resistance for 0WE106000000, is ca. 84Ω/km</td>
<td>Make proper wiring</td>
</tr>
<tr>
<td>0 measure</td>
<td>Cable cut or damaged.</td>
<td>Make proper wiring</td>
</tr>
<tr>
<td>Overrange measure</td>
<td>Cable cut or damaged.</td>
<td>Repair the cable. Cable splicing kit available at Sisgeo.</td>
</tr>
</tbody>
</table>

Example

Full scale load cell: 750kN (readings mV/V)

\[ S = 0.002 \text{mV/V/kN} \]

\[ A = 5.987 \times 10^{-01} ; \quad B = 4.994 \times 10^{+02} , \quad C = 2.177 \times 10^{+00} \]

\[ L_1 = -0.005 \text{mV/V} ; \quad L_2 = 0.895 \text{mV/V} \]

Using:

Linear factor: \((L_2 - L_1)/S : (0.0895 -(-0.005))/0.002 = 450 \text{kN} \)

Polynomial factor: \((L_2^2 x A)+(L_2 x B)+C - (L_1^2 x A)+(L_1 x B)+C) = 449.62-(0.32) = 449.94 \text{kN} \)

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MAINTENANCE

After-sales assistance for calibrations, maintenance and repairs, is performed by SISGEO's service department.

The authorization for shipment shall be activated by RMA “Return Manufacturer Authorization.” Create your account and then fill in the RMA module clicking on:

http://www.sisgeo.com/repairs.html

Send back the instrument/equipment with the complete accessories, using suitable packaging, or, even better, the original ones.

The shipping costs shall be covered by the sender.

Please return to the following address with correct delivery documentation:

SISGEO S.r.l.
Via F. Serpero, 4/F1
20060 MASATE (MI)

On the delivery document it is mandatory to indicate the RMA code received.

Technical assistance e-mail: assistance@sisgeo.com