



Vibrating wire strain gauges



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Vibrating wire strain gauges



WARNINGS



This instrument must be utilized only for the application it has been designed for, OTR declines all responsibility for any improper use;



Do not use the instrument in water where an electric dissipation is in progress;



Don't overload the cell



Do not put the instrument in flammable liquids or potentially explosive gases; Don't shear stress the pressure cell;



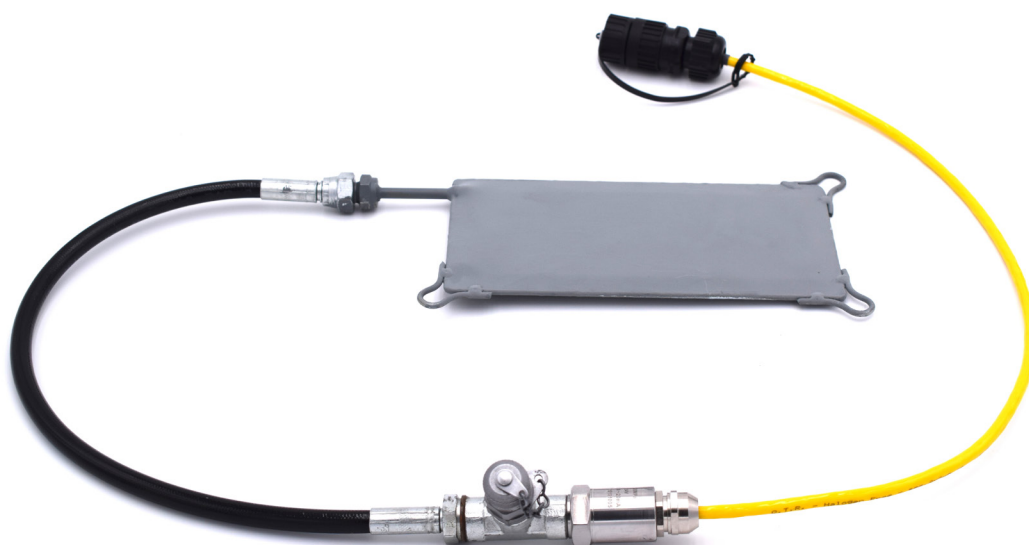
Use protective gloves;
Do not bend the chord, do not push or pull bu hands;
Use iron wire for Embedment Type fixing.

Furthermore

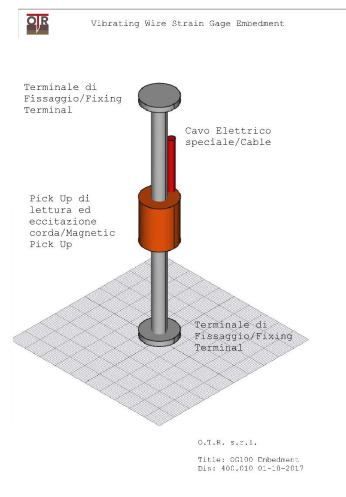
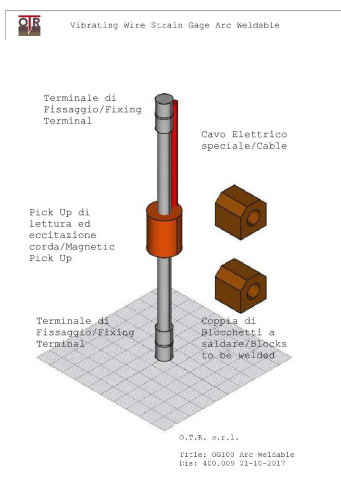
- Do not open the instrument, contact the manufacturer for checks and repairs;
- Keep out of reach of children;
- Do not connect the instrument to the readout unit with wet hands;
- Clean the instrument and its cable with alcohol or water, do not use acetone or aggressive liquids for plastics or labels;
- Use surge arresters for installations with cables larger than 30 meters if necessary;
- During the installation phase, disconnect the instrument from measuring devices or from any device connected to the AC power supply;
- Do not weld the arc weldable type blocks with the real chord installed;

Applications

Vibrating wire strain gauges are used to assess strains in concrete or steel structural elements. The instrument consists of a steel wire which is tensioned between two end blocks. The end blocks are anchored to the structure to be monitored, and the wire is excited by an electromagnet. A deformation in the structure will cause the two blocks to move, thus altering the tension in the steel wire. Said change in the wire tension causes a variation in the vibration frequency of the wire, which will be measured by a dedicated readout unit.



Description



Vibrating wire strain gauges consist of a stainless steel tubular housing with two anchoring end blocks. Inside the tube is a steel wire which is excited by an electromagnet fitted inside a resin housing anchored to the center of the tube.

The following types of strain gauges are available:

- **Embedment strain gauge** It is designed to be installed directly into the concrete mix. It features two flanges at the ends, and its pretensioned in the range of ± 1500 .
- **Weldable strain gauge** It is designed to be installed on anchoring blocks which are welded or glued to the rebar or to the surface. In this case, the wire tensioning is carried out during the installation of the gauge on the anchoring blocks.
- **Spot Weldable strain gauge** It is designed to be installed on steel pipes with apposite spot welder

Identification

Strian gauges are sold with:

- Batch calibration;
- Model Identification;
- Full scale indication;
- Nominal Gage Factor;

Technical Features

Full scale	$\pm 1500 \mu\text{Strain}$
Model	Embedment/Arc Weldable/Spot Weldable
Output	Vibratine Wire
Thermistor	Embedded
Gauge Factor Embedment Type	3.304
Gauge Factor Arc Weldable Type	4.062
Gauge Factor Spot WeldableType	0.390



Installation

Vibrating wire strain gauges are usually installed in concrete in two ways

- Installation by embedment of the vibrating wire embedment strain gauge directly in the concrete mix
- Installation by means of welding the weldable vibrating wire strain gauge



Embedment strain gauge Installation

Vibrating wire embedment strain gauges are installed directly in the concrete mix, and care has to be taken to avoid applying large forces to the end blocks during installation. The instrument can be installed by tying it to a rebar (Fig. 4) with soft iron wire (without tensioning the wire excessively). It is also possible to cast the strain gauge directly in the concrete mix. Care has to be taken to make sure that the orientation of the instrument will be unaffected by concrete placement.

Here follows the procedure for suspending the strain gauge between rebars:

- If necessary, wrap a layer of self-vulcanizing rubber tape around the strain gauge at a distance of about 3 cm from the electromagnet, in the two places shown in figure 4 (around the tie points). The rubber tape layer serves as a shock absorber, reducing any vibration of the suspension system. Make two loops in the wire, one on either side of the strain gauge, at a distance of about 3 cm from the body of the gauge;
- Position the gauge between the rebars and twist the wire ends twice around the rebar, then around itself;
- Tighten the wire and adjust the position of the gauge by twisting the two loops;
- Tie the instrument cable to one of the rebars using a nylon tie.

Vibrating wire embedment strain gauges have to be assembled with their electromagnet, so the following preliminary check has to be performed before casting the concrete:

- Connect the cable terminal to the Geotester 2 readout unit;
- Set the Geotester 2 readout unit to reading mode;
- Read the measurement displayed. The value must be between 800 and 1000 Hz;
- Applying light pressure to the ends of the strain gauge should make the displayed value decrease;
- Check the temperature measurement making sure it is correct.



Weldable strain gauge Installation

Weldable vibrating wire strain gauges are connected to two mounting blocks which have to be welded to the structure of the surface to be monitored. A spacer bar (which has to be purchased from by the manufacturer) is used to place the two blocks at the correct distance.

Fit the two mounting blocks over the ends of the spacer bar and tighten the screws. The mounting blocks are supplied in pairs.

- Clean the steel surface where the instrument will be installed using a wire brush to remove irregularities, rust, dirt and grease;
- Holding the spacer bar, place the mounting blocks firmly against the steel surface. The edges of the blocks can now be welded;
- Avoid excessive heat and do not weld the flat end surfaces, as this will prevent the removal of the spacer bar;
- After welding, let the blocks cool down, then loosen the set screws and slide out the spacer bar;
- Clean away any welding slag using a chisel and a wire brush;
- Once the mounting blocks are welded in place, install the strain gauge with the electromagnet, loosening the two screws of the mounting block and inserting the end of the gauge in the hole of the mounting block;
- Insert the end of the strain gauge in the hole of the mounting block and use only one set screw with a conical tip;
- Once the strain gauge has been inserted, tighten the set screws of both mounting blocks;
- Connect the instrument to the readout unit. Turn on the readout unit and set the display to Hz;
- Once the desired reading has been obtained, secure the mounting blocks by tightening the two set screws. The readings might change slightly during this operation.

Special care has to be taken when laying electrical cables. These have to be protected from any type of damage on site (as might happen with cables which are left loose during installation).

It is advised to protect cables by means of sheaths or fairleads to be installed in sheltered areas.

Electrical cables can be extended by means of joints, without affecting the readings. The joint has to be waterproof, and it is necessary to observe polarity, paying attention to the colors of the wires.



Readouts

Readings can be taken by means of manual or automatic readout systems. The Geotester 2 readout unit displays a frequency value, and at the same time it measures the temperature expressed in °C. For indications on how to use a given readout unit, please refer to its instruction manual



Installations exemples

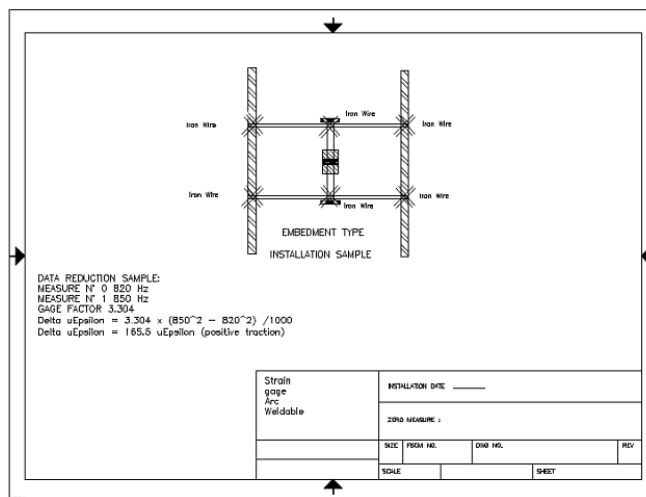


Fig.4 - Estensimetro da annegare (Embedment type) – Schema installazione

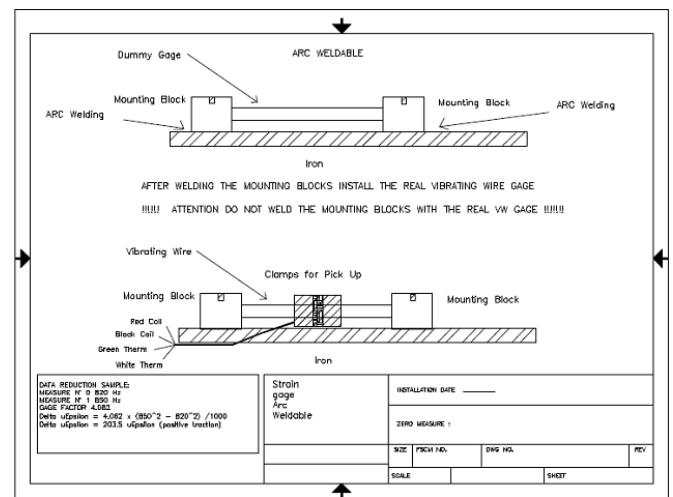


Fig.5 - Estensimetro da saldare (Weldable type) – Schema installazione

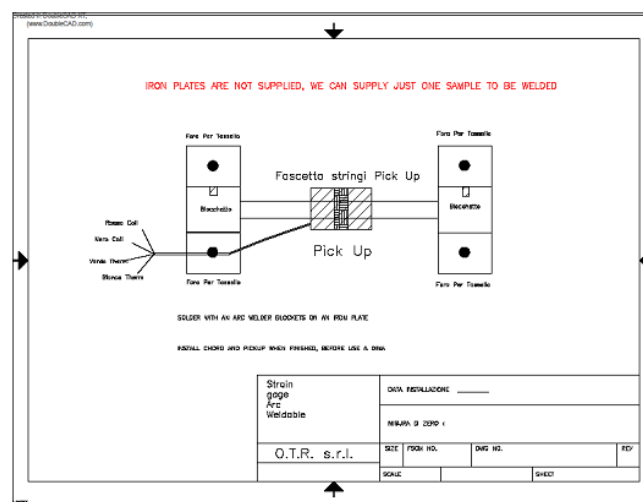


Figura 3 Vista dall'alto, Esempio montaggio superficiale