

Standard Inclinometer Casing User Manual



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Section 1 : Forward

This instruction manual, describes the technique required for the installation of riveted inclinometer casing tube.

Use of the inclinometer probe and readout unit, and also data reduction and analysis are discussed in separate manuals.

It is important that the materials and equipment covered by this manual should be installed by competent and suitably qualified personnel. They must READ AND UNDERSTAND the procedures outlined in this manual before attempting installation of the equipment on site.

Soil Instruments will not accept for repair under guarantee, instruments/materials neglected or mishandled in any way.

The techniques described are intended to serve as a general guide and may vary to suit particular site conditions.

Section 2 : Introduction

The inclinometer casing tube is installed in either a vertical or inclined borehole and normally grouted into place (see page 6).

An inclinometer probe reads the deflection of the casing. This consists of two sprung pairs of wheels in the inclinometer probe body, which in conjunction with internal keyways in the casing tube; ensure constant orientation of the probe, relative to the measuring direction throughout the installation length. The profile of the installed casing, which is assumed to be moving with the borehole into which it is grouted is obtained by interpretation of the observed slope values from the base/ref datum. Changes in consecutive casing tube profiles will indicate the direction and magnitude of m.

1.1 Inclinometer Casing Tube

The casing tube is made from ABS (Acrylonitrile Butadiene Styrene). It has four orthogonal opposed keyways, a maximum outside diameter of 70mm and supplied in 3m lengths. Joints between lengths are either made using 380mm long telescoping couplings or standard 160mm couplings of the same respective material with a maximum outside diameter of 77mm. The internal diameter of the casing is nominally 60mm.

The couplings are connected to the casing tube using 12mm long alloy rivets. (See fig.1)

By leaving a gap between each casing tube within the telescopic coupling, lateral movements can be accommodated if required.

Section 3 : Preparation

Preparation of materials can reduce both time and effort during installation time and reduce the possibility of errors in calculation of lengths.

An installation schedule sheet should be prepared to enable casing lengths to be marked off during installation and allow an installation record to be recorded during installation.

On receipt of the inclinometer casing tube, it should be stored on a flat surface to prevent distortion.

Check with the engineer the exact location of the casing tubes and boreholes as well as the alignment of the keyways of the casing within the boreholes.

Please Note – Telescoping Couplings Only

If IPI (In-Place Inclinometer) sensors are to be installed in casing fitted with telescoping couplings (a practice Soil Instruments do not recommend), then the groves of the casing either side of the coupling *must* be 'chamfered' with a round file or similar prior to the installation of the casing/telescoping coupling joint. Failure to do so may result in the IPI wheel assemblies 'locking' at the notch between the un-chamfered casing/telescoping coupling joint and thus rendering the sensors non-retrievable. It is also recommended that even if a traversing probe (e.g. Soil Instruments Digital Bluetooth Inclinometer System) is to be used with telescoping couplings that this procedure is carried out to remove any risk of the wheels leaving the casing groves at the coupling point.

Section 4 : Installation of Inclinometer

Select the required number of casing tubes and couplings to suit the installation.

Each casing tube is then pre-fitted with a coupling; this will simplify the installation when the casing tubes are joined together.

- (a) **It is crucial to ensure one set of grooves is in-line with the expected direction of movement.** Misaligned casing is the main reason for engineers rejecting Inclinometer installations. The alignment of the grooves should be maintained during the installation of the casing, failure to do this could result in spiralling. Do not rotate the casing after installation, as this will induce spiral. Should the casing be installed with incorrectly aligned grooves, this can be corrected on some Inclinometer Processing Software packages by inputting skew angles determined from a spiral probe. Should spiralling be suspected Soil Instruments are able to carry out a spiral survey of the installation
- (b) Mark one end of each casing tube with a mark corresponding to the length of an inserted coupling.
- (c) Run a bead of sealing mastic around the outside of the casing tube, approximately halfway between the end and the mark.
- (d) Push the coupling over the casing tube down to the mark. Drill through the casing tube either through the drill hole (standard coupling) or at the desired point in the slot in the coupling (telescoping coupling – see Fig. 1) and rivet using two large headed rivets. Run a bead of sealing mastic around the shoulder formed by the casing tube and coupling and (if using telescoping couplings) infill the two slots and rivet heads with mastic. Wrap sealing tape (DENSO TAPE or similar) tightly with half width overlap for approximately 75mm over the coupling end and over the slots and rivets.
- (e) Pass each pre-assembled length of casing tube and coupling into the borehole and use Stilsons or similar to prevent the casing from becoming 'lost' down the hole. The next length is then joined together in the same manner as described above (c), with each casing tube being fully positioned into the preceding coupling before riveting.. Continue until the casing is to the required depth
- (f) If telescoping couplings are used, these are fitted in exactly the same way as normal couplings. Ensure that the telescoping section is set to maximum extension where settlement is expected, to minimum extension where heave is expected or at mid-point if unsure. Position the tube in the coupling to allow for the expected movement. Please see the note of telescoping sections and In-Place Inclinometer sensors on page 5.
- (g) Grouting - the strength of the grout backfill is fundamental to an Inclinometer providing good data. Ideally, the strength of the grout should match the strength and deformation characteristics of the surrounding strata. Control of grout strengths, particularly for a weak grout is not always easy under field conditions. Grout properties depend on material proportions, mixing equipment, mixing sequence, temperature etc. The grout must be sufficiently fluid to allow it to be easily pumped down the hole.

Depending on the diameter of the borehole/casing/void former the installation can either be pre-grouted and the Inclinator casing installed into the grout; or if the diameter permits the Inclinator casing installed first followed by the grouting process. For both techniques if water or drilling fluids are present in the borehole a tremie pipe/hose must be lowered to the base of the installation and the water/drilling fluids displaced with grout. Further advice on grouting is available from Soil Instruments

- (h) Finally, cut an excess casing to the correct level above the top of the borehole and protect the casing tubes from debris etc. by fitting an end cap.

Additional Notes on Installation

4.01 Buoyancy

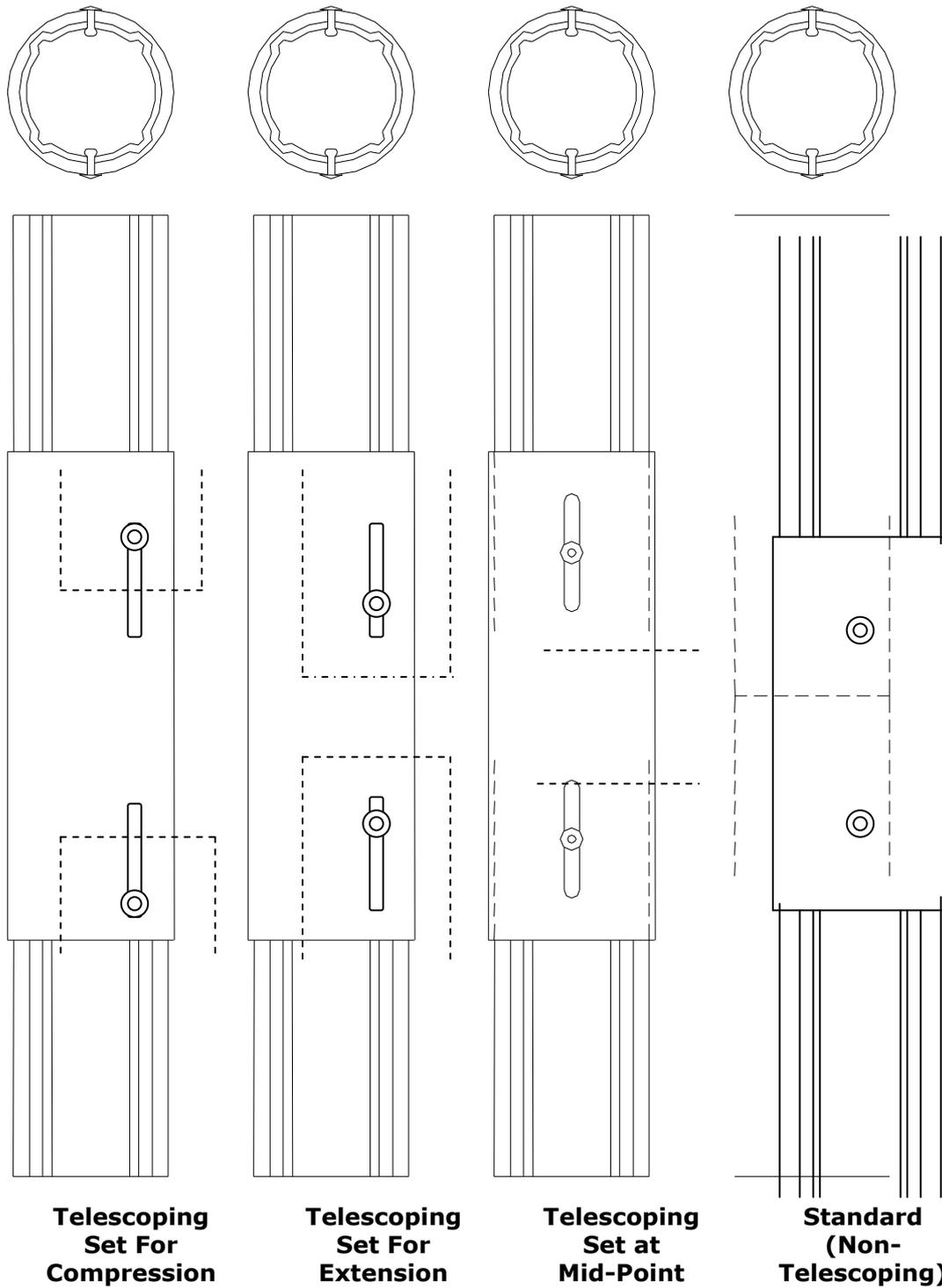
Inclinator casing will float in a water-filled borehole, to counteract buoyancy the Inclinator casing must be filled with clean water during the installation process. This buoyancy is increased when grout is introduced to the installation. To counteract this greater buoyancy a down force should be applied to the bottom of the casing. Only on shallow installations when the annulus between the OD of the Inclinator casing and the diameter of the installation is small can a downward force be applied from the top of the casing, otherwise distortion of the Inclinator will occur.

Completion Works

After successfully installing your Inclinator casing and recovering temporary drill casing, the following day the installation should be checked, if required the grout topped up and protective headwork's/cover installed to ensure your instrument remains in good order. After 3-4 days, base readings can be taken, we recommend 3 sets of readings are taken to ensure repeatability of data.

During any stage of the installation Soil Instruments will be pleased to offer phone advice; +44(0)1825 765044 www.soilInstruments.com

Figure 1 - Inclinometer Casing Couplings (Telescopic & Standard)



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