

Guideline for Installation of Pneumatic Piezometers (PP)

1. GENERAL

Pneumatic piezometers (PP) are pressure transducers that permit the measurement of pore water pressure in soils around itself. It is mainly used in a stratum of very low permeability. The measurement of pore water pressures, more importantly the rate of pore water increase or decrease has direct application in civil construction, slope stability analysis and other applications. These guidelines provide the minimum standard of care for installation of pneumatic piezometers on Alberta Transportation projects. Deviations from these guidelines may be permitted by the Director of Geotechnical and Materials Section, Technical Standards Branch.

These guidelines do not address: the selection of pneumatic piezometer materials; the rationale for locating and placing PPs; the frequency of monitoring; or other aspects of a properly executed instrumentation monitoring program. It is expected that the staff or consultant responsible for the PP installation will chose the correct type of PPs. The depth and location of placement of pneumatic piezometers will be determined by site conditions, soil conditions, objectives of the monitoring program and other factors.

2. INSTALLATION

Pneumatic piezometers are most commonly installed in a borehole either alone at a discrete depth, or within the same hole with other piezometers at multiple depths, or adjacent to a slope inclinometer. Occasionally PPs are placed in a shallow trench where embankment fill is to be placed. The following guidelines assume the pneumatic piezometer tip and system have been conditioned and tested prior to deployment to the field operation.

Installation of a single PP in a borehole:

- The borehole should be a minimum diameter of 100 mm. If borehole collapse is an issue the PP may be installed through the annulus of hollow stem augers.
- The borehole should be cleaned out to remove all cuttings, without smearing the walls of the borehole.
- The depth of PP placement should be verified by the field staff with the project engineer prior to installing. Adjustments to the depth of tip placement may be required in response to observed soil conditions.

- There are three PP tip installation methods available, all methods are acceptable for AT projects:
 - grout in method
 - sand bag method
 - push in method (suitable for soft saturated soils, minimum push-in of 0.3 m)
- Guide the instrument down the borehole to the desired depth – typically done using markings on the tubing.
- Once the tip is in-place the remainder of the hole is backfilled with either a bentonite/grout mix, or a minimum of 1.5 m of bentonite chips above the PP zone and at ground surface to ensure a watertight seal. Refer to diagram for clarity.

Installation of a multiple PP in a borehole:

It is common to install multiple piezometers within a single borehole to obtain pore-pressure measurements at several depths. Also, additional instrument types can be installed into the same borehole (e.g., slope inclinometers) if their installation coincides with a fully grouted borehole.

- The same general guidelines provided for single PP installations apply for multiple PP installations in the same borehole.
- Multiple PP installations may be problematic if borehole collapse is an issue and hollow stem casing is required. It may be cost effective under these soil and site conditions to drill one borehole per instrument since the adjacent boreholes can be drilled rapidly (no sampling or testing required).

Installation at or near ground surface:

PPs are often installed at ground surface or at depth below future embankment fills. In these situations the PP's hose will create difficulties for the contractor placing fill, and it is best to protect the PP installation and trail the hose to a remote location away from the contractor's activities. In these situations the following guidelines apply, see diagram for clarity:

- PP should be installed in shallow trenches, a minimum of 0.15 m deep and 0.15 m wide.
- The portion of the PP hose within the trench should be inserted through a protective pipe, typically a 2" diameter PVC or ABS pipe. A 90 degree pipe bend (elbow) should be inserted to transition the hose from the tip location to the trench.
- The PP hose should be left loose to accommodate vertical and lateral movements.
- A layer of sand should be placed below and above the pipe to protect it from construction activity.

- The trench should extend from the PP location to a location remote from the construction activity where monitoring activities can be undertaken in safety, without disruption to the construction activities.
- It is preferable to use the trench technique rather than extend the PP up within an embankment construction. The latter method disrupts the contractor placing fill and does not permit adequate compaction of the fill immediately adjacent the PP zone.

Common guidelines:

- During installation, the tubing should be handled carefully, making sure not to bend or kink the tubing or allowing moisture or debris to enter the ends.
- The tubing should also be clearly marked for the sake of identification. A weatherproof tag showing the PP number, depth of tip, date of installation, borehole number and consultant identifier should be attached to each PP tip. If the PP was laid in a trench the tip location should also be indicated on the tag. The tag should also indicate the instrument is the property of the Government of Alberta.
- To maintain visibility of the installation, an 8'long 4"x4" wooden post with the piezometer number should be installed to a depth of 4' in a hole immediately adjacent to the PP borehole location.
- The piezometer hose should be extended through a short length of 1" diameter tubing to a terminal box. The terminal box should be of sufficient size to store several coils of PP tubing, and may be metal, wood or plastic.
- The end of the tubing must be kept clean and dry, capped and stored within the terminal box, and coiled and suspended from the top of the post.
- In urban areas the terminal box must be padlocked.

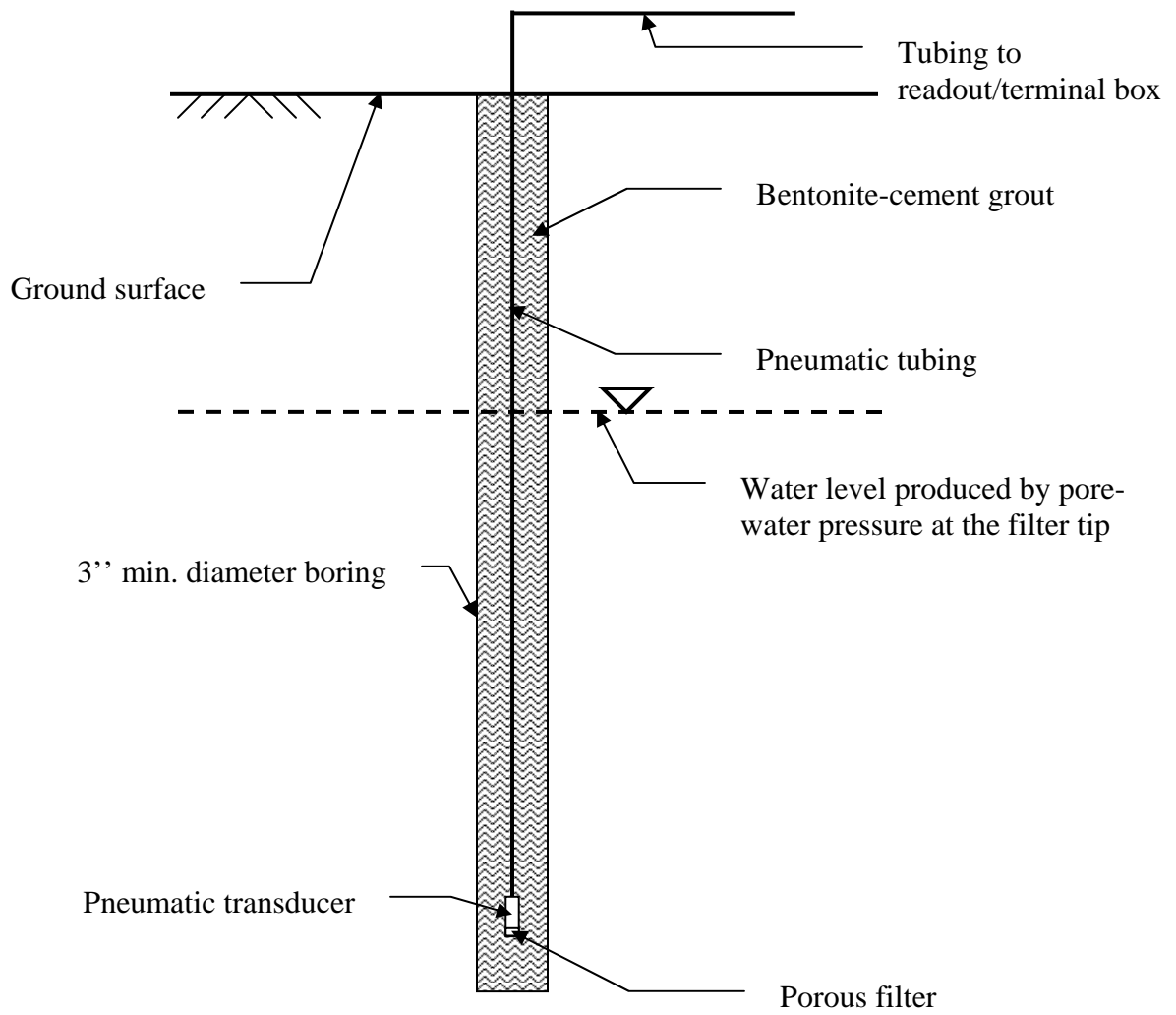


Figure 1 Typical installation of pneumatic piezometer – grout-in method

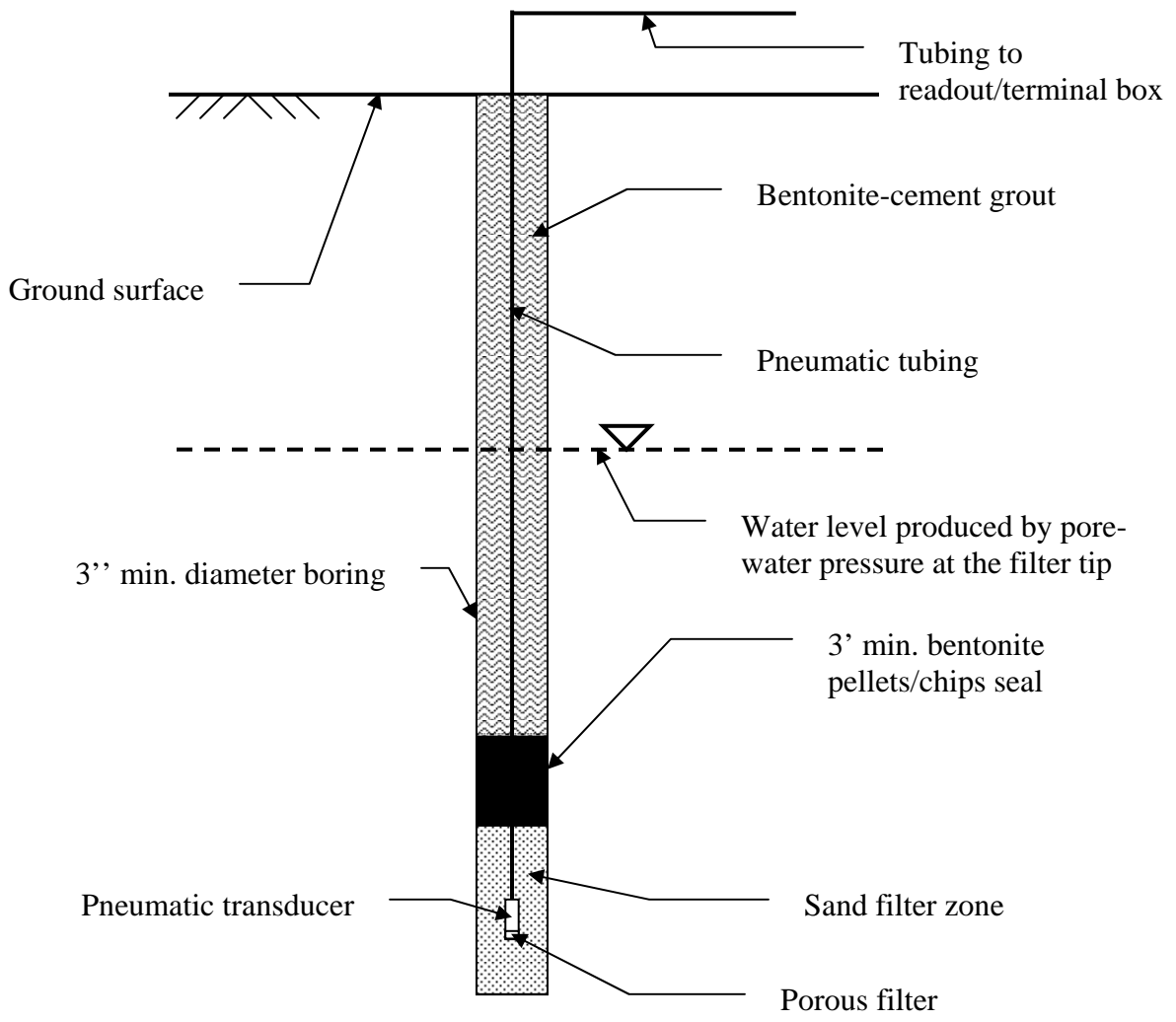


Figure 2 Typical installation of pneumatic piezometer – sand-bag method

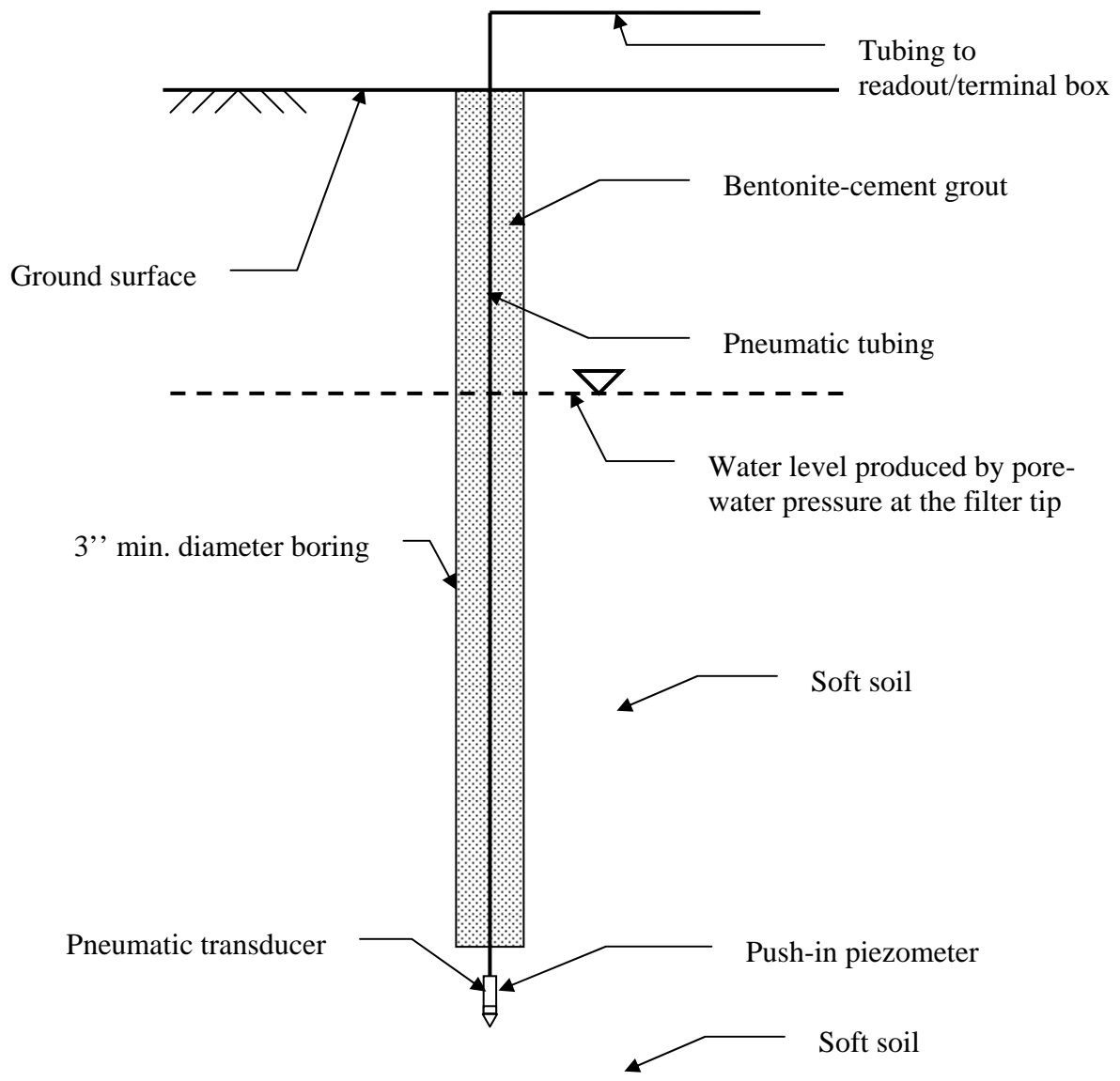


Figure 3 Typical installation of pneumatic piezometer – push-in method

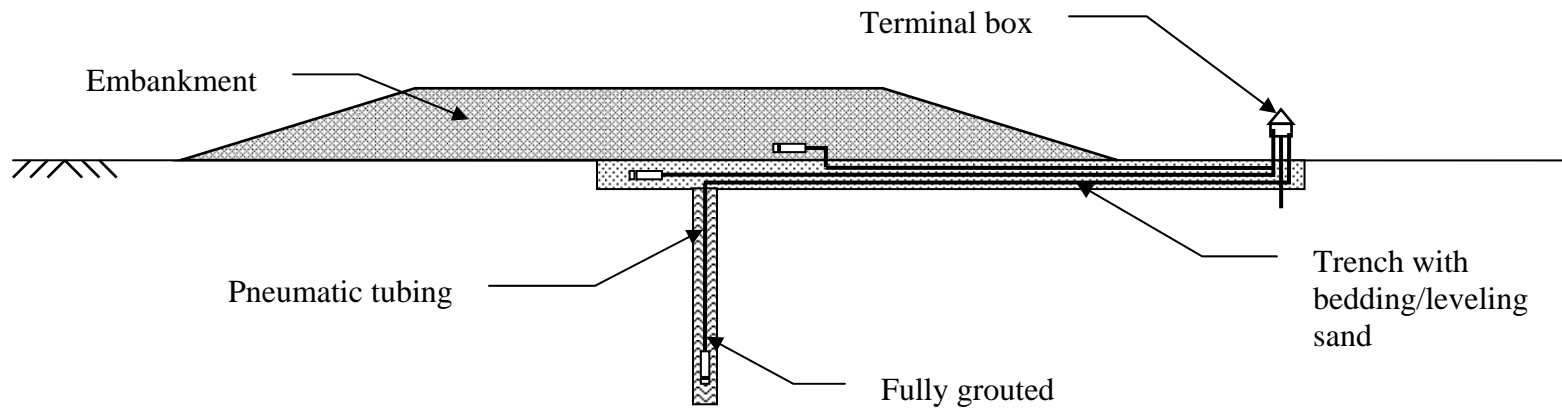


Figure 4 Typical installation of pneumatic piezometer within, at the bottom and under the embankment