

Simple test for accuracy of VW piezometer

Piezometers using vibrating wire type or electronic sensors type are 100% identical to the manufacturing principle industrial pressure gauges.

Some of the parts are designed to complement the Geotechnical engineering applications and require precise manufacturing and output characteristics.

These high-quality, high-reliability sensors need to be distributed in large quantities from very small companies without the correct calibration equipment, and some of them are as if they are a huge new technology instruments they manufactured.

Since the measurement of groundwater level and pore water pressure is very important in Geotechnical engineering measurement, it is required to have high-level manufacturing technology. In general, piezometer is required to measure for 3 years in short time and all instruments installed on the dam must measure for more than 50 years, so the reliability of the product should be high.

Long-term stability and repeatability are of paramount importance when considering to use the piezometer.

1. Regarding High-reliable piezometer

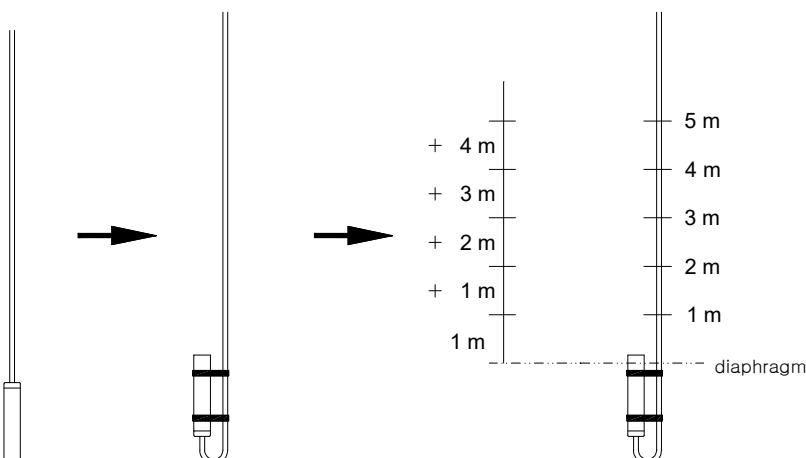
1. The number of sensitive thermometers should be very small due to changes in atmospheric temperature. However, many piezometer on the market have a very large temperature coefficient.
2. Since a piezometer on the market have a very large temperature coefficient.
3. The piezometer shall be a product with little or no change in the initial value by comparing the calibration sheet..
4. The filter should be made of stainless steel or ceramic. It is usually used in the range of 50 ~ 60 micron when installed in borehole. It is recommended to use 1 ~ 2 micron at the point where the negative pore water pressure is expected in the unsaturated permeable layer.
5. The calibration sheet shall indicate atmospheric pressure at the time of calibration. Since the groundwater level changes by 10 cm at 1 mm bar atmospheric pressure, the difference in atmospheric pressure between low-pressure and high-pressure on sunny fog at mid-summer fog is about 5-15mm bar. There fore, in the field where precise measurement is required, the atmospheric pressure error must be corrected during the calculation,
6. Piezometer with good resolution and sensitivity are located within 0.025% full scale when expressed as a percentage of the total measurement range. In addition, the linearity error should be within 1% full scale, and the sensitivity (output value indicated by the sensor relative to the applied pressure) drops to a similar degree when several piezometer are delivered at the same time. Same definitions can check on the calibration sheet as well.

2. Precision Accuracy Simplified Test Method

In order to prevent the use of improper and inadequate piezometer, engineer can also conduct actual tests at the office or on the construction site.

1. Install casing vertically using the inclinometer casing at a height of about 10m from the construction site or the office..
2. Fill the inside of the inclinometer casing completely with water and record the height.
3. Check the initial value of the supplied piezometer, record the initial value by comparing with the calibration report. Since the piezometer with a large initial value is a defective product, please return back to supplier.
4. Using a cable tie as shown in the figure, tie the tip of the piezometer to the upper side. When the piezometer is placed under the inclinometer casing and the piezometer is facing downwards, residual air will not escape when encountering water. Straighten the signal cable and mark it on the cable in 1m increments based on where the diaphragm is located..
5. When it's ready, put the piezometer into the inclinometer casing and lower it to the bottom. It should be noted that the water in the full with inclinometer casing is overflowing with the volume of the cable and the piezometer body.
6. Wait about 20 minutes for the piezometer to fully reflect the water temperature, then lift it up by 1 meter and note the every reading as measured..
7. By referring to the calibration sheet, it is a precise piezometer when the accuracy is within 0.5% by comparing the value obtained when simulating down by 1m and actual test result.

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For example, to calculate

- Calculation of the total internal volume of the casing: Installation height 10m x 60mm inner casing = 28.27
- Piezometer + volume of signal cable = 0.036 + 0.33 = 0.366
- Actual total volume of water in the casing = 28.27 - 0.366 = 27.904

Since 0.366 of water has flowed over 10m, 0.366 = 13mm will correspond.

Therefore, the actual water pressure will be 1000mm - 1.3mm = 998.7mm when the piezometer is lowered by 10m.

If lowering the piezometer by 1m which Initial value 2743.1Hz, A Factor : -0.000000320279

B Factor : -0.0033027265914

C Factor : 11.4682990416022

Theoretically, the pressure will be $998.7\text{mm} / 10.017 = 0.0997\text{kg/cm}^2$

In the formula of the actual pressure = $A \times F^2 + B \times F + C$

$$-0.000000320279 \times F^2 + -0.0033027265914 \times F + (-0.0033027265914) = 0.0997 \text{ kg/cm}^2$$

F = 2723.09 Hz must be shown

※ Caution

When installing the piezometer, be sure to use a sealing kit using Epoxy for the signal cable connection

Just like connecting the signal cable of a measuring instrument in a humid place, simply taping in connecting parts, moisture and water will penetrate into this place and eventually become short circuit.