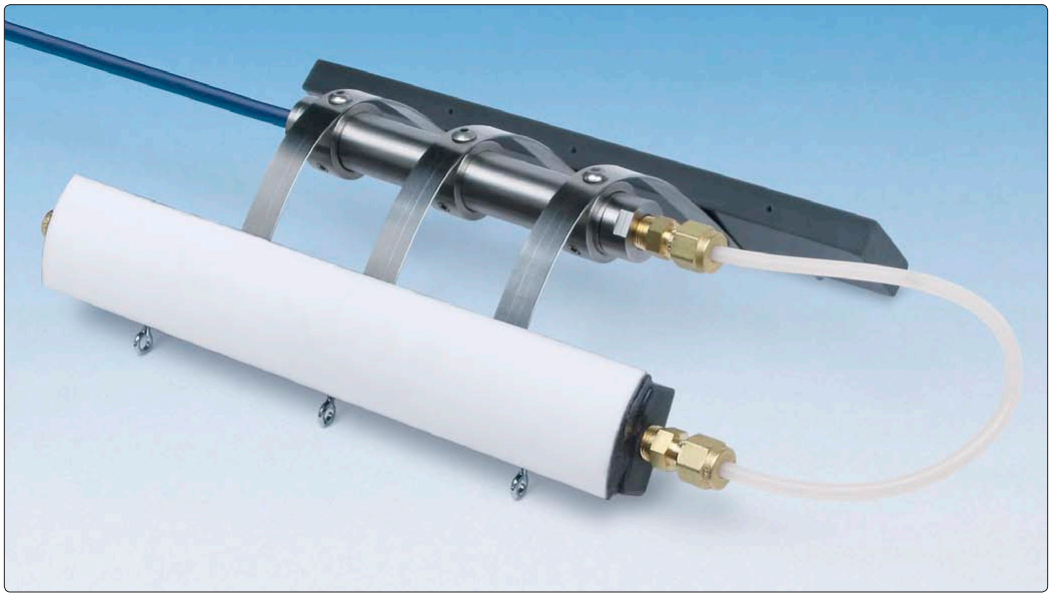
Multilevel Piezometer

Applications

For the measurement of ground water pressures at multiple levels in a single borehole

Model 4500MLP shown in closed, pre-installed configuration.



Model 4500MLP Multilevel Piezometer shown in open position.

Operating Principle

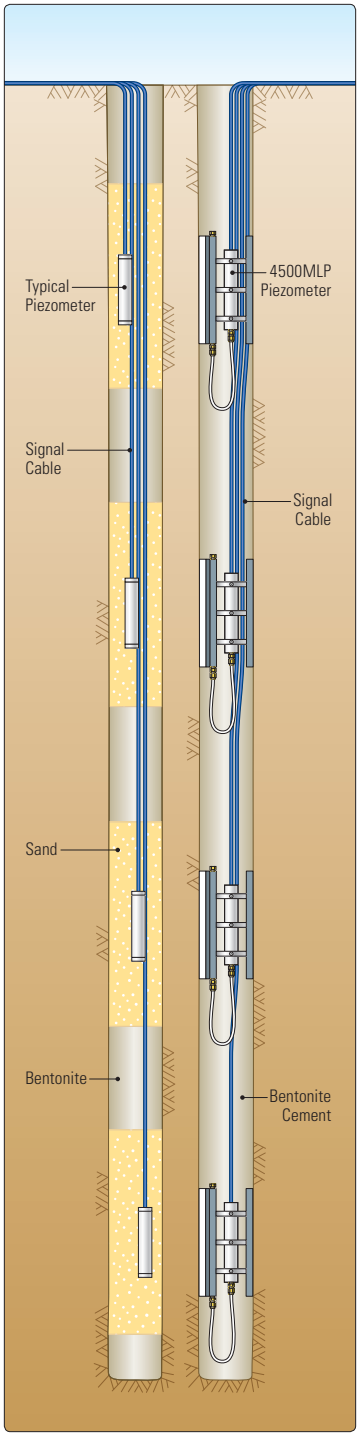
Where it is desirable to measure piezometric water pressures at more than one elevation in a single borehole there are difficulties in making multiple piezometer installations on account of the great amount of time and labor required to position the piezometers correctly, to surround them with sand lenses and to fill the intervening spaces with impermeable bentonite grout.

Much of the difficulty can be removed by eliminating the need for the sand lenses, replacing them with another method of ensuring that the piezometer tips are coupled hydraulically to the surrounding ground at each specific elevation. With the Multilevel Piezometer method, this is accomplished by a spring actuated device which presses the piezometer filter against the wall of the borehole so that it cannot be plugged by the bentonite. It thus becomes a simple operation, beginning with the lowest piezometer, to lower each piezometer by its cable to the desired elevation and then to actuate the spring loading mechanism which forces the filter against the wall of the borehole and holds the piezometer in place. When all the piezometers are in position, the borehole is filled with a bentonite cement slurry, from bottom to top, using a tremie pipe.

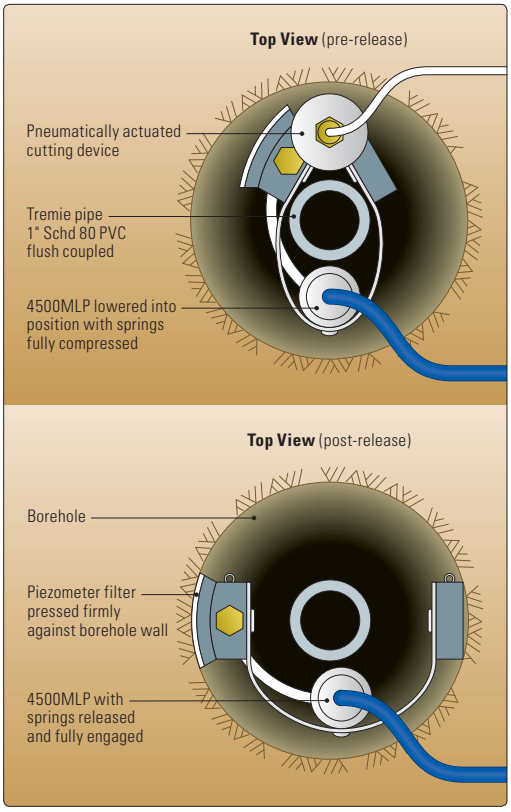
Advantages and Limitations

The biggest advantage lies in the greatly reduced amount of time required for installation. Borehole sizes are not critical but they should be at least 100 mm in diameter and not more than 30 mm larger than the nominal size for which the spring loading mechanisms are designed.

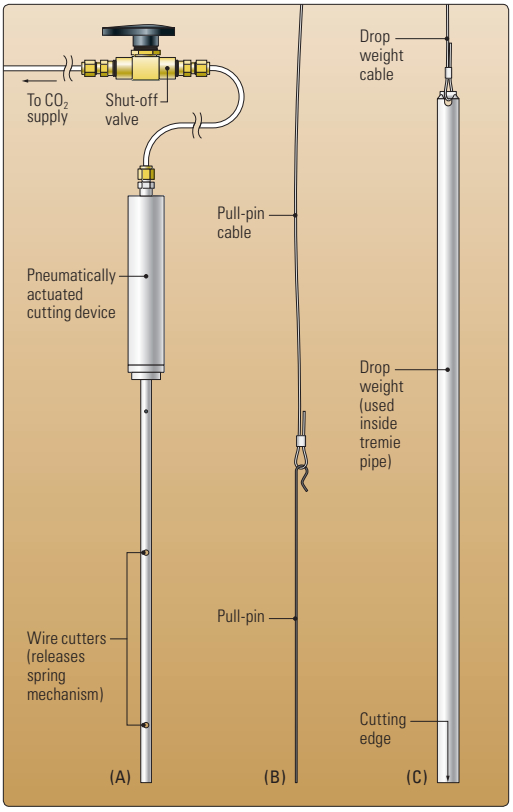
Care needs to be exercised in choosing the piezometer pressure range. During installation the full bentonite grout pressure will be felt by the piezometer for as long as it takes for the grout to set up and for the excess grout pressures to be dissipated. Geokon vibrating wire piezometers can withstand over-ranging to 200% of the calibrated range without damage and without affecting the calibration. However, the piezometer may temporarily cease reading during the over-ranging and if the grout pressures are to be measured then the maximum pressure range of the piezometer should be selected accordingly.



Typical method of piezometer installation at multiple levels within a borehole (left) and the Multilevel Piezometer method, which allows a much faster, simpler installation (right).



Model 4500MLP installation details showing spring-loaded mechanism in closed configuration (top), then released (bottom).



Tie wrap release options: (A) pneumatically actuated cutting device; (B) pull-pin; (C) drop weight.

System Components

A grout tremie pipe that reaches the bottom of the borehole is required. The tremie pipe can be made from 1" PVC flush coupled pipe or equivalent.

The individual piezometer assemblies are lowered to their correct locations on the end of their signal cables, with the spring-loaded mechanism held in a closed configuration by tie wraps or by a pull-pin. The release of the spring-loaded mechanism is accomplished using 1 of 3 options: (A) a pneumatically actuated cutting device connected to a source of CO_2 (supplied by the customer); (B) a pull-pin attached to a cable that leads to the surface (this option is not recommended for holes longer than 30 m); or (C) a drop weight—this option is used in vertical holes when the 4500MLPs are tie wrapped to the tremie pipe at predetermined depths. The tie wraps pass through the center of the tremie pipe and a cutting edge on the drop weight cuts the tie wrap as it falls inside the tremie pipe.

A supply of bentonite cement grout and a grout pump, with adapters to connect to the grout tremie pipe, is also required.

Technical Specifications

Standard Ranges	*4500S* –100 to 350, 700 kPa; 1.0, 2.0, 3.0, 5.0, 7.5 MPa *4500AL(V)* 70, 170 kPa
Over Range[1]	2 × rated pressure
Resolution	0.025% F.S. (minimum)
Accuracy	±0.1% F.S.
Linearity	< 0.5% F.S. (±0.1% F.S. optional)
Temperature Range	–20°C to +80°C
Borehole Diameter	100 - 150 mm
Borehole Oversize Capacity	nominal size +30 mm
Cable	*(non-vented)* 02-250V6 4-conductor PVC jacket, 6.4 mm diameter *(vented)* 02-335VT8 4-conductor Polyurethane jacket, 9.5 mm diameter
Filter	Porous Polyethylene, 60 micron
Thermistor Operating Accuracy	±0.5° C

[1]*Maximum, without damage.*

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