

HIGH TEMPERATURE PIEZOMETERS AND PRESSURE TRANSDUCERS

GEOKON®

MODEL 4500HT SERIES

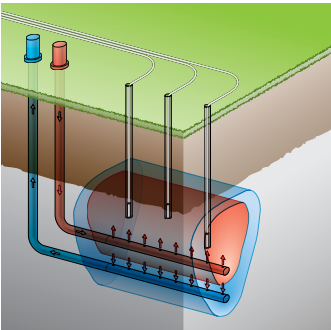


Model 4500HT High Temperature Piezometer (front) and Model 4500HT High Temperature Pressure Transducers (center, back).

APPLICATIONS

For the measurement of downhole pressures and temperatures in:

- Oil recovery systems
- Geothermal applications



Model 4500HT used for monitoring pressures and temperatures in oil recovery applications.

INTRODUCTION

The 4500HT Series High Temperature Piezometers and 4500HT Pressure Transducers are designed for monitoring downhole pressures and temperatures in oil recovery systems and geothermal applications.

These sensors are capable of operation under extreme conditions

and at temperatures up to 250 °C. In thermal recovery applications (steam assisted gravity drainage (SAGD) or cyclic steam stimulation (CSS), they can provide accurate, real-time, continuous monitoring of pressures in production and injection wells thereby optimizing the recovery

rate and reducing the costs of the steam injection process. In geothermal applications, they offer a means for in situ and continuous monitoring of pressures and temperatures over extended periods of time.

OPERATING PRINCIPLE

The sensors use a pressure sensitive diaphragm with a vibrating wire element attached to it. The diaphragm is welded to a capsule, which is evacuated and hermetically sealed.

Fluid pressures acting upon the outer face of the diaphragm cause deflections of the diaphragm and changes in tension and frequency of the vibrating wire. The changing

frequency is sensed and transmitted to the readout device by an electrical coil acting through the walls of the capsule.



Model 4500HT shown with TEC cable (coiled, pre-installed configuration).

ADVANTAGES AND LIMITATIONS

Vibrating wire sensors can be modified for use in environments subject to temperature extremes more easily than many other commercially available sensor types because the electromagnetic coil (used to excite the wire) is the only electronic component inside the sensor. In addition, the construction of vibrating wire sensors that are highly corrosion-resistant and capable of long-term use, in very aggressive environments, is possible due to the careful selection of materials and use of proprietary assembly techniques. All exposed components are made of corrosion-resistant stainless steels and internal components (plucking coils, electrical hook-up wire, thermistors,

and internal seals) are high-temperature versions.

The 4500HT Series High Temperature Piezometers and 4500HHT Series Pressure Transducers offer outstanding long-term stability and reliability, and low thermal zero shift. Cable lengths of several kilometers are possible and the frequency output signal is not affected by changing cable resistances (caused by splicing, changes of length, terminal contact resistances, etc.), nor by penetration of moisture into the electronic circuitry. A secondary vibrating wire temperature sensor (or thermistor), located in the same housing, permits the measurement of temperatures at the piezometer location.

Calibrations are performed at six different temperatures throughout the range to determine zero shift and the change in gauge factor with temperature.

The 4500HT/HHT Series piezometers and pressure transducers are delivered either with mineral insulated cables, comprising 4 x 22 AWG solid copper conductors in magnesium oxide inside a stainless steel tube, or with tubular encapsulated cables (TEC) comprising 4 x 24 AWG stranded, tinned copper, conductors with PFA insulation, encapsulated inside a 316L stainless steel tube.

These sensors are designed for static measurements only and at least one second is required to excite and read the sensor.

TECHNICAL SPECIFICATIONS

Standard Ranges	350, 700 kPa; 1, 2, 3, 5, 7.5, 10, 20, 35, 50, 75, 100 MPa
Over Range	1.5 × rated pressure
Resolution	0.025% F.S. (minimum)
Accuracy ²	±0.1% F.S.
Linearity	< 0.5% F.S. (±0.1% F.S. optional)
Temperature Range ¹	0 °C to +250 °C
Thermal Zero Shift	< 0.05% F.S./°C
Diaphragm Displacement	< 0.001 cm ³ at F.S
4500HT Piezometer Dimensions (L × Ø) ³	191 × 19 mm (350, 700 kPa; 1, 2, 3, 5, 7.5, 10 MPa)
4500HHT Pressure Transducer Dimensions (L × Ø) ⁴	191 × 19 mm (350, 700 kPa; 1, 2, 3, 5, 7.5, 10 MPa) 191 × 25 mm (20, 35 MPa) 216 × 32 mm (50, 75, 100 MPa)

Note: PSI = kPa × 0.14503, or MPa × 145.03.

¹Piezometers with a range of 350 kPa and higher are capable of reading negative pressures to -100 kPa. Contact GEOKON for more information. Other ranges available on request.

²Accuracy established under laboratory conditions.

³Please contact GEOKON for dimensions of ranges higher than 10 MPa.

⁴Pressure Connections are Female 7/16-20 UNF Medium Pressure 60° Cone.

CABLE SPECIFICATIONS

Mineral Insulated		Tubular Encapsulated (TEC)	
Conductors	4-conductors, 22 AWG, solid copper	Conductors	4-conductors 24 AWG, stranded, tinned, copper
Sheath	Stainless Steel	Insulation	PFA
Sheath Wall	0.76 mm (0.03")	Sheath	316L Stainless Steel
Nominal O.D.	4.76 mm (0.1875")	Sheath wall	0.76 mm (0.03")
Coil ID	1 m (3 ft)	Nominal OD	4 mm (0.16")
		Coil Diameter	1 m (3 ft)