

# High temperature pressure sensor for cylinder pressure measurement in glow plug adapter

Type 6056A...

Patent No. US 6,105,434

Pressure sensor Type 6056A... is designed specifically for use in glow plug adapters. A large number of different glow plug adapters can be fitted with the sensor Type 6056A... . Sensors with special lengths are not necessary. This greatly simplifies the preparation for combustion analysis measurements and storekeeping.

- Ideal for measurements with glow plug adapter Type 6542Q...
- Good temperature stability of the sensitivity
- Acceleration compensated
- Front diameter  $\varnothing 4.4$  mm
- Low thermal shock error and long life due to front seal
- High sensitivity
- Highly miniaturized plug connection (M3 size)

### Description

In Type 6056A... the PiezoStar, a new piezoelectric crystal from Kistler is used with which a sensitivity of  $-20$  pC/bar and high thermal stability is achieved. The sensitivity changes by not more than  $\pm 0.5$  % over a temperature range of  $200 \pm 50$  °C. The front seal allows good heat dissipation permitting a maximum operating temperature of up to  $400$  °C for brief duration.

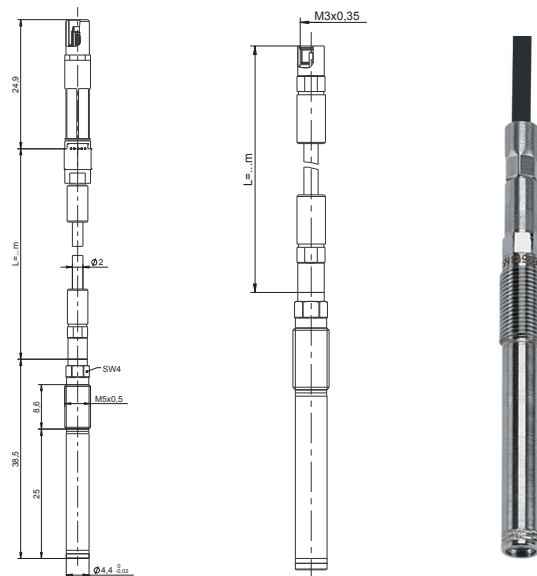
The connector enables pressure sensors of standard length to be installed in varying length glow plug adapters. This distinctly simplifies the preparation for indicating measurements and storekeeping.

### Application

The miniature sensor Type 6056A... is used typically in glow plug adapters for pressure measurement in diesel engines (Fig. 3); see also data sheet 6542Q\_000-570.

However, due to its small dimensions, it can also be used in engines with complex structural geometries in indicating bores.

The rugged, turned diaphragm also allows measurements beyond the knocking limit; at the same time, thanks to its low thermal shock error, very accurate thermodynamic investigations are still assured.



### Technical data

Measuring range	bar	0 ... 250
Calibrated ranges	bar	0 ... 50, 0 ... 100, 0 ... 150, 0 ... 250
Overload	bar	300
Sensitivity	pC/bar	$\approx -20$
Natural frequency, nominal	kHz	$\approx 160$
Linearity in all ranges (at RT)	% FSO	$\leq \pm 0.3$
Acceleration sensitivity	bar/g	$\leq 0.0005$
Operating temperature range	°C	$-20 \dots 350$
temperature, min./max.		$-50 \dots 400$
Sensitivity shift		
200 $\pm$ 50 °C	%	$\leq \pm 0.5$
23 ... 350 °C	%	$\pm 2$
Short term drift (thermal shock) (at 1 500 1/min, IMEP = 9 bar)		
$\Delta p$ (short-term drift)	bar	$\leq \pm 0.5$
$\Delta$ IMEP	%	$\leq \pm 2$
$\Delta p_{max}$	%	$\leq \pm 1$
Insulation resistance at 23 °C	$\Omega$	$\geq 10^{13}$
Shock resistance	g	2 000
Tightening torque	N·m	1.5
Capacitance, without cable	pF	5
Weight with cable	g	20
Connector, ceramic insulator	–	M3x0.35

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### Technical data (continuation)

#### Type 6056A...U20 (other specifications as for Type 6056A...)

Measuring range	bar	0 ... 300
Calibrated partial ranges	bar	0 ... 100, 0 ... 200, 0 ... 300
Overload	bar	350
Sensitivity	pC/bar	≈-19
Acceleration sensitivity		
axial	bar/g	<0.0005
radial	bar/g	<0.0005
Thermal shock error (at 1 500 1/min, IMEP = 9 bar)		
$\Delta p$ (short time drift)	bar	≤±0.7
$\Delta$ IMEP	%	≤±3
$\Delta p_{max}$	%	≤±1.5

### Mounting in glow plug adapter

Sensor Type 6056A... is typically used in glow plug adapters (Fig. 3). For this purpose, Kistler offers the customized optimum adapters of the Type 6542Q... (see also data sheet 6542Q\_000-570). These are provided with a hole bored according to requirements (Fig. 1) for the sensor mounting, and have been optimized with regard to signal quality and longevity. As a general rule, we would advise against the use of a self-manufactured glow plug adapter. On request, Kistler will provide an engine-specific adapter for your use.

### General mounting

When mounting the sensor into the adapter, it is essential to apply a tightening torque of 1,5 N·m. The sensor with the connected cable should therefore be mounted with the socket wrench Type 1300A14 and the torque wrench Type 1300A17.

A slotted mounting key must be used for sensors with Piezo-Smart. The mounting bore must either be exactly  $\varnothing 5.7$  mm (with step drill) or larger than  $\varnothing 7.5$  mm.

The mounting key Type 1300B14 is for  $\varnothing 5.7$  mm. The mounting key Type 1300B14Q01 is for  $\varnothing \geq 7.5$  mm.

For the tightening torque of the glow plug adapter into the cylinder head please refer to the specific data sheet.

### Direct mounting

Sensor Type 6056A... can be mounted directly in the cylinder head (Fig. 2). When drilling the hole, bore specifications must be machined according to Fig. 1.

The following Kistler tools:

Step drill	Type 1300A16
Tap	Type 1357A
Reaming tool	Type 1300A99

enable you to maintain the tolerances required. The hole must be drilled in one work holding fixture. Before mounting the sensors, in particular the sealing surface in the hole must be checked; use of the reaming tool Type 1300A99 is mandatory. You will find additional information on drilling the hole and mounting in the instruction manual. Your Kistler distributor will provide you with further information such as, for example, concerning the preferred location of the indicating bore in the combustion chamber.

### Sleeve mounting

Where space allows or if the sensor must be mounted through the water jacket of the cylinder head, we recommend the use of a mounting sleeve. Mounting sleeves are manufactured to customer specifications. An additional advantage of mounting sleeves is that the actual sensor bore in the sleeve can be very precisely machined. On request, Kistler will provide mounting sleeves Type 6561AQ... for your particular mounting situation.

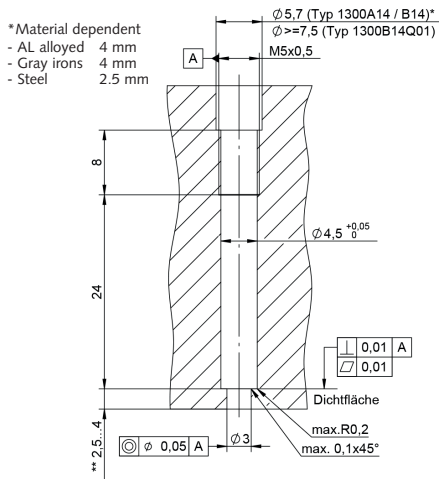


Fig. 1: Dimensions of mounting bore

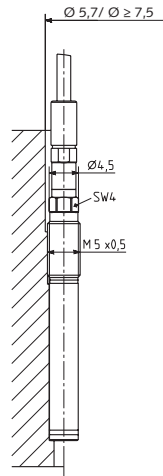


Fig. 2: Direct mounting

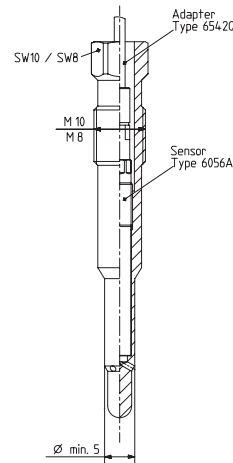


Fig. 3: Mounting in glow plug adapter

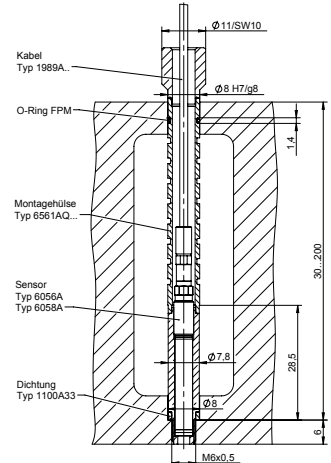


Fig. 4: Mounting in mounting sleeve

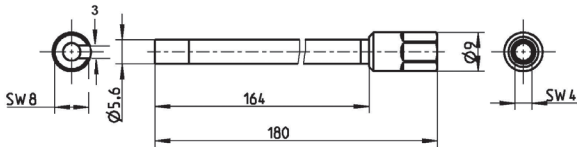


Fig. 5: Mounting key Type 1300A14

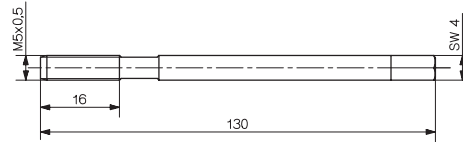


Fig. 6: Special tap Type 1357A

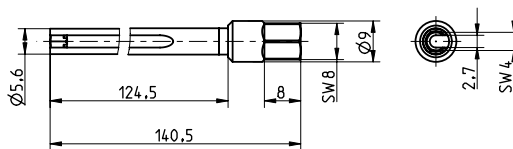


Fig. 7: Mounting key  $\phi 5.6$  mm, slotted, Type 1300B14

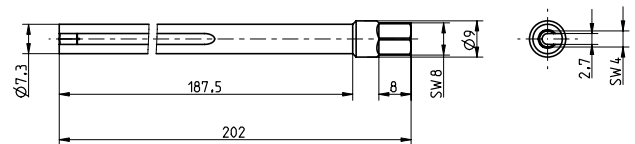


Fig. 8: Mounting key  $\phi 7.3$  mm, slotted, Type 1300B14Q01

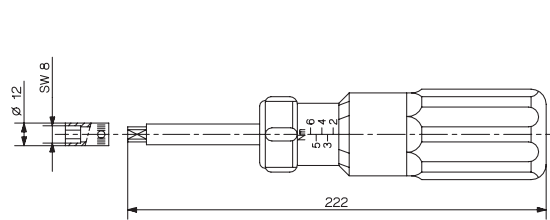


Fig. 9: Torque wrench Type 1300A17

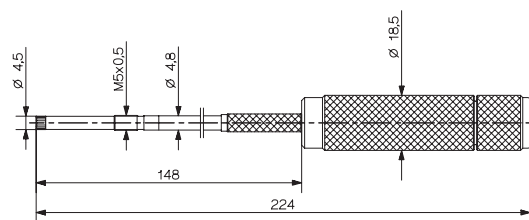


Fig. 10: Reaming tool Type 1300A99

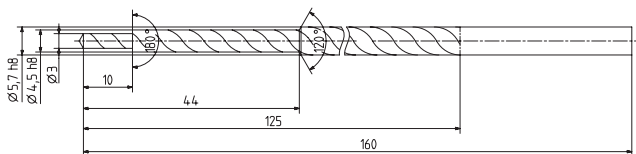


Fig. 11: Step drill Type 1300A16

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**Scope of delivery**

- Pressure sensor
- Connecting cable acc. to ordering key
- Calibration certificate
- Adapter M3x0.35 neg. – BNC pos. (not for PiezoSmart)

**Type/Art. No.**

1706

**Ordering key**

Type 6056A

**Version**

Standard	-
Reinforced diaphragm	U20

**PiezoSmart**

Without PiezoSmart	-
With PiezoSmart	S

**Cable type**

PFA with steel braiding	3
Fluoropolymer, oil-proof	7

**Cable length**

1 m	1
2 m	2
3 m	3

**Optional accessories**

- Adapter Triax – BNC pos. **Type/Art. No.** 1704A4
- PiezoSmart extension cables
  - L = 1 m 1987B1
  - L = 2 m 1987B2
  - L = 10 m 1987B10
- Replacement connecting cables, PFA steel braiding
  - L = 1 m 1989A311
  - L = 2 m 1989A321
  - L = 3 m 1989A331
  - incl. PiezoSmart, L = 1 m\* 1985A8S311
  - incl. PiezoSmart, L = 2 m\* 1985A8S321
  - incl. PiezoSmart, L = 3 m\* 1985A8S331
- Replacement connecting cables, FPM oil-tight
  - L = 1 m 1989A711
  - L = 2 m 1989A721
  - L = 3 m 1989A731
  - incl. PiezoSmart, L = 1 m\* 1985A8S711
  - incl. PiezoSmart, L = 2 m\* 1985A8S721
  - incl. PiezoSmart, L = 3 m\* 1985A8S731
- Mounting key standard Ø5.6 mm, not slotted (L = 180 mm) 1300A14
- Mounting key for PiezoSmart
  - Ø5.6 mm, slotted (L = 140.5 mm) 1300B14
  - Ø7.3 mm, slotted (L = 202 mm) 1300B14Q01
  - Ø7.3 mm, slotted (L = 242 mm) 1300B14Q03
- Torque wrench 1 ... 6 N·m 1300A17
- Step drill 1300A16
- Tap M5x0.5 1357A
- Reamer 1300A99
- Mounting sleeve incl. O-ring<sup>1)</sup> 6561AQ...
- O-ring for mounting sleeve 65007541
- Adapter for pressure generator Type 6904 6591
- Temperature dummy 6056AT
- Dummy sensor 6405
- Extraction tool for dummy sensor Type 6405 1349
- Flame guard 6539A1Q01
- Membrane shield 6539A2

For PiezoSmart specifications please refer to the PiezoSmart brochure.

**Ordering examples**

- Version with 1 m FPM oil-proof cable
- Version with PiezoSmart and 2 m FPM oil-proof cable

**Type**

6056A-7-1  
6056AS7-2

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\* with factory calibration data, state SN with order  
<sup>1)</sup> customer specific