

# Preloading elements

Type 9422A01 ... 9422A51

## Preloading screw for Piezoelectric Force Sensor

Standardized preloading screws for the installation of Piezo-electric force sensor Types 9001 ... 9051 and 9101 ... 9105.

- Elastic preloading screw, optimized for the ideal pretension for compression force measurement
- Low force shunt

### Description

Preloading elements Type 9022Ax1 consist of an optimized socket head cap preloading screw and a centering sleeve. Further accessories, such as electrically insulating washers or force distributing rings, are available separately.

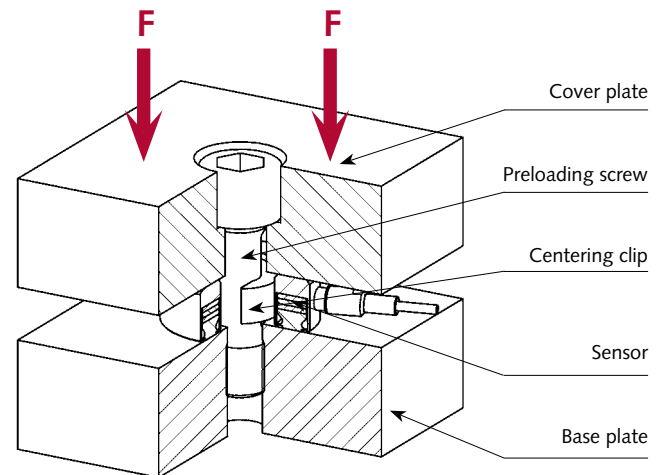
### Application

The preloading screw is used to preload a ring force transducer for optimized force application in the recommended measuring range. When installed correctly, the piezoelectric force sensor provide precise results with high repeat accuracy. In practice, the sensors are mechanically preloaded during installation.

- Bending moments and lateral loads are captured but not measured
- Micro-gaps are closed: this ensures high rigidity and, consequently, a wide frequency range
- Improvement of the linearity

The contact surfaces must be flat and stiff. This is best achieved though grinding. Base plate and cover plate must be thick enough to avoid undesired deformation.

In practice, a plate thickness of twice the height of the sensor has proven to be a general rule of thumb. A plate thickness less than the height of the sensor should not be selected if the entire measurement range of the sensor is to be utilized.



Before screwing in the preloading screw, grease is to be applied on the contact surface under the screw head and to the thread of the screw bolt.

### Installation

Piezoelectric force sensors are installed most easily with a central threaded joint.

- Carefully clean all contact surfaces of the sensor and of the base plate and cover plate with a degreasing cleaning agent.
- Grease the screw thread and contact surface under the screw head with special grease 1063 (red marks in Fig.1).
- Connect sensor to charge amplifier, set sensitivity according to package label or calibration certificate.
- Plug together sensor, centering ring, preloading screw, base plate and cover plate and use the charge amplifier to bring to the desired pretension.
- Adjust the sensitivity; this is performed most precisely by recalibrating on-site. For many measuring tasks, however, the sensitivity can also be reduced by the amount of the shunt. Example: A sensitivity of  $-4.0\text{pC/N}$  when preloading, means a measurement sensitivity of  $-3.72\text{pC/N}$  ( $-7\%$ ) for a Set 9422A01. The accuracy tolerance is then  $\pm 1\%$ .

→ To keep the sensor mounting from sliding due to the lateral loads, the screw pretension must be at least 10 times greater than the acting lateral load.

→ Lateral loads also generally produce a bending moment on the ring force transducer. The limit values specified in the data sheet must not be exceeded.

### Scope of delivery

- 1 preloading screw
- 1 centering clip

### Example:

A ring force transducer Type 9021 is to be preloaded with 8 kN. There are two ways to achieve this:

- If a charge amplifier, e.g., Type 5015A, is available, the sensitivity for a standard pretension, e.g.,  $-3.846\text{pC/N}$  must be set on the amplifier so that the desired preloading force can be set as accurately as possible with the torque wrench. Depending on the sensor type, the sensitivity is stated on the packaging label or on the calibration certificate of the sensor (largest calibration range).
- If no charge amplifier is available, the following torque must be set on the torque wrench:  $8\text{ kN} \times 1.4\text{ N}\cdot\text{m/kN} = 11.2\text{ N}\cdot\text{m}$  (see table)

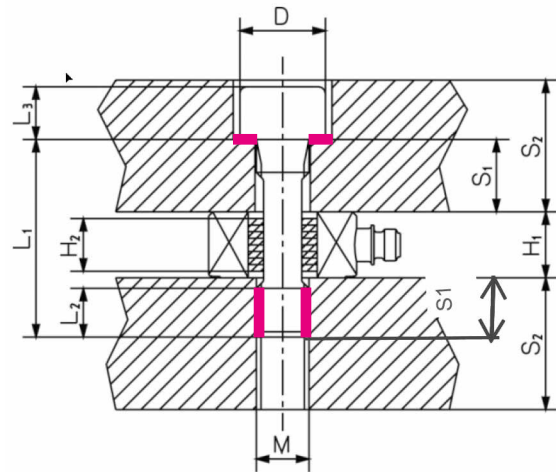


Fig. 1: Detailed dimensions for sensor installation

Pre-load set		9422A01	9422A11	9422A21	9422A31	9422A41	9422A51
Thread diameter		M3	M5	M8	M10	M12	M14
Thread pitch	[mm]	0.5	0.5	1.25	1.5	1.75	2
D	[mm]	5.5	8.5	13	16	18	21
L1	[mm]	16	20	30	35	40	45
L2	[mm]	4.2	6.5	10	12	14.3	16.6
L3	[mm]	3	5	8	10	12	14
H1	[mm]	6.5	8	10	11	12	13
H2	[mm]	6	6	8	8	8	9
S1	[mm]	6.5	8	10	11	13	15
S2	[mm]	7	10	16	20	25	30
Force shunt	%	≈7	≈8	≈9	≈9	≈9	≈9
Max. preloading force $F_v^{1)}$	[kN]	2.5	6	15	30	45	60
Tightening torque per 1 kN pretension <sup>2)</sup>	[N·m/kN]	0.548	0.83	1.4	1.7	2	2.3
Max. tightening torque <sup>2)</sup>	[N·m]	1.37	5	21	51	90	138
Compatible sensors <sup>3)</sup>		9001	9011 9101	9021 9102	9031 9103	9041 9104	9051 9105

<sup>1)</sup> Recommended preload force of the respective piezoelectric force sensor is shown on the sensor data sheet.

<sup>2)</sup> Installation aid if no charge amplifier is available. Important: Grease correctly acc. to point 2.

<sup>3)</sup> Without claim to completeness.