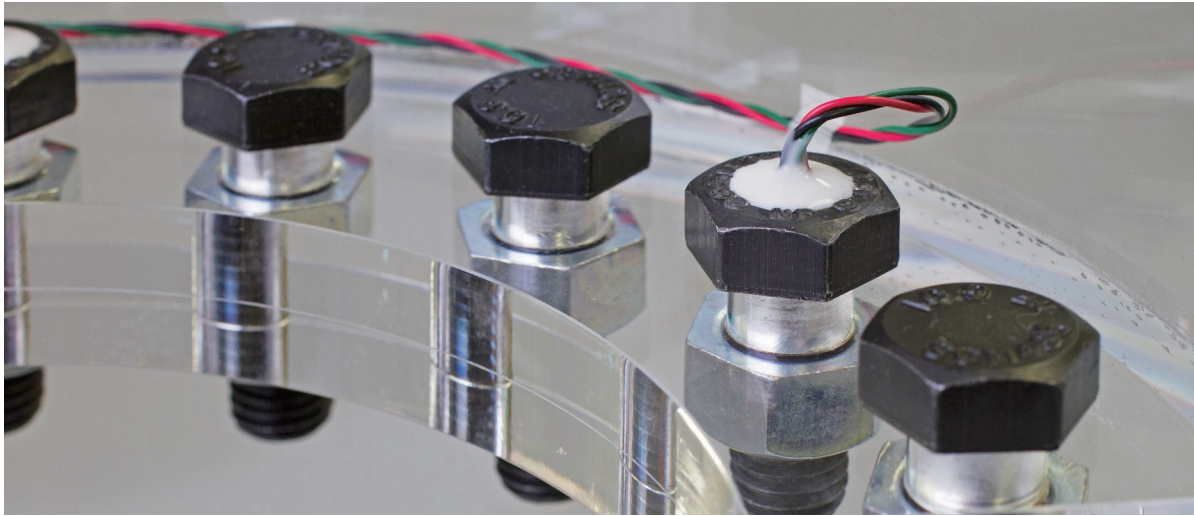


# Manufacturing of Tension Bolts/ Calibration Service



## Supporting the embedded -40°C to +150°C specification for M3 bolts!!

The bolt fastening is utilized in a wide range of fields. By measuring the axial force applied to the bolts, it is possible to check and control the state of fastening (checking for looseness, overtightening, and the specified fastening force). This is also utilized for the measurement of bolt strength and the bolt fastening designs.

**We accept machining a hole in your supplied bolts, installing the gauges for the bolts, and performing load calibration. Please consult us on the installation of embedded bolt gauges and surface strain gauges, and on the special bolt shapes.**

We can provide the load calibration test reports and the temperature characteristic test data for performing high-precision measurements. The embedded strain gauge for machined  $\phi 0.8$  mm hole supports M3 size, which has been difficult to handle from the viewpoint of impairment of the cross-sectional area.

Installation method	Embedding type				Surface bonding type		
Sensor	Embedding strain gauge				Strain gauge		
Operating temperature	-30~+100°C	<b>-40~+150°C</b>	-10~+80°C	-40~+150°C	-296~+80°C	-40~+80°C	-40~+300°C
Machining	Machining hole diameter $\phi 0.8$	Machining hole diameter <b><math>\phi 0.8</math></b>	Machining hole diameter $\phi 1.6, \phi 2.0$	Machining hole diameter $\phi 1.6, \phi 2.0$	Surface processing		
Applicable bolt	M3 or more	<b>M3 or more</b>	M6 or more		M3 or more		
others			Available with temperature measurement function		Axial force measurement, bending measurement, torque measurement		

### Supports for various bolts



Various types of jigs are prepared for supporting a wide variety of bolts.

\*For bolts that are not supported, please contact us

### Installation Case Examples

Some of the examples of installation procedures. After machining a hole in the bolt head, a bolt gauge is embedded, a gauge terminal is attached, the lead wires are connected, and the coating treatment is performed.



## Installation Methods

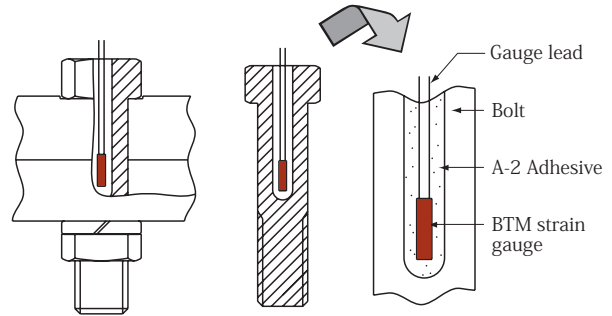
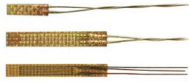
Strain gauges are either embedded inside the bolt or attached to the surface, and a selection will be made according to the conditions of use.

## Manufacturing of Embedded Type Tension Bolt

Burying: Strain gauges for bolts (BTM-Series)

Machine a  $\phi 0.8$ ,  $\phi 1.6$  or  $\phi 2$  mm hole in the bolt center and bury a gauge for bolts inside using the dedicated adhesive. The damage on strain gauge from the washer during bolt tightening is avoided.

● Embedded Type Strain Gauge BTM-Series



## Manufacturing of High Temperature Buried Tension Bolt

We accept orders for high-temperature tension bolts (operating temperature range:  $-40^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$ ) using the embedded type strain gauges for high-temperature applications.

Newly developed embedded type bolt strain gauge has enabled installation in a  $\phi 0.8$  hole.

## Manufacturing of Surface Attached Type Tension Bolt

Attach: F, QF, ZF, EF, CEF, CF-Series

Two pieces are attached in symmetrical positions (facing each other) on the bolt shank to cancel the influence of bending. To prevent damage to the strain gauge during bolt installation or due to contact with washers, the surface of the shank is scraped for installing the strain gauge. Select a strain gauge according to the temperature and environment of use.

● Typical Strain Gauges Used

F-Series for general use



CF-Series for cryogenic use



QF/ZF/EF-Series for high temperature use



1. When using this service

- Please inform our sales staff of the conditions of use and implementation of this service, such as integration into various experiments to be conducted and equipment. We will determine whether or not this service is applicable based on the conditions of use and will propose an appropriate installation method.

2. Inspection before supplying the bolts to us

- Please confirm that there is no abnormality in the appearance of the bolt, especially no deformation or damage to the seating surface or threads, before supplying it to us.
- Please supply spare bolts when ordering. If those are not used, they will be returned to you.

3. Our bolt receiving inspection

- We only perform simple visual inspections and do not perform inspections using thread gauges.

4. Installation of strain gauges

- Please contact us in advance when we have to pay close attention to the handling of bolts because a special surface treatment is applied or coated with rust-preventive oil or grease.
- Please note that fine scratches and discoloration due to baking temperature may occur depending on the bolt material or surface treatment.

5. Bolt calibration services

- For safety reasons, the **upper limit of the calibration load is set to 60% of the lower of the proof stress of the tension bolt (strength class) and the proof stress of our calibration jig (strength class: 12.9 (9.8 depending on size)).**

- Please note that if the proof stress (strength classification) or the material of bolt is unknown, we may decline to perform the calibration for safety control reasons.

- For special bolts, the design and manufacturing of jigs that are necessary for calibration are accepted at an additional cost.

6. Temperature test of bolts

- The temperature test requirement will be accepted at an additional cost. The temperature test will be conducted while the bolts are unloaded. We will also submit as test data, the temperature characteristic formula (third order approximation formula) of a zero point shift due to temperature fluctuations.

7. Warranty

- This service is outside the scope of the product warranty.

The contents of this catalog are subject to change without prior notice.

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Approval Certificate **ISO9001**  
Design and manufacture of  
strain gauges, strain measuring  
equipment and transducers