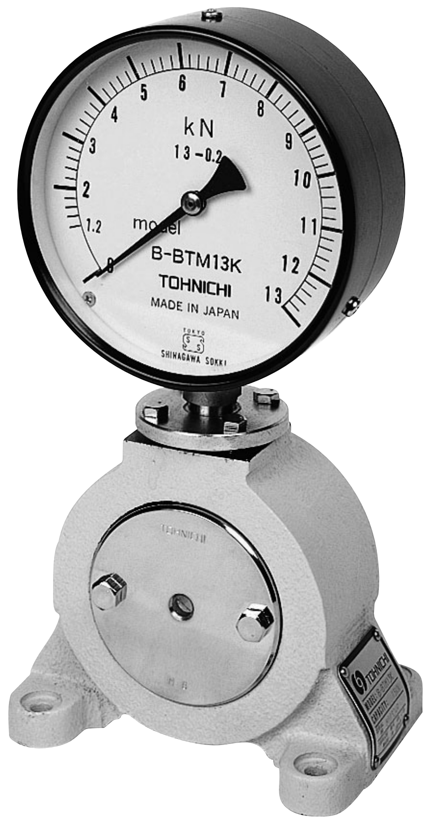
Your Torque Partner
TOHNICHI

BOLT TENSION METER
MODEL B-BTM

OPERATING INSTRUCTION

B-BTM **B-BTM Model**



To use this product properly and safely, please read this manual carefully before use. If you have any question about the product and its operations, please contact your nearest distributor or TOHNICHI MFG. CO., LTD.

Safety Precautions

Before using this product, please read this operating instruction carefully to use it properly. If you have any question, please contact your nearest distributor or TOHNICHI MFG. CO., LTD. This operating instruction should be stored in a safe place.

⚠ **Safety Symbol**

This symbol is used for drawing attention to "safety precautions". If you see this symbol in this operating instruction, attention should be paid to safety. Take preventative actions according to the description and conduct "safe operations and proper control".

Signal Words

The signal words are the headers which indicate the level of hazard that should be known for human safety and in handling devices. The signal words for safety are "Danger", "Warning" and "Caution" depending on the level of hazard to human. The signal words are used with the safety symbol to indicate the following situations.

"⚠ Danger": Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

"⚠ Warning": Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

"⚠ Caution": Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

⚠ Warning

- Before use, fix this meter with bolts to a stable object such as workbench and steel frame that has a sufficient strength. If its fixing state is not proper, the meter may fall down or drop off, resulting in an accident.
- Do not remodel the meter. Remodeling may cause an accuracy error or damage to the meter.

⚠ Precautions for use

- This meter is a precision measuring instrument. Do not give a strong impact to the meter by dropping or throwing it.
  It may cause an accuracy error or a failure. Take due care when carrying the meter.
- Do not expose the meter to rain. Do not use it in a hot and humid place. Rust may cause a malfunction.
- Do not use in a dusty place. Use in a dusty place may cause an accuracy error or a failure.
- Before starting the operation, warm up the meter till oil operates smoothly. Particularly in winter, oil viscosity is increased, and indicated values may become lower.
- When using the meter in summer, do not expose it to direct sunlight for a long time.
- After completion of measurement, loosen the bolt immediately. Leaving it under loaded conditions may cause leakage of oil.
- Bring the head plate into contact with the piston properly. Incomplete fitting may damage the meter.

Contents

1 Outline

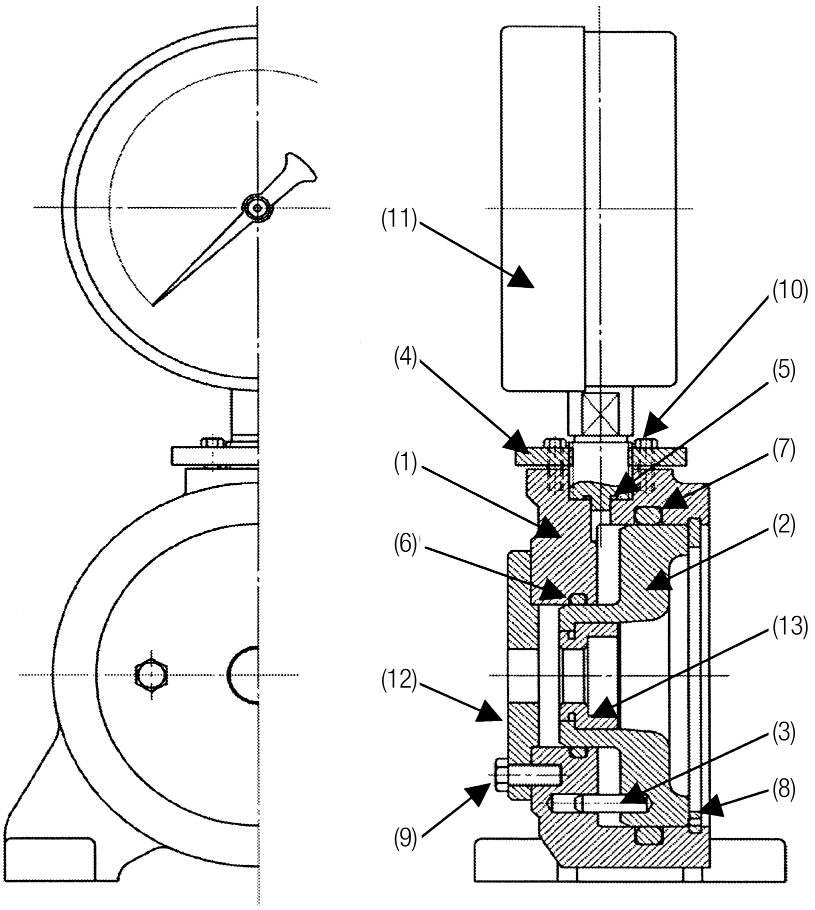
The bolt tension meter is an instrument for measuring the bolt axial tension generated when the bolt and nut are tightened in combination.

※ Combined use of a bolt tension meter and a torque wrench permits a simplified determination of the torque coefficient of a tightening device.

※ It is possible to measure the tightening capacity of power wrench.

2 Components (Each Part Name)

This bolt tension meter is made up with the following parts:



(1): Cylinder
(2): Piston
(3): Piston pin
(4): Flange
(5): O-ring
(6): O-ring
(7): O-ring
(8): C-type snap ring
(9): Bolt
(10): Bolt
(11): Axial tension gauge
(12): Nut plate
(13): Head plate

Accessories
- Case
- Spanner

For mounting a nut plate)
- Bolt

For mounting a nut plate)
- Calibration certificate
- Operating Instruction

3 Specifications

There are 4 models for B-BTM. Each specification is as shown in Table 1.

Table 1 Major Specifications of B-BTM

Model	Axial tension measurement range (kN)		Measurable bolt size Bolt size (minimum length: mm)
	Min. to Max.	1 graduation	
B-BTM13K	1.2 to 13	0.2	M5(20), M6(21), M7(21.5), M8(22.5)
B-BTM40K	4 to 40	0.5	M10(29), M12(31), M14(32)
B-BTM130K	12 to 130	2	M16(41), M18(43), M20(44), M24(47)
B-BTM400K	40 to 400	5	M27(72), M30(74), M36(79), M42(84)

4 How to use

Bolt test and power wrench capacity measurement with the bolt tension meter shall be carried out according to the following procedures:

4-1. Standard bolt test (measurement of torque coefficient)

(1) Preparation

a) Fix the bolt tension meter to a workbench or steel frame.

b) Attach the nut plate and head plate that fit the bolt size to the meter.

(2) Bolt test

a) Insert the bolt to be tested from the head plate side and tighten the nut from the nut plate side. (Refer to the dimensional drawing on the back cover.)

b) Gradually apply force to the torque wrench to tighten the nut, and read the axial tension at the time when the testing torque is reached.

c) The torque coefficient is determined by the following expression:

$K=T/(d \cdot N)$ In this expression:

K: Torque coefficient

T: Torque (N·m){kgf·cm}

d: Nominal diameter of bolt (cm)

N: Axial tension of bolt (N){kgf}

Note) 1. It is not desirable to test the same bolt repeatedly.

2. For a bolt test, refer to JIS B 1186.

4-2. Power wrench capacity measurement

(1) Insert the bolt from the head plate side, and tighten the nut lightly from the nut plate side.

(2) Tighten the nut with the power wrench for a predetermined time.

Note) 1. The tightening torque of power wrench (particularly impact wrench) varies depending on the tightening conditions. Therefore, the value measured with this meter itself cannot be regarded as a work tightening value.

5 Excerpts from JIS B 1986

The excerpts from "Sets of high strength hexagon bolt, hexagon nut and washer for friction grip joints (JIS B 1186-1995)" are referred.

5-1. Torque coefficient values of sets

Torque coefficient values of sets measured according to the procedure mentioned in 5.2 must meet the specified values shown in Table 2. In this case, the torque coefficient value is determined by the following expression:

$K=T/(d \cdot N) \cdot 1000$ In this expression: K: Torque coefficient value

T: Torque (Nut tightening moment)(N·m){kgf·m}

d: Standard outside diameter of bolt thread (mm)

N: Bolt axial tension[1] (N){kgf}

Table 2 Torque coefficient values of the sets

Category	Types of sets by torque coefficient values	
	A	B
Average value of torque coefficient values of 1 production lot[1]	0.110 to 0.150	0.150 to 0.190
Standard deviation of torque coefficient values of 1 production lot[1]	below 0.110	below 0.013

Note (1) "1 production lot" means that bolts, nuts and washers included in a set are produced in the same lots, respectively.

Bolts, nuts and washers in the same lots refer to those that meet the following conditions:

(1) Bolts produced in the same lot refer to bolts in 1 production lot where the bolts have the same (a) dissolution number of material (steel), (b) grade by mechanical property, (c) nominal diameter of thread, (d) length "l", (e) machining process and (f) heat treatment conditions. However, bolts that have somewhat difference in length "l" may be regarded as in the same lot.

(2) Nuts produced in the same lot refer to nuts in 1 production lot where the nuts have the same (a) dissolution number of material (steel), (b) grade by mechanical property, (c) nominal diameter of thread, (d) machining process and (e) heat treatment conditions, and additionally, (f) surface treatment conditions if surface treatment is applied.

(3) Washers produced in the same lot refer to washers in 1 production lot where the washers have the same (a) dissolution number of material (steel), (b) grade by mechanical property, (c) nominal diameter of washers, (d) machining process and (e) heat treatment conditions.

Remark: If the torque coefficient values of sets cannot be measured because the length "l" is short, take the actions according to the agreement made with the supplier.

5-2. Measurement of torque coefficient values of sets

Torque coefficient values of sets shall be measured as follows:

(1) Torque coefficient values of sets shall be measured under the operating conditions, and the coefficient values of the same test sample shall not be measured repeatedly.

(2) Use a torque tester or a tension meter for measurement.
If a torque tester is used, read a torque and an axial tension respectively by one-half of the scale interval from the torque-axial tension diagram recorded in the gauge connected to the tester.
If an axial tension meter is used, set a test sample to the tension meter, apply torque to the nut gradually so that no error is produced. Then, measure the torque with a torque meter (refer to JIS B 4650) and the bolt axial tension with the tension meter, respectively, by one-half of the scale interval of the tester.
At this time, the washer shall not turn.
If the jig that comes in contact with the bearing surface of bolt is as hard as or harder than the washer, the washer may be omitted from the bearing surface of bolt.

(3) Measure the torque applied to the nut and the bolt axial tension produced by the torque at 3 points where the bolt axial tension values are within the range shown in Table 3. If a torque tester is used for measurement, the measurement may be carried out at one point around the middle of the value shown in Table 3.

Table 3 Axial tension for measurement of torque coefficient value Unit: kN{kgf}

	Axial tension of bolt						
	Nominal diameter of thread						
	M12	M16	M20	M22	M24	M27	M30
F8T	38 to 51 {3875 to 5201}	71 to 95 {7240 to 9687}	110 to 148 {11217 to 15092}	136 to 184 {13868 to 18763}	159 to 214 {16214 to 21822}	206 to 279 {21006 to 28450}	252 to 341 {25697 to 34772}
F10T	54 to 72 {5506 to 7342}	99 to 134 {10095 to 13664}	155 to 209 {15806 to 21312}	191 to 259 {19417 to 26411}	223 to 301 {22740 to 30694}	290 to 392 {29572 to 39973}	354 to 479 {36098 to 48845}
F11T	57 to 76 {5812 to 7750}	105 to 141 {10707 to 14378}	163 to 221 {16621 to 22536}	202 to 273 {20598 to 27838}	235 to 318 {23963 to 32427}	306 to 414 {31203 to 42216}	374 to 506 {38138 to 57598}

(4) Substitute the torques and axial tensions measured according to the procedure specified in (3) and the standard outside diameters of bolt thread into the expression indicated in 5. to determine 3 calculated values. Then, round off the average value of the 3 calculated values (or round off the calculated value in the case where only one point is measured using a torque tester) to the third decimal place according to the procedure specified in JIS Z 8401 to determine the torque coefficient value of the test sample.
(5) The scale interval of torque-axial tension drawing determined by the torque tester shall be 10 N·m {1 kgf·m} or less for torque, and 1% or less of the axial tension to be measured for axial tension.
(6) The scale interval of the tension meter shall be 1% or less of the axial tension to be measured. Its error shall be 2 % or less of the indicated value within the axial tension range to be measured.

5-3. Inspection of torque coefficient values of sets

Torque coefficient values of sets measured according to the procedure mentioned in 11.2 must meet the specified values shown in Table 2. The quality assurance level of the inspection lot(10) shall be as follows:

(1) The quality assurance level of the standard deviation of torque coefficient value of the inspection lot(10) shall be a risk rate of 5% or less and a standard relative error of 8% or less.
Remark: For the application of 5.3(1), if the process is in a steady condition, the recent x-R control chart or inspection data including data of the inspection lot may be used.
If necessary, under the agreement made with the supplier, the standard relative error that is a little larger than the specified value may be determined to reduce a test sample.
(2) The quality assurance level of the average value of torque coefficient value of the inspection lot(10) shall be larger than the value indicated in Table 9.

Note (10) "1 inspection lot" refers to 1 production lot specified in (3) of Note (1) in the section 5.

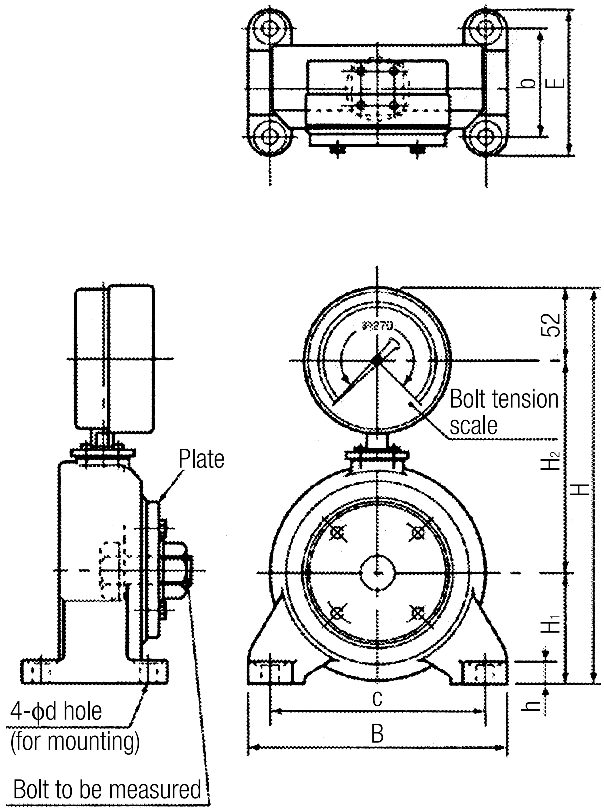
Table 4 Quality assurance level of average value of torque coefficient values

Types of sets by torque coefficient values	Lower limit values		Upper limit values	
	m0”(α ≒ 0.05)	m1”(α ≒ 0.10)	m0’(α ≒ 0.05)	m1’(α ≒ 0.10)
A	0.110	0.100	0.150	0.160
B	0.150	0.140	0.190	0.200

Remark: 1. The meanings of m0”, m1”, m0’ and m1’ shall be specified in JIS Z 9003.
2. For the standard deviation, the value determined by 5.3(1) shall be used.

6 Appendix (Dimensional Drawing/Specifications)

■ Model B-BTM



■ Specifications

Accuracy: ±3%

Model	Measuring range of axial tension [kN]		Measurable bolt [mm]		Optimum under head length [mm]	Measurable bolt [mm]									Approx. weight [kg]
						Total length	Total thickness	Total height	Main body						
	Min. to Max.	1 graduation	Bolt size (minimum length)			B	E	H	b	c	h	d	H_1	H_2	
B-BTM13K	1.2 to 13	0.2	Standard bolts	M5(20), M6(21) M7(21.5), M8(22.5)		106	78	217	62	86	10	6	46	119	7.7
B-BTM14K	4 to 40	0.5		M10(29), M12(31) M14(32)		135	82	241		110	12	7	58	131	9.8
B-BTM140K	12 to 130	2		M16(41), M18(43) M20(44), M24(47)		188	106	287	87	156	16	12	81	154	17.5
B-BTM400K	40 to 400	5		M27(72), M30(74) M36(79), M42(84)		280	126	369	90	240	25	14	122	195	31.0

Designs and specifications are subject to change without notice.

Your Torque Partner
TOHNICHI

■ **TOHNICHI MFG. CO., LTD.**
TEL: +81-3-3762-2455 FAX: +81-3-3761-3852
2-12, Omori-kita, 2-Chome Ota-ku, Tokyo 143-0016, JAPAN
E-mail: overseas@tohnichi.co.jp
Website: http://tohnichi.jp

■ **N. V. TOHNICHI EUROPE S. A.**
TEL: +32-16-606661 FAX: +32-16-606675
Industrieweg 27 Boortmeerbeek, B-3190 Belgium
E-mail: tohnichi-europe@online.be
Website: http://www.tohnichi.be

■ **TOHNICHI AMERICA CORP.**
TEL: +1-847-272-8480 FAX: +1-847-272-8714
677 Academy Drive, Northbrook, Illinois 60062, U. S. A.
E-mail: inquiry@tohnichi.com
Website: http://www.tohnichi.com