ThreeBond

June 3, 2011
ThreeBond Co., Ltd.

Technical Data
ThreeBond 2458B
Pre-coated bolts MEC process
(water-based, acrylic, low-strength, and fewer-flake type)

1. Product description

ThreeBond 2458B is an acrylic resin-based, low-strength sealing and locking agent for pre-coated bolts. This water-based product that does not contain organic solvents is an environmentally-friendly microencapsulated thread locking agent. When a bolt is screwed, the microcapsules are broken and their acrylic resin reacts with the curing agent to prevent leaking and loosening of the threaded portion.

Hereinafter, ThreeBond is abbreviated as TB.

2. Features

(1) Low level of fixing strength
(2) Fewer flakes generated during tightening
(3) Excellent heat resistance (Locking: 100°C, sealing: 170°C)
(4) Applicable to minimum screw diameter of M3
(5) Standard curing condition: 25°C for 24 hours

3. Applications

For fixing and sealing bolts, screws, etc.

4. Properties

Table 1. Properties

Product name	TB2458B
Primary component	Acrylic resin
Color	Green

5. Characteristics

5.1 Curing rate

After the bolts processed with TB2458B are tightened at each temperature, the fixing strength is measured after a lapse of the specified time.

- Bolts, nuts: JIS class 2 M10 x P1.5, zinc-plated and chromate-treated
- Number of test pieces: n=5
- Tightening torque: 30 Nm
- Curing temperature conditions: -5°C, 5°C, 10°C, 25°C, 40°C
- Measurement condition: 3TS-306-05

1) Curing rate at -5°C

Table 2. Curing rate at -5°C

Elapsed time (h)	Fixing strength (breaking torque) range (Nm)	Average (Nm)
0.5	30.4 to 33.0	32.0
3	30.9 to 34.7	32.2
6	32.6 to 37.6	35.6
12	34.3 to 39.4	36.0
24	34.2 to 39.4	37.3
48	37.0 to 39.3	38.6
72	37.2 to 39.9	38.7

2) Curing rate at 5°C

Table 3. Curing rate at 5°C

Elapsed time (h)	Fixing strength (breaking torque) range (Nm)	Average (Nm)
0.5	30.9 to 35.5	32.3
3	31.6 to 36.2	33.5
6	33.1 to 38.0	36.2
12	34.9 to 38.4	36.8
24	34.8 to 38.9	37.7
48	37.4 to 39.7	38.4
72	35.5 to 40.4	38.4

3) Curing rate at 10°C

Table 4. Curing rate at 10°C

Elapsed time (h)	Fixing strength (breaking torque) range (Nm)	Average (Nm)
0.5	30.6 to 33.3	31.9
3	30.5 to 37.3	33.3
6	34.7 to 38.9	37.3
12	37.7 to 39.9	38.6
24	36.9 to 40.3	38.2
48	37.8 to 40.1	39.3
72	35.3 to 41.6	40.6

4) Curing rate at 25°C

Table 5. Curing rate at 25°C

Elapsed time (h)	Fixing strength (breaking torque) range (Nm)	Average (Nm)
0.5	31.9 to 34.5	33.4
3	35.1 to 38.9	37.8
6	36.5 to 38.8	38.0
12	36.5 to 39.4	38.2
24	37.3 to 40.9	39.3
48	39.2 to 41.5	40.5

5) Curing rate at 40°C

Table 6. Curing rate at 40°C

Elapsed time (h)	Fixing strength (breaking torque) range (Nm)	Average (Nm)
0.5	30.6 to 37.0	34.7
3	35.7 to 41.8	39.4
6	37.9 to 41.0	40.1
12	37.7 to 42.2	40.3
24	39.2 to 41.8	40.8
48	37.6 to 45.2	41.0

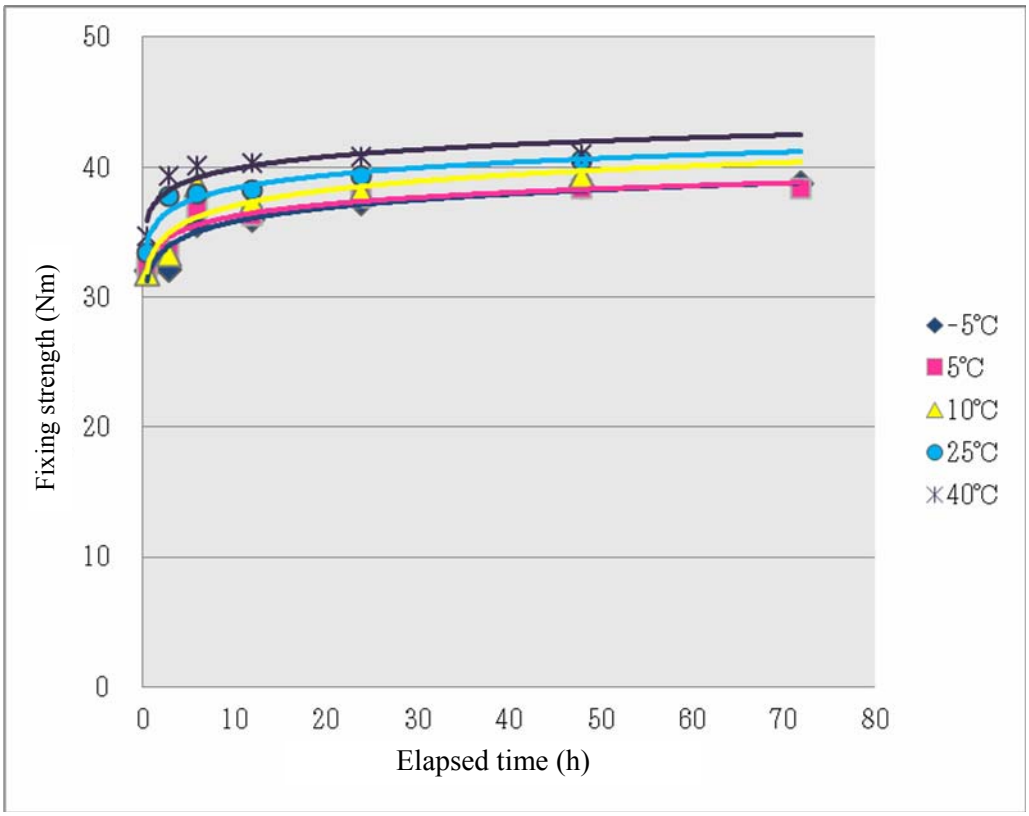

Figure 1. Curing rate

5.2 Fixing strength at each size

After TB2458B-applied bolts with different sizes are tightened and the agent is cured at 25°C for 24 hours, the fixing strength is measured.

- Bolts, nuts: They should be zinc-plated and chromate-treated. Their sizes are shown in the following table.
- Number of test pieces: n=5
- Measurement conditions: 3TS-306-05 (bolt M10), 3TS-306-02 (other than bolt M10)

Table 7. Fixing strength at each size

Bolt Size Pitch	Tightening torque (Nm)	Fixing strength (breaking torque) range (Nm)	Average (Nm)
M3 P0.35	1.0	1.0 to 1.1	1.0
M4 P0.7	2.0	2.0 to 2.4	2.1
M6 P1.0	8.0	8.0 to 8.8	8.5
M8 P1.25	15	17.3 to 19.1	18.1
M10 P1.25	30	37.7 to 41.1	39.4
M10 P1.5	30	37.3 to 40.9	39.3
M12 P1.25	50	56.0 to 66.0	60.6
M12 P1.5	50	58.0 to 64.0	60.8
M12 P1.75	50	55.0 to 62.0	57.7
M14 P2.0	90	104.0 to 115.0	107.6

5.3 Fixing strength of each material

After bolts treated with TB2458B are tightened and the agent is cured at 25°C for 24 hours, the fixing strength is measured.

- Bolts, nuts: JIS class 2 M10 x P1.5
- Number of test pieces: n=5
- Tightening torque: 30 Nm (Brass and aluminum bolts: 15 Nm)
- Measurement condition: 3TS-306-05

Table 8. Fixing strength of each material

Bolt and nut material	Fixing strength (breaking torque) range (Nm)	Average (Nm)
Iron workpiece	38.4 to 40.2	39.2
Zinc-plated, chromate-treated	37.3 to 40.9	39.3
Chrome-plated	38.3 to 41.8	40.3
Nickel-plated	37.7 to 42.0	40.7
Unichromate-plated	37.8 to 41.0	39.4
Black oxide	33.5 to 39.7	36.9
SUS304	36.2 to 40.6	38.5
Brass	27.0 to 30.8	28.4
Aluminum	20.1 to 21.5	20.9

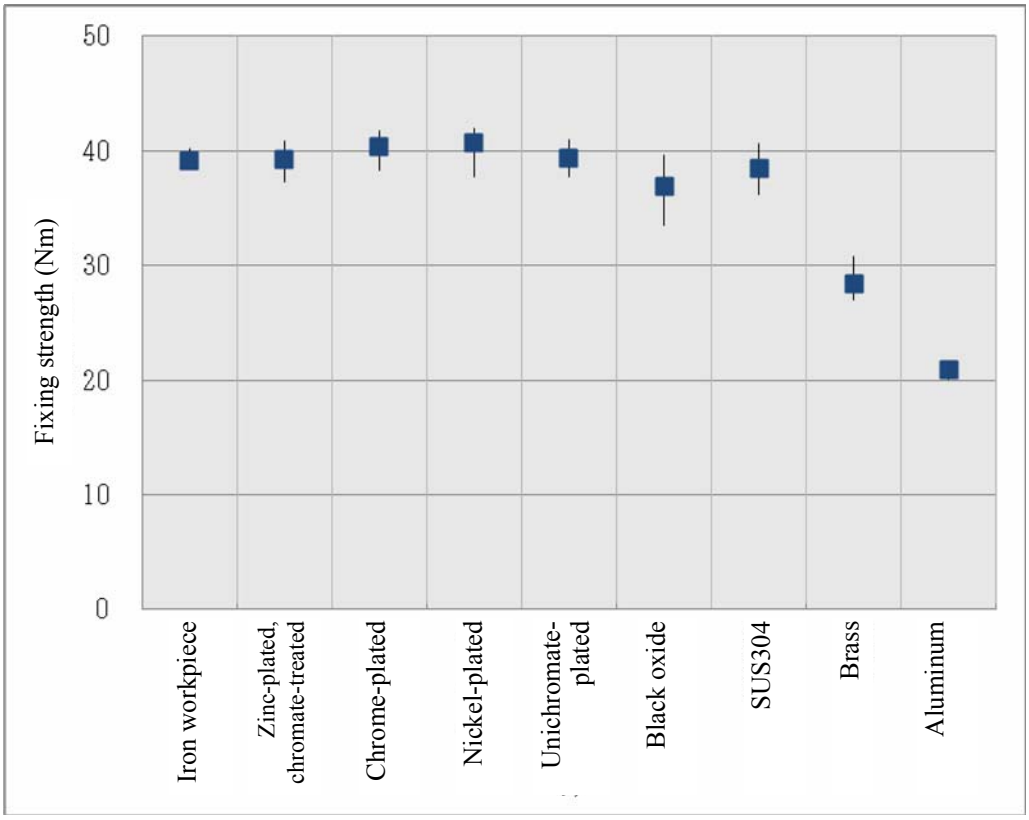

Figure 2. Fixing strength of each material

5.4 Chemical resistance test

After bolts treated with TB2458B are tightened and the agent is cured at 25°C for 24 hours, the bolts are immersed in each medium. After a lapse of the specified time, the bolts are taken out from the medium, and the fixing strength is measured.

- Bolts, nuts: JIS class 2 M10 x P1.5, zinc-plated and chromate-treated
- Number of test pieces: n=5
- Tightening torque: 30 Nm
- Measurement condition: 3TS-306-05

Table 9. Chemical resistance test

Test medium	Immersion conditions	Fixing (breaking torque) range (Nm)	Average (Nm)
Blank		37.3 to 40.9	39.3
NaOH 10% aq.	25°C x 7 days	36.8 to 42.5	39.4
Gas oil	40°C x 7 days	41.5 to 47.1	45.1
Gasoline	40°C x 7 days	42.3 to 46.7	45.3
n-hexane	40°C x 7 days	41.6 to 44.3	42.7
Methanol	40°C x 7 days	42.2 to 46.4	44.5
Water	100°C x 7 days	39.9 to 43.2	41.3
Ethylene glycol	100°C x 7 days	38.0 to 41.7	39.5
Ethylene glycol 50% aq.	100°C x 7 days	38.1 to 43.2	40.8
Engine oil	100°C x 7 days	37.2 to 44.0	39.9
Turbine oil	100°C x 7 days	36.7 to 39.9	38.2
AT fluid	100°C x 7 days	38.4 to 41.4	39.8
Gear oil	100°C x 7 days	39.5 to 45.1	42.2

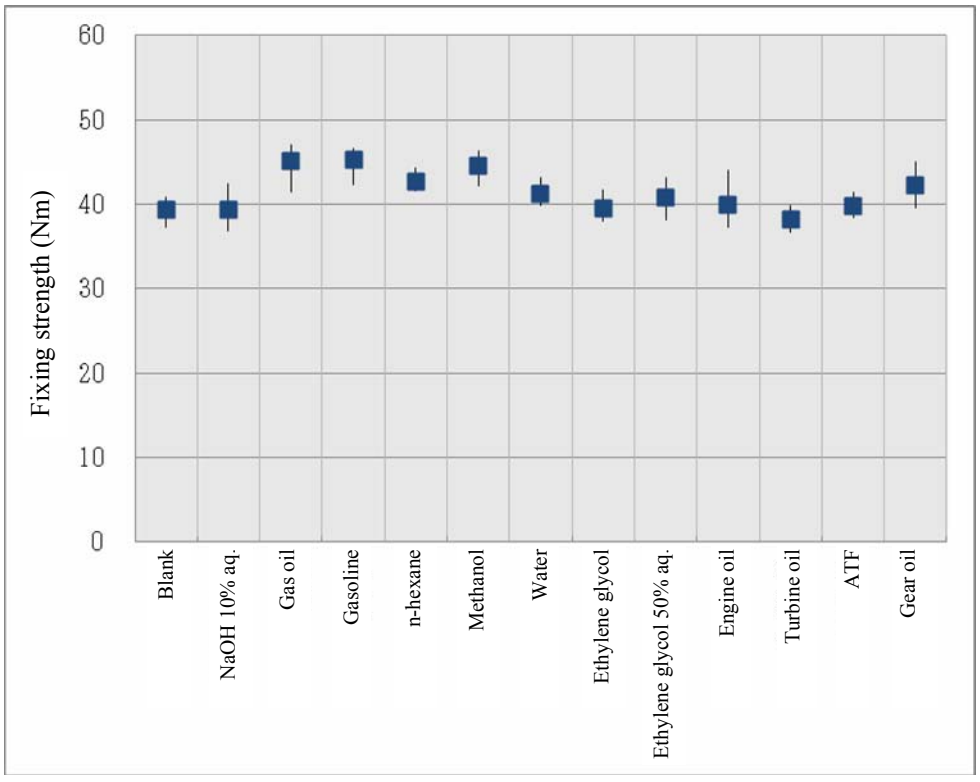

Figure 3. Chemical resistance test

5.5 Heat deterioration test

Bolts treated with TB2458B are tightened, and they are exposed to each temperature after the agent is cured at 25°C for 24 hours. The bolts are taken out after a lapse of the specified time and cooled to room temperature, and the fixing strength is measured.

- Bolts, nuts: JIS class 2 M10 x P1.5, zinc-plated and

chromate-treated

- Number of test pieces: n=5
- Tightening torque: 30 Nm
- Temperature conditions: 100°C, 120°C, 150°C
- Measurement condition: 3TS-306-05

1) 100°C

Table 10. Heat deterioration test at 100°C

Time of exposure	Fixing strength (breaking torque) range (Nm)	Average (Nm)
Initial	37.3 to 40.9	39.3
7 days	37.7 to 44.4	41.3
14 days	37.2 to 43.2	41.3
21 days	34.5 to 45.2	40.1
28 days	35.6 to 44.4	40.2

2) 120°C

Table 11. Heat deterioration test at 120°C

Time of exposure	Fixing strength (breaking torque) range (Nm)	Average (Nm)
Initial	37.3 to 40.9	39.3
7 days	37.5 to 41.9	40.7
14 days	33.2 to 44.1	38.5
21 days	34.8 to 42.5	39.2
28 days	34.4 to 42.5	38.5

3) 150°C

Table 12. Heat deterioration test at 150°C

Time of exposure	Fixing strength (breaking torque) range (Nm)	Average (Nm)
Initial	37.3 to 40.9	39.3
7 days	36.6 to 43.8	40.3
14 days	31.9 to 40.6	34.8
21 days	32.8 to 36.9	34.5
28 days	33.2 to 35.7	34.4

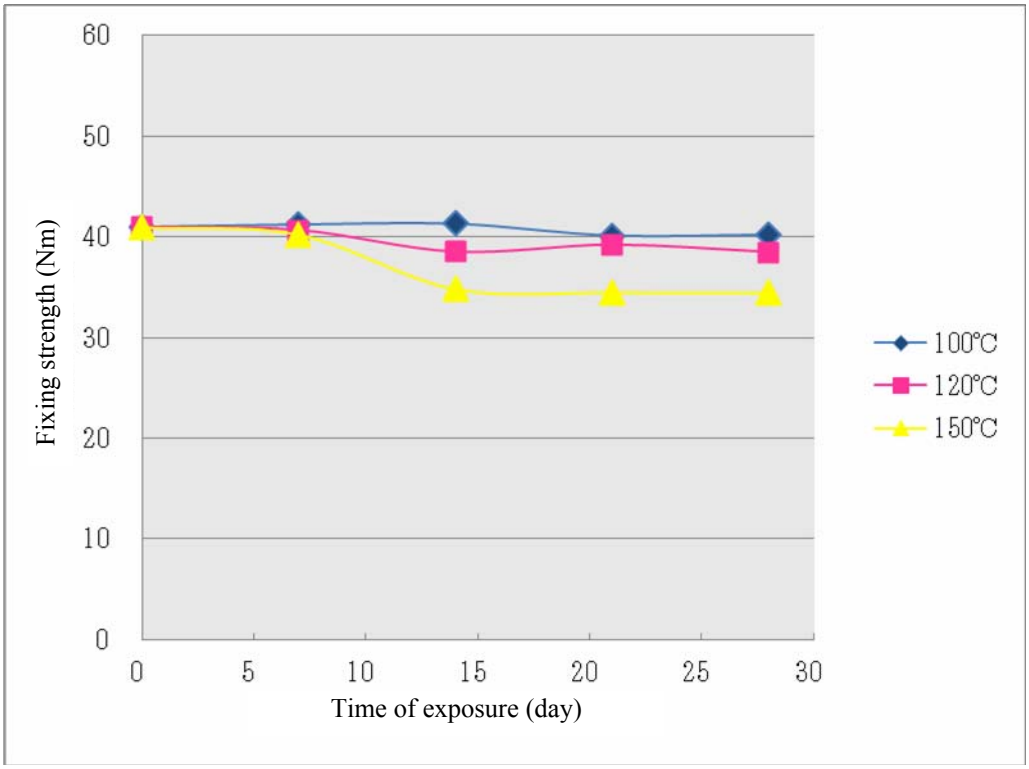

Figure 4. Heat deterioration test

5.6 Fixing strength test at various temperatures

After bolts treated with TB2458B are tightened and the agent is cured at 25°C for 24 hours, the bolts are kept at each temperature for 2 hours, and the fixing strength is measured at the temperature.

- Bolts, nuts: JIS class 2 M10 x P1.5, zinc-plated and chromate-treated
- Number of test pieces: n=5
- Tightening torque: 30 Nm
- Measurement condition: 3TS-306-02

Table 13. Fixing strength at each temperature

Test temperature (°C)	Fixing strength (breaking torque) range (Nm)	Average (Nm)
25	37.3 to 40.9	39.3
60	35.5 to 40.5	38.0
80	30.5 to 34.6	31.9
90	30.3 to 34.6	31.5
100	30.1 to 33.7	31.5
130	23.2 to 30.0	26.1
150	23.7 to 28.2	25.9
180	18.2 to 24.6	21.3

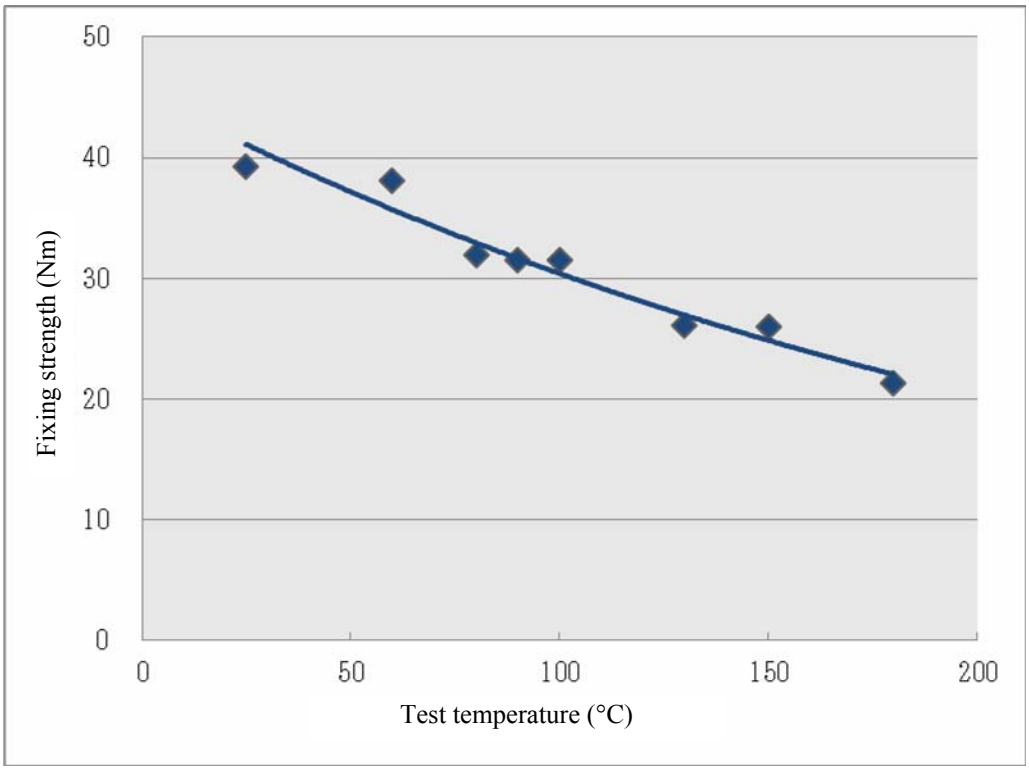

Figure 5. Fixing strength at each temperature

5.7 Axial force at various tightening torques

Bolts treated with TB2458B are set on tightening testing equipment, and the axial force at each tightening torque is measured.

- Bolts: JIS class 2 M10 x P1.5 zinc-plated and chromate-treated hexagon head bolt with tensile strength rank 10.9
- Nuts: ISO class 1 zinc-plated and chromate-treated hexagon nuts
- Number of test pieces: n=5
- Testing equipment: Tightening testing equipment NST-500NM made by Japan Instrumentation System Co., Ltd.

Table 14. Axial strength at various tightening torques

Tightening torque (Nm)	Axial force (kN)			
	TB2458B		Non-coating	
	Range	Average	Range	Average
20	6.1 to 7.4	6.8	3.5 to 4.5	4.1
30	8.6 to 10.7	9.6	5.5 to 7.3	6.5
40	11.2 to 14.3	12.4	7.5 to 10.0	9.0
50	13.7 to 17.9	15.3	9.6 to 12.9	11.7
60	16.2 to 21.0	18.0	12.0 to 15.6	14.2

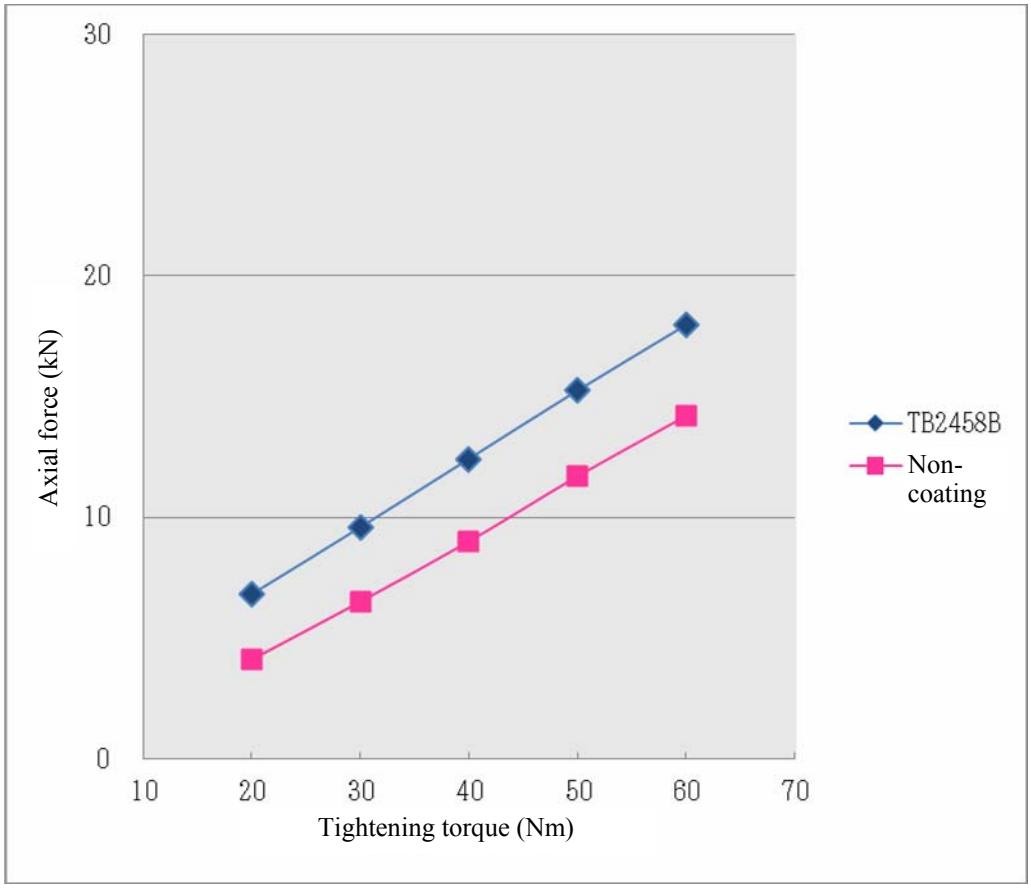

Figure 6. Axial strength at various tightening torques

5.8 Sealing test (air tightness)

Bolts treated with TB2458B are tightened on a seal test block at the specified torque, and the agent is cured at 25°C for 24 hours. Then, the block is mounted on seal testing equipment. Immediately the nitrogen gas pressure is increased to 0.5 MPa, and the block is kept at the pressure for 5 minutes, for which the bolts are checked for leak. Then, the pressure is increased up to 2.0 MPa by 0.5 MPa. The block is kept at each pressure for 2 minutes. The bolts are checked for leak at each pressure under water.

- Bolt: JIS class 2 M10 x 1.5, zinc-plated and chromate-treated
- Seal test block: Iron, aluminum
- Tightening torque: 30 Nm
- Test temperature: 25°C
- Test medium: Nitrogen gas
- Number of test pieces: n=10
- Measurement condition: 3TS-350-01

Table 15. Sealing test (air tightness)

Seal test block material	Test temperature (°C)	Pressure (MPa)			
		0.5	1.0	1.5	2.0
Iron	25	0/10	0/10	0/10	0/10
Aluminum	25	0/10	0/10	0/10	0/10

* 0/10 indicates that none of the ten bolts showed any leak.

5.9 Sealing test (oil tightness)

Bolts treated with TB2458B are tightened on a seal test block at the specified torque, and the agent is cured at 25°C for 24 hours. Then, the block is mounted on seal testing equipment. Immediately the oil pressure is increased to 2.0 MPa, and the block is kept at the pressure for 5 minutes, for which the bolts are checked for leak. Then, the pressure is increased up to 10 MPa by 2.0 MPa. The block is kept at each pressure for 2 minutes. The bolts are visually checked for leak at each pressure using a developer.

- Bolt: JIS class 2 M10 x 1.5, zinc-plated and chromate-treated
- Seal test block: Iron, aluminum
- Tightening torque: 30 Nm
- Test temperature: 25°C, 170°C
- Test medium: Turbine oil
- Number of test pieces: n=10
- Measurement condition: 3TS-350-01

Table 16. Sealing test (oil tightness)

Seal test block material	Test temperature (°C)	Pressure (MPa)				
		2.0	4.0	6.0	8.0	10
Iron	25	0/10	0/10	0/10	0/10	0/10
	170	0/10	0/10	0/10	0/10	0/10
Aluminum	25	0/10	0/10	0/10	0/10	0/10
	170	0/10	0/10	0/10	0/10	0/10

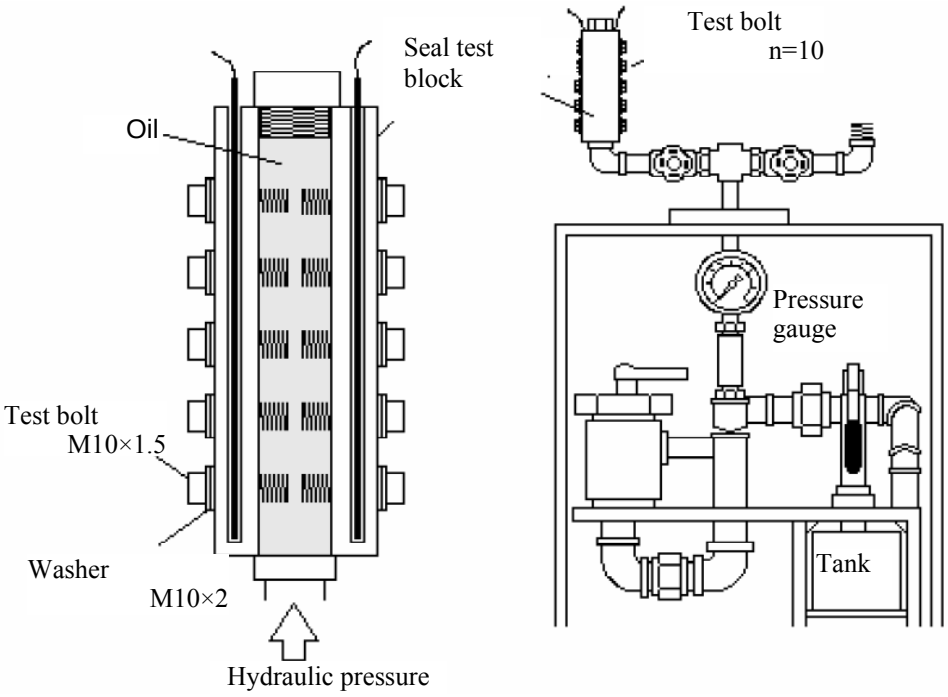

Figure 7. Seal testing equipment

6. Precautions for handling and storage

6.1 Health effects and precautions

- Pre-coated bolts are delivered to customers after a pre-coating agent applied to their threads has been dried up. Therefore, it is rare for the pre-coating agent to adhere to your fingers or hands or to enter your eyes or mouth. However, the flakes of the agent generated when the bolts are tightened may irritate your body.
- Irritation is a medical physiological phenomenon, and the degree of irritation greatly varies among individuals, which makes it difficult to completely prevent the irritation. It is important to examine how to handle pre-coated bolts to avoid irritation. Your skin may be irritated after you have handled them several times. When handling them, observe the following instructions.
  (1) People who have sensitive skin should not handle them.
  (2) Wear impervious gloves to prevent direct contact of your hands with treated portions and adhesion of flakes of the agent to your hands.
  (3) If flakes of the pre-coating agent adhere to your fingers or hands, thoroughly wash them with soap. If the flakes cannot be removed, it is effective to wipe them off with a solvent (thinner). However, take care not to chap the hands.
  (4) If the flakes have entered your eyes, rinse them thoroughly with clean water and get medical attention.
  (5) If the flakes have entered your mouth, spit them out immediately and get medical attention.
  (6) If any bodily abnormalities occur, discontinue use, and get medical attention.

6.2 Directions for use

1) Use of product for special purposes, such as medical and food manufacturing purposes
   - This product was developed for general industrial use. We do not confirm the safety of the use of the product in medical devices or food-related equipment. If it is used for such a purpose, conduct the preliminary verification test appropriate to the purpose of use, and sufficiently confirm the safety prior to use. Never use it for medical implant products.
2) Improper conditions of use
   - In the following cases, the product will not exhibit sufficient locking or sealing ability.
     (1) Adhesion of foreign substances (water, oil, solvents, dust, etc.) to the threaded portions
     (2) Improper tightening (excessive or insufficient tightening)
     (3) Too large clearance
     (4) Out of working temperature range during and after tightening
     (5) Reuse of used pre-coated bolts
3) Material of mating part
   - The material may be cracked or deformed by screwing the pre-coated bolt depending on the strength of the internal threads. Check the strength in advance.
4) Removal of attached flakes
   - The flakes of the pre-coating agent on your clothes can be removed by a gloved hand or an air blower.
   - To remove the pre-coating agent on work, it is effective to blow air or wipe with a solvent (thinner). If the pre-coating agent cannot be removed by wiping, it must be physically peeled off because it has cured.
5) Use of a parts feeder
   - In a parts feeder, pre-coated bolts get into contact with one another, and flakes of the pre-coating agent can be generated. The flakes stick to the parts feeder, and it may not operate normally. To prevent this, clean the parts feeder on a daily basis to remove the flakes.

6.3 Instructions for storage and transportation

- Note that the MEC treatment bolt pre-coating agent does not exhibit its original performance if appropriate storage conditions are not met.

1) Prevention of adhesion of foreign substances
   - Keep the bolts away from water, oil, solvents, dust, etc.
   - Store the product in a sealed state in a less-dust environment, or lid or cover the pre-coated bolt container.
2) Attention to collision
   - Take care that the coating of the pre-coated bolts is not removed by hard collision of bolts during transportation. Take special care when handling heavy bolts.
3) Storage and conditions of use
   - The quality of the MEC treatment bolt pre-coating agent deteriorates under the influence of high temperature, moisture and UV light. To prevent deterioration

due to these factors and entry of foreign substances, observe the following instructions.

(1) Store the product, if possible, in a sealed state in an indoor dark place with as low humidity as possible at 0 to 25°C away from direct sunlight and rain. (Use of a desiccant is effective in prevention of deterioration due to humidity.)
(2) Do not allow condensation to occur.
(3) Use the bolts on a first-in, first-out basis.
(4) In a season with high temperature and humidity, use the bolts as soon as possible.

7. Treatment and delivery system

We have established a system for treating the bolts and plugs supplied by customers at our plant and delivering them after treatment. For the details, contact one of our sales offices.

8. Cautions

For Industrial Use Only (Do not use for household purposes)

This product was developed for general industrial use. Before using this product, users must accept the following terms.

- The technical data given herein are not guaranteed values, but examples of experimental values obtained by our specified test methods. We do not guarantee that the uses described herein do not conflict with any intellectual property right.
- Users are asked to examine whether the product is appropriate to the purpose of use and can be used safely before they use it and bear all responsibilities and hazards involved in its use. Never use the product for medical implants that may be embedded, injected or left in the body.
- We are not liable for personal injury or property damage caused by improper handling of this product. If the properties or usage of the product to be used are unclear, never use it.
- For detailed safety information of the product, see the material safety data sheet (MSDS). To obtain the MSDS, contact our sales office or customer service center.
- Information in this technical document is subject to change at our discretion without notice.