ThreeBond

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ThreeBond Co., Ltd.

Technical Data
ThreeBond 2448B
MEC treatment for pre-coating bolts (water-based, high-strength epoxy type)

1. Product description

ThreeBond 2448B is a high-strength epoxy sealing and locking agent for pre-coating bolts. This product is a water-based agent not containing organic solvents and is an environmentally-friendly microencapsulated thread locking agent.
When a bolt treated with ThreeBond 2448B is screwed, the microcapsules are broken, and the epoxy resin reacts with the curing agent to prevent leaking and loosening of the threaded portion.

Hereinafter, ThreeBond is abbreviated to TB.

2. Features

(1) Highest level of fixing strength
(2) Excellent heat resistance(Lock ：160°C、seal：170°C）
(3) Applicable to minimum screw diameter of M2
(4) Standard drying conditions: 25°C for 24 hours

3. Applications

Locking and sealing of bolts and screws

4. Properties

Table 1 Properties of TB2448B

Product name	TB2448B
Main component	Epoxy resin
Color	Orange

5. Characteristics

5.1 Curing speed

After bolts treated with TB2448B are tightened at each temperature, the bolts are taken out after a lapse of the specified time, and the fixing strength is measured.

- Bolts, nuts: JIS class 2 M10 x P1.5 Galvanized chromate treatment
- Number of test pieces: n=5
- Tightening torque: 30N･m
- Curing temperature conditions: -5°C、5°C、10°C、25°C、40°C
- Measuring conditions: 3TS-4150-005

1) Curing speed at -5°C

Table 2 Curing speed of TB2448B at -5°C

Elapsed time (h)	Fixing strength range (N·m)	Average (N·m)
0.5	57.1～65.0	61.9
3	63.9～70.3	67.3
6	67.2～70.9	69.5
12	65.9～71.0	68.1
24	65.4～72.1	68.6
48	64.8～72.0	69.2
72	65.7～69.9	68.3

2) Curing speed at 5°C

Table 3 Curing speed of TB2448B at 5°C

Elapsed time (h)	Fixing strength range (N·m)	Average (N·m)
0.5	59.3～64.6	62.0
3	62.7～68.5	66.1
6	67.3～70.8	69.2
12	68.1～70.4	69.1
24	67.3～71.2	69.2
48	68.1～70.5	69.1
72	67.4～71.3	69.2

3) Curing speed at 10°C

Table 4 Curing speed of TB2448B at 10°C

Elapsed time (h)	Fixing strength range (N·m)	Average (N·m)
0.5	60.8～66.5	62.9
3	64.6～69.6	67.2
6	66.1～70.3	68.1
12	66.4～71.3	68.7
24	66.3～70.1	68.4
48	66.6～70.5	68.5
72	66.3～71.3	68.9

4) Curing speed at 25°C

Table 5 Curing speed of TB2448B at 25°C

Elapsed time (h)	Fixing strength range (N·m)	Average (N·m)
0.5	60.3～66.4	61.8
3	60.5～66.4	63.6
6	64.7～68.4	66.8
12	65.8～68.7	67.3
24	66.7～75.3	70.7
48	66.6～70.5	68.4
72	65.7～71.7	68.1

5) Curing speed at 40°C

Table 6 Curing speed of TB2448B at 40°C

Elapsed time (h)	Fixing strength range (N·m)	Average (N·m)
0.5	60.0～61.7	60.5
3	64.1～67.7	65.9
6	65.7～68.8	67.2
12	66.0～68.7	67.3
24	65.8～67.0	67.0
48	66.8～68.2	66.9
72	66.4～69.1	67.1

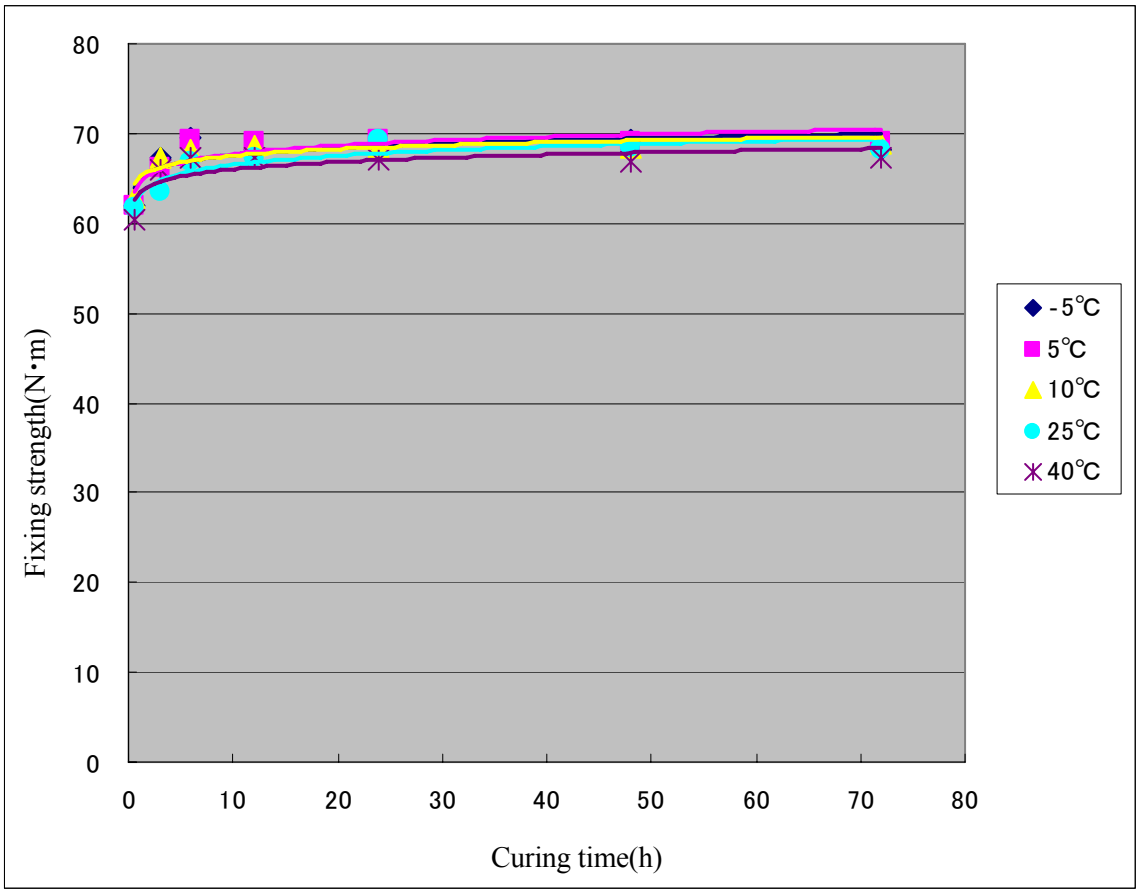

Fig. 1 Curing speed of TB2448B

5.2 Fixing strength for each size

After bolts treated with TB2448B are tightened and the agent is cured at 25°C for 24 hours, the fixing strength is measured.

- Bolts, nuts: The sizes of the bolts and nuts after galvanized chromate treatment are shown in the following table.
- Number of test pieces: n = 5
- Measuring conditions: 3TS-4150-005 (bolt M10), 3TS-4150-002 (other than bolt M10)

Table 7 Fixing strength of TB2448B for each size

Bolt size pitch	Tightening torque (N･m)	Fixing strength range (N･m)	Average (N･m)
M 2 P0.25	0.3	0.35 to 0.43	0.37
M2.6 P0.35	0.4	0.44 to 0.64	0.55
M 3 P0.35	1.0	1.3 to 1.6	1.4
M 4 P0.7	2.0	2.9 to 3.1	3.0
M 6 P1.0	8.0	11.4 to 13.5	12.6
M 8 P1.25	15	21.0 to 23.0	22.0
M10 P1.25	30	62.4 to 71.3	68.0

M10 P1.5	30	66.7 to 75.3	70.7
M12 P1.25	50	92.0 to 98.0	95.6
M12 P1.5	50	98.0 to 106.0	101.2
M12 P1.75	50	94.0 to 98.0	95.6
M14 P2.0	90	154.0 to 163.0	157.8

5.3 Fixing strength to various materials

After bolts treated with TB2448B 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: piecesn=5
- Tightening torque: 30N·m (Brass and aluminum bolts: 15N·m)
- Measuring conditions: 3TS-4150-005

Table 8 Fixing strength of TB2448B to various materials

Material of bolt and nut	Fixing strength range (N·m)	Average (N·m)
Plain steel	63.0 to 67.1	64.6
Galvanized chromate treatment	66.7 to 75.3	70.7
Chromium plating	59.1 to 63.4	62.1
Nickel plating	62.8 to 66.8	65.1
Unichrome plating	63.7 to 69.4	66.5
Black oxide	60.7 to 67.9	64.1
SUS304	61.5 to 70.9	66.8
Brass	35.4 to 40.0	37.8
Aluminum	35.8 to 45.0	40.9

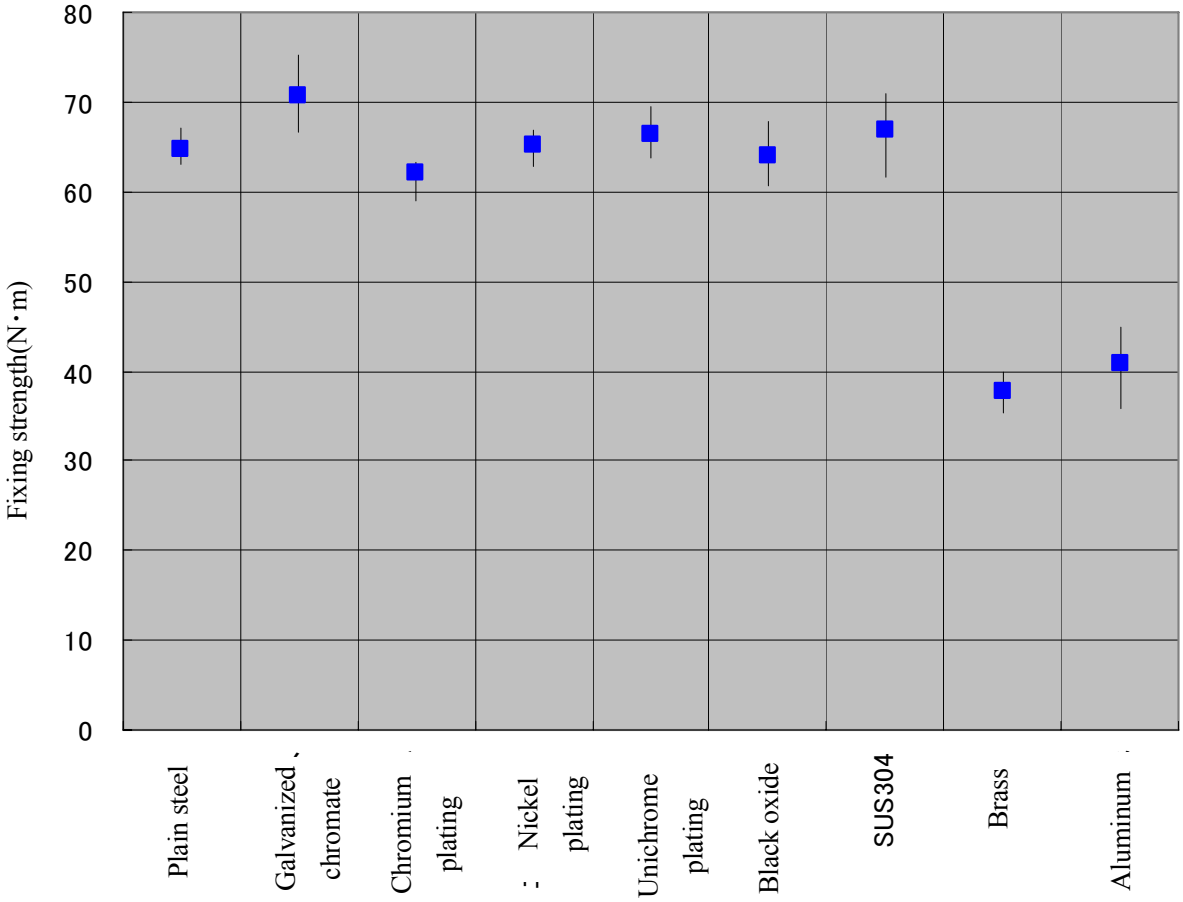

Fig. 2 Fixing strength of TB2448B to various materials

5.4 Chemical resistance test

Bolts treated with TB2448B are immersed in each medium after curing at 25°C for 24 hours. The bolts are taken out of the medium after a lapse of the specified time and the fixing strength is measured.

・Bolts, nuts: JIS class 2 M10 x P1.5 Galvanized chromate treatment

・Number of test : piecesn=5

・Tightening torque: 30N・m

・Measuring conditions: 3TS-4150-005

Table 9 Chemical resistance test of TB2448B

Test medium	Immersion conditions	Fixing strength range (N・m)	Average (N・m)
Blank		66.7～75.3	70.7
NaOH 10% aq.	25°C for 7 days	62.1～70.4	66.8
Gas oil	40°C for 7 days	70.1～80.0	77.2
Gasoline	40°C for 7 days	75.3～81.1	75.9
n-hexane	40°C for 7 days	76.4～79.0	77.1

Methanol	40°C for 7 days	69.2～79.7	75.9
Water	100°C for 7 days	66.5～74.4	70.4
Ethylene glycol	100°C for 7 days	61.2～79.6	70.5
Ethylene glycol 50%aq	100°C for 7 days	68.6～81.3	72.9
Engine oil	100°C for 7 days	66.6～77.0	73.4
Turbine oil	100°C for 7 days	70.7～76.3	73.4
AT fluid	100°C for 7 days	73.9～84.6	78.8
Gear oil	100°C for 7 days	61.7～83.0	71.3

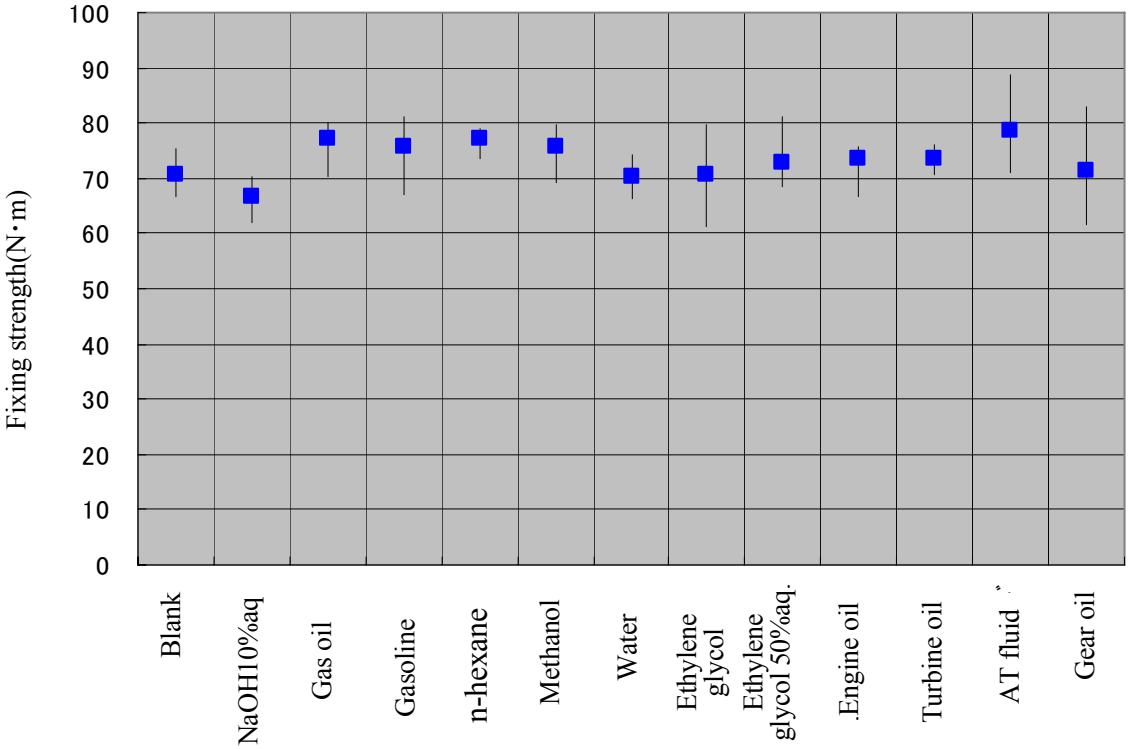

Table 3 Chemical resistance test of TB2448B

5.5 Heat deterioration test

Bolts treated with TB2448B are exposed to each temperature after curing 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 Galvanized chromate treatment
- Number of testpieces: n=5
- Tightening torque: 30N・m
- Temperature conditions: 100°C, 120°C, 150°C
- Measuring conditions: 3TS-4150-005

1）100**°C**

Table 10 Heat deterioration test of TB2448B at 100°C

Time of exposure	Fixing strength range (N·m)	Average (N·m)
Initial	66.7 to 75.3	70.7
7 days	69.4 to 78.6	73.8
14 days	70.9 to 88.0	78.8
21 days	62.3 to 83.1	77.5
28 days	67.0 to 84.7	75.7

2）120**°C**

Table 11 Heat deterioration test of TB2448B at 120°C

Time of exposure	Fixing strength range (N·m)	Average (N·m)
Initial	66.7 to 75.3	70.7
7 days	65.0 to 87.0	77.3
14 days	64.9 to 87.6	74.8
21 days	70.6 to 81.1	76.5
28 days	65.5 to 83.3	74.7

3）150**°C**

Table 12 Heat deterioration test of TB2448B at 150°C

Time of exposure	Fixing strength range (N·m)	Average (N·m)
Initial	66.7 to 75.3	70.7
7 days	74.3 to 78.4	76.4
14 days	65.5 to 78.0	70.6
21 days	64.1 to 79.5	71.7
28 days	61.6 to 80.5	71.4

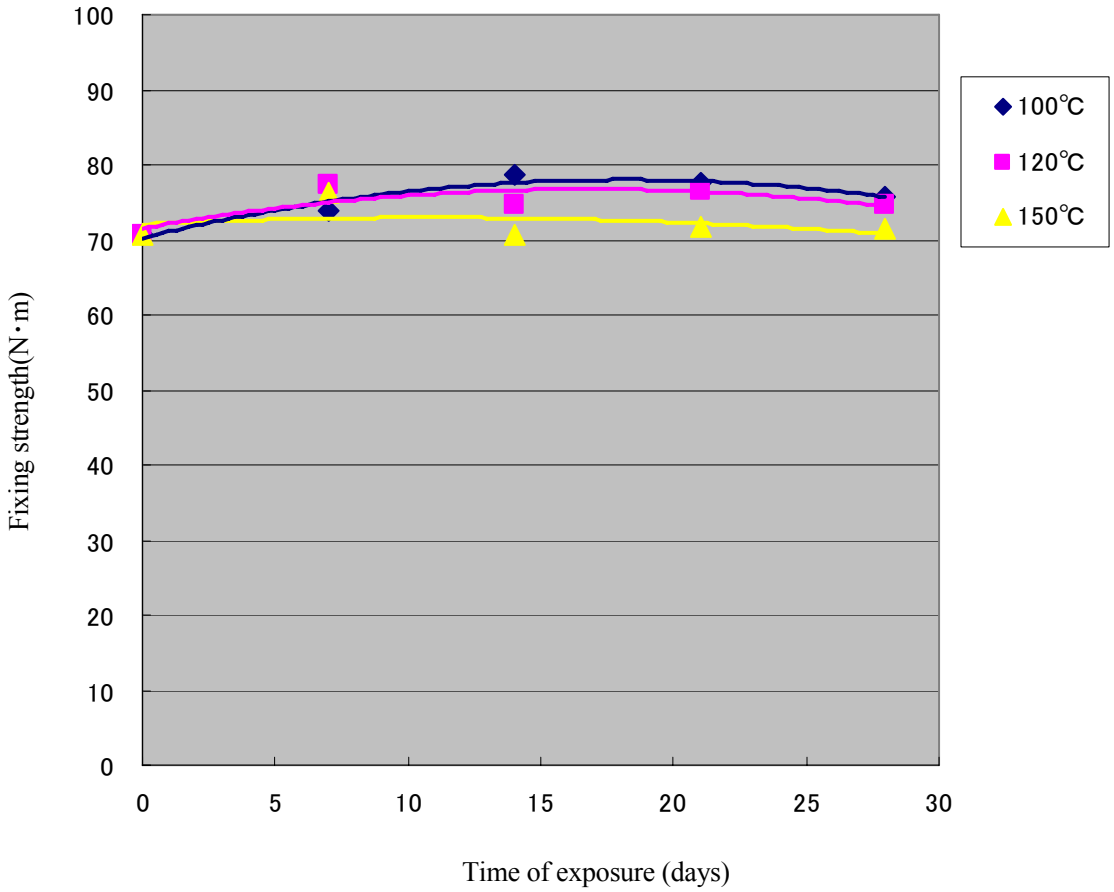

Fig. 4 Heat deterioration test of TB2448B

5.6 Fixing strength test at various temperatures

Bolts treated with TB2448B are kept at each temperature for 2 hours after curing at 25°C for 24 hours, and the fixing strength at the temperature is measured.

・Bolts, nuts: JIS class 2 M10 x P1.5 Galvanized chromate treatment

・Number of test: piecesn=5

・Tightening torque: 30N・m

・Measuring conditions: 3TS-4150-002

Table 13 Fixing strength of TB2448B at various temperatures

Test temperature (°C)	Fixing strength range (N·m)	Average (N·m)
25	66.7～75.3	70.7
60	50.5～57.0	54.4
80	49.0～53.5	52.0
100	42.0～51.0	47.6
130	40.0～44.0	42.0
150	37.0～39.0	38.0
180	20.0～22.5	21.0

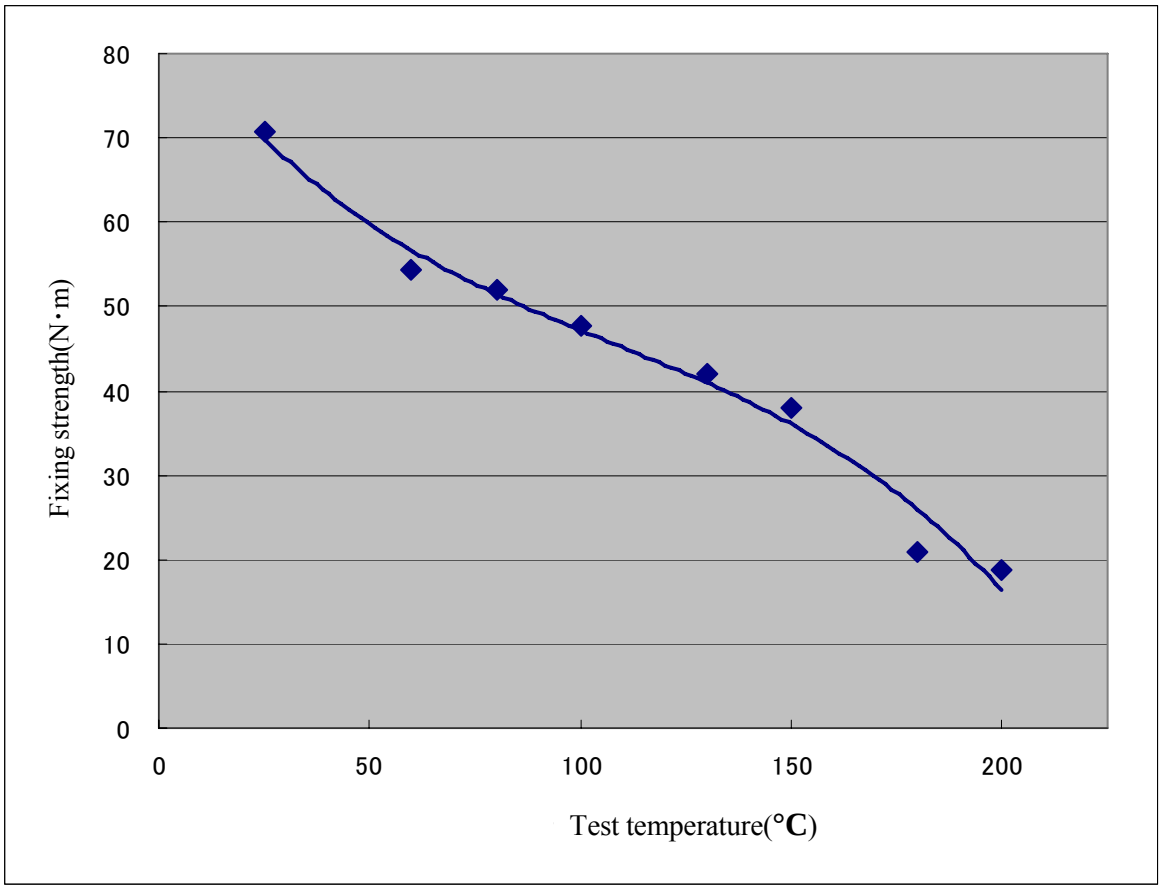

Fig. 5 Fixing strength of TB2448B at various temperatures

5.7 Axial force at various tightening torques

Bolts treated with TB2448B are set on tightening testing equipment, and the axial force at each tightening torque is measured.

- Bolts: JIS class 2 M10 x P1.5 Galvanized chromate treatment, hexagon head bolt, tensile strength rank 10.9
- Nuts: ISO class 1 Galvanized chromate treatment, hexagon nut
- Number of testpieces: n=5

・Testing equipment: Tightening testing equipment NST-500NM made by Japan Instrumentation System Co., Ltd.

Table 14 Axial force at various tightening torques

Tightening torque (N·m)	Axial force (kN)			
	TB2448B		Non-coating	
	Range	Average	Range	Average
20	5.3 to 5.9	5.5	3.5 to 4.5	4.1
30	8.1 to 8.7	8.2	5.5 to 7.3	6.5
40	10.7 to 11.3	10.8	7.1 to 9.8	8.4
50	13.0 to 13.8	13.4	9.0 to 12.2	10.6
60	15.7 to 16.3	16.1	10.9 to 14.6	12.8

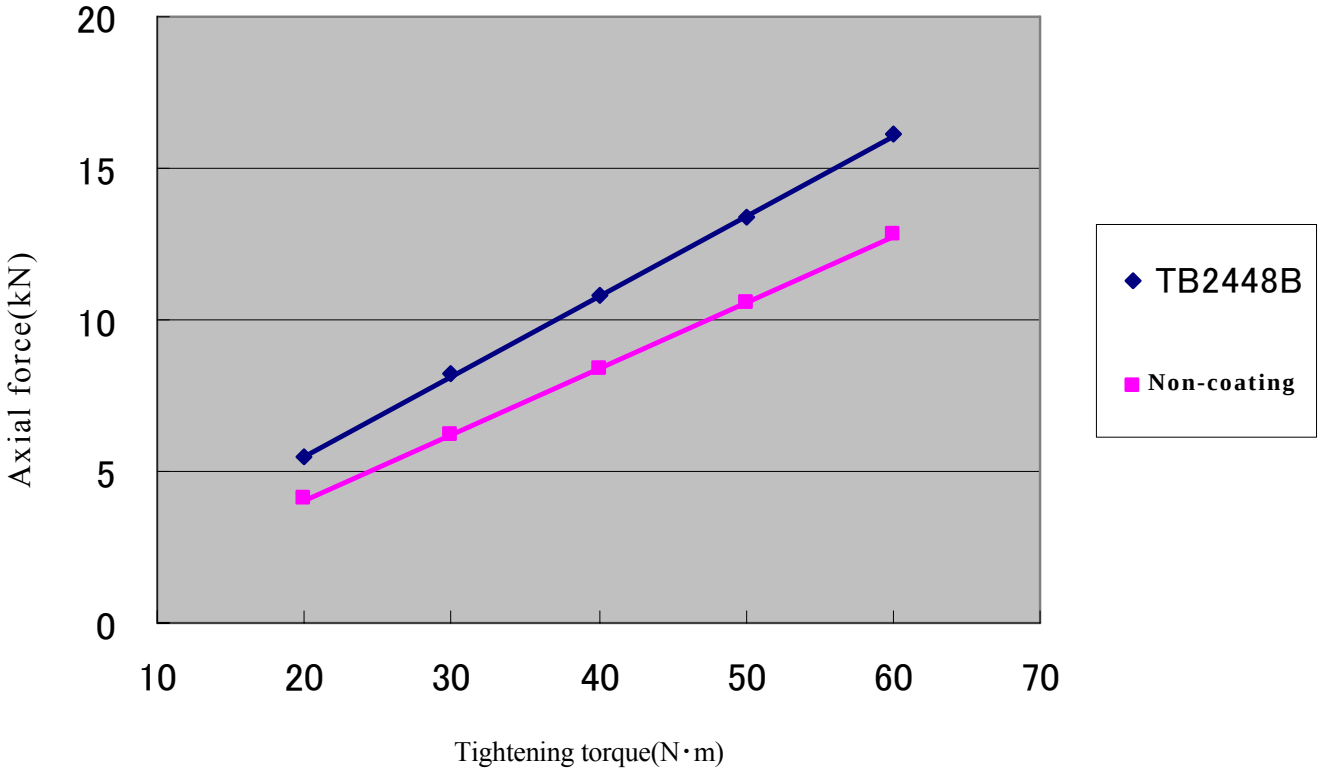

Fig. 6 Axial force at various tightening torques

5.8 Seal test (air tightness)

Bolts treated with TB2448B 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 by 0.5 MPa to up to 2.0 MPa. The block is kept at each pressure for 2 minutes. The bolts are checked for leak at each pressure under water.

- Bolts: JIS, class 2, M10×P1.5 Galvanized chromate treatment
- Seal test block: Iron, aluminum
- Tightening torque: 30N・m
- Test temperature: 25°C
- Test medium: Nitrogen gas
- Number of test pieces: n=10
- Measuring conditions: 3TS-4600-001

Table 15 Seal test (air tightness) of TB2448B

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 Seal test (oil tightness)

Bolts treated with TB2448B 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 hydraulic 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 by 2.0 MPa to up to 10 MPa. The block is kept at each pressure for 2 minutes. The bolts are visually checked for leak at each pressure using a developer.

- Bolts JIS, class 2, M10×P1.5 Galvanized chromate treatment
- Seal test block Iron, aluminum
- Tightening torque 30N・m
- Test temperature 25°C、170°C
- Test medium Turbine oil
- Number of test pieces n=10
- Measuring conditions 3TS-4600-001

Table 16 Seal test (oil tightness) of TB2448B

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

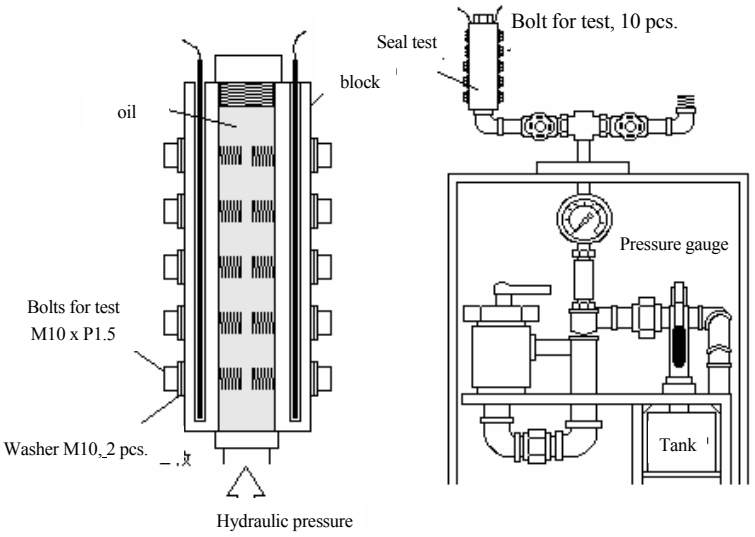

Fig. 7 Seal testing equipment

6. Precautions for handling and storage

6.1 Health effects and precautions

- Pre-coated bolts are delivered to customers after the pre-coating agent is applied to the threads and dried. Therefore, it is rare that the pre-coating agent adheres to the fingers or hands or gets in the eyes or mouth. However, flakes generated during tightening may cause irritation.
- The irritation is a medical physiological phenomenon, and the degree of irritation greatly varies between individuals. It is difficult to completely prevent the irritation. It is important to examine how to handle pre-coated bolts to avoid irritation. The skin may be irritated after you handle 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 the hands with treated portions and adhesion of flakes of the agent to the hands.
  (3) If flakes of the pre-coating agent adhere to 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 in eyes, rinse thoroughly with clean water, and get medical attention.
(5) If in mouth, spit 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) Foreign substances (water, oil, solvents, dust, etc.) have adhered 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 on 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 parts feeder

・In a parts feeder, pre-coated parts 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 Precautions 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 low dust environment, and cover the container with a lid.

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, the user 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.