# Instruction Manual (B)

## STP Series Turbomolecular Pumps
## STP-XA4503 Series
## Pump Specific Information

| *Model name* | *Voltage* |
|---|---|
| *STP-XA4503 series* | *200 - 240 Va.c.* |


STP pump consists of the three-volumed Instruction Manuals.

| | |
|---|---|
| Instruction Manual (A): | STP pump generic Instruction Manual<br>Supplied with STP pump |
| **Instruction Manual (B):<br>(This Instruction Manual)** | **STP pump specific information<br>Supplied with STP pump** |
| Instruction Manual (C): | STP control unit Instruction Manual<br>Supplied with STP control unit |

EDWARDS

This page intentionally blank

The description of this product consists of the three-volumed Instruction Manuals. Read through each Instruction Manual before operation.
The separate volume contents of each description are as follows:

**Instruction Manual (A)**

STP pump generic Instruction Manual:

- Introduction
- Installation of the STP pump
- Installation of the STP control unit
- Operation
- Safety functions
- Maintenance and inspection
- Storage and disposal
- Service, Spares and accessories

**Instruction Manual (B)**

STP Pump specific information:

- Technical data
- How to Secure the STP pump
- Temperature Management System（TMS）

**Instruction Manual (C)**

STP control unit Instruction Manual:

- Introduction
- Technical data
- Installation
- Operation
- Serial communication protocol
- STP-Link (except for SCU-750)
- Maintenance
- Storage, transportation and disposal
- Service, spares, and accessories

Keep the manuals in an easily accessible location.

EDWARDS

# EC DECLARATION OF CONFORMITY

Manufacture: Edwards Japan Limited
1078-1, Yoshihashi, Yachiyo-shi, Chiba 276-8523, Japan

EU Representative: Edwards Limited
York Road, Burgess Hill, West Sussex RH15 9TT, UK

declare under our sole responsibility that the product

Product Name: Turbomolecular pump

Model Number: STP-XA4503 series

Accessories Covered: TMS Unit

to which this declaration relates is in conformity with the following standards:

EN 1012-2: 1996
EN 61010-1: 2001
EN 61326: 1997 +A1 +A2 +A3
EN 61000-6-4: 2001
EN 55011: 1998 +A1 +A2 (Group1, Class A)
EN 61000-6-2: 2001

and with the following provisions of EC directive

Machinery Directive (98/37/EC)

Low Voltage Directive (2006/95/EC)

EMC Directive (2004/108/EC)

EMC test report is certified by

Certificate number: AE 50090546 0001

Certification Body: TÜV Rheinland Product Safety GmbH
Am Grauen Stein D-51105 Köln

Manufacture:

Yachiyo 10th Aug. '07
Place and date

Masaharu Miki
Mr. Masaharu Miki
Director, Technology
Edwards Japan Limited

EU representative:

Crawley, 17th August 2007
Place and date

Stephen E. Ormrod
Dr. Stephen E Ormrod
Technical Director
Edwards Limited

VI-DOC-67-002

# CONTENTS

# ILLUSTRATIONS



# TABLES

# 1 TECHNICAL DATA

## 1.1 Applicable pump specifications

| Model Name | Specification | Applicable Control unit[*1] |
|---|---|---|
| STP-XA4503 series | Extreme Advanced throughput type | SCU-1500/SCU-1400 |

[*1] Applicable control unit: There are different performance specifications between SCU-1500 and SCU-1400. Refer to Section 1.1.1, "STP pump specifications" for the differences.

Naming convention:

- "C" following a pump model name indicates a corrosion resistant[*2] type (e.g. STP-XA4503C).
- "CV" indicates an enhanced corrosion resistant type with TMS[*3] (e.g. STP-XA4503CV).

[*2] Corrosion resistant: STP pump with anti-corrosive treatment.

[*3] Temperature Management System: TMS maintains the temperature of the turbomolecular pump by monitoring the temperature with the thermistor in the base of the turbomolecular pump, and performing the TMS valve and base heater ON/OFF control.

### 1.1.1 STP pump specifications

The values shown below are typical. They are not guaranteed.

| Item | | | XA4503 series | | |
|---|---|---|---|---|---|
| Flange size | Inlet port flange | | VG300 | ISO320F | VG350 |
| | Outlet port flange | | KF40 | KF40 | KF40 |
| Pumping speed | $N_2$ | L/s | 3800 | 4000 | 4300 |
| | $H_2$ | L/s | 2500 | 2500 | 2500 |
| Compression ratio | $N_2$ | | $>10^8$ | | |
| | $H_2$ | | $>6\times10^3$ | | |
| Ultimate pressure | | Pa | $10^{-7}$ order [after baking] | | |
| Allowable backing pressure | | Pa (Torr) | 266 (2): Water cooling/TMS unit used | | |
| Flow rate of purge gas <$N_2$> | | Pa·m$^3$/s (SCCM) | $8.4\times10^{-2}$ (50) | | |
| Rated speed | | rpm | 24,000 | | |
| Backup rotational speed[*1] | | rpm | Approximately 6,000 | | |
| Starting time[*2] | | min | 12: with SCU-1500<br>13: with SCU-1400 | | |
| Stopping time[*2] | | min | 12: with SCU-1500<br>16: with SCU-1400 | | |
| Noise | | dB | <50 (at 24,000 rpm) | | |
| Temperature Management System (TMS) | | | Available | | |
| Baking temperature | | °C | <120 | | |
| Lubricating oil | | | Not necessary | | |
| Installation position | | | Free | | |
| Cooling method | | | Water cooling | | |
| Mass[*3] | | kg | 105 | | 97 |
| Ambient temperature range | | °C | 0 to 40 | | |
| Storage temperature range | | °C | -25 to 55 | | |
| Applicable Control unit | | | SCU-1500/SCU-1400 | | |

[*1] A backup rotational speed is the lowest rotational speed to which the magnetic bearing can be backed up at a power failure.

[*2] Time varies depending on the control unit used.

[*3] Mass is a value of state that the only standard accessory was installed (except the optional accessory).

Maximum gas flow-rate [*3]

| Gas | Condition | | | | Maximum gas flow-rate [*3] | |
|---|---|---|---|---|---|---|
| | TMS | | Cooling water | Purge gas $N_2$ gas flow rate | SCU-1500 | SCU-1400 |
| | Yes/No | Set point | | | $Pa \cdot m^3/s$ (SCCM) | $Pa \cdot m^3/s$ (SCCM) |
| Ar | No | - | Temperature: 5 to 25 °C Flow rate: 3 L/min | $8.4 \times 10^{-2}$ $Pa \cdot m^3/s$ (50 SCCM) | 3.63 (2150) | 3.38 (2000) |
| | Yes | 70°C | | | 2.36 (1400) | 2.36 (1400) |
| $N_2$ | No | - | | | 4.73 (2800) | 4.22 (2500) |
| | Yes | 70°C | | | 4.22 (2500) | 3.88 (2300) |

[*3] The maximum gas flow-rate is applicable under conditions that $N_2$ or Ar gas is vacuumed continuously and the backing backing-pump (pumping speed: 10,000 L/min) is used. It is changed depending on condition. For example, when the gas is exhausted intermittently, the gas more than the maximum gas flow-rate can be exhausted. In this case, contact Edwards.

### 1.1.2 Condition for the water-cooling unit

| Item | Specification | |
|---|---|---|
| | Without TMS | With TMS |
| Port type | Rc 1/4 (Female) [*1] | |
| Flow rate L/min | 3 | 3 |
| Water temperature °C | 5 to 25 | |
| Water pressure MPa ($kgf/cm^2$) | 0.3 (3) | |

[*1] Standard type

## 1.2 External appearance of the STP pump

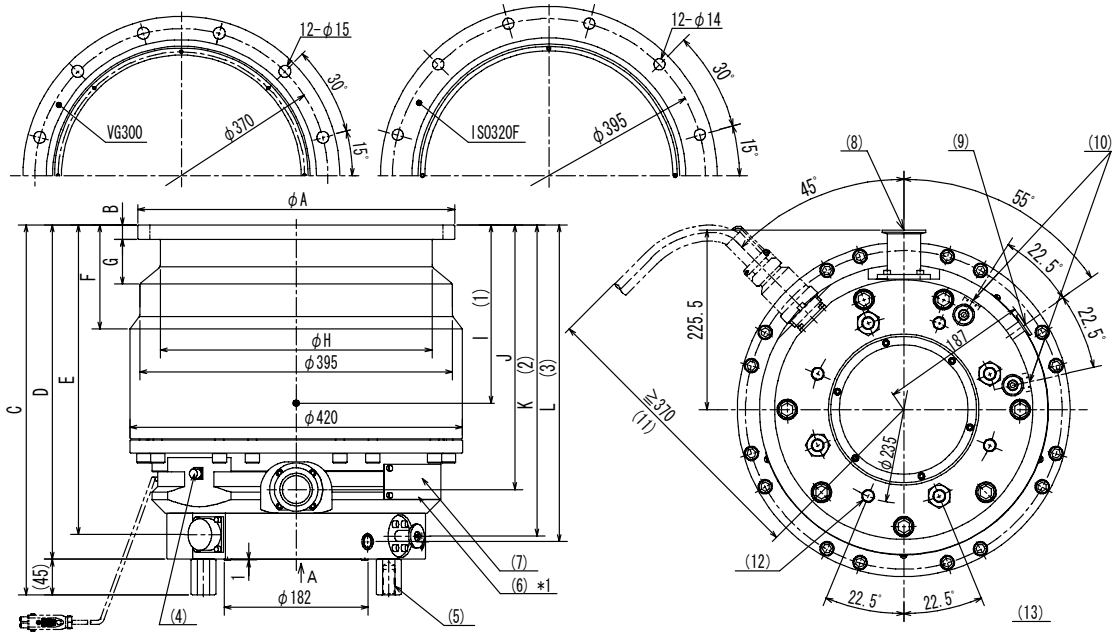



Figure 1 - STP-XA4503 series: VG300/ISO320F

| No. | Item | Description |
|---|---|---|
| 1 | Center of gravity | |
| 2 | Height of the purge port | |
| 3 | Height of water cooling port | |
| 4 | TMS sensor | |
| 5 | Screw hole of legs | 4-M16 depth 33 |
| 6 | TMS heater[*1] | Built-in |
| 7 | TMS heater cover | |
| 8 | Outlet port flange | KF40 |
| 9 | Purge port | KF10 |
| 10 | Cooling water port | 2-Rc[*2]1/4 |
| 11 | Bending dimension of the STP connection cable | |
| 12 | Screw hole for legs | 8-M16 depth 24 |
| 13 | Viewed from arrow A | |

| Inlet port flange | VG300 | ISO320F |
|---|---|---|
| φA | 400 | 425 |
| B | 18 | 20 |
| C | 465 | 455.5 |
| D | 420 | 410.5 |
| E | 388.5 | 379.5 |
| F | 131 | 121.5 |
| G | 56 | 44.5 |
| φH | 343 | 370 |
| I | 224 | 217 |
| J | 332.5 | 323 |
| K | 390.5 | 381.5 |
| L | 398 | 389.5 |

[*1] TMS used only

[*2] ISO

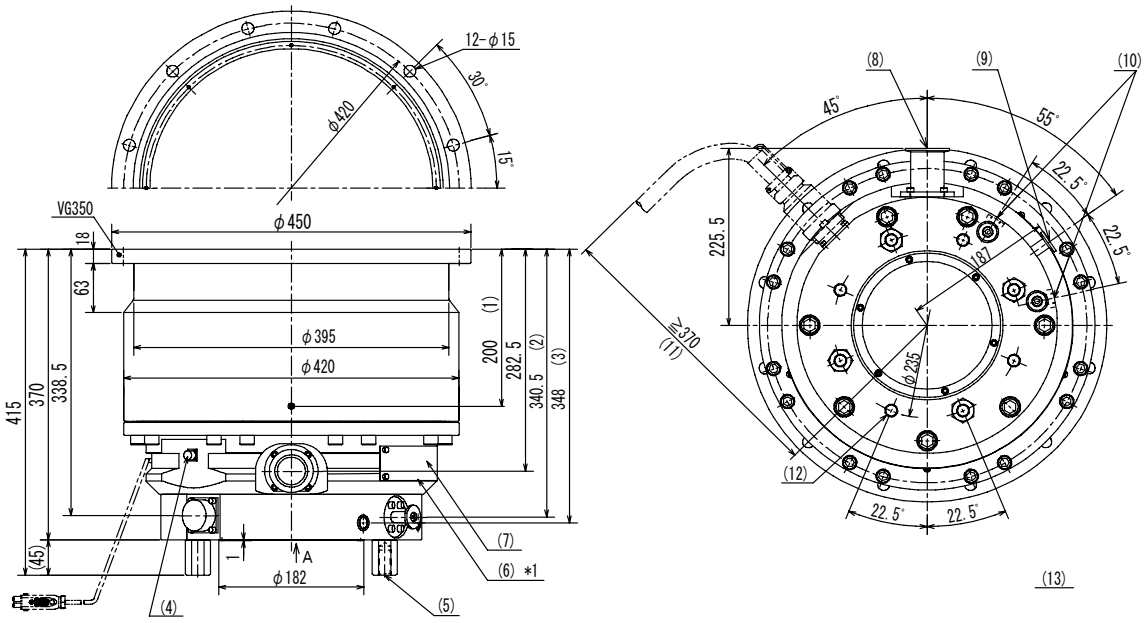



Figure 2 - STP-XA4503 series: VG350

| No. | Item | Description |
|---|---|---|
| 1 | Center of gravity | |
| 2 | Height of the purge port | |
| 3 | Height of water cooling port | |
| 4 | TMS sensor | |
| 5 | Screw hole of legs | 4-M16 depth 33 |
| 6 | TMS heater[*1] | Built-in |
| 7 | TMS heater cover | |
| 8 | Outlet port flange | KF40 |
| 9 | Purge port | KF10 |
| 10 | Cooling water port | 2-Rc[*2]1/4 |
| 11 | Bending dimension of the STP connection cable | |
| 12 | Screw hole for legs | 8-M16 depth 24 |
| 13 | Viewed from arrow A | |

[*1] TMS used only

[*2] ISO

### 1.3 Label affixing positions

Refer to the Instruction Manual (A) for the details of the labels 1 to 7.

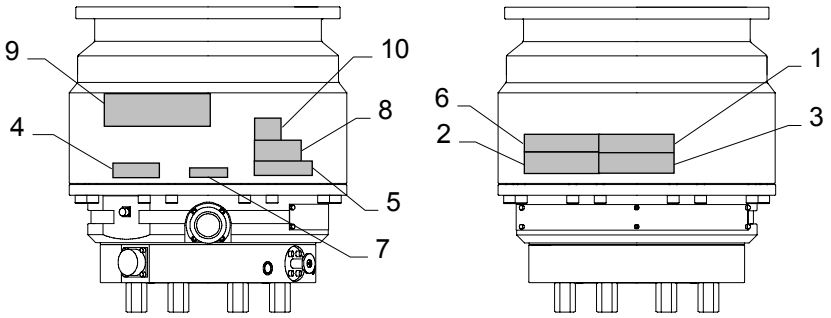



Figure 3 - Label Affixing Positions for the STP pump

1 STP pump installation warning label
2 Hot surface warning label
3 Heavy product caution label
4 Connector caution label
5 STP pump/control unit caution label
6 TMS heater caution label
7 Rotational direction instruction label
8 Name plate
9 Company logo
10 Parts number

## 1.4 Accessories

| Item | Q'ty | Remarks |
|---|---|---|
| Inlet port cover | 1 | |
| Outlet port cover | 1 | |
| STP connector cover | 1 | |
| Blank flange for purge port | 1 | KF10 |
| Clamping ring for purge port | 1 | KF10 |
| O-ring washer for purge port | 1 | KF10 |
| Leg | 4 | |
| Instruction Manual (B) | 1 | This manual |

This page intentionally blank.

# 2 HOW TO SECURE THE STP PUMP

WARNING

The STP pump is provided with a high-speed rotor. Any internal abnormality/error may result in a jump in rotational torque leading to personal injury or peripheral equipment damage.

The STP pump is provided with a high-speed rotor. The worst-case failure may result in a jump in rotational torque leading to personal injury or peripheral equipment damage.

Secure the STP pump to the vacuum equipment according to the method specified in this manual.

The generated torque during a pump failure is called "Destructive torque". Design and secure the mounting for the STP pump so that it can withstand the maximum rotational torque. Refer to Table 2 for torque in pump abnormality.

| Bolt size | Tightening torque (Nm) |
|---|---|
| M8 | 12 |
| M10 | 24 |
| M12 | 42 |

Table 1 - Tightening torque of bolt

When making the legs to secure the base, make them shorter than the ones attached to the STP pump. Use a material that has a tensile strength of 600N/mm$^2$ or more.

When securing the base, use stainless steel securing bolts with a tensile strength class of 70 or more.

*Note: When using any securing method other than that specified in this manual, contact Edwards.*

The generated destructive torque depends on the presence of a torque reduction mechanism that can be built into the flange, according to the pump model and flange type. This mechanism, shown in Figure 5, is designed to absorb energy and also buffer the destructive torque.

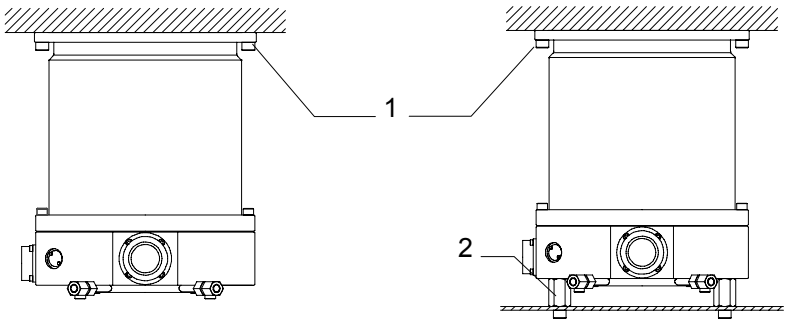
There are two installation methods for the pump, as shown in Figure 4. Make sure to secure the inlet port flange of the pump with the recommended bolts, as described in Figure 5 and Table 2, according to the installation method used.

Note that special washers will be required if the pump includes the inlet torque reduction mechanism. The washer shape is shown in Figure 5.

| **Pump model** | | **STP-XA4503 series** | | | |
|---|---|---|---|---|---|
| Flange type | | VG300/ISO320F/VG350 | | | |
| Toque reduction mechanism | | Equipped (optional) | | Not Equipped (standard) | |
| Destructive Torque [kNm] | | 53.7 | | 68.8 | |
| Base (4 positions) securing | | No | Yes | No | Yes |
| Recommended bolt | Shape | Standard | Standard | Standard | Standard |
| | Material[*1] | Carbon steel Alloyed steel | Carbon steel Alloyed steel | Carbon steel Alloyed steel | Stainless steel |
| | Strength[*1] | 12.9 or more | 12.9 or more | 12.9 or more | 70 or more |
| | Special washer | Figure 5 | Figure 5 | Not necessary | Not necessary |

[*1] Refer to ISO898-1 (JISB 1051), ISO3506 (JISB 1054).

Table 2 - Maximum torque predicted and recommended securing bolt for inlet port flange



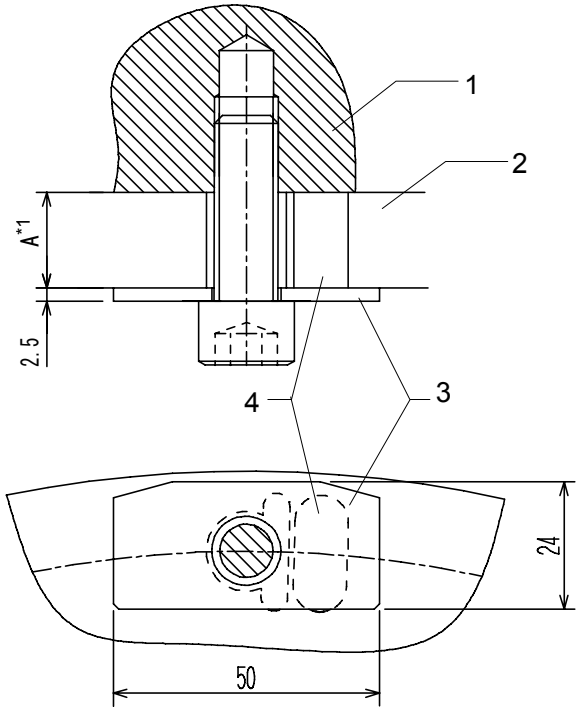

(A) When the base is not secured (B) When the base is secured

1. Recommended fitting bolt for flange
2. Secure the base

Figure 4 - Methods of securing the STP pump

| CAUTION |
| --- |
| Install the flange securing bolts in the proper position with the special square washer shown in Figure 5. Failure to do so may cause abnormal operation of the torque reduction mechanism and damage the pump. |

| CAUTION |
| --- |
| When any internal abnormality/error results in high rotational torque, causing the torque reduction mechanism to operate, the pump may rotate a maximum of 5 degrees around the rotor rotation at axis. |




*1 VG300/VG350: A=18, ISO320F: A=20

1. Vacuum equipment
2. Inlet port flange
3. Washer
4. Torque reduction mechanism

Figure 5 - Shape of reduced diameter shank bolts

This page intentionally blank

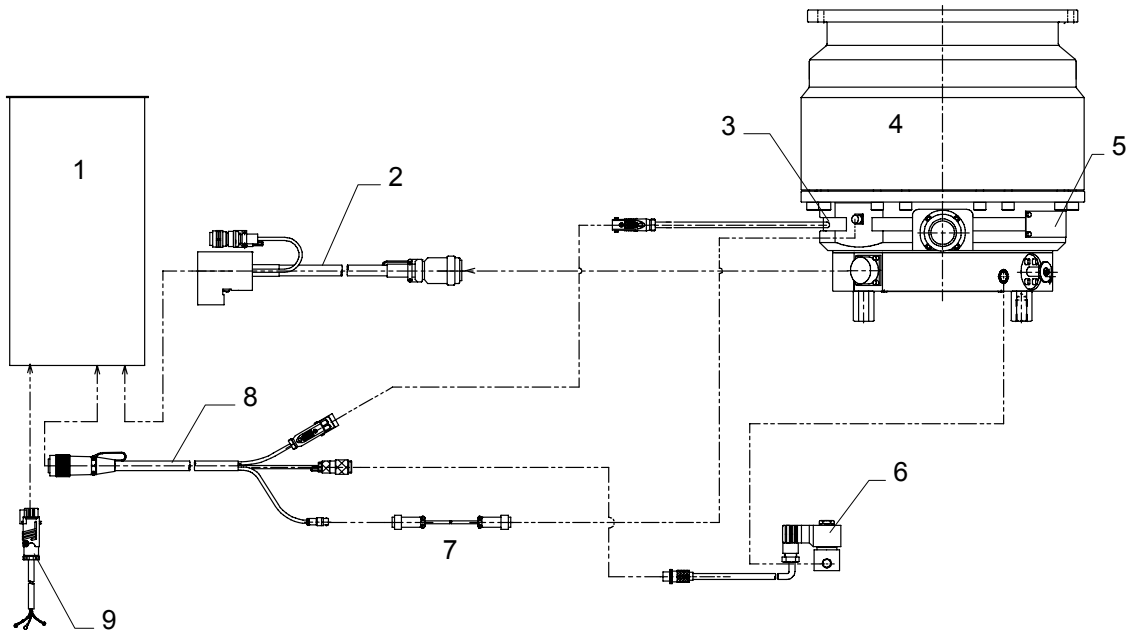
# 3 TEMPERATURE MANAGEMENT SYSTEM (TMS)

WARNING

The STP pump operates at high temperatures while the Temperature Management System (TMS) unit is in operation. NEVER touch the STP pump and its peripheral equipment while TMS unit are in operation. Operators can burn hands. Moreover, NEVER remove the TMS cover while the Temperature Management System (TMS) unit is in operation. Doing so may result in electric shock or burnt hands.

The Temperature Management System (TMS) maintains the temperature of the turbomolecular pump by monitoring the temperature with temperature sensor in the base of the turbomolecular pump, and performing the TMS valve and TMS heater ON/OFF control.

## 3.1 Configuration of the STP pump with the TMS




1. STP control unit
2. STP connection cable
3. TMS heater (Built-in)
4. STP pump
5. TMS heater cover
6. TMS valve
7. TMS sensor cable
8. TMS connection cable
9. Power cable

Figure 6 - Configuration of the TMS

*Note: The shape of each part is an example. It varies according to specifications.*

### 3.2 TMS connection cable

The components of the TMS connection cables are as follows: (see Figure 7)

| Item | Description | Function |
|---|---|---|
| 1 | Connector X5A | For the STP control unit |
| 2 | CON1 HEATER OUT connector | For the TMS heater |
| 3 | CON2 COOLING VALVE OUT connector | For the TMS valve |
| 4 | CON3 TC IN connector | For the TMS sensor cable |

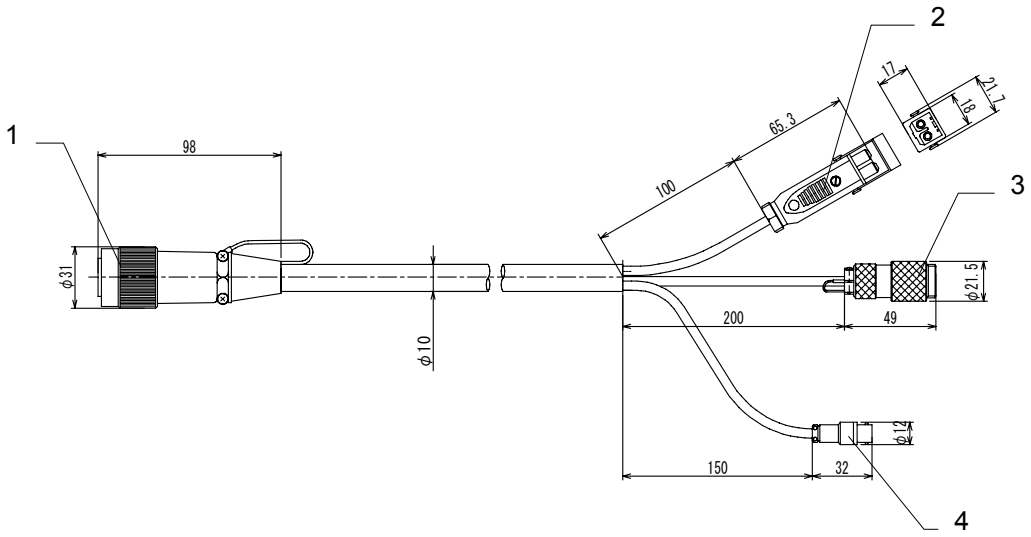



Figure 7 - External view of TMS connection cable

*Note: The shape of the TMS connection cable is an example. It varies according to specifications.*

### 3.3 TMS heater

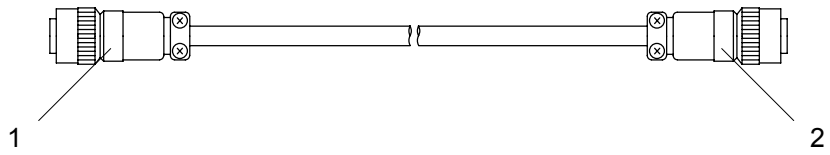
The TMS heater heats the base of the STP pump. It's fitted with the STP-XA4503 series at the factory.

### 3.4 TMS valve

The TMS valve controls the cooling water in order to maintain a constant temperature inside the STP pump. The shape of the TMS valve varies according to specifications.

### 3.5 TMS sensor cable

The TMS sensor cable is for reading the TMS sensor signal from the base of the STP pump.




1. TMS connection cable side (5 pin, pin type)
2. STP pump side (5 pin, socket type)

Figure 8 - TMS sensor cable

### 3.6 Installation of the TMS unit

| CAUTION |
| --- |
| DO NOT install the TMS unit in places with high temperature, humidity, noise, vibration, or other unstable environment. |

| CAUTION |
| --- |
| DO NOT apply force to the TMS unit and cables during installation and DO NOT bend the cables excessively. |

#### 3.6.1 Connecting the TMS connection cable to the STP control unit

Insert the connector X5A of the TMS connection cable into the connector X5 of the STP control unit. (see the "STP control unit Instruction Manual (C)" for the position of the connector X5.)

#### 3.6.2 Connecting the pump and cables

Refer to Figure 6, "Configuration of the STP pump with the TMS" to connect the pump and TMS sensor cable, TMS valve proceed as follows:

1. Connect the TMS sensor cable to the connector of the temperature sensor in the base of the pump.
2. Connect the cooling water pipe to the TMS valve. Pay special attention to the port label on the cooling water valve to connect proper port. Connect the NC side (or OUT side) of the TMS valve to the STP pump, and COM side (or IN side) of the TMS valve to the equipment.

Use cooling water under the conditions in Section 3.7, “Condition for the TMS unit”.

*Note: Procure and connect the cooling water pipe and affix the electromagnetic cooling water valve at your site. The diameter of the valve is Rc1/4 (ISO standard).*

#### 3.6.3 Connecting TMS connection cable to STP pump

Refer to Figure 6, "Configuration of the TMS unit".
Connect the TMS connection cable to the STP pump as follows:

1. Connect the cable for the TMS heater to the "CON1 HEATER OUT" connector of the TMS connection cable.
2. Connect the cable for the TMS valve to the "CON2 COOLING VALVE OUT" connector of the TMS connection cable.
3. Connect the TMS sensor cable to the "CON3 TC IN" connector of the TMS connection cable.

### 3.7 Condition for the TMS unit

The values shown below are typical. They are not guaranteed.

| Item | | Condition |
|---|---|---|
| Ambient temperature range | °C | 0 to 40 |
| Storage temperature range | °C | -20 to 55 |
| Input voltage | | Same voltage as the STP control unit 200 to 240 Vac |
| Temperature control method | | Control ON/OFF of the TMS heater and cooling water |
| Setting temperature | °C | Standard type: 70 |
| Cooling water temperature | °C | 5 to 25 |
| Quantity of cooling water flow | L/min | 3 |
| Alarm output | | Alarm outputs from the STP control unit |

### 3.8 Accessories

| Item | Q'ty | Condition |
|---|---|---|
| TMS heater | 1 | Attached to the STP pump |
| TMS connection cable | 1 | With connector at each end |
| TMS valve | 1 | Coupling for water cooling port,<br>cable with connector on one side |
| TMS sensor cable | 1 | With connector at each end |

This page intentionally blank

For more information, contact the nearest Service Office.

---

**Manufacturer:**

**Edwards Japan Limited**

1078-1, Yoshihashi, Yachiyo-shi, Chiba 276-8523 JAPAN

| | | |
|---|---|---|
| Telephone: | Domestic | 047-458-8822 |
| | International | +81-47-458-8822 |
| Facsimile: | Domestic | 047-458-8833 |
| | International | +81-47-458-8833 |


---