

Instruction Manual

Seiko Seiki STP200/300/400 (P001) Turbomolecular Pump System

(Document number MT-01E-0A3-C)



**STP-200/300/400 Series
Turbomolecular Pump
(CE Marking Compatible Product)
INSTRUCTION MANUAL
(Third Edition- c)**

Read through the Safety Precautions and each section of this Manual carefully before using the STP pump.

Keep this Manual in a place where you can quickly access it at any time.

SAFETY PRECAUTIONS

The Safety Precautions in this Manual constitute guidelines to protect operators, the STP pump and its peripheral equipment. To avoid personal injury and prevent product and/or peripheral equipment damage, observe the Safety Precautions as well as the general safety rules (your country's laws, regulations, safety standards and so on).

SYMBOLS

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Minor Personal Injury, Product and/or Peripheral equipment Damage

Failure to follow the guidelines marked with this symbol may result in minor personal injury, product and/or peripheral equipment damage.



Items you must follow during operation and maintenance.

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and



specified in this manual.



- ◇ The STP pump is provided with a high-speed rotor. Secure the STP pump according to the specified method. Failure to do so may lead to serious personal injury, product and/or peripheral equipment damage if any abnormality/error occurs in the rotor.
- ◇ The STP pump operates at high temperatures while the baking heater is in operation. NEVER touch the STP pump and its peripheral equipment while the baking heater is in operation. Operators can burn hands.
- ◇ Always exhaust residual gases thoroughly from the STP pump when removing the STP pump from the vacuum equipment. Residual gases in the STP pump may cause an accident which, for certain gases, may involve serious injury or death. Confirm the characteristics of the gas to be used, referring to the Material Safety Data Sheet (MSDS) you obtain from the gas supplier. Wear personal protective equipment if necessary.
- ◇ NEVER throw the battery into fire nor heat it. Failure to do so may result in an explosion, production of fire and/or serious personal injury. Observe the instructions given by the battery maker, the national and/or local government when disposing of the battery.
- ◇ Exhaust residual gas thoroughly when disposing of the STP pump. If the STP pump is used for any toxic or reactive gas, always clean the STP pump and dispose of it as industrial waste in accordance with guidelines given by the national and/or local government. Residual gas in the STP pump may cause an accident which, for certain gases, may involve serious injury or death.
- ◇ Always remove the battery from the STP control unit when disposing of it. Failure to do so may result in fire or other accident.



- ◇ **NEVER** use any gas that is not specified as usable in this Manual. The use of such gas may corrode the STP pump and damage it.
- ◇ **Always** check the STP pump has stopped, then turn **OFF** the primary power (Switch the breaker "OFF") before proceeding to any of the following operations. Failure to do so may cause the STP pump to rotate accidentally, which may injure operators seriously or result in electric shock.
 - **Connect or disconnect cables;**
 - **Connect an external battery;**
 - **Perform maintenance and inspections such as replacement of the internal battery and/or fuses as well as inspections of deposit and/or the air cooling fan; or**
 - **Perform investigations into probable causes and action/measures taken in the event of occurrence of a problem.**
- ◇ **The STP control unit is a heavy product. Always use a crane or the like when lifting it. Failure to do so may damage your hipbone or injure you due to occurrence of an accident such as fall.**
- ◇ **Install the STP control unit not only by fitting it with the front panel fitting screws but also by supporting it from the bottom side. Fitting the STP control unit with the screws only cannot sustain its weight, and therefore resulting in product damage.**
- ◇ **Always use the STP pump, STP control unit and STP connection cables of the same model name, serial number and cable length, which are specified on their own name plate. Failure to do so may result in product damage. If you plan to use the units with the same model name but different serial numbers and cable length; they must be adjusted. If the model names are different, they may not be used even when performing adjustment. In both cases, contact BOC Edwards.**



- ◇ Use the STP connection cable that has a label affixed

STP-200/300/400
Series

- ◇ The use of a different cable may result in product damage.
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- ◇ Always use the power voltage specified on the name plate for the primary power voltage of the STP control unit. Wire the power cable securely. Incorrect wiring may result in electric shock or product damage.
- ◇ NEVER remove the splinter shield from the STP pump. Doing so may result in product damage.
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- ◇ Always replace batteries once a year. Failure to do so, the battery backup operation may not run at the power failure.
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- ◇ DO NOT move the STP pump and the STP control unit while the STP pump is in operation. Doing so may result in product damage.

INTRODUCTION

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This manual covers all items necessary to ensure safe installation, operation and maintenance of the following series of the STP-200/STP-300/STP-400 turbomolecular pump:

Model Name	Specification
• STP-200	High-vacuum type
• STP-300	High-vacuum type
• STP-400	High-vacuum type
• STP-200C	High-vacuum type, chemical specific ^{*1}
• STP-300C	High-vacuum type, chemical specific ^{*1}
• STP-400C	High-vacuum type, chemical specific ^{*1}

For the specifications of other models, contact BOC Edwards.

In this manual, the above STP pump series is collectively referred to as the "STP pump."

APPLIED STANDARDS

The STP pump conforms to the following directives and standards:

- ◇ Applied Directives
 - EC Machinery Directive
 - EC Electromagnetic Compatibility Directive
 - EC Low Voltage Directive

- ◇ Applied Standards
 - EN292-1
 - EN292-2
 - EN60204-1
 - EN55011 (class A)
 - EN50082-2

^{*1} : Chemical specific: STP pump with anti-corrosive treatment (responding to chlorine, fluorine or other system gases)

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REQUEST

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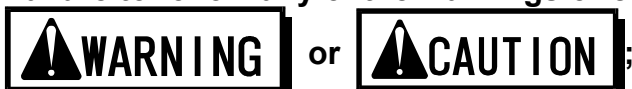
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- 3) **Installation, operation or maintenance using parts which are not specified by BOC Edwards;**
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- 7) **Defect resulting from deposit;**
- 8) **Water cooling system defect resulting from water quality used;**
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 - 15) **When continuously operated without overhaul after the WARNING indication ("WARNING" message) on the LCD display;**
 - 16) **Overhaul and replacement of maintenance parts;**
4. SPARE PARTS:
- Fuse and air cooling fan for control unit
 - Touch down bearing
 - Heater

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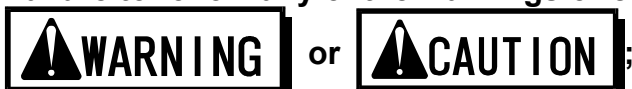
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 - Heater

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1 Precautions for Safe Operation of the STP Pump

1.1 Usable Gases

Chlorine or fluorine system gases can be used in chemical specific pumps (STP-200C/300C/400C or other models). When you use gases including alkaline metals, but excluding Li, gases including Ga, Hg, In, or Sn, or HBr, contact BOC Edwards. Confirm the characteristics of the gas to be used, referring to the Material Safety Data Sheet (MSDS) you obtain from the gas supplier.



- ◇ **NEVER use corrosive gases (chlorine, fluorine, or other system gases) in the STP-200/300/400 pump or other models without anti-corrosion treatment.**
- ◇ **Introduce a dry N₂ gas (purge gas) to protect the inside of the STP pump when using reactive or corrosive gases (See Section 7.3, "Gas Suction").**
- ◇ **Cool the STP pump to prevent the STP pump from overheating when sucking gases (See Section 7.2, "Cooling the STP Pump").**

1.2 Maintenance and Inspection Precautions

Read through Section 12, "Maintenance and Inspection" before performing any maintenance or inspection of the STP pump and the STP control unit (battery replacement, fuse replacement).





- ◇ **Always turn OFF the primary power (Switch the breaker "OFF") before performing any maintenance.**
- ◇ **NEVER touch any portions other than those designated when performing maintenance.**
Careless touch may cause electric shock and/or a short-circuiting of the internal circuit, resulting in product damage or a problem.

1.3 Labels

The following labels are affixed to the STP pump and STP control unit. Read the contents of the labels before operation. For the positions of the labels, see [Figures 16.4 to 16.6](#).



1) STP Pump Caution Label

This label describes precautions for operating the STP pump. Follow these precautions.

 注意	 CAUTION
<ul style="list-style-type: none"> ◇必ず指定の型式のケーブルを使用してください。 ◇最初にアース線を接続してください 	<ul style="list-style-type: none"> ◇Use only designated type of cables. ◇Connect ground cable first.




2) STP Control Unit Caution Label

This label describes precautions for operating the STP control unit. Follow these precautions.

 注意	 CAUTION
<ul style="list-style-type: none"> ◇ポンプとコントロールユニットを異なるNoの組合せで使用する場合、接続ケーブル長を変更する場合は取扱説明書に従い調整を行ってください。 ◇必ず指定の型式のケーブルを使用してください。 ◇最初にアース線を接続してください。 	<ul style="list-style-type: none"> ◇Adjust levitation according to instruction manual, if pump and control unit have different serial number or you change connection cable length. ◇Use only designated type of cables. ◇Connect ground cable first.

3) Heavy Product Caution Label



This label is affixed to the product with a weight of 18 kg or more. Follow the precautions of [Section 2, "Unpacking"](#) so as not to cause any accident during handling.

 注意		 CAUTION
重量物 kg 取扱注意		Heavy product kg Handle with caution.

4) STP Pump Installation Warning Label


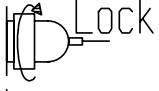
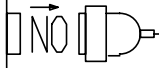

This label describes installation of the STP pump.

Install the STP pump according to the precautions of Section 3, "Installation of the STP Pump."

 警告	 WARNING
ポンプは取扱説明書の指示に従い確実に固定してください。	Install pump securely according to instruction manual.

5) Connector Caution Label

- i. This label describes lock of the connector.
- ii. This label instructs operators to prevent the connectors from being disconnected while the STP pump is in operation.

 注意	 	 CAUTION
◇コネクタは確実にロックしてください。 ◇ブレーカONの時はコネクタを外さないでください。		◇Lock connector securely. ◇Do not remove connector while breaker is ON.

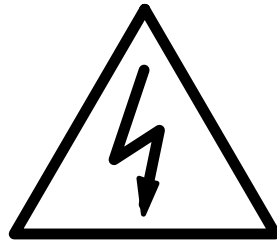
6) STP Control Unit Safety Instruction Label

This label describes instructions before operating the STP control unit.

安全上の指示事項	SAFETY INSTRUCTIONS
使用前に取扱説明書をお読みください。	Read instruction manual before operation.

7) High Voltage Device Caution Label

The STP control unit is equipped with a high voltage device. This label warns operators to pay attention to the high voltage device.



8) Battery Instruction Label

This label instructs operators to replace batteries once a year. The next replacement date of batteries is specified upon delivery of the STP pump.

Record the next replacement date (after one year) of batteries in the blank of the label when replacing them.

This label describes precautions for use of external batteries.

⚠ 注意	⚠ CAUTION
◇バッテリーは1年毎に交換してください。 ◇内部バッテリーと外部バッテリーを同時に使用しないでください。	◇Change batteries every year. ◇Do not use external batteries in combination with internal batteries.
次回交換日/Next exchange date	

9) Rotational Direction Instruction Label

This label describes the rotational direction of the STP pump. The STP pump rotates in this direction.



10) Voltage Rating Label

This label describes the rated voltage of the STP control unit.
Use voltage specified in this label.

<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">200V</div> <p>200 V specification</p>	<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">100V</div> <p>100 V specification</p>
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">220V</div> <p>220 V specification</p>	<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">110V</div> <p>110 V specification</p>
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">240V</div> <p>240 V specification</p>	<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">120V</div> <p>120 V specification</p>

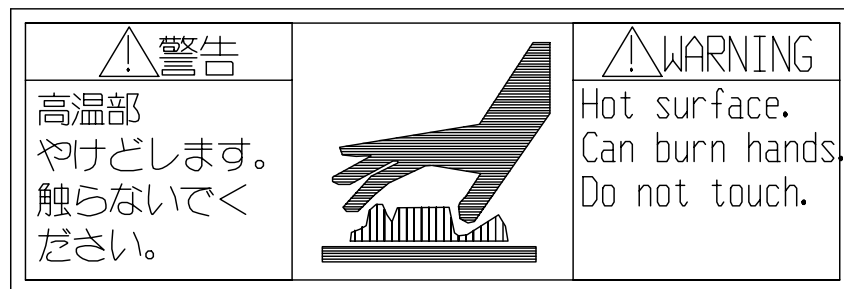
11) Hot Surface Warning Label

This label instructs operators so as not to touch the hot surface of the STP pump.

The use of the baking heater (optional accessory) may lead to a considerable rise in temperatures outside the STP pump.

This label warns operators so as not to burn hands.

(only when using the baking heater.)



2 Unpacking

2.1 Unpacking the STP Pump

Check the following before unpacking the STP pump.

- 1) Check the package for bruises, breakage, wetness, and other.
If there is any abnormality/error or it is judged necessary to return the product, contact BOC Edwards or the selling agency.
- 2) Check the contents of the package.
See Section 16.3, "Accessories."



- ◇ **Be careful not to scratch the flange of the STP pump. Before installing the STP pump, check whether or not there are scratches on the surface.**
- ◇ **It is recommended to keep the packaging materials, such as the corrugated fiberboard container and cushioning material for possible reuse.**

2.2 Unpacking the STP Control Unit

Check the following before unpacking the STP control unit.

- 1) Check the package for bruises, breakage, wetness, and other.
If there is any abnormality/error or it is judged necessary to return the product, contact BOC Edwards.
- 2) Check the contents of the package.
See Section 16.3, "Accessories."



- ◇ **The net mass of the STP control unit is approx. 27 kg. Use a crane or other appropriate means to lift the STP control unit. Lift the STP control unit using the two handles attached to the front panel.**
- ◇ **Observe national laws/regulations, safety standards and so on when lifting the STP control unit.**
- ◇ **Use a crane or other appropriate means sufficient enough to withstand the load when lifting the STP control unit.**
- ◇ **Always lift the STP control unit in stable places free of excessive shock or vibration to prevent it from shaking or dropping.**
- ◇ **Have at least two people lift the STP control unit when doing so by hand.**



- ◇ **It is recommended to keep the packaging materials, such as the corrugated fiberboard container and cushioning material for possible reuse.**

3 Installation of the STP pump

3.1 Name and Function of Each Part

(See Figure 3.1.)

- (1) Inlet Port Flange (ICF*1 , VG*2, ISO, and other)
 - Connected to the vacuum equipment (at the high vacuum side).



- ◇ **A splinter shield is attached to the inlet port flange to prevent foreign materials from falling into the STP pump. NEVER remove it.**

- (2) Outlet Port Flange (KF*2 25)
 - Connected to the inlet port side of the backing pump.
- (3) STP Connector (41 pins)
 - Connected to the STP connection cable.
- (4) Ground Terminal
 - Used for grounding.
Connect the ground cable between this terminal and the ground terminal of the STP control unit.

The ground terminal is marked with \oplus label.

- (5) Purge Port (KF*2 10) (Chemical Specific Pump Type C)
 - Introduces a purge gas.
This port is attached only to the chemical specific pump (type C).
In order to protect the inside of the STP pump when pumping reactive or corrosive gases.
The STP pump is delivered with a blank flange attached to this port.

*1: JVIS
*2: JIS

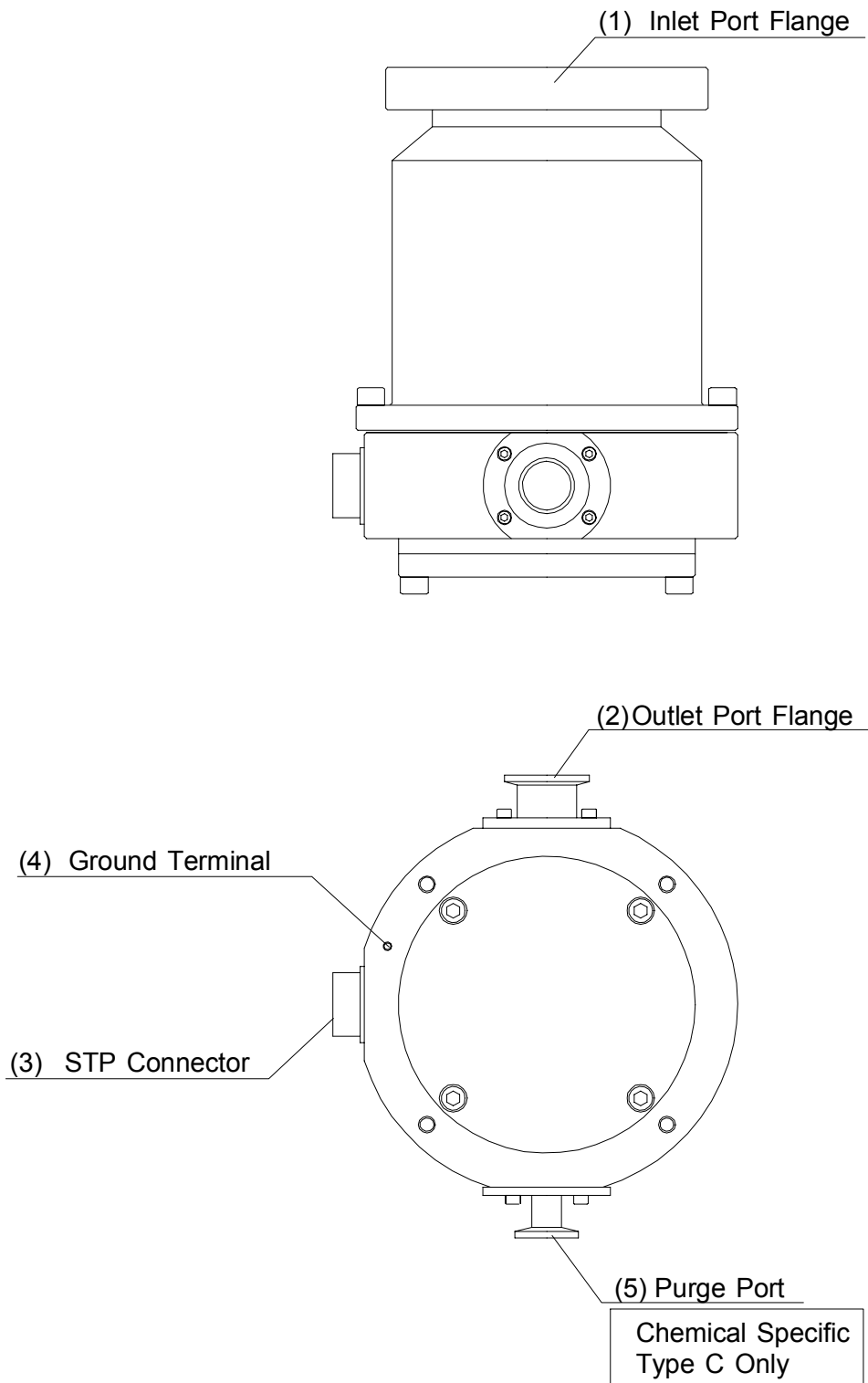


Figure 3.1 Configuration of the STP Pump

3.2 Precautions Before Installation

3.2.1 Operating Environment



- ◇ Chlorine or fluorine system gases can be used in chemical specific pumps (type C). When you use gases including alkaline metals, but excluding Li, gases including Ga, Hg, Sn, or HBr, contact BOC Edwards.
- ◇ NEVER use corrosive gases (chlorine, fluorine, or other system gases) in the STP-200/STP-300/STP-400 pump or other models without anti-corrosion treatment (See Section 1.1, "Usable Gases").

Install the STP pump in a place meeting the following requirements:

Ambient Temperature	0 to 40 °C
Ambient Relative Humidity	30 to 95 % (no dew condensing)
Environment	<ul style="list-style-type: none"> • A place free of externally-applied mechanical shock. • A place free of a heat source (Keep clear of the heat source or attach a thermal shield plate). • A place free of a strong magnetic field (Range: up to <u>150 gauss (15 mT) in the axial direction, and up to 30 gauss (3 mT) in the radial direction</u> with respect to the rotational axis of the STP pump). • A place free of a strong electric field. • A place free of exposure to radiation. • No discharge of high voltage (more than 500 V) (If more than 500 V is discharged, contact BOC Edwards).
STP Pump Installation Equipment Conditions	<ul style="list-style-type: none"> • Install the STP pump securely so that foreign materials will easily fall into the STP pump (Ex.: Si wafers or samples are positioned above the STP pump)(To prevent foreign materials from falling into the STP pump, design a shield plate with large conductance).

3.2.2 Installation Area

Leave enough space for the following in addition to that for the STP pump:

- Space for maintenance and inspection
- Space for connecting cables



- ◇ **The minimum bending radius of the STP connection cable is 150 mm (See Figures 16.1 and 16.2, "External Appearance of the STP Pump" [bending dimensions of the STP connection cable]). DO NOT excessively bend the cables and beware of any obstacles when installing the STP pump. Also, leave enough space to install other cables without bending them excessively.**

3.2.3 Bench

A bench must be prepared by the customer to secure the STP pump. The shape and size of the bench differ depending upon the type of STP pump. Follow the precautions of the WARNING, CAUTION, or NOTICE (See Section 3.3.3, "How to Secure the STP Pump").



- ◇ **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. Design and secure the bench for the STP pump so that it can withstand the maximum torque generated due to the occurrence of an abnormality/error. Refer to Section 3.3.3 "How to Secure the STP Pump" for abnormal torque.**



- ◇ **Secure the customer-prepared bench and the vacuum equipment on the floor or peripheral equipment and other equipment in accordance with the customer application. NEVER move them while the STP pump is in operation.**
- ◇ **Use fitting bolts with strength equal to or higher than SUS 304^{*1}.**

*1: JIS



- ◇ **The screw hole for leg for securing the STP pump is M8^{*1}, and the depth is 16 mm (4 positions).
For the external appearance of the STP pump, see Figures 16.1 and 16.2, "External Appearance of the STP Pump."**

*1: JIS

3.3 How to Install the STP Pump

Install the STP pump to the vacuum equipment as shown in Figure 3.2.

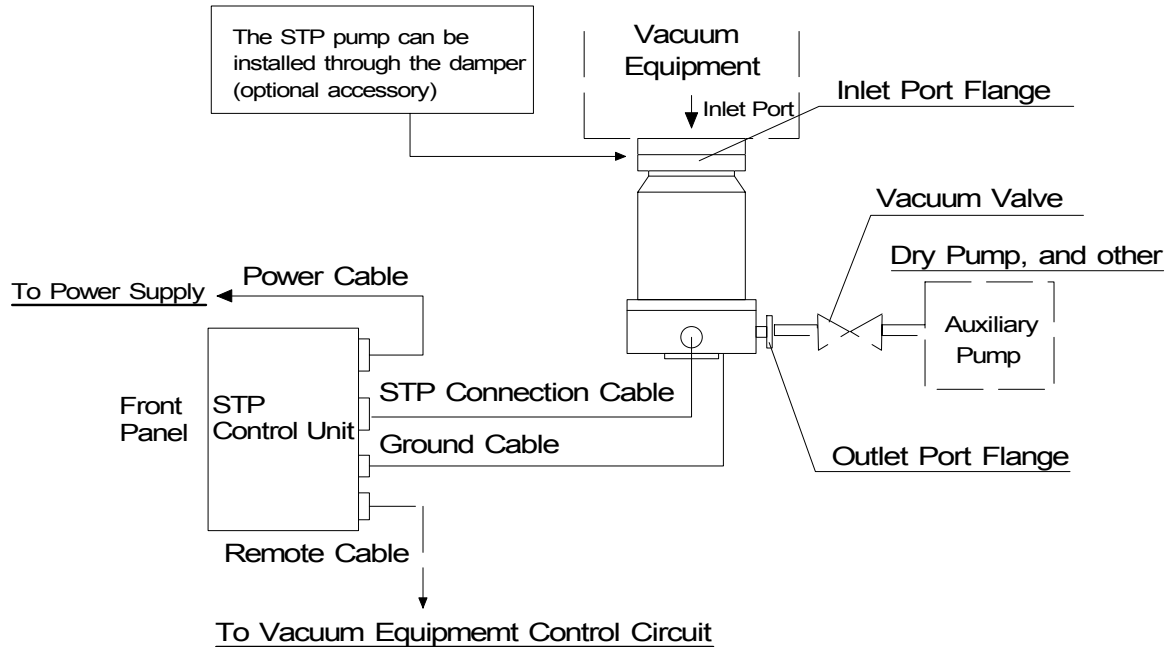


Figure 3.2 Installation of the STP Pump to the Vacuum Equipment

CAUTION

- ◇ Chlorine or fluorine system gases can be used in chemical specific pumps (type C). When you use gases including alkaline metals, but excluding Li, gases including Ga, Hg, In, or Sn, or HBr, contact BOC Edwards.
- ◇ NEVER use corrosive gases (chlorine, fluorine, or other system gases) in the STP-200/STP-300/STP-400 pump or other models without anti-corrosion treatment (See Section 1.1, "Usable Gases").
- ◇ When you use the STP pump in a place subjected to exposure to radiation, contact BOC Edwards.
- ◇ DO NOT open the STP pump through the flange to atmospheric air while the STP pump is running. If atmospheric air flows into the STP pump, it may not function normally.
- ◇ Depending upon the type of the backing pump used, atmospheric air may reverse flow into the STP pump when the backing pump stops. Attach a vacuum valve to the middle of the piping between the STP pump outlet port flange and the backing pump, and close the vacuum valve when the backing pump stops.


NOTICE

- ◇ The STP pump cannot be used with the outlet port open to atmospheric air.
Always use the backing pump (dry pump or similar one).
- ◇ Use a backing pump with a pumping speed of 160 L/min or more for the STP-200 series, or 240 L/min or more for the STP-300/400 series.
- ◇ Depending upon the type of the backing pump used, oil vapor may contaminate the inside of the STP pump. Some oil viscosity could cause a malfunction when there is a strong reverse flow of oil.
Take the following measures to ensure the correct flow of oil:
 - Attach a vacuum valve to the middle of the piping between the STP pump outlet port flange and the backing pump.
 - Attach an absorption trap adjacent to the vacuum valve.

3.3.1 Cleaning the Seal

Inspect the seals of inlet and outlet port flanges for dirt or oil spots before installing the STP pump in the vacuum equipment.
Take the following measures for cleaning the seals:

- Clean off with a pure gas.
- Wipe with proper solvent (such as alcohol).


CAUTION

- ◇ A splinter shield is attached to the inlet port flange to prevent foreign materials from falling into the STP pump.
Always leave the splinter shield attached during operation.


NOTICE

- ◇ The splinter shield cannot perfectly prevent foreign materials from falling into the STP pump.
DO NOT install the STP pump in such a manner that foreign materials can easily fall into it (for example, Si wafers or samples are positioned above the STP pump). If installing the STP pump in such a manner, always attach a shield plate with sufficient conductance above the STP pump to prevent foreign materials from falling into it. Foreign materials falling into the STP pump through the splinter shield may result in product damage.
- ◇ Be careful not to scratch the flange of the STP pump.
Check whether or not there are scratches on the surface, before installing the STP pump.

3.3.2 STP Pump Installation Positions

The STP pump can be installed vertically, horizontally, upside-down and slanted (See Figure 3.3, "STP Pump Installation Positions").

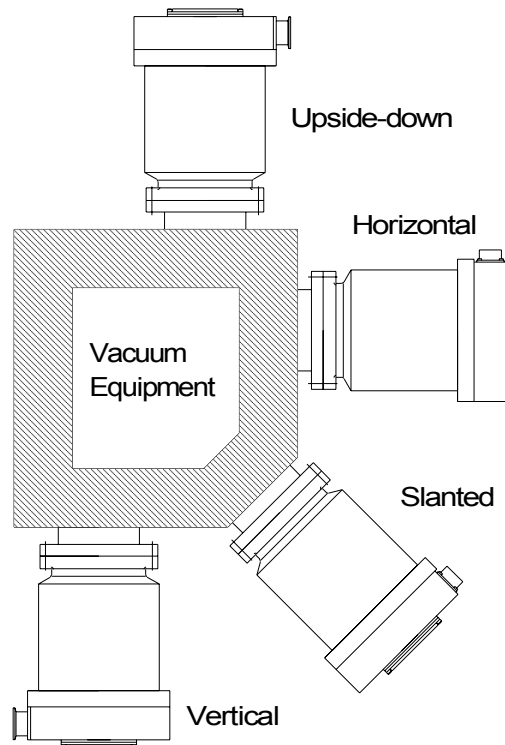


Figure 3.3 STP Pump Installation Positions

When installing the STP pump in a horizontal or slanted position, it is recommended to install it so that the direction of the outlet port is on a vertical or horizontal plane in the direction of the gravity.

This makes it possible to reduce the load on the magnetic bearing and the heat generated by the STP pump (See Figure 3.4, "Positions of the Outlet Port on the Horizontally or Slanted Installed STP Pump").

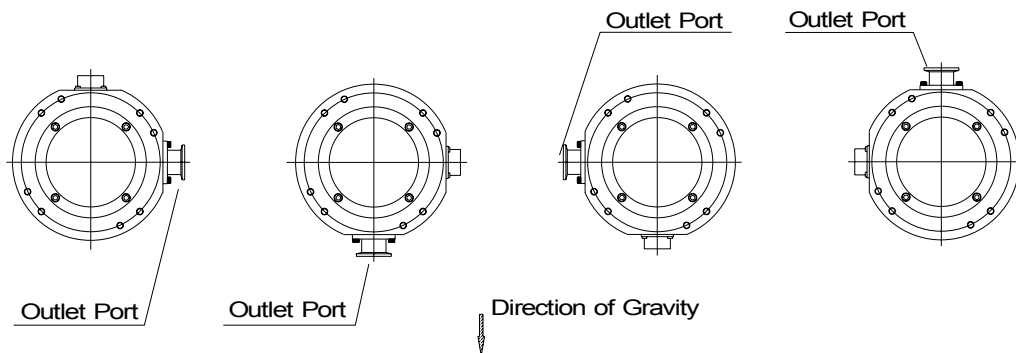
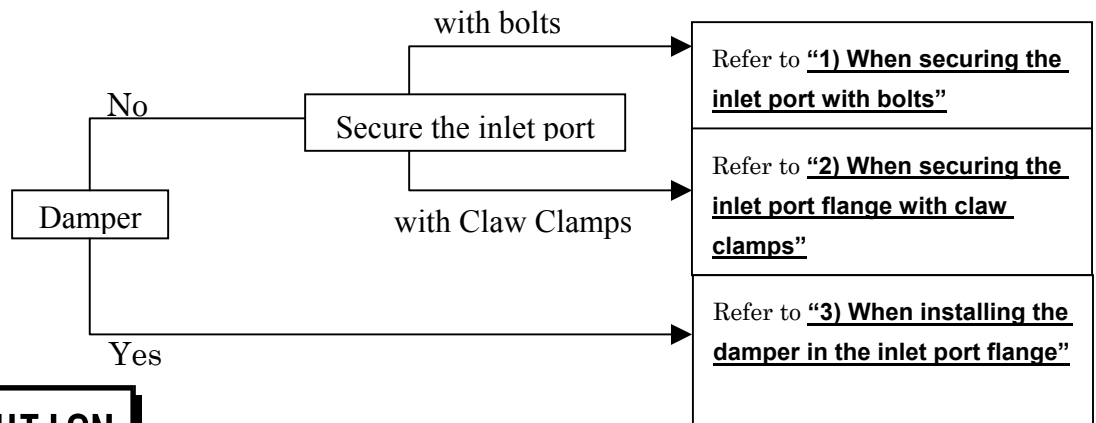


Figure 3.4 Positions of the Outlet Port on the Horizontally or Slanted Installed STP Pump

3.3.3 How to Secure the STP Pump



- ◇ 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. The method of securing the STP pump will depend on the installation requirements. Secure the STP pump to the vacuum equipment as follows:
- ◇ Design and secure the mounting for the STP pump so that it can withstand the maximum rotational torque. Refer to Table 3.2 for torque in pump abnormality.



- ◇ In some cases, the damper and the claw clamping securing cannot be used depend on the type of the STP pump.
- ◇ Refer to Table 3.1 for tightening torque of the bolt.

Table 3.1 Tightening torque of bolt

Size of bolt	Tightening torque of bolt (Nm)
M8	12.0
M10	24.1
M12	42.1

- ◇ When making the leg to secure the base, make them shortened more than ones attached to the STP pump. Use a material that has a tensile strength of 600N/mm² or more.
- ◇ When securing the base, use stainless steel securing bolts with a tensile strength class is 70 or more.



- ◇ When using any securing method other than that specified in this manual, contact BOC Edwards.

1) When securing the inlet port with bolts

Refer to Table 3.2 for torque in pump abnormality and recommended securing bolts.

Secure the inlet port flange with all of the boltholes of the size specified in the Inlet Port Flange Standard.

Secure the base with all 8 screw-holes for legs or all 8 attached legs.

Follow "CAUTION" on page 3-9 about legs and bolts for securing the base.

Make sure that the recommended securing bolt may be different depending on the method of securing the base.

Table 3.2 Maximum Torque predicted and Recommended securing bolt for inlet port flange

Model of TMP		STP-200/300					
Type of flange		VG100		ISO100F/ISO100		ICF152	
Torque in pump abnormality [Nm]		3.4×10 ³		3.4×10 ³		3.4×10 ³	
Base(8 positions)securing		No	Yes	No	Yes	No	Yes
Recommended securing bolt for TMP Flange	Type of bolt	Standard	Standard	Standard	Standard	Standard	Standard
	Type of steel*1	Stainless steel	Stainless steel	Stainless steel	Stainless steel	Stainless steel	Stainless steel
	Strength*1	70 or more	70 or more	70 or more	70 or more	70 or more	70 or more
Model of TMP		STP-400					
Type of flange		VG125/VG150		ISO160F/ISO160		ICF203	
Torque in pump abnormality [Nm]		3.4×10 ³		3.4×10 ³		3.4×10 ³	
Base(8 positions)securing		No	Yes	No	Yes	No	Yes
Recommended securing bolt for TMP Flange	Type of bolt	Standard	Standard	Standard	Standard	Standard	Standard
	Type of steel*1	Stainless steel	Stainless steel	Stainless steel	Stainless steel	Stainless steel	Stainless steel
	Strength*1	70 or more	70 or more	70 or more	70 or more	70 or more	70 or more

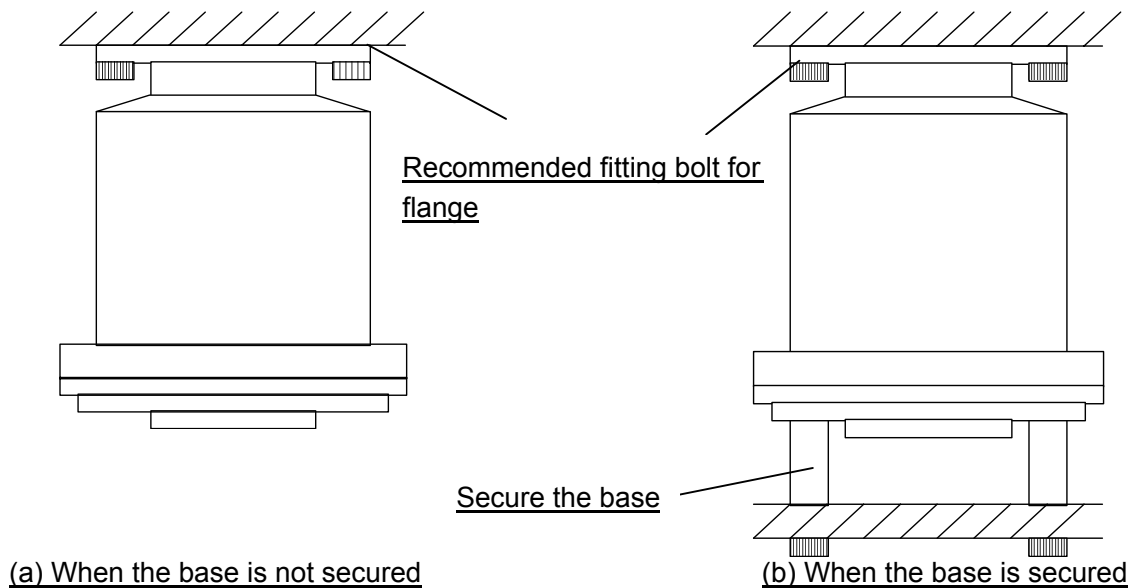


Figure 3.5 Example of securing the STP pump
(When securing the inlet port with bolts)

*1 Refer to ISO898-1(JISB1051), ISO3506(JISB1054) and AMS6419(Aerospace Material Specification)

2) When securing the inlet port flange with claw clamps

Refer to Table 3.2 for rotational torque.

When securing the inlet port flange with only the claw clamp, the vacuum equipment cannot withstand the maximum rotational torque generated by the worst-case failure. To make the vacuum equipment withstand abnormal torque, secure the base with all 8 screw-holes for legs or all 8 attached legs. Follow "CAUTION" on page 3-9 about legs and bolts for securing the base.

For the claw clamp-type, use the required number of claw clamps as specified in Table 3.3. Position the claw clamps evenly on the circumference.

Table 3.3 Number of Claw Clamps by Size of Flange

Size of Flange	Number of Claw Clamps
ISO 160 or less	4 or more
ISO 200 to 250	6 or more
ISO 320 or more	8 or more

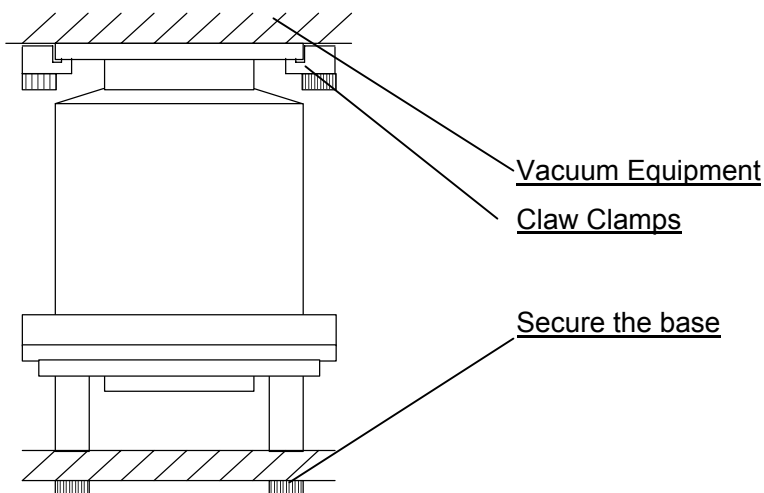


Figure 3.6 Example of securing the STP pump
(When securing the inlet port flange with claw clamps)

3) When installing the damper in the inlet port flange

Refer to Table 3.2 for rotational torque.

In case of using a damper, secure the base with all 8 screw-holes for legs or all 8 attached legs. Follow "CAUTION" on page 3-9 about legs and bolts for securing the base.

When the base cannot be secured because of the equipment design, install the pump with a torque restraint like the one shown in Figure 3.7 (b).



- ◇ Use a damper only at the vertically upright position.
- ◇ DO NOT remove the bolts and nuts attached to reinforce the damper.

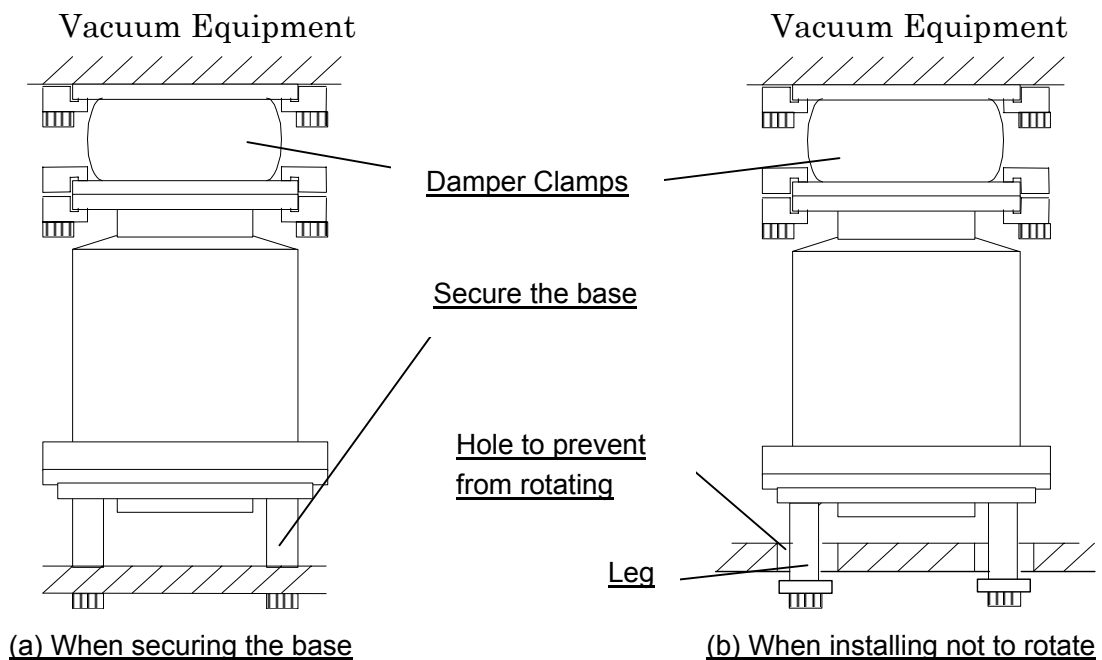


Figure 3.7 Example of securing the STP pump
(When installing the damper in the inlet port flange)

3.3.4 Vacuum Piping



- ◇ **DO NOT** open the STP pump through the flange to atmospheric air while the STP pump is running. If atmospheric air flows into the STP pump, it may not function normally.
- ◇ Depending upon the type of the backing pump used, atmospheric air may reverse flow into the STP pump when the backing pump stops. Attach a vacuum valve to the middle of the piping between the STP pump outlet port flange and the backing pump, and close the vacuum valve when the backing pump stops.

In order to let the STP pump bring its performance into full play, follow the precautions below:

- 1) Be careful not to scratch the flange of the STP pump. Before installing the STP pump, check whether or not there are scratches on the surface.
- 2) Use steel or aluminum tubes with a low gas loss to connect the vacuum equipment to the STP pump.
- 3) Take measures for minimizing leakage. It is also necessary to degrease the tubes as regularly as possible to keep the gas loss as low as possible.
- 4) It is recommended to use a backing pump of pumping speed 160 L/min or more for the STP-200 series, or pumping speed 240 L/min or more for the STP-300/400 series.

However, the pressure at the inlet and outlet ports varies with the flow rate of gas, capacity of the vacuum equipment, length and material of the piping. Select a backing pump in accordance with the capacity and starting method (simultaneous starting, starting after generating roughing vacuum) suitable for the vacuum equipment you use.

- 5) Connect the STP pump and the backing pump using stainless steel or aluminum alloy tubing, flexible tubing, vacuum rubber or Teflon tubing, and other.

The following measures can be used to avoid the transmission of the vibration of the backing pump to the STP pump and the vacuum equipment.

- DO NOT place the backing pump on the same floor as the vacuum equipment.
- Locate the backing pump on a vibration-proof table. Attain 1/3 or less of the rotational speed of the backing pump, when adjusting the inherent frequency of the backing pump installed on a vibration-proof table.
- Attach a weight to the piping from the backing pump, or secure the piping to a rigid, heavy object free of vibration.
- Use a tube of high flexibility.

- 6) Depending upon the type of the backing pump used, oil vapor may contaminate the inside of the STP pump. Some oil viscosity could cause a malfunction when there is a strong reverse flow of oil.

Take the following measures to ensure the correct flow of oil:

- Attach a vacuum valve to the middle of the piping between the STP pump outlet port flange and the backing pump.
- Attach an absorption trap adjacent to the vacuum valve.

Piping at the Inlet Port Flange

Attach the inlet port to the high vacuum side.

Maximum working pressure:	1.3×10^{-2} Pa [1×10^{-4} Torr]
[Pressure at the inlet port flange applicable continuously]	(for natural air cooled)

Piping at the Outlet Port Flange

Attach the outlet port to the inlet port flange of the backing pump (primary side pump).

Allowable backing pressure:	13 Pa [0.1 Torr]
[Pressure at the outlet port flange applicable continuously]	(for natural air cooled)



- ◇ **To attain the ultimate pressure shown in Table 16.1, "Specifications for the STP Pump," set the pressure at the outlet port flange to 1.3 Pa (10^{-2} Torr) or less.**

3.3.5 Connecting the Ground Cable

Connect the ground cable (yellow/green) between the ground terminal of the STP pump and the ground terminal of the STP control unit.

When the resistance between the ground terminals is lower than 0.1Ω , it is not necessary to connect the ground cable after installing the STP pump and the STP control unit.



- ◇ **When the resistance between the ground terminals is over 0.1Ω , always connect the ground cable.**

3.3.6 Connecting the Purge Port

(For the chemical specific pump type C)

When pumping reactive or corrosive gases, introduce a dry N_2 gas or other gas into the STP pump in order to protect the inside of the STP pump.

As shown in Figure 3.8, introduce a dry N_2 gas through the electromagnetic vent valve, needle valve or similar valve (must be prepared by the customer) from the purge port.

For instructions on how to introduce the purge gas, see [Section 7.3, "Gas Suction."](#)



- ◇ **The proper amount of gas purge is approx. $1.7 \times 10^{-2} \text{ Pa} \cdot \text{m}^3/\text{sec}$. (10 SCCM).**
- ◇ **The allowable gas pressure ranges from zero (atmospheric pressure) to 0.5 kgf/cm^2 (gauge pressure).**
- ◇ **When not introducing the purge gas, close the purge port with the blank flange (attached at delivery).**

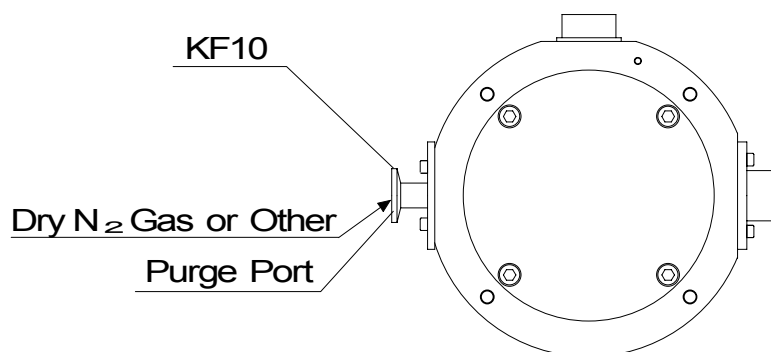


Figure 3.8 Connecting the Purge Port

4 Installation of the STP Control Unit

4.1 Name and Function of Each Part

4.1.1 Front Panel

(See Figure 4.1.)

- (1) "POWER ON/OFF" Switch (illuminated alternate push button switch, green LED)
 - Press this switch to power ON/OFF the STP pump (valid in MANUAL operation only).
 - The POWER ON/OFF built-in lamp lights when the power is ON.
- (2) "MOTOR START" Switch (momentary push button switch, black)
 - Press this switch with power ON to start and accelerate the STP pump (valid in MANUAL operation only).
 - The "ACCELERATION" lamp lights simultaneously.
- (3) "MOTOR STOP" Switch (momentary push button switch, red)
 - Press this switch to decelerate and stop the STP pump (valid in MANUAL operation only).
 - The "NORMAL OPERATION" lamp or the "ACCELERATION" lamp goes out.
- (4) "NORMAL OPERATION" Lamp (green LED)
 - Lights during rated operation (NORMAL OPERATION state).
- (5) "ACCELERATION" Lamp (green LED)
 - Lights during acceleration (ACCELERATION state).
- (6) "OVER TEMPERATURE" Lamp (red LED)
 - Lights when any of the following abnormalities occurs:
 - a) When the motor or electromagnet overheats (90 °C or more).
 - b) When the STP connection cable is not connected.
- (7) "BATTERY OPERATION" Lamp (red LED)
 - Lights while the power is being supplied from the battery to the STP pump during a power failure.

(8) "FAILURE" Lamp (red LED)

- Lights when any of the following abnormalities occurs:
 - a) When the inside of the STP control unit overheats (75 °C or more inside the heat sink).
 - b) When the motor or electromagnet overheats (100 °C or more).
 - c) When an abnormality occurs inside the inverter (overload, overspeed).
 - d) When the battery is thoroughly worn out and cannot be charged.
 - e) When the STP connection cable is not connected.

(9) "EMERGENCY OPERATION" Lamp (red LED)

- Lights when any of the following abnormalities occurs:
 - a) When a power failure occurs.
 - b) When continuous vibration impact is applied to the rotor causing it to come into contact with the touch down bearing.
 - c) When the STP connection cable is not connected.

For details concerning lamps (6) to (9) and abnormalities, see Section 6, "Safety Functions When an Abnormality/Error Occurs" and Section 15, "Troubleshooting."

(10) ROTATION Meter (tachometer)

- Indicates the number of rotations (rpm).
- The needle moves to the black with an increase in rpm.
- The needle moves to the red with a decrease in rpm.
- The needle is located in the black during the rated operation.

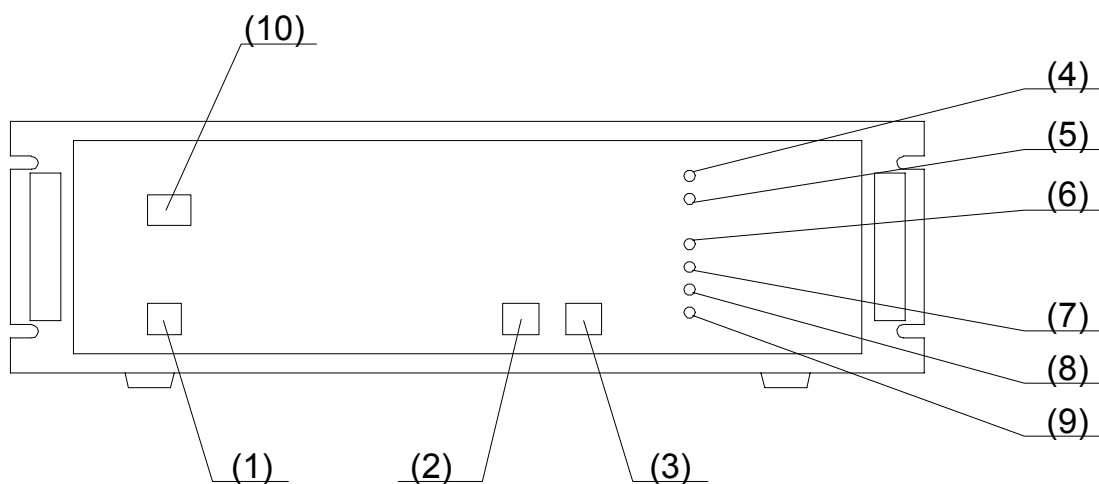


Figure 4.1 STP Control Unit Front Panel

4.1.2 Rear Panel

(See Figure 4.2.)

(11) AC POWER Connector (CON30)

- For primary power input.

(12) MAIN POWER Breaker

- Switches ON/OFF the primary power.
- A metal fitting is attached to secure the breaker at the OFF position.

(13) P. CONNECTOR (CON20)

- For connection of the STP connection cable.

(14) REMOTE CONNECTOR (CON40)

- For remote control.

For details of the REMOTE CONNECTOR (14), see Section 8, "Remote Input/Output Signal Connector."

(15) "MANUAL/REMOTE" Changeover Switch

- When setting to MANUAL, only start, stop or other operations can be performed with the switches on the STP control unit front panel.
- When setting to REMOTE, only start, stop or other operations can be performed by inputting the remote signal.

(16) EXT. BATTERY Connector (CON90)

- For connection of an external battery.



- ◇ **When using an external battery, always disconnect the internal battery connector (See Section 10, "External Battery" for details).**

(17) Ground Terminal

- For connection of the ground cable between the STP pump and the STP control unit.

(18) Air Cooling Fan

- For cooling the inside of the STP control unit.

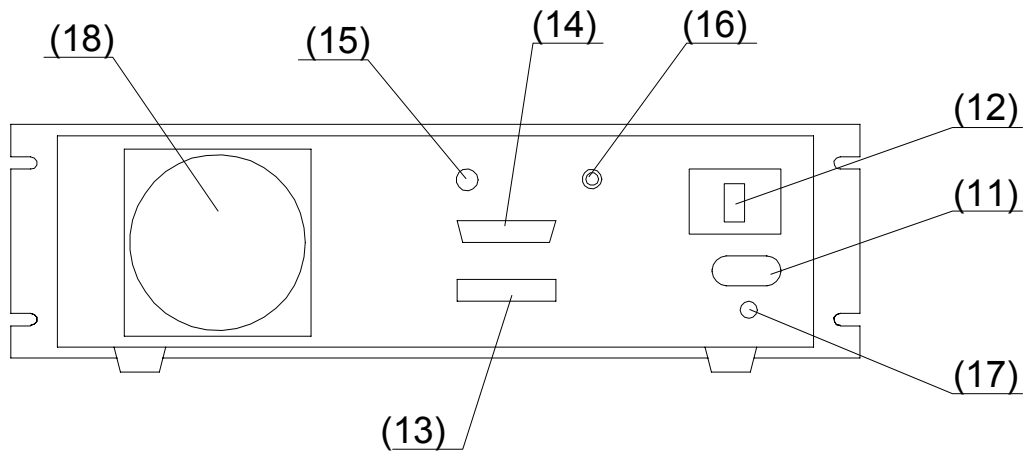


Figure 4.2 STP Control Unit Rear Panel

4.1.3 Inside of the STP Control Unit

(See Figure 4.3.)

(19) Fuses 2 to 5

- These fuses protect as follows:

F2 : 125 V, 8 A (for control power protection)

F3 : 250 V, 3 A

(for inverter and air cooling fan protection)

F4 : 250 V, 5 A (for control power protection)

F5 : 125 V, 10 A

(for internal and external batteries protection)

(20) Inverter

- This is a three-phase transistor-inverter which starts/stops the STP pump.

(21) Internal Battery

- For backup during a power failure.

(22) Internal Battery Connector

- For connection of internal battery (When using an internal battery, connect it to this connector).
- The internal battery has been installed upon shipment of the STP control unit so that the customer can use it (The internal battery connector is connected to the internal battery).



- ◇ **When using an external battery, disconnect the internal battery connector, then connect the external battery connector (See Section 10, "External Battery" for details).**

(23) Control Circuit Boards

- For control of the magnetic bearing, motor, safety functions, and others.

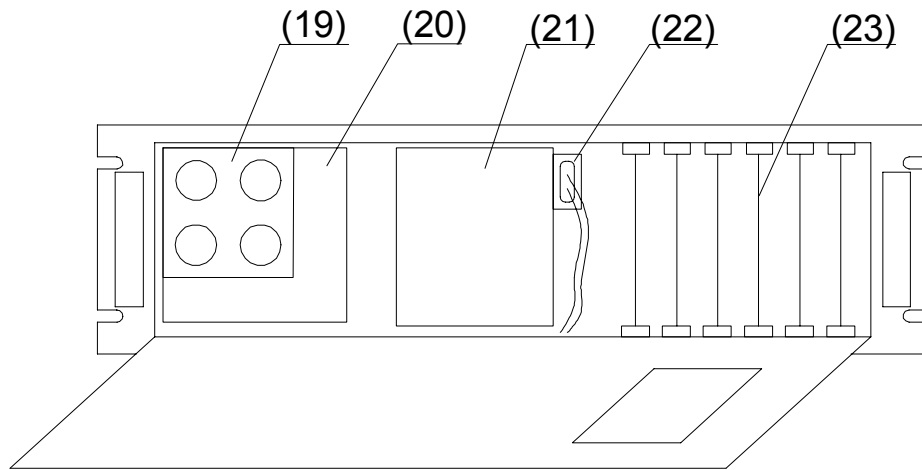


Figure 4.3 Inside of the STP Control Unit

4.2 Precautions Before Installation

4.2.1 Operating Environment

Install the STP control unit in a place meeting the following requirements:

Ambient Temperature	0 °C to 40 °C
Ambient Relative Humidity	30 to 95% (no dew condensing)
Environment	<ul style="list-style-type: none"> • A place free of exposure to direct sunlight. • A place free of high humidity. • A place free of dust. • A place free of salty air. • A place free of dripping water. • A place free of explosive or inflammable gas. • A place free of corrosive gas. • A place free of radiation. • A place free of strong magnetic and electric fields. • A place free of excessive vibration. • A place free of a source of electric noise.
Installation Condition	<ul style="list-style-type: none"> • Install the STP control unit horizontally (within $\pm 10^{\circ}\text{C}$).

4.2.2 Installation Area

Leave enough space for the following in addition to that for the STP control unit (See Figure 4.4, "Peripheral Space of the STP Control Unit.")

- Space for maintenance and inspection
- Space for inlet and outlet of air for cooling
 - Top and side: 5 cm or more
 - Bottom: 1.8 cm or more (height of the rubber foot)
- Space for connecting the cables
 - Rear: 15 cm or more



- ◇ **The minimum bending radius of the STP connection cable is 150 mm (See Figure 16.3, "External Appearance of the STP Control Unit" [Cable Space]). DO NOT excessively bend the cables and beware of any obstacles when installing the STP pump. Also, leave enough space to install other cables without bending them excessively.**

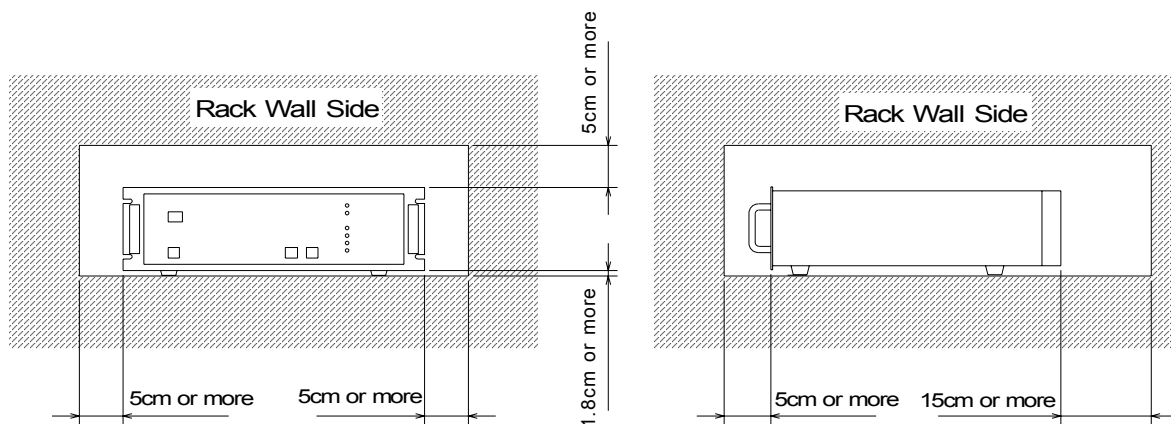


Figure 4.4 Peripheral Space of the STP Control Unit

4.3 Attaching the STP Control Unit to a Rack

The dimensions of the STP control unit front panel conform to EIA standard. Therefore, this panel can be attached to any type of commercially-available racks. Attach the STP control unit to the rack according to the following steps:

1) When attaching the STP control unit to a rack:

- Attach the front panel to a rack using the screw holes for the front panel.
- Also support the STP control unit from the bottom using a support angle or a similar tool.

2) When attaching the STP control unit to a movable rack:

- Attach the front panel to a movable rack using the screw holes for the front panel.
- To protect the STP control unit during transport, remove the rubber foot from the bottom and attach the STP control unit to the rack using the screw holes for the rubber foot.



- ◇ The STP control unit cannot be supported with only the screws on the front panel (The STP control unit is a heavy product). Always support it from the bottom. DO NOT block the ventilation port.
- ◇ For the peripheral space of the STP control unit, see Figure 4.4, "Peripheral Space of the STP Control Unit."



- ◇ For the dimensions of the front panel and positions of screw holes for the rubber foot, see Figure 16.3, "External Appearance of the STP Control Unit."

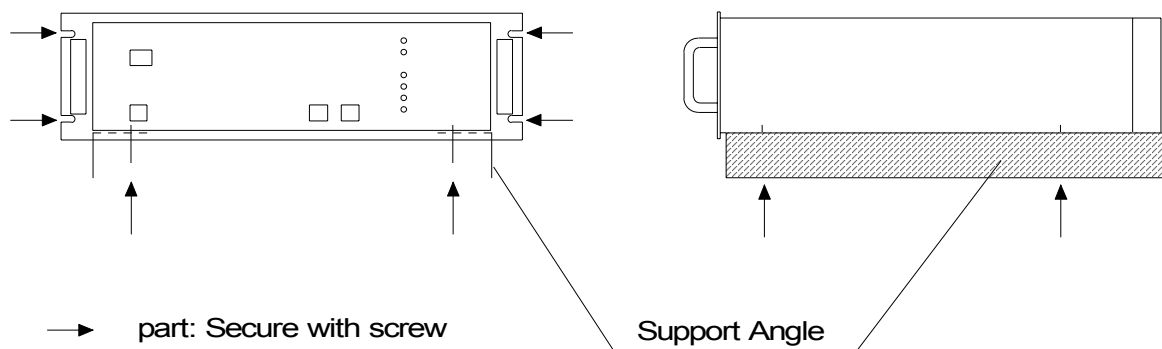


Figure 4.5 Example of Securing the STP Control Unit

4.4 Cable Connection

4.4.1 Name and Dimensions of Each Cable

(unit : mm)

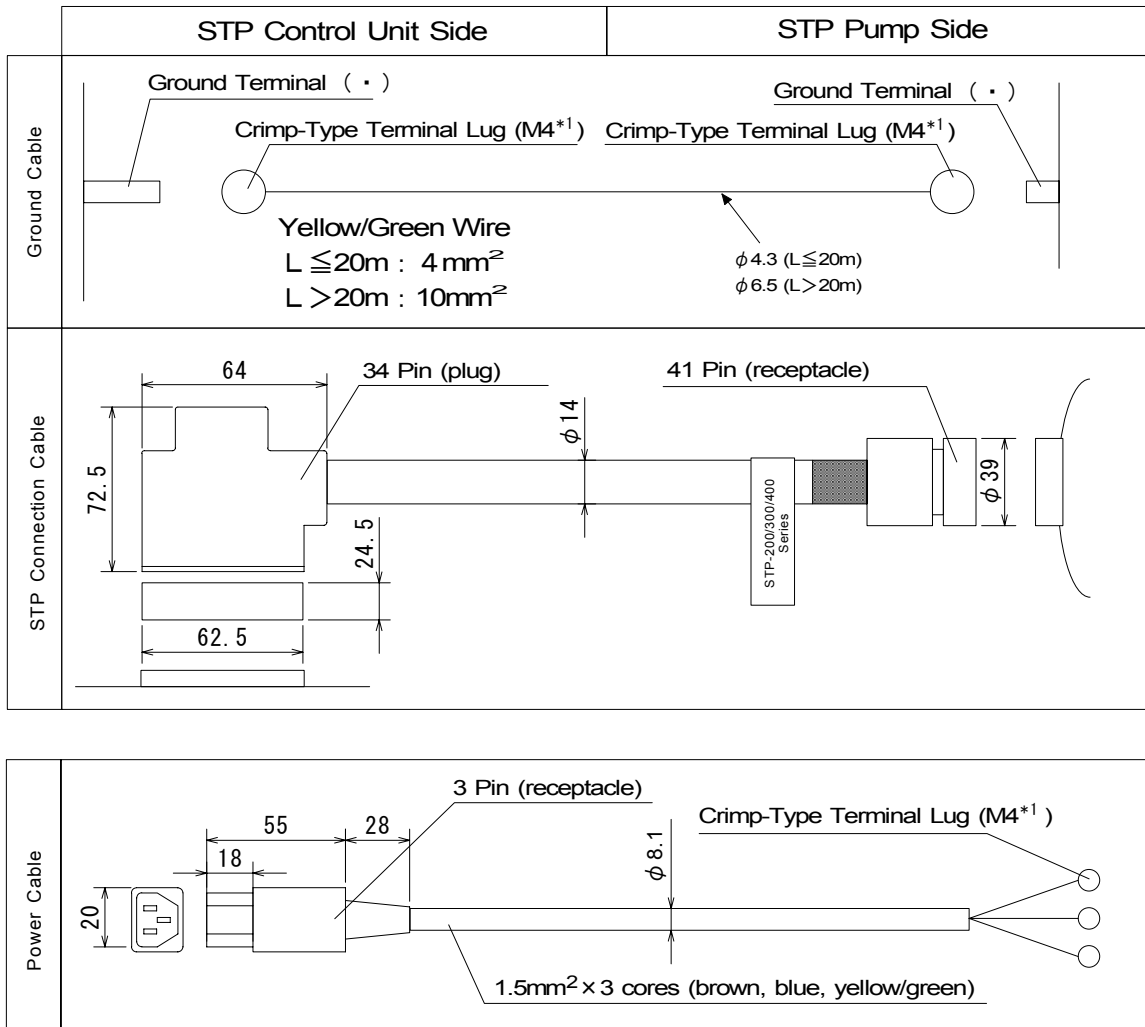


Figure 4.6 External Dimensions of Each Cable

*1 : JIS

4.4.2 How to Connect the Cables



- ◇ **When connecting/disconnecting cables, always power OFF the STP pump (Switch the breaker "OFF").**
Failure to do so may result in electric shock or product damage.
- ◇ **With each connector, align the position of the guide key and insert the pin vertically so as not to bend it.**
If the pin is bent, not only may the connector not function normally, but may make the pins contact each other, resulting in a malfunction.
- ◇ **Lock and securely tighten each connector and screw.**
- ◇ **DO NOT apply voltage to each pin and DO NOT cause any short-circuiting between pins.**
- ◇ **Connect each cable securely. DO NOT place heavy objects on the cables nor bend them excessively.**
Support each cable so as not to apply direct force to the connectors or terminals.
If any problem occurs in cables, connectors or terminals, the STP pump may not function normally.

1) Connecting the Ground Cable

Connect the ground cable (yellow/green) between the ground terminal of the STP pump and the ground terminal of the STP control unit.

When the resistance between the ground terminals is lower than 0.1 Ω , it is not necessary to connect the ground cable after installing the STP pump and the STP control unit.



- ◇ **First, connect the ground cable. Next, connect other cables.**
- ◇ **When the resistance between the ground terminals is over 0.1 Ω , always connect the ground cable. Failure to do so may result in electric shock.**

2) Connecting the STP Connection Cable

Connect the receptacle side of the STP connection cable to the STP connector of the STP pump and connect the plug side to "P.CONNNECTOR CON20" of the STP control unit.



- ◇ **Always use the STP pump, STP control unit and the STP connection cables of the same model name, serial number and cable length. Failure to do so may result in product damage. Contact your nearest BOC Edwards representative if you plan to use units with the same model name but different serial numbers and cable length; They must be adjusted. In some cases, the configuration may need more adjustment.**
- ◇ **Use the STP connection cable that has a label affixed**

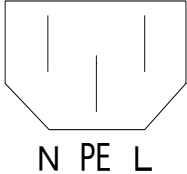
**STP-200/300/400
Series**

The use of different cables may result in product damage.

3) Connecting the Power (Primary Side) Cable

Connect the primary power cable to the "AC POWER CON30" on the STP control unit rear panel as shown in Table 4.1.

Table 4.1 Connecting the Power Cable

CON30 Pin No.	Cable Color	Remarks	
1 (L)	Brown	Single phase 200 V AC $\pm 10\%$ (for 200 V specification) Single phase 220 V AC $\pm 10\%$ (for 220 V specification) Single phase 240 V AC $\pm 10\%$ (for 240 V specification)	Rear Panel "AC POWER" Outline of connector 
2 (N)	Blue	Single phase 100 V AC $\pm 10\%$ (for 100 V specification) Single phase 110 V AC $\pm 10\%$ (for 110 V specification) Single phase 120 V AC $\pm 10\%$ (for 120 V specification) Both 50/60 Hz	
3 (PE)	Yellow/Green	Ground	

Secure the power cable to the STP control unit rear panel using the cable fitting tool (See Figure 4.7).



- ◇ Confirm the power voltage on the name plate.
- ◇ Connect the power cable securely to prevent incorrect wiring.
- ◇ DO NOT apply surge voltage exceeding 1 kV to the input power line.
- ◇ Always ground power cable to prevent electric shock.

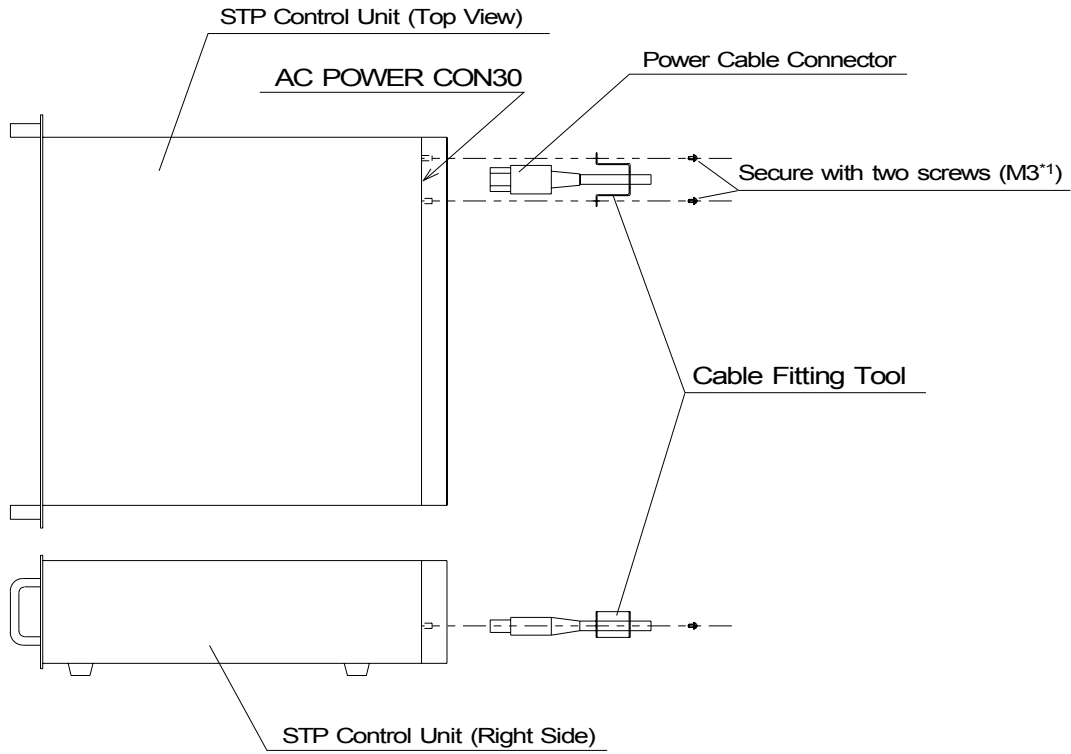


Figure 4.7 How to Secure the Power Cable

*1 : JIS

5 How to Start/Stop the STP Pump



- ◇ **NEVER** connect or disconnect any cables while the power is **ON**.
- ◇ **NEVER** turn the primary power **OFF** (Switch the breaker "OFF") while the STP pump is in rotation.
- ◇ **DO NOT** release the inlet port flange or outlet port flange into the atmosphere while the STP pump is in rotation.

5.1 Before Starting

After completing installation, piping, leakage test of the STP pump, installation of the STP control unit, and wiring, the STP pump is ready for start.

Check the following items before starting:

- 1) Are the STP pump and the STP control unit secured according to the appropriate method?
- 2) Is the primary power cable connected correctly to the power supply?
- 3) Is the power voltage selected properly?
- 4) Do the serial number and the cable length of the STP pump, the STP control unit and the STP connection cable match?
- 5) Is the label affixed correctly to the STP connection cable?

STP-200/300/400
Series

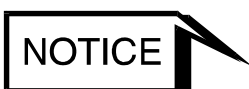
- 6) Are the ground cable and the STP connection cable securely connected?
Are each terminal and each connector securely locked?

5.2 Starting/Stopping Time

Starting time: Approx. 10 minutes after start operation.

Stopping time: Approx. 15 minutes after stop operation.

If the rotational speed does not attain the rated speed within approx. 30 minutes, the "FAILURE" lamp lights. Before restarting the STP pump, always check whether or not there is leakage from the piping or the vacuum equipment and also confirm the capacity and the START state of the backing pump.



- ◇ **When start/stop operations are frequently performed, the STP pump may overheat. Avoid doing so.**

5.3 Start Procedures

Start the backing pump before or simultaneously with start of the STP pump. Open the vacuum valve located at the outlet port flange side after starting the backing pump.



- ◇ **DO NOT open the vacuum valve without operating the backing pump. Depending upon the type of the backing pump, doing so may cause a reverse flow of oil, which could contaminate the inside of the STP pump.**

5.4 Stop Procedures

Close the vacuum valve located at the outlet port flange side just before or after stopping the STP pump. After closing the valve, stop the backing pump.



- ◇ **DO NOT stop the backing pump without closing the vacuum valve. Depending upon the type of the backing pump, doing so could cause a reverse flow of atmospheric air into the STP pump, which may result in a malfunction.**



- ◇ **DO NOT stop the backing pump without closing the valve. Depending upon the type of the backing pump, doing so may cause a reverse flow of oil, which could contaminate the inside of the STP pump.**

There are two methods of operating the STP pump: MANUAL and REMOTE.

Select one which fits your vacuum equipment.

5.5 Manual Operation

Slide the "MANUAL/REMOTE" changeover switch on the rear panel to "MANUAL."

5.5.1 Powering ON

- 1) Switch "ON" the breaker on the rear panel.
(A metal fitting is attached to the breaker to lock the breaker at the "OFF" position. Loosen the screw, lower the metal fitting, switch "ON" the breaker, then tighten the screw.)
- 2) Press the "POWER ON/OFF" switch (The switch is thoroughly locked down).
The magnetic bearing functions and the rotor levitates.
The "POWER ON/OFF" switch built-in lamp lights (POWER ON state).



- ◇ **Although the POWER ON operation may cause an "Abnormality/Error Warning" lamp to light and an alarm signal to be output from the REMOTE CONNECTOR, this is not an indication of abnormality. This state is released within 5 seconds.**

5.5.2 Starting the STP Pump

- 1) Press the "MOTOR START" switch on the front panel after powering "ON" to start the STP pump.
The STP pump starts to accelerates.
The "ACCELERATION" lamp lights (ACCELERATION state).
- 2) When the STP pump attains the rated speed of rotations, the "ACCELERATION" lamp goes out, and the "NORMAL OPERATION" lamp lights (NORMAL OPERATION state).

5.5.3 Stopping the STP Pump

- 1) Press the "MOTOR STOP" switch on the front panel to stop the STP pump. The STP pump starts to decelerate and stops. The "NORMAL OPERATION" lamp or the "ACCELERATION" lamp goes out (BRAKE state).
- 2) The number of rotations goes down to approx. 3,000 rpm or less in approx. 15 minutes. This decrease in rpm is indicated by the ROTATION meter on the front panel showing a full-scale deflection to the red.



- ◇ **Make sure the STP pump stops thoroughly by confirming that the ROTATION meter on the front panel deflects to full-scale in the red.**
- ◇ **When the pressure inside the STP pump is 1.3×10^{-5} Pa [10^{-7} Torr] or less, the stopping time is 15 minutes or more.**
- ◇ **The STP pump can be stopped faster by introducing a gas (such as dry N₂ gas) into the STP pump. Introduce a gas so that the pressure inside the STP pump increases to 5.3×10^2 to 6.7×10^2 Pa [4 to 5 Torr] in 10 seconds after gas introduction.**
Note that a sharp increase in the pressure may cause the STP pump to operate abnormally.

5.5.4 Starting the STP Pump after Stopping

Press the "MOTOR START" switch on the front panel to reaccelerate the STP pump.
The STP pump can be reaccelerated even while it is stopping.

5.5.5 Powering OFF

- 1) When both the "ACCELERATION" and "NORMAL OPERATION" lamps are off and the ROTATION meter shows a full-scale deflection to the red:
 - i. Press the "POWER ON/OFF" switch. The switch pops up into the unlocked position, the magnetic bearing stops, and the rotor lands (POWER OFF state).
The "POWER ON/OFF" switch built-in lamp goes out.
 - ii. Switch "OFF" the breaker on the rear panel.

- 2) When either of the "ACCELERATION" and "NORMAL OPERATION" lamps is lit or the ROTATION meter does not show a full-scale deflection to the red:
 - i. Even by pressing the "POWER ON/OFF" switch to switch it "OFF," the rotor does not land, the pump's operation state remains unchanged, and the "POWER ON/OFF" switch built-in lamp remains lit.
When the number of rotations goes down to approx. 3,000 rpm or less, the magnetic bearing stops, the rotor lands, and the "POWER ON/OFF" switch built-in lamp goes out.
 - ii. Switch "OFF" the breaker on the rear panel.



- ◇ **The brake of the STP pump disengages at approx. 3,000 rpm, after which the STP pump still rotates by inertia. Powering OFF immediately after pressing the "MOTOR STOP" switch or while either of the "ACCELERATION" and "NORMAL OPERATION" lamps is being lit causes the touch down bearing to touch the rotor resulting in a noise when the brake disengages. Although this is not an indication of abnormality, repetitions of such an operation will expedite the wear of the touch down bearing. Such operations will expedite the wear of the touch down bearing. It is recommended to power "OFF" the STP pump after it stops thoroughly.**
- ◇ **Although the POWER OFF operations may cause an "Abnormality/Error Warning" lamp to light and an alarm signal to be output from the REMOTE CONNECTOR, this is not an indication of abnormality. This state is released within 5 seconds.**

5.6 Remote Operation

(Read through Section 8, "Remote Input/Output Signal Connector" before use.)

Slide the "MANUAL/REMOTE" changeover switch on the rear panel to "REMOTE."

5.6.1 Powering ON

- 1) Switch "ON" the breaker on the rear panel.
(A metal fitting is attached to the breaker to lock the breaker at the "OFF" position. Loosen the screw, lower the metal fitting, switch "ON" the breaker, then tighten the screw.)
- 2) Input 24 V DC between (1)-(13) (POWER ON) of the REMOTE CONNECTOR (CON40) for 0.3 seconds or more ((1): "+" side; (13): "-" side).
The magnetic bearing functions, and the rotor levitates.
The "POWER ON/OFF" switch built-in lamp lights (POWER ON state).



- ◇ **Although the POWER ON operation may cause an "Abnormality/Error Warning" lamp to light and an alarm signal to be output from the REMOTE CONNECTOR, this is not an indication of abnormality. This state is released within 5 seconds.**

5.6.2 Starting/Stopping the STP Pump

Table 5.1 describes how to start or stop the STP pump during remote operation.

Table 5.1 Starting/Stopping the STP Pump during Remote Operation

Connector	Starting the Pump	Stopping the Pump
Remote Connector (CON40)	Input 24 V DC between (3)-(15) (MOTOR START) for 0.3 seconds or more ((3): "+" side; (15): "-" side). However, when inputting this START signal simultaneously with inputting the POWER ON signal, input this signal for 5 seconds or more.	Input 24 V DC between (4)-(16) (MOTOR STOP) for 0.3 seconds or more ((4): "+" side; (16): "-" side). The STOP signal has priority over the START signal.



- ◇ **Make sure the STP pump stops thoroughly by confirming that the ROTATION meter on the front panel deflects to full-scale in the red.**
- ◇ **When the pressure inside the STP pump is 1.3×10^{-5} Pa [10^{-7} Torr] or less, the stopping time is 15 minutes or more.**
- ◇ **The STP pump can be stopped faster by introducing a gas (such as dry N₂ gas) into the STP pump. Introduce a gas so that the pressure inside the STP pump increases to 5.3×10^2 to 6.7×10^2 Pa [4 to 5 Torr] in 10 seconds after gas introduction.**
Note that a sharp increase in the pressure may cause the STP pump to operate abnormally.

5.6.3 Starting the STP Pump after Stopping

Perform the start operation to reaccelerate the STP pump. See [Section 5.6.2, "Starting/Stopping the STP Pump."](#)

The STP pump can be reaccelerated even while it is stopping.

5.6.4 Powering OFF

The POWER OFF signal has priority over the START signal.

- 1) When both the "ACCELERATION" and "NORMAL OPERATION" lamps are off and the ROTATION meter shows a full-scale deflection to the red:
 - i. Input 24 V DC between (2)-(14) (POWER OFF) of the REMOTE CONNECTOR (CON40) for 0.3 seconds or more ((2): "+" side; (14): "-" side). The magnetic bearing stops, and the rotor lands (POWER OFF state).
The "POWER ON/OFF" switch built-in lamp goes out.
 - ii. Switch "OFF" the breaker on the rear panel.

- 2) When either of the "ACCELERATION" and "NORMAL OPERATION" lamps is lit or the ROTATION meter does not show a full-scale deflection to the red:
 - i. Even by inputting the POWER OFF signal from the REMOTE CONNECTOR in the same way as 1), the rotor does not land, the pump's operation state remains unchanged, and the "POWER ON/OFF" switch built-in lamp remains lit.
When the number of rotations goes down to approx. 3,000 rpm or less, the magnetic bearing stops, the rotor lands, and the "POWER ON/OFF" switch built-in lamp goes out.
 - ii. Switch "OFF" the breaker on the rear panel.



- ◇ **The brake of the STP pump disengages at approx. 3,000 rpm, after which the STP pump still rotates by inertia. Powering OFF immediately after pressing the "MOTOR STOP" switch or while either of the "ACCELERATION" and "NORMAL OPERATION" lamps is being lit causes the touch down bearing to touch the rotor resulting in a noise when the brake disengages. Although this is not an indication of abnormality, repetitions of such an operation will expedite the wear of the touch down bearing. Such operations will expedite the wear of the touch down bearing. It is recommended to power "OFF" the STP pump after it stops thoroughly.**
- ◇ **Although the POWER OFF operations may cause an "Abnormality/Error Warning" lamp to light and an alarm signal to be output from the REMOTE CONNECTOR, this is not an indication of abnormality. This state is released within 5 seconds.**

6 Safety Functions When an Abnormality/Error Occurs

The STP pump is provided with safety functions for various abnormalities/errors (See [Table 6.4, "Safety Functions."](#))

For troubleshooting, see [Section 6.2, "Restarting after Any Safely Function Operates"](#) and [Section 15, "Troubleshooting."](#)

6.1 Safety Functions

6.1.1 Power Failure

< I . Operation at a Power Failure >

When the power voltage drops below approx. 85% of the rated voltage due to a power failure, the internal battery of the STP control unit automatically activates to supply power to the STP pump in order to maintain normal function of the magnetic bearing (backup operation during a power failure).

- 1) The STP control unit detects any power failure of 50 milliseconds or more and automatically switches to the BATTERY OPERATION mode. The STP pump decelerates and the rotor lands on the touch down bearing and stops at approx. 3,000 rpm.

In the BATTERY OPERATION mode, the "BATTERY OPERATION" lamp and the "EMERGENCY OPERATION" lamp light, and the alarm signals with the same names as those of the lighting lamps are output from REMOTE CONNECTOR pins (10)-(22) and (7)-(19) regardless of MANUAL or REMOTE OPERATION mode.

When the rotor lands on the touch down bearing, the "BATTERY OPERATION" lamp and the "EMERGENCY OPERATION" lamp go out, and the alarm output is reset.

- 2) In case of a power failure of less than 50 milliseconds, the STP control unit does not detect it and the STP pump continues rotating.



- ◇ **Depending upon the condition of the STP control unit, it may detect a power failure of approx. 35 milliseconds to less than 50 milliseconds. For details, see < II . Operation after a Power Recovery >.**

Table 6.1 shows the states of lamps and REMOTE output signals at a power failure.

Table 6.1 States of Lamps and REMOTE Output Signals at a Power Failure

Power failure time	Number of rotations	LED lamps	REMOTE output signals	
		"BATTERY OPERATION" "EMERGENCY OPERATION"	"POWER ON" signal	"BATTERY OPERATION" signal "EMERGENCY OPERATION" signal
Approx. 50msec. or more	3,000rpm or more	Lights	ON	ON
	Less than 3,000rpm	Goes out	OFF	OFF
Less than approx. 50msec.	Does not detect power failure*1.			

<II. Operation after a Power Recovery>

1) MANUAL Operation

The STP pump continues decelerating even after a power recovery. Press the "START" switch to reaccelerate the STP pump.

2) REMOTE Operation

- i. When the power is recovered at approx. 3,000 rpm or more:
 - When the START signal is input to the REMOTE CONNECTOR after a power recovery, the STP pump reaccelerates.
 - When the START signal is not input to the REMOTE CONNECTOR after a power recovery, the STP pump continues the BRAKE operation.
- ii. When the power is recovered at less than 3,000 rpm (after the rotor lands):
 - When the POWER ON signal is input to the REMOTE CONNECTOR after a power recovery, the rotor re-levitates.
 - When the POWER ON and START signals are input to the REMOTE CONNECTOR after a power recovery, the rotor re-levitates and the STP pump reaccelerates.
 - When the POWER ON signal is not input to the REMOTE CONNECTOR after a power recovery, the pump's state remains unchanged.

¹ : Depending upon the condition of the STP control unit, it may detect a power failure of approx. 35 milliseconds to less than 50 milliseconds.



- ◇ **Establish a sequence so that power can be supplied to the STP control unit immediately after a power recovery.**

Tables 6.2 and 6.3 show operations of the STP pump after a power recovery.

Table 6.2 Operations of the STP Pump after a Power Recovery
(during MANUAL OPERATION)

Power failure time	Number of rotations after a power recovery	State of "POWER ON" switch after a power recovery	STP pump's operation after a power recovery
Approx. 50msec. or more	3,000rpm or more	ON/OFF	Deceleration/Stop
	Less than 3,000rpm	ON	Re-levitation
		OFF	POWER OFF state
Approx. 35msec. to less than 50msec.	3,000rpm or more	ON	Continues as before.
		OFF	Deceleration/Stop
	Less than 3,000rpm	ON	Re-levitation
		OFF	POWER OFF state
Less than approx. 35msec.	Continues as before.		

**Table 6.3 Operations of the STP Pump after a Power Recovery
(during REMOTE OPERATION)**

Power failure time	Number of rotations after a power recovery	Remote signal input after a power recovery		STP pump's operation after a power recovery
		POWER ON signal	START signal	
Approx. 50msec. or more	3,000rpm or more	Yes/No	Yes	Reacceleration
		Yes/No	No	Deceleration/Stop
	Less than 3,000rpm	Yes	No	Re-levitation
		Yes	Yes	Re-levitation, reacceleration
		No	Yes/No	POWER OFF state
Approx. 35msec. to less than 50msec.	3,000rpm or more	Yes	Yes/No	Continues as before.
		No	Yes	Reacceleration
		No	No	Deceleration/Stop
	Less than 3,000rpm	Yes	Yes	Re-levitation, reacceleration
		Yes	No	Re-levitation
		No	Yes/No	POWER OFF state
Less than approx. 35msec.	Continues as before.			

6.1.2 Abnormal State of Magnetic Bearing

When the magnetic bearing does not function normally due to a breakage of the STP connection cable, disconnection of connectors, or any abnormality/error of the STP control circuit, the rotor falls on the touch down bearing, and the STP pump stops.

The "EMERGENCY OPERATION" lamp lights.



- ◇ **When an abnormality/error occurs in the magnetic bearing, check the STP pump as well as the STP control unit, and contact Service office.**

6.1.3 Excessive Vibration

When serious vibration or mechanical shock causes the rotor to touch the touch down bearing (due to external vibration/impact, intrusion of atmosphere or foreign materials into the STP pump or rotor imbalance) the STP pump enters the STOP operation.

The "EMERGENCY OPERATION" lamp lights.

6.1.4 Inverter Overload

When the STP pump does not attain the rated speed within approx. 30 minutes after starting or when the ACCELERATION state remains unchanged during operation for approx. 30 minutes, the inverter stops and the STP pump stops as well. The "FAILURE" lamp lights.

6.1.5 Overheating Inside the STP Pump

When the temperature of the motor inside the STP pump exceeds 90°C due to an abnormal baking temperature or overload operation, the STP pump decelerates down to 40,000 rpm.

The "OVER TEMPERATURE" lamp lights.

Further, when the temperature inside the STP pump exceeds 100°C, the STP pump enters the STOP operation.

The "OVER TEMPERATURE" and "FAILURE" lamps light.

6.1.6 Overheating Inside the STP Control Unit

When the temperature inside the STP control unit (at the heat sink) exceeds 75 °C due to a failure in the air cooling fan, external heat source, and others, the STP pump enters the STOP operation.

The "FAILURE" lamp lights.

6.1.7 Overspeed

When the rotational speed of the STP pump exceeds 52,500 rpm due to a failure in the inverter, the STP pump enters the STOP operation.

The "FAILURE" lamp lights.

6.1.8 Abnormal Battery Voltage

When the battery voltage is 21 V DC or less due to deterioration in the battery or incorrect connection while the power is ON, the STP pump does not rotate even if the STP pump START operation is performed.

The "FAILURE" lamp lights.



- ◇ **NEVER disconnect the internal or external battery connection cable while the STP pump is under POWER ON state.**

6.2 Restarting after Any Safety Function Operates

1) In case of a power failure:

Establish a sequence so that power can be supplied to the STP control unit immediately after a power recovery.

2) In case the "FAILURE" lamp lights due to an overload of the inverter or the "EMERGENCY OPERATION" lamp lights due to excessive vibration:

Confirm that the STP pump stops thoroughly (that the ROTATION meter deflects to full-scale in the red), and perform the POWER OFF operation. The "FAILURE" or the "EMERGENCY OPERATION" lamp goes out. Then, restart the STP pump and check if it operates correctly.



- ◇ **For probable causes and troubleshooting, see Section 15, "Troubleshooting."**

3) In other cases:

Confirm that the STP pump stops thoroughly (that the ROTATION meter deflects to full-scale in the red), and remove the cause of the abnormality/error. Then, restart the STP pump and check if it operates correctly.



- ◇ **For probable causes and troubleshooting, see Section 15, "Troubleshooting."**

Table 6.4 Safety Functions (1/2)

Abnormality /Error	Operation state of safety functions	Lamp indication	REMOTE output signal	State of the STP pump	Probable causes of an abnormality/error
Power failure	Failure time: approx. 50 msec or more (for details, see <u>Section 6.1.1, "Power Failure"</u>).	"BATTERY OPERATION" "EMERGENCY OPERATION"	"BATTERY OPERATION" "EMERGENCY OPERATION"	Levitation continues by battery. The STP pump stops. The rotor lands on the touch down bearing at approx. 3000 rpm.	Power failure. Power cable breakage. Power cable disconnection
Abnormal magnetic bearing	Rotor descends onto the touch down bearing.	"EMERGENCY OPERATION"	"EMERGENCY OPERATION"	The STP pump stops.	STP connection cable breakage. STP connection cable disconnection. Abnormal control circuit.
Excessive vibration	Rotor vibration: 100 μm O-P or more.	"EMERGENCY OPERATION"	"EMERGENCY OPERATION"	The STP pump stops.	External vibration, and impact. Intrusion of atmospheric air. Intrusion of foreign particles.
Overload of inverter	Current of more than 7 A flows into the inverter momentarily or current of more than 1.2 A flows into the inverter continuously for 30 minutes.	"FAILURE"	"FAILURE"	The inverter stops. The STP stops.	Leakage from the vacuum equipment or piping. Insufficient pressure at inlet and outlet port sides. Failure of starting of the backing pump.

Table 6.4 Safety Functions (2/2)

Abnormality /Error	Operation state of safety functions	Lamp indication	REMOTE output signal	State of the STP pump	Probable causes of an abnormality/error
Overheating inside the STP pump	Temperature of the STP pump motor: 90°C or more	"OVER TEMPERATURE"	"OVER TEMPERA-TURE"	Decelerates down to 40,000 rpm.	Abnormal baking temperature. Insufficient cooling. Leakage of vacuum equipment or piping. Continuous repetition of start/stop. Extraordinarily-high temperature.
	Temperature of the STP pump motor: 100°C or more	"OVER TEMPERATURE" "FAILURE"	"OVER TEMPERA-TURE" "FAILURE"	The STP pump stops.	
Overheating inside the STP control unit	75°C or more in the STP control unit and heat sink.	"FAILURE"	"FAILURE"	The STP pump stops.	Failure in the cooling fan. Shielding of cooling air inlet and ventilation port. Extraordinarily-high temperature
Overspeed	Rotational speed of the STP pump: 52,500 rpm or more.	"FAILURE"	"FAILURE"	The STP pump stops.	Failure in the inverter.
Abnormal battery terminal voltage	Battery terminal voltage: 21 V or less	"FAILURE"	"FAILURE"	The STP pump does not start.	Incorrect connection of the battery. Deterioration in the battery.

7 Baking, Cooling and Gas Suction of the STP Pump

7.1 Baking the STP Pump

To attain a lower pressure in a shorter time and reduce the exhaust time, bake the vacuum equipment and STP pump.

WARNING

- ◇ The surfaces of the STP pump and its peripheral equipment will become extremely hot when performing baking. **NEVER** touch them with bare hands.

CAUTION

- ◇ When baking the STP pump, always cool it to prevent overheating (For the cooling method, see Section 7.2, "Cooling the STP Pump").
- ◇ Start baking after cooling is started.
Set the temperature of the baking heater to 120°C or less (An optional baking heater is set to 110°C or less).
- ◇ **DO NOT** pump gases during baking to prevent overheating.

NOTICE

- ◇ To exhaust the gas discharged from the vacuum equipment and the inner wall of the STP pump, run the STP pump during baking.

7.1.1 Attaching a Baking Heater

- 1) Attach a baking heater (optional accessory) as near as possible to the inlet port flange (See Figure 7.1, "Attaching Positions of the Cooling Unit and Baking Heater").
- 2) Affix the "Hot Surface Warning Label" to the surface of the STP pump so that the operator can see it clearly at any time (See Figure 7.1, "Attaching Positions of the Cooling Unit and Baking Heater").



- ◇ **Check the rated voltage of the baking heater before use.**
- ◇ **Wind the baking heater around the surface of the STP pump tightly. If the baking heater is not wound tightly, the loose parts will overheat.**
- ◇ **Procure protective parts for the baking heater, such as an earth leakage breaker and fuses, when using the baking heater.**
- ◇ **DO NOT apply excessive force to the cable for the baking heater.**

7.2 Cooling the STP Pump

(See Figure 7.1.)

There is a method using an air cooling unit.
When performing baking, always cool the STP pump.
Also, when pumping gases, cool the STP pump.

7.2.1 Air Cooling Method

Use the air cooling unit (optional accessory).
Attach the air cooling unit using 4 screws at screw holes for legs (4-M8*1, depth 16 mm).
(For the positions of the screw holes for legs, see Figures 16.1 and 16.2, "External Appearance of the STP Pump.")



- ◇ **Since the air cooling unit is attached using 4 screw holes for legs, the base for securing the STP pump cannot be installed using screw holes for legs (See Section 3.3.3, "How to Secure the STP Pump"). When using the air cooling unit, design your vacuum equipment so that the STP pump installing flange at the vacuum equipment side can withstand the torque generated by the abnormal STP pump.**



- ◇ **Check the rated voltage of the air cooling unit before use.**
- ◇ **Procure protective parts for the air cooling unit, such as an earth leakage breaker and fuses, when using the air cooling unit.**
- ◇ **DO NOT apply excessive force to the cable for the air cooling unit.**

*1 : JIS

7.3 Gas Suction



- ◇ When pumping gases, they may remain in the STP pump. Introduce a purge gas and then exhaust all gasses. Residual gases in the STP pump may cause an accident when the STP pump is removed. Confirm the characteristics of gases to be used, referring to the Material Safety Data Sheet (MSDS) you obtain from the gas supplier.



- ◇ Chlorine or fluorine system gases can be used in the chemical specific STP-200C/300C/400C (type C). When you use gases including alkaline metals, but excluding Li, gases including Ga, Hg, In, or Sn, or HBr, contact BOC Edwards (See Section 1.1, "Usable Gases").
- ◇ NEVER use corrosive gases (chlorine, fluorine, or other system gases) in the STP-200/300/400 pump or other models without anti-corrosion treatment.
- ◇ Cool the STP pump to prevent the STP pump from overheating when pumping gases (See Section 7.2, "Cooling the STP Pump").

7.3.1 How to Introduce a Purge Gas (for Chemical Specific Pump Type C)

When pumping reactive or corrosive gases, introduce a purge gas to protect the inside of the STP pump.

- 1) Connect a needle valve or a similar part to the purge port and introduce a dry N₂ gas or other gas to perform a gas purge (See Section 3.3.6, "Connecting the Purge Port").
- 2) The proper amount of the gas purge is approx. 1.7×10^{-2} Pa · m³/sec (10SCCM). The allowable gas pressure ranges from zero (atmospheric pressure) to 0.5 kgf/cm² (gauge pressure).



- ◇ When not using the purge port, always mount the blank flange (attached at delivery).
- ◇ High-pressure at the inlet port may result in a noise. This is no abnormality/error.

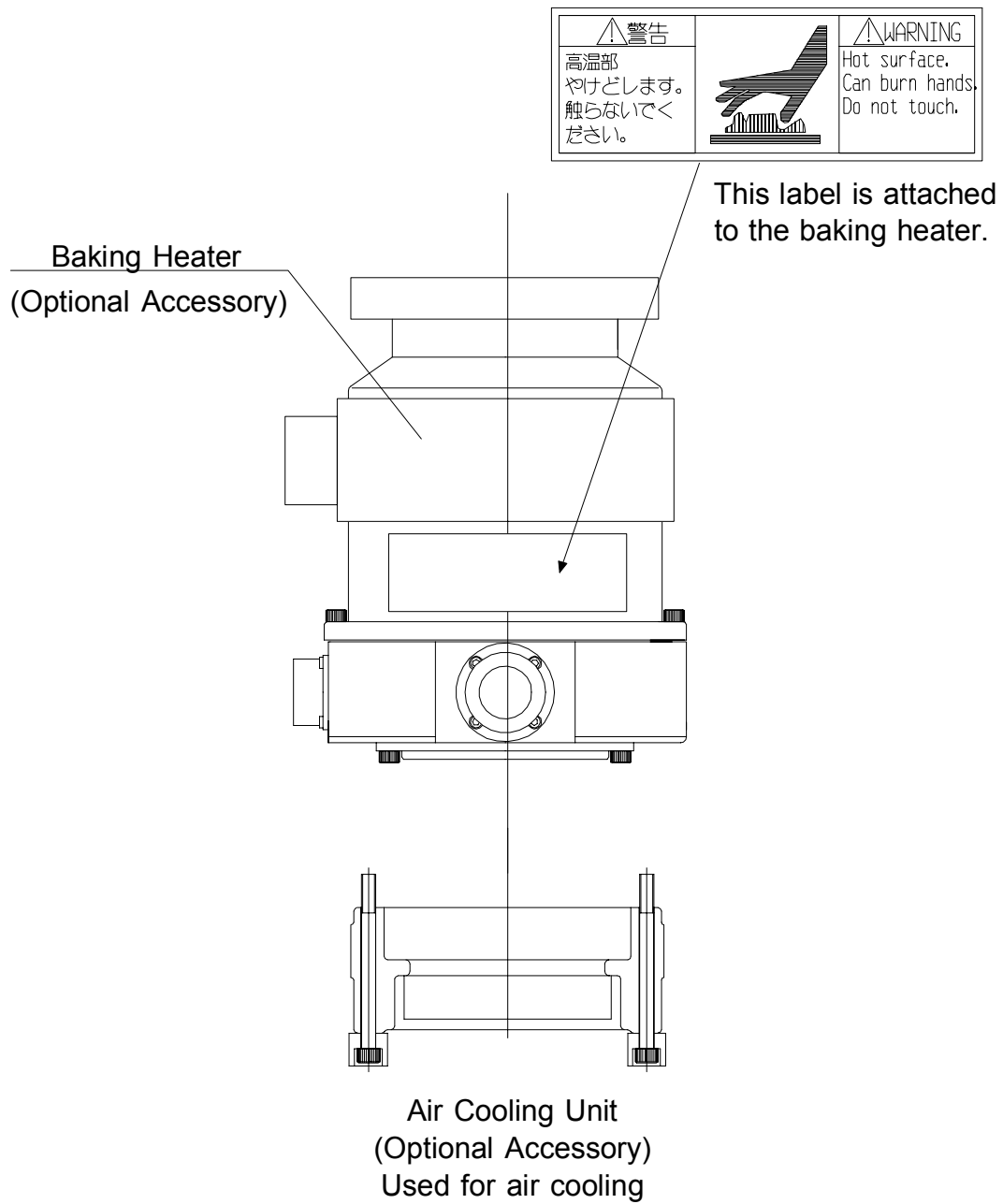


Figure 7.1 Attaching Positions of the Cooling Unit and Baking Heater

8 Remote Input/Output Signal Connector

The remote input/output signal connector (REMOTE CONNECTOR CON40) is used to input and output remote signals.

This connector is of GP-IB type*1 (24-pin, receptacle).

Four abbreviations are used in Tables 8.1 and 8.2:

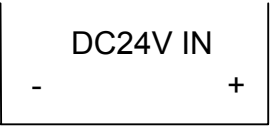
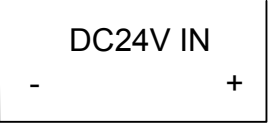
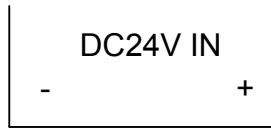
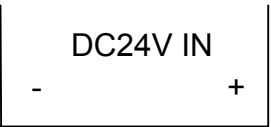
N.O :Normal Open N.C :Normal Close
 IN :Input Pin OUT :Output Pin

8.1 Remote Input Signals

Remote input signals function during REMOTE operation only.

Use input signals according to Table 8.1 and Figure 8.1.

Table 8.1 Remote Input Signals

Pin	Description
(13) POWER ON (1) 	Pins for inputting the POWER ON signal. Input 24 V DC between these pins for 0.3 seconds or more, and the magnetic bearing functions and the rotor levitates ((1): "+"; (13): "-").
(14) POWER OFF (2) 	Pins for inputting the POWER OFF signal. The POWER OFF signal has priority over the POWER ON signal. Input 24 V DC between these pins for 0.3 seconds or more, and the magnetic bearing stops and the rotor lands ((2): "+"; (14): "-").
(15) MOTOR START(3) 	Pins for inputting the START signal. Input 24 V DC between these pins for 0.3 seconds or more, and the STP pump starts to accelerate ((3): "+"; (15): "-").
(16) MOTOR STOP(4) 	Pins for inputting the STOP signal. The STOP signal has priority over the START signal. Input 24 V DC between these pins for 0.3 seconds or more, and the STP pump stops ((4): "+"; (16): "-").

*1 : General Purpose-Interface Bus (Conforms to IEEE-STD-488-1978)

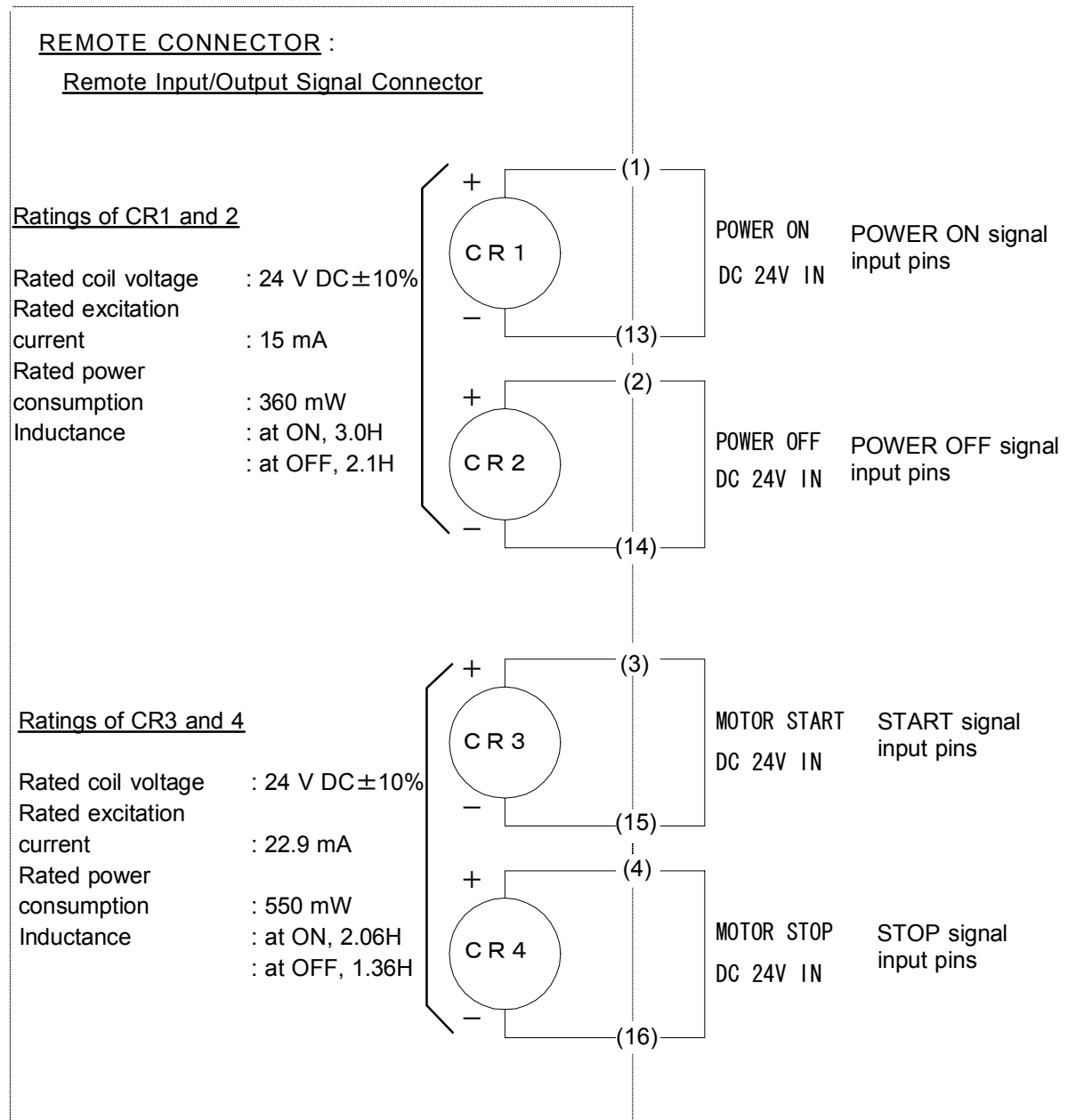
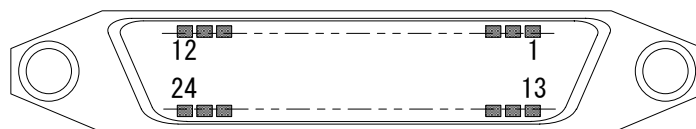


Figure 8.1 Remote Input Signal Pins



REMOTE CONNECTOR CON40 Pin Arrangement

8.2 Remote Output Signals

Remote output signals function during MANUAL or REMOTE operation. Use output signals according to Table 8.2 and Figure 8.2.

Table 8.2 Remote Output Signals

Pin	Description
(17) REMOTE (5) N.O OUT	Pins for outputting the STP pump REMOTE SELECTION state signal. These pins are closed when the MANUAL/REMOTE changeover switch on the rear panel is set to "REMOTE."
(18) POWER (6) N.O OUT	Pins for outputting the POWER ON state signal. These pins are closed when the magnetic bearing functions and the rotor levitates.
(19) EMERGENCY OPERATION (7) N.O OUT	Pins for outputting the EMERGENCY OPERATION state signal. These pins are closed when the "EMERGENCY OPERATION" lamp on the front panel is lit.
(20) FAILURE (8) N.O OUT	Pins for outputting the FAILURE state signal. These pins are closed when the "FAILURE" lamp on the front panel is lit.
(21) OVER TEMPERATURE (9) N.O OUT	Pins for outputting the OVER TEMPERATURE state signal. These pins are closed when the "OVER TEMPERATURE" lamp on the front panel is lit.
(22) BATTERY OPERATION (10) N.O OUT	Pins for outputting the BATTERY OPERATION state signal. These pins are closed when the "BATTERY OPERATION" lamp on the front panel is lit.
(23) ACCELERATION (11) N.O OUT	Pins for outputting the ACCELERATION state signal. These pins are closed when the STP pump is in accelerating.
(24) NORMAL OPERATION (11) N.O OUT	Pins for outputting the NORMAL OPERATION state signal. These pins are closed when the STP pump is in rated operation.

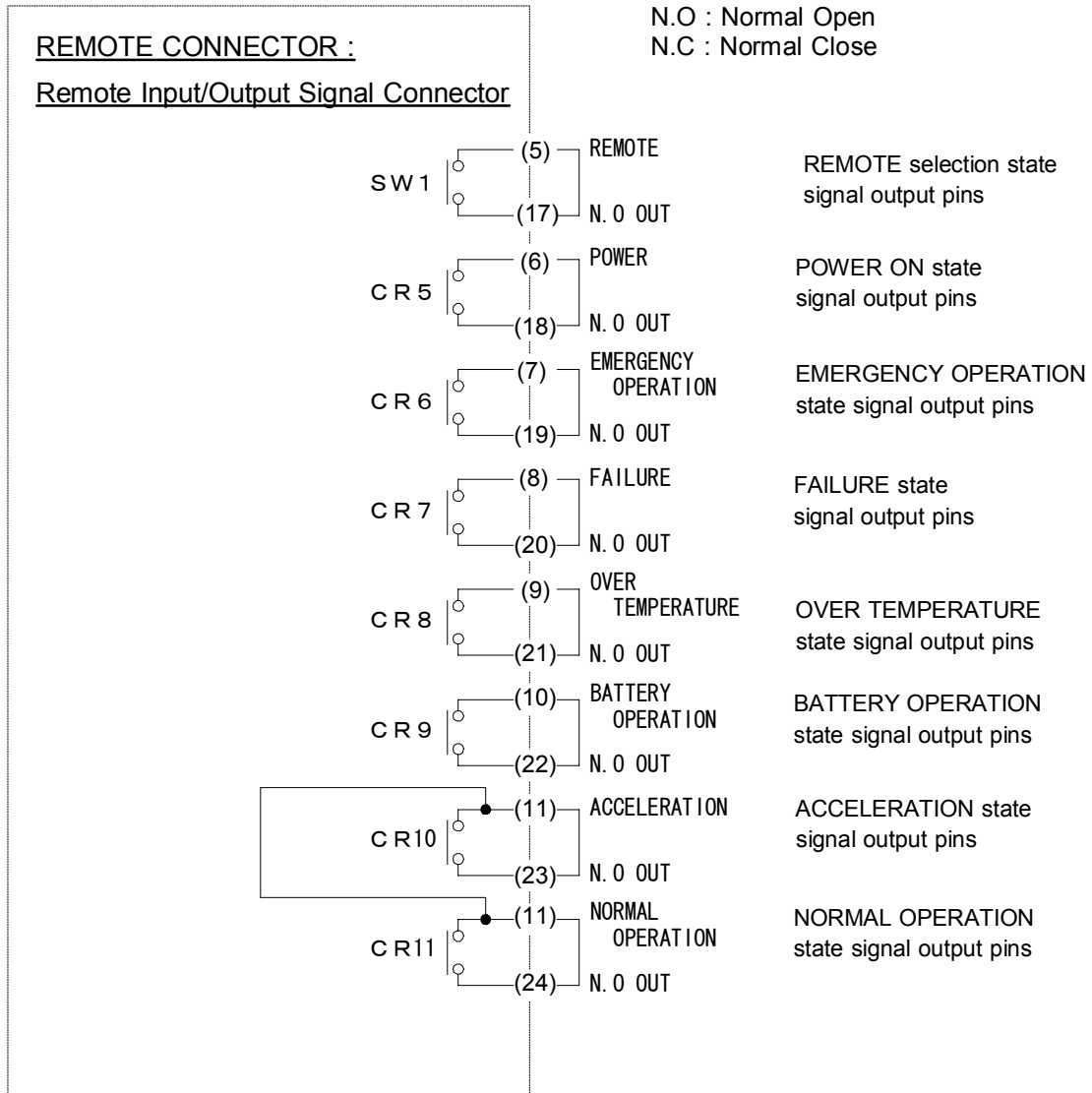


Figure 8.2 Remote Output Signal Pins

Table 8.3 shows the rated contacts for switch SW1 (See Figure 8.2).

Table 8.3 Rated Contacts for Switch SW1

	Resistance Load (cos ϕ =1)
Rated Current	250 V AC 3 A 125 V AC 6 A 30 V DC 4 A
Recommended Minimum Voltage and Current	2 V, 0.1 A AC/DC
Minimum Cut-Off Voltage and Current	1 V, 10 mA AC/DC

Table 8.4 shows rated contacts for relays CR5 to 11 (See Figure 8.2).

Table 8.4 Rated Contacts for Relays CR5 to 11

	Resistance Load (cos ϕ =1)	Induction Load (cos ϕ =0.4) (L/R=7 ms)
Rated Load	110 V AC 0.3 A 24 V DC 1 A	110 V AC 0.2 A 24 V DC 0.3 A
Rated Current	2A	
Maximum Contact Point Voltage	125 V AC 125 V DC	
Maximum Contact Point Current	2 A	
Maximum Open/Close Capacity	AC: 60 VA DC: 30 W	AC: 22 VA DC: 10 W
Minimum Applicable Load	100 mV DC 10 μ A	

8.3 Remote Cables (Optional Accessories)

Remote cables are provided as optional accessories. Remote cables are available in two types: single-side connector type and both-side connector type. For details, contact Service office.

Table 8.5 shows connections of remote cables of single-side connector type.

Table 8.5 Remote Cable Connections (Single-Side Connector Type)

Connector Pin No.	Cable Color	Connector Pin No.	Cable Color
1	Brown	13	White/Orange
2	Red	14	White/Yellow
3	Orange	15	White/Green
4	Yellow	16	White/Blue
5	Blue	17	Green
6	Purple	18	White/Black/Brown
7	Gray	19	White/Black/Red
8	White	20	White/Black/Orange
9	White/Black	21	White/Black/Yellow
10	White/Brown	22	White/Black/Green
11	White/Red	23	White/Black/Blue
12, hood	Shielded	24	White/Purple, White/Gray

9 Internal Battery

Two batteries (PORTALAC Series Small-Sized Sealed Lead-Acid Batteries, PE12V 7F1 : 12 V, 7 Ah, manufactured by Japan Storage Battery Co., Ltd.) (hereinafter referred to as the internal battery) are inserted into the STP pump for backup during a power failure. These are rechargeable. During a power failure, power is supplied from the batteries, and levitation by a magnetic bearing continues for 15 minutes while the pump is decelerating and the rotor is landing.

Fully-charged batteries are capable of consecutively backing up the operation of the STP pump twice.

9.1 Life of the Internal Battery

The life of the internal battery is affected by ambient temperatures.

Pay attention to ambient temperatures (The operating ambient temperatures range from 0 to 40 °C).

Figure 9.1 shows the relationship between the ambient temperatures and the battery life.



- ◇ **Replace the battery approx. once a year to make sure it is always ready to back up the operation of the STP pump. For instructions on how to replace the battery, see Section 9.4, "How to Replace the Internal Battery."**

9.2 Allowable Shelf Life of the Internal Battery

When the internal battery is left uncharged, its capacity will be reduced by self-discharge. The allowable shelf life of the internal battery is affected by ambient temperatures. Pay attention to its storage temperatures (The storage temperatures range from - 20 to + 40 °C).

Figure 9.2 shows the relationship between storage temperatures and the allowable shelf life of the internal battery.



- ◇ **When the STP pump is left unused over the specified period, charge the internal battery for 3 hours or more, or replace it with a new one before starting the STP pump. For instructions on how to recharge the internal battery, see Section 9.3, "How to Charge the Internal Battery." For instructions on how to replace the internal battery, See Section 9.4, "How to Replace the Internal Battery."**

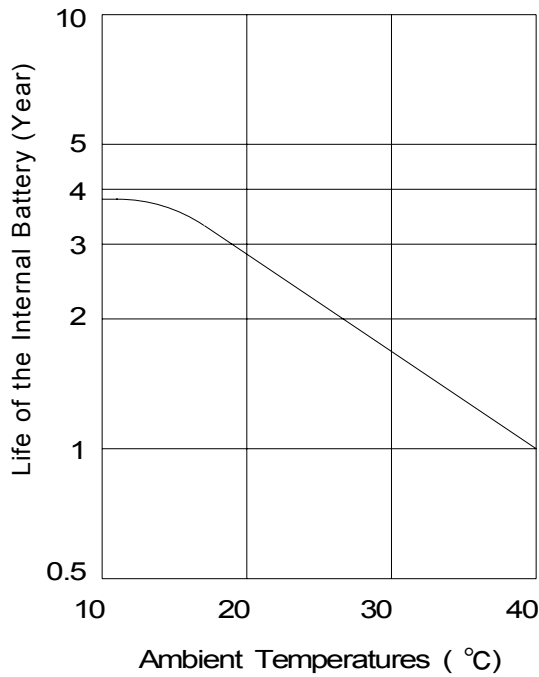


Figure 9.1 Life of the Internal Battery

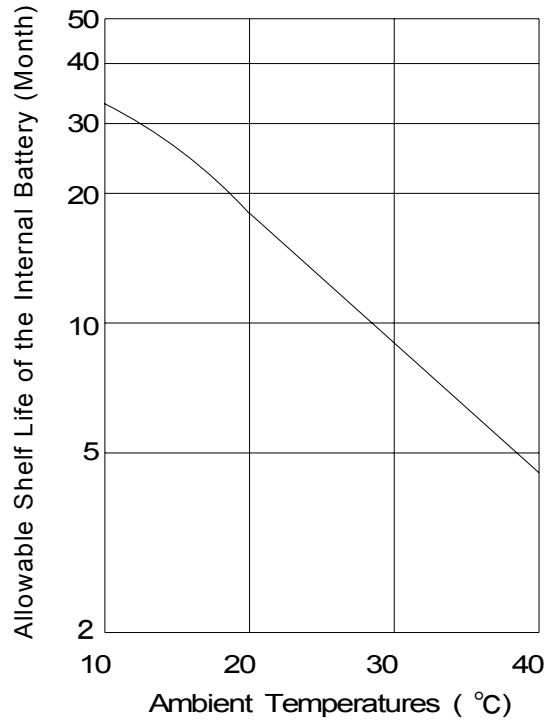


Figure 9.2 Allowable Shelf Life of the Internal Battery

9.3 How to Charge the Internal Battery

The battery is charged while the power is "ON," regardless of the operation state of the STP pump.

After a power failure, charge the battery for approx. 12 times the BATTERY BACKUP time. For example, when the BATTERY BACKUP time is 15 minutes, it takes approx. 3 hours to charge the battery.

If a power failure occurs 2 times within 3 hours, charge the battery for more than 3 hours before starting to operate the STP pump.

9.4 How to Replace the Internal Battery



- ◇ Turn OFF the primary power (Switch the breaker "OFF"), before replacing the battery.
Failure to do so may result in product damage or a problem due to electric shock or short-circuiting of the internal circuit.
- ◇ The battery terminal is exposed. DO NOT touch the terminal with a metallic part (such as a screwdriver). Failure to do so may result in a problem due to electric shock or short-circuiting of the battery.
- ◇ DO NOT touch any portions other than those designated.
Careless touch may cause electric shock and/or a short-circuiting of the internal circuit, resulting in product damage or a problem.
- ◇ DO NOT use a new battery and a worn-out battery simultaneously.
- ◇ DO NOT use different types of batteries simultaneously.



- ◇ When replacing the battery, record the next replacement date of the battery on the "Battery Instruction Label" (See Figure 9.3) on the front panel.
- ◇ The first replacement date of the battery has been specified on the "Battery Instruction Label" (See Figure 9.3) on the front panel at delivery.

9.4.1 How to Replace the Battery Case

- 1) Stop the STP pump, and turn OFF the primary power (Switch the breaker "OFF").
- 2) Unscrew the 4 screws attached to front panel (1) and bring the front panel down towards you.
- 3) Disconnect internal battery connector (2) (CON85).
- 4) Unscrew battery case screws (3) and pull out battery case (4) from the STP control unit.
- 5) Replace battery case (4) containing a new battery.
- 6) Tighten battery case screw (3) and secure the battery case (4).
- 7) Connect internal battery connector (2) (CON85).
- 8) Close front panel (1) and tighten the 4 screws that secure the front panel.
- 9) Record the next replacement date (after one year) of the battery on "Battery Instruction Label" (8) attached to the front panel (See Figure 9.3).

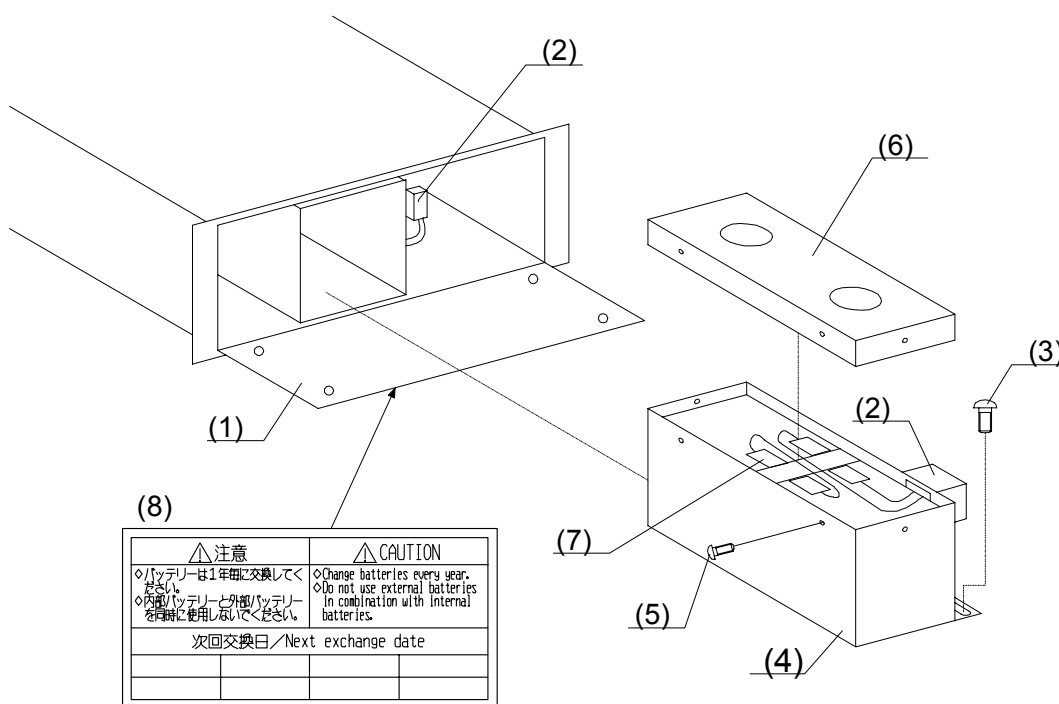
9.4.2 How to Replace the Battery in the Battery Case

- 1) Unscrew 4 top panel screws (5) from battery case (4), and remove top panel (6).
- 2) Disconnect lug terminal (7), and pull out the battery from the battery case.
- 3) Replace the two worn-out batteries with new ones in the battery case, and connect lug terminal (7) correctly (red: "+" side; black: "-" side).
- 4) Attach top panel (6) to the battery case using 4 top panel screws (5), using care not to catch the cable between the top panel and the battery case.



- ◇ **New batteries and battery cases are supplied by Service office.**

(1)	STP Control Unit Front Panel
(2)	Internal Battery Connector
(3)	Battery Case Screw
(4)	Battery Case
(5)	Top Panel Screw
(6)	Top Panel of Battery Case
(7)	Lug Terminal
(8)	Battery Instruction Label



Affix this label to the front panel.

Figure 9.1 How to Replace the Internal Battery

9.5 How to Dispose of the Internal Battery

Dispose of or collect worn-out batteries in accordance with the guidelines given by each national and/or local government. If you procure batteries, dispose of them in accordance with the guidelines given by the battery manufacturer.



- ◇ Pay attention to short-circuiting or leakage of the batteries when disposing of them.
- ◇ To prevent the batteries from short-circuiting, remove the lead wires and connectors from the batteries.
- ◇ Coat the conductive part of the batteries with tape.



- ◇ It is recommended to dispose of worn-out batteries after discharging them thoroughly.
- ◇ Batteries manufactured by Japan Storage Battery Co., Ltd. will be collected by Japan Storage Battery Co., Ltd. For detailed information, contact Japan Storage Battery Co., Ltd. or Service office.

10 External Battery



- ◇ **DO NOT use (an) external batteries when internal batteries are inserted. Failure to do so may result in product damage or a problem.**
It could cause a problem, such as product damage.
- ◇ **DO NOT connect batteries in parallel.**
- ◇ **Replace batteries with new ones before the end of their life.**
- ◇ **When the STP pump is left unused over the specified period, charge battery for 3 hours or more, or replace it with a new one before starting the STP pump.**



- ◇ **The life, allowable shelf life, and operation frequency of the battery differ depending upon the type of the battery and ambient temperatures. See technical data and information prepared by the battery manufacturer.**

10.1 Specifications for the External Battery

When you use external batteries, select one in accordance with the specifications given in Table 10.1.



- ◇ **If you use external batteries which do not conform to the specifications, battery backup will not function during a power failure which could result in damage to the STP pump.**

Table 10.1 Specifications for the External Battery

Item	Specifications
Capacity (Ah)	4.5 or more
Voltage (V)	24
Current (A)	3
Operation time (minutes)	Approx. 15
Operation frequency (times)	Continues 2 or more
Charging voltage (V)	27.3

It is recommended to use PORTALAC Series Small-Size Sealed Lead-Acid Battery manufactured by Japan Storage Battery Co., Ltd. as an external battery.

10.2 Installation of the External Battery



- ◇ Turn OFF the primary power (Switch the breaker "OFF"), before connecting the battery.
Failure to do so may result in product damage or a problem due to electric shock or short-circuiting of the internal circuit.
- ◇ After disconnecting the internal battery connector (CON85), connect the external battery connector (CON90).
Having both connected simultaneously may result in damage to the STP control unit.
- ◇ DO NOT use new batteries and worn-out batteries simultaneously.
- ◇ DO NOT use different types of batteries simultaneously.
- ◇ If the battery is not securely connected, backup during a power failure does not function.

Install the external battery in accordance with the following steps:

- 1) Stop the STP pump, and turn OFF the primary power (Switch the breaker "OFF").
- 2) Unscrew the 4 screws attached to the front panel and bring it down towards you.
- 3) Pull out the battery according to the method described in Section 9.4.1, "How to Replace the Battery Case," Steps 3) and 4).
Secure the internal battery connector (CON85) so as not to interfere with other parts inside the STP control unit.
- 4) Close the front panel of the STP control unit and tighten the 4 screws that secure the front panel.
- 5) Connect the external battery to the attached external battery plug, paying attention so that "+" and "-" are positioned correctly. "+" and "-" of the external battery plug are represented by (1) and (2), respectively.

CON 90 PIN No.	Polarity of Battery
1	+
2	-

- 6) Connect the external battery plug to the external battery connector (EXT. BATTERY CON90) on the rear panel.
- 7) Record the next replacement date of the battery in the "Battery Instruction Label" (See Figure 9.3) on the front panel for the Next Replacement Date of Battery (See the technical data prepared by the battery manufacturer).

10.3 How to Charge the External Battery

The STP control unit is equipped with a constant voltage (27.3 V) circuit and a constant current (0.3 A) circuit for charging the battery.

The battery is charged while the power is "ON," regardless of the operation state of the STP pump.

After a power failure, charge the battery for approx. 12 times the BATTERY BACKUP time. For example, if the BATTERY BACKUP time is 15 minutes, it takes approx. 3 hours to charge the battery.

If a power failure occurs 2 times within 3 hours, charge the battery for more than 3 hours before starting the STP pump.

10.4 How to Dispose of the External Battery

Dispose of or collect worn-out batteries in accordance with the guidelines given by each national and/or local government. If you procure the batteries, dispose of them according to the guidelines given by the battery manufacturer.



- ◇ Pay attention to short-circuiting or leakage of the batteries when disposing of them.
- ◇ To prevent the batteries from short-circuiting, remove the lead wires and connectors from the batteries.
Cut the lead wires one by one so as not to cause a short-circuiting.
- ◇ Coat the conductive part of the batteries with tape.



- ◇ It is recommended to dispose of worn-out batteries after discharging them thoroughly.
- ◇ Batteries manufactured by Japan Storage Battery Co., Ltd. will be collected by Japan Storage Battery Co., Ltd. For detailed information, contact Japan Storage Battery Co., Ltd. Or Service office.

11 Operation Principle of the STP Pump

(See Figure 11.1.)

The STP-200/300/400 is a series of magnetically-levitated turbomolecular pumps, featuring the following:

- Oil free
- Low vibration
- High reliability

The STP pump is configured so that rotor blade (1) and stator blade (2) are aligned alternately in the axial direction. Gas molecules are pumped from the inlet port to the outlet port by the high speed rotation of the rotor.

Rotor blade (1) is supported by the magnetic bearing without mechanical contact. Therefore the STP pump requires no lubrication oil unlike conventional turbomolecular pumps using ball bearings.

The magnetic bearing consists of 3 pairs of active magnetic bearings. The rotor is supported in the radial direction by 2 pairs of radial direction active magnetic bearings that consist of radial sensor (3) and radial electromagnet (4). A pair of axial direction active magnetic bearings consists of axial sensor (5) and axial electromagnet (6) to support the rotor in the axial direction. Because the rotor is supported without mechanical contact, it can rotate at low vibration.

There is less heat generated from magnetic bearings because there is no friction. Therefore the STP pump requires no cooling. However, the STP pump requires air cooling during baking and gas suction. Taking into consideration a breakage of magnetic bearings, touch down bearings (7) and (8) coated with solid lubrication have been installed. They do not contact with the rotor during the rated operation.

A radial sensor, an axial sensor, a rotation sensor and a temperature sensor always monitor the magnetic bearing as well as the rotor. If an abnormality/error occurs, the rotor will stop.

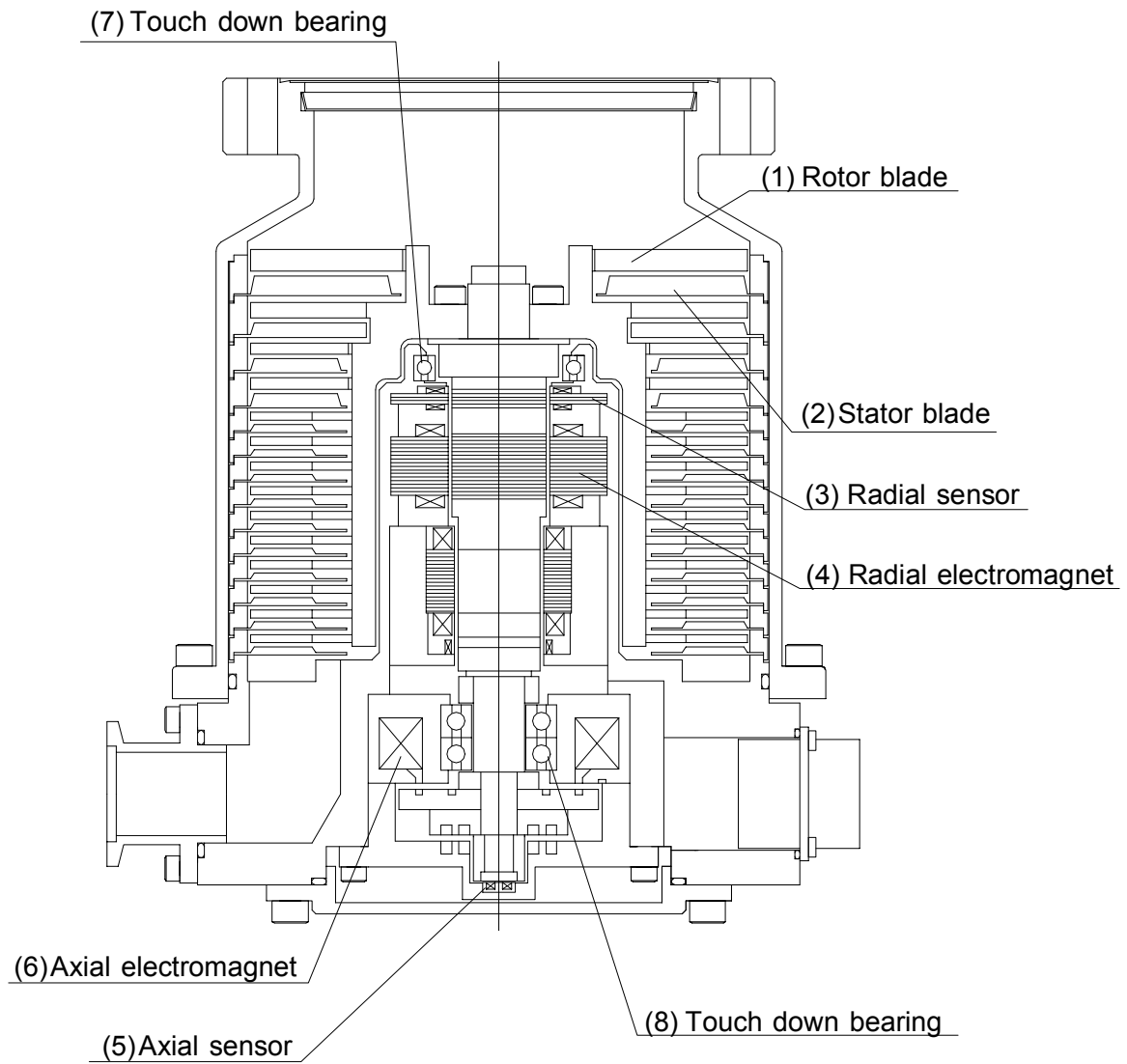


Figure 11.1 Cross Sectional View of the STP Pump

12 Maintenance and Inspection



- ◇ Stop the STP pump, and turn OFF the primary power (Switch the breaker "OFF"), before performing maintenance of the STP control unit (battery replacement/fuse replacement).
Failure to do so may result in an accident such as electric shock.
- ◇ Stop the STP pump, and turn OFF the primary power (Switch the breaker "OFF"), before performing inspections of the STP pump (for deposit).
Failure to do so may result in the inadvertent rotation of the STP pump, which may result in an accident.
- ◇ Power OFF the baking heater and the air cooling unit, before performing maintenance or inspections.
- ◇ DO NOT touch any of the blocks, parts, or connectors inside the STP control unit (excluding the battery connector). These parts are excluded from maintenance or inspection.

12.1 Replacing the Internal Battery

The STP pump is equipped with rechargeable batteries for backup during a power failure inside the STP control unit. In order to ensure that the battery functions normally during a power failure, replace the batteries before the end of their life (approx. one year).

See Section 9.4, "How to Replace the Internal Battery."

The "Battery Instruction Label" is affixed to the front panel. After replacing the battery, always record the next replacement date.

12.2 Inspecting the Air Cooling Fan

In MANUAL OPERATION mode, turn ON the primary power (Switch the breaker "ON"), and press the "POWER ON/OFF" switch on the front panel to switch it "ON." Confirm that the air cooling fan in the rear panel of the STP control unit (See Figure 4.2) is operating.

If the air cooling fan is not operating, contact Service office to replace it.

It is recommended to inspect the air cooling fan when replacing the battery.

12.3 Replacing the Fuses



- ◇ Remove the probable causes of the blown fuse before replacing the fuse.
- ◇ Always use specified and rated fuses.



- ◇ If fuses are blown frequently even after they are replaced, contact Service office.

The following are protective fuses used in the STP control unit (See Section 4.1.3, "Inside of the Control Unit").

- F2 : 125 V, 8 A (for control power protection)
- F3 : 250 V, 3 A (for inverter and air cooling fan protection)
- F4 : 250 V, 5 A (for control power protection)
- F5 : 125 V, 10 A (for internal and external batteries protection)



- ◇ Two of each four different kinds of fuses are attached for replacement (See Table 16.4).
- ◇ For recommended fuses, see Table 16.6, "Recommended Spare Parts."

12.4 Inspecting for Deposit



- ◇ **When inspecting for deposit, exhaust gases inside the STP pump thoroughly.**
Residual gases may cause an accident when removing the STP pump.
Confirm the characteristics of gas to be used, referring to the Material Safety Data Sheet (MSDS) you obtain from the gas supplier.
Wear personal protective equipment if necessary.

Leaving the STP pump without removing the deposit may cause the STP pump to be corroded beyond repair.

Deposit may have accumulated inside the STP pump depending upon the type of the vacuum equipment installed in the STP pump. An increase in the amount of deposit may lead to a malfunction of the STP pump.

Therefore, perform regular maintenance (once every three to six months).

Inspect the inside of the outlet port flange for adhesion of deposit while watching the outlet port flange. If deposit has accumulated to some extent, an overhaul (cleaning) is required.

Contact Service office.

Note that the costs of troubleshooting problems resulting from deposit will be at your own charge even during the warranty period.

If a problem resulting from deposit occurs inside the STP pump, hermetically seal inlet port, outlet port, purge port, and leak port flanges, and immediately return them to Service office.

For the transport method, see Section 12.6, "Transport for Repair or Overhaul."



- ◇ **Contact with atmospheric air may cause a reaction of the deposit.**
DO NOT open the STP pump to atmospheric air as much as possible.

12.5 Overhaul

The recommended maintenance intervals for different process applications are tabulated below:

	Process	Period	Remarks
Etching*1	Metal Etch	1 year	Ensure that TMS (Temperature Management System) is fitted and operational to prevent accumulation of by-product deposition in the pump.
	Other Etch Processes	2 years	
	It is recommended to change the pump rotor after 5 years due to accumulated wear of the protective plating material		
	Other semiconductor process	2 years	Processes resulting in accumulation of deposits in the pump will require more frequent service.
	Clean applications (Only vacuum pumping)	5 years	
	Other use	(2 years)	Dependent on application, contact BOC Edwards or our local Service office.



- ◇ **The touch down bearing inside the STP pump will be worn out after a number of full speed touch downs. When the STP control unit displays "w," it is essential to have the touch down bearings replaced.**

The costs of replacing parts that need to be replaced because of deterioration or abrasion will be at your own charge.

When overhaul of the STP pump or the STP control unit is needed, contact BOC Edwards or our local Service office.

*1 "Etching" includes semiconductor etching and LCD etching.

12.6 Transporting for Repair or Overhaul



- ◇ **When removing the STP pump from the vacuum equipment, exhaust gases inside the STP pump thoroughly. Residual gases may result in an accident when removing the STP pump. Confirm the characteristics of gas to be used, referring to the Material Safety Data Sheet (MSDS) you obtain from the gas supplier.**
- ◇ **When returning the STP pump which has used corrosive, reactive or inflammable gases to Service office, specify the type of gas and handling precautions on the surface of the package. Confirm the characteristics of gas to be used, referring to the Material Safety Data Sheet (MSDS) you obtain from the gas supplier.**



- ◇ **When returning the STP pump to Service office, be sure to pack it well to prevent external damage. If any of the specifications has not been satisfied, BOC Edwards will not be responsible for any damage during transport.**

i) Always contact Service office before returning the STP pump for repairs, overhaul, and other purpose. To avoid any accident by gases or corrosion inside the STP pump, particularly when corrosive, reactive or flammable gases have been used, ii) vacuum and hermetically seal the STP pump before transport. iii) Specify the type of gases used and handling precautions in the "Malfunction Information" and return the STP pump to Service office.

When returning the STP pump to Service office, be sure to pack it well to prevent external damage. Use similar or superior packaging material as originally supplied.

"Return Procedure" and the "Malfunction Information" are in the end of the Instruction Manual. When additional sheet is needed, contact Service office.



- ◇ **The costs of cleaning and overhaul of the STP pump will be at your own charge.**
- ◇ **When returning the STP pump to Service office, fill in the necessary items in the "Malfunction Information" and fax it to Service office.**

13 Storage

13.1 The STP Pump

When the STP pump is left unused over the specified period (more than a few months), follow the precautions below:

- 1) Close the inlet port of the STP pump and vacuum it using a backing pump.
- 2) Introduce dry N₂ gas or dry air from the outlet port or the purge port.
- 3) Close the outlet port and purge port.
- 4) If the STP pump is water cooled, introduce compressed air from one side of the cooling water port so that no water remains in the STP pump.
- 5) Store the STP pump in a vertical position.
- 6) DO NOT store the STP pump in the following places:
 - Place of high humidity.
(If it must be stored in a place of high humidity, insulate it from the outside and use a dehumidifying agent.)
 - Place of high temperatures (more than + 55 °C) and low temperatures (less than - 25 °C).
 - Place where there are corrosive gases.
 - Place subjected to dripping water.
 - Place with a lot of dust.
 - Place with insufficient ventilation.
 - Place subjected to strong magnetic or electric fields.
 - Place subjected to radiation.

13.2 The STP Control Unit

If the STP control unit (including cables) is not used for a long period (more than a few months), follow the precautions below:

- 1) Remove the internal battery from the STP control unit (See Section 9, "Internal Battery").



- ◇ **Always remove the battery when the STP control unit is not used for a long period.**

- 2) Store the STP control unit in a horizontal position.
- 3) DO NOT store the STP control unit in the following places:
 - Place of high humidity.
(If it must be stored in a place of high humidity, insulate it from the outside and use a dehumidifying agent.)
 - Place of high temperature (more than + 55 °C) and low temperature (less than - 25 °C) (excluding the battery)



- ◇ **Storage temperatures of the battery range from - 20 to + 40 °C.**
 - Place subjected to direct sunlight.
 - Place where there are corrosive gases.
 - Place subjected to dripping water.
 - Place with a lot of dust.
 - Place of insufficient ventilation.
 - Place subjected to strong magnetic or electric field.
 - Place subjected to radiation.
 - Place subjected to mist.
 - Place with electric noise.
 - Place with vibration.

13.3 Restarting Precautions

- 1) Stored for more than four months:
Charge internal batteries for three hours or more under the "POWER ON" state before starting to operate the STP pump.
- 2) Stored for more than one year or when the date of replacement has passed:
Replace with new batteries.

14 Disposal

14.1 The STP Pump

Dispose of the STP pump as **industrial waste** according to the guidelines given by each national and/or local government.



- ◇ When disposing of the STP pump, exhaust gases inside the STP pump thoroughly.
Residual gases may result in an accident when disposing of the STP pump.
If the STP pump has been used with reactive or corrosive gasses, always clean thoroughly before disposing of it to avoid any injury.
Confirm the characteristics of gas to be used, referring to the Material Safety Data Sheet (MSDS) you obtain from the gas supplier.



- ◇ BOC Edwards is not responsible for problems during or after disposal.

14.2 The STP Control Unit

Dispose of the STP control unit as **industrial waste** according to the guidelines given by each national and/or local government.



- ◇ Remove the battery from the STP control unit.
Failure to do so may result in an accident or fire.
Always remove the battery from the STP control unit and strictly follow the guidelines for battery disposal in accordance with Section 14.3, "How to Dispose of The Battery."



- ◇ BOC Edwards is not responsible for problems during or after disposal.

14.3 The Battery

Dispose of or collect worn-out batteries in accordance with the guidelines given by each national and/or local government.

If you procure batteries, dispose of them in accordance with the guidelines given by the battery manufacturer.



- ◇ **Pay attention to short-circuiting or leakage of the battery at their disposal.**
- ◇ **To prevent the battery from short-circuiting, remove lead wires and connectors from the battery.
Cut lead wires one by one so as not to cause short-circuiting.**
- ◇ **Coat the conductive part of the battery with tape or a similar material.**



- ◇ **It is recommended to dispose of batteries after discharging them thoroughly.**
- ◇ **Batteries manufactured by Japan Storage Battery Co., Ltd. will be collected by Japan Storage Battery Co., Ltd.
For detailed information, contact Japan Battery Co., Ltd. or Service office.**

15 Troubleshooting

If an abnormality/error is found when using the STP pump, check it and take measures in accordance with the following procedures.

If you cannot trace it or if the STP pump does not function normally after troubleshooting, fill in the necessary information in the "Malfunction information" and fax it to Service office.



- ◇ **After making sure that the STP pump stops thoroughly, and always turn OFF the primary power (Switch the breaker "OFF"), check probable causes and remove them.**

15.1 Troubleshooting Immediately after an Abnormality/Error Occurs

- 1) In case the "FAILURE" lamp lights due to an overload of the inverter or the "EMERGENCY OPERATION" lamp lights due to excessive vibration:

Confirm that the STP pump stops thoroughly (that the ROTATION meter deflects to full-scale in the red), and perform the POWER OFF operation. The "FAILURE" or the "EMERGENCY OPERATION" lamp goes out. Then, restart the STP pump and check if it operates correctly.

- 2) Other Cases:

Confirm that the STP pump stops thoroughly (that the ROTATION meter deflects to full-scale in the red), and remove the probable causes of the abnormality/error. Then, restart the STP pump and check if it operates correctly.

15.2 Abnormalities When Powering ON

(When any "Abnormality/Error Warning" lamp lights, see Section 15.5, "When any Abnormality/Error Warning Lamp Lights.")

Table 15.1 Troubleshooting after Powering ON

No.	Symptom	Probable Cause	Countermeasures	Referred Section
1	The "POWER ON/OFF" switch built-in lamp (green LED) does not light, when powering ON.	Incorrect connection of the power cable.	Connect the power cable correctly.	4.4.2
		Blown fuses F2, F4.	Replace blown fuses.	4.1.3 12.3
		Abnormal power voltage	Set the voltage to the rated voltage $\pm 10\%$.	4.4.2 16.2
		Power failure.	Check whether or not a power failure has occurred.	6.1.1
		Remote signal input error (REMOTE operation only)	Check the remote signal for voltage, polarity, and pin number.	5.6.1 8.1

15.3 Abnormalities When Performing the STP Pump Start Operation

(When any "Abnormality/Error Warning" lamp lights, see Section 15.5, "When any Abnormality/Error Warning Lamp Lights.")

Table 15.2 Troubleshooting When Performing the STP Pump Start Operation

No.	Symptom	Probable Cause	Countermeasures	Referred Section
1	The "ACCELERATION" lamp does not light.	The "MANUAL/REMOTE" changeover switch is not in the correct position.	Slide the "MANUAL/REMOTE" changeover switch on the rear panel of the STP control unit to the correct position.	4.1.2 5.5 5.6
		Remote signal input error (during REMOTE operation only)	Check the remote signal for voltage, polarity, and pin number.	5.6.1 8.1

15.4 Abnormalities While the STP Pump Is Rotating

(When any "Abnormality/Error Warning" lamp lights, see [Section 15.5, "When any Abnormality/Error Warning Lamp Lights."](#))

Table 15.3 Troubleshooting While the STP Pump Is Rotating (1/2)

No.	Symptom	Probable Causes	Countermeasures	Referred Section
1	The "NORMAL OPERATION" lamp does not light approx. 30 minutes after performing start operation.	Insufficient pressure at the inlet port.	Use at 1.3×10^{-2} Pa (1×10^{-4} Torr) or less.	3.3.4 16.1
		Insufficient pressure at the outlet port.	Use at 13 Pa (0.1 Torr) or less.	3.3.4 16.1
		Leakage of the piping system.	Check piping.	3.3.4
		Failure in the backing pump.	Check capacity and starting state (Use a pump of 160 L/min or more for STP-200 or 240 L/min or more for STP-300/400.)	3.3 16.1
2	The STP pump stops.	Baking temperature overheat.	Set the temperature to 120°C or less.	7.1
		Insufficient cooling.	Always cool during baking or gas suction.	7.2
		Power failure.	Check if power has failed.	6.1.1
		Over vibration (vibration 100 μ m O-P or more).	After the STP pump stops thoroughly, power OFF and remove external vibration so as not to transmit it to the STP pump.	6.1.3
		Overheating inside the STP control unit	Remove heat source or shield for air route	12.2
		1) Ambient temperature	1) Keep ambient temperature 40°C or less.	4.2.1
		2) Insufficient cooling of the STP control unit.	2) Remove obstacles at the ventilation port. If the air cooling fan is broken, contact Service office.	4.2.2 12.2
		Improper pressure of the inlet port.	Use at 1.3×10^{-2} Pa (1×10^{-4} Torr) or less.	3.3.4 16.1
Improper pressure of the outlet port.	Use at 13 Pa (0.1 Torr) or less.	3.3.4 16.1		

Table 15.3 Troubleshooting While the STP Pump Is Rotating (2/2)

No.	Symptom	Probable Causes	Countermeasures	Referred Section
3	Rotor falls during operation.	Failure of the STP connection cable.	Inspection is needed. Contact Service office.	4.4.2
		Failure of the battery.	Inspection is needed. Contact Service office.	9 10
4	Ultimate pressure is insufficient.	Failure of the backing pump.	Check the capacity and starting state (Use a pump of 160 L/min or more for STP-200 or of 240 L/min or more for STP-300/400).	3.3 16.1
		Leakage of the piping system.	Check the piping system.	3.3.4
		Residual molecule.	If the main composition is H ₂ or H ₂ O, perform baking; if it is other than H ₂ or H ₂ O, clean the inside of the vacuum equipment (If gases remain inside the STP pump, contact Service office when it is needed to be cleaned).	7.1 12.4

15.5 When any Abnormality/Error Warning Lamp Lights

When any Abnormality/Error Warning lamp lights, check which lamp is being lit and see Table 15.4 for which procedure No. to follow.

Then, follow the steps of that procedure No. (shown in Table 15.5) to remove the problem (For the names and positions of the "Abnormality/Error Warning" lamps, see Figure 4.1).

Table 15.4 Cross Reference of Items of Abnormality Warning Lamps

OVER TEMPERATURE	BATTERY OPERATION	FAILURE	EMERGENCY OPERATION	PROCEDURE No.
○	—	○	○	No. 1
○	—	△	—	No. 2
—	○	—	○	No. 3
—	—	○	—	No. 4
—	—	—	○	No. 5

○: The lamp is being lit.

△: The lamp may light.

—: The lamp is not being lit.

Table 15.5 Troubleshooting When any of Abnormality/Error Warning Lamp Lights (1/2)

Procedure No.	Lamp Being Lit	Probable Causes	Countermeasures	Referred Section
No.1	"OVER TEMPERATURE" "FAILURE" "EMERGENCY OPERATION"	Incorrect connection of the STP connection cable.	Connect cables correctly. If the cable connector is not locked, lock it securely.	4.4.2
No.2	"OVER TEMPERATURE" "FAILURE"	Overheat inside the STP pump: 1) Overheat during baking. 2) Insufficient cooling. 3) Leakage of the vacuum piping system. 4) Repetitious start/stop operations.	 1) Set the temperature of the baking heater to 120 °C or less. 2) At the time of baking or gas suction, always cool the STP pump. 3) Check the piping system for leakage. 4) Repetitious start/stop operations may cause the STP pump to overheat.	 7.1 7.2 3.3.4 5.2
No.3	"BATTERY OPERATION" "EMERGENCY OPERATION"	Power failure.	Check a power failure.	6.1.1
No.4	"FAILURE"	When the rated operation does not start approx. 30 minutes after start operation is executed: When the ACCELERATION state continues for approx. 30 minutes: 1) Insufficient pressure at the inlet port. 2) Insufficient pressure at the outlet port. 3) Leakage of the piping system. 4) Failure of the backing pump.	 1) Use at 1.3×10^{-2} Pa (1×10^{-4} Torr) or less. 2) Use at 13 Pa (0.1 Torr) or less. 3) Check the piping system for leakage. 4) Check the capacity and start state (Use a pump of 160 L/min or more for STP-200 or of 240 L/min or more for STP-300/400).	 3.3.4 16.1 3.3.4 16.1 3.3.4 3.3 16.1

Table 15.5 Troubleshooting When any of Abnormality/Error Warning Lamp Lights (2/2)

Procedure No.	Lamp Being Lit	Probable Causes	Countermeasures	Referred Section
No.4	"FAILURE"	Overheating inside the STP control unit: 1) Ambient temperature. 2) Insufficient cooling of the STP control unit	1) Set the ambient temperature to 40 °C or less. 2) Remove obstacle from the ventilation port. If the air cooling fan is broken, contact Service office.	4.2.1 4.2.2 12.2
		Insufficient charging or deterioration of the battery.	Check that the battery is fully charged. If the battery is not charged, charge it. Check the battery for deterioration and the next replacement date. If the battery deteriorates or its replacement date has passed, replace it.	9 10
		Incorrect connection of the battery.	Check that external or internal batteries are correctly connected.	9 10
		Blown fuse F5 (for battery protection).	Replace the blown fuse (125 V, 10 A).	12.3
No.5	"EMERGENCY OPERATION"	Different model name or No. on the name plate.	Check that the model name, serial number and cable length of the STP pump, the STP control unit and the STP connection cable are the same.	Safety Precautions 4.4.2
		Excessive external vibration (vibration of 100 μm O-P or more).	After the STP pump stops thoroughly, power OFF and remove external vibration so as not to transmit it to the STP pump.	6.1.3

16 Specifications and Accessories

16.1 Specifications for the STP Pump

Table 16.1 Specifications for the STP Pump

Item		STP-200 series	STP-300 series	STP-400 series
Flange size*1	Inlet port flange	ICF152/VG100/ISO100		ICF203/VG150 /ISO160
	Outlet port flange	KF25		
Pumping speed	N ₂ L/s	270	340	420
	He L/s	220	330	410
	H ₂ L/s	200	310	385
Compression ratio	N ₂	1 × 10 ⁸	>10 ⁸	>10 ⁸
	He	1 × 10 ³	2 × 10 ⁵	2 × 10 ⁵
	H ₂	2 × 10 ²	1 × 10 ⁴	1 × 10 ⁴
Ultimate pressure (after baking) Pa (Torr)	Without anti-corrosion treatment	10 ⁻⁷ (10 ⁻⁹) order	10 ⁻⁸ (10 ⁻¹⁰) order :ICF flange	
	Chemical specific type		10 ⁻⁷ (10 ⁻⁹) order :VG/ISO flange	
Maximum working pressure	Pa (Torr)	1.3 × 10 ⁻² (1 × 10 ⁻⁴)		
Allowable backing pressure	Pa (Torr)	13 (0.1)		
Rated speed	rpm	48,000		
Starting time	min	10		
Stopping time	min	15		
Vibration	μ m O-P	<0.01 (at 48,000 rpm)		
Noise	dB	<50 (at 48,000 rpm)		
Baking temperature	°C	<120		
Lubricating oil		Not necessary		
Installation position		Free		
Cooling method		Natural air cooling (Air cooling: for baking/gas pumping)		
Standard backing pump	L/min	160	240	240
Weight	kg	12		
Dimensions	mm	Φ 180 × H248	Φ 180 × H248	Φ 180 × H218
Ambient temperature range	°C	0 to 40		
Storage temperature range	°C	- 25 to + 55		

The values shown in the table are typical. They are not guaranteed.

*1 : ICF (JVIS)
VG, KF (JIS)

16.2 Specifications for the STP Control Unit

Table 16.2 Specifications for the STP Control Unit (1/2)

Item		Specifications	
Input voltage	V AC	200±10%, 220±10%, 240±10%, 100±10%, 110±10%, 120±10% (Depends on voltage spec.)	
Input power	At start:	VA	500
	Under rated operation:	VA	150
Input frequency	Hz	50/60±2	
Input phase		Single phase	
Motor drive system		3-phase transistor-inverter	
Output voltage or less rated operation (3-phase)	V AC	45	
Output frequency or less rated operation	Hz	800	
Ambient temperature range	°C	0 to 40	
Storage temperature range	°C	- 25 to + 55 (excluding a battery)	
Battery storage temperature range	°C	- 20 to + 40	
Weight	kg	27	
Dimensions	mm	W482.6 × H132.6 × D473	
Battery used		12 V 7 Ah x 2 (Japan Storage Battery Co., Ltd./Small-Sized Sealed Lead-Acid Battery/PORTALAC series PE12V7F1)	
Operation switches		<p>[Front Panel]</p> <ul style="list-style-type: none"> ● POWER ON/OFF (Illuminated alternate push button switch, black/green) ● MOTOR START (Momentary push button switch, black) ● MOTOR STOP (Momentary push button switch, red) <p>[Rear Panel]</p> <ul style="list-style-type: none"> ● MANUAL/REMOTE Changeover (Toggle switch) 	
Panel indication lamps		<p>[Front Panel]</p> <ul style="list-style-type: none"> ● ACCELERATION (Green LED) ● NORMAL OPERATION (Green LED) ● EMERGENCY OPERATION (Red LED) ● FAILURE (Red LED) ● OVER TEMPERATURE (Red LED) ● BATTERY OPERATION (Red LED) <p>[Switch Built-In Lamp]</p> <ul style="list-style-type: none"> ● POWER ON (POWER ON/OFF, green) 	

Table 16.2 Specifications for the STP Control Unit (2/2)

Item	Specifications
Input/output terminal	<ul style="list-style-type: none"> ● AC POWER CON30 (3 pins) ● P.CONNECTOR CON20 (34 pins) ● REMOTE CONNECTOR CON4 (24 pins) ● EXT. BATTERY CON90 (2 pins)
Input/output cables	<ul style="list-style-type: none"> ● Power cable ● STP connection cable ● Ground cable
Safety functions	<ul style="list-style-type: none"> ● Magnetic bearing abnormality/error detection (Rotor vibration: 100 μ m O-P or more) ● STP pump overheat detection (Motor: 90 and 100 °C or more) ● Inverter overload detection (Inverter current: 7 A over, instantaneous, 1.2 A or more for 30 minutes) ● Battery abnormality/error detection (Battery terminal voltage: 21 V or less) ● Power failure detection (Detects power failure of approx. 50msec. or more) ● STP pump overspeed detection (52,500 rpm or more) ● STP control unit overheat detection (75 °C or more)

16.3 Accessories

Table 16.3 Accessories

Item		Q'ty	Remarks
STP control unit		1	
Power cable*1		1	With a single-side connector
STP connection cable*1		1	With both-side connectors
Ground cable*1		1	With both-side crimp-type terminal lugs
Inlet port cover		1	
Outlet port cover		1	
STP connector cover		1	
External battery connection plug		1	
Spare fuses	125 V, 8 A	2	F2
	250 V, 3 A	2	F3
	250 V, 5 A	2	F4
	125 V, 10 A	2	F5
Instruction Manual		1	

Table 16.4 Accessories for Chemical Specific Pump (Type C)

The accessories listed below are supplied to the chemical specific pump (type C) in addition to the accessories in Table 16.3.

Item		Q'ty	Remarks
Blank flange for purge port		1	KF*2 10
Clamping ring for purge port		2	KF*2 10
O-ring washer for purge port		2	KF*2 10

*1: The standard cable length is 3 m.

*2: JIS

16.4 Recommended Spare Parts

Table 16.5 Recommended Spare Parts

Item	Model and Manufacturer	Specifications
Fuse for F2	MGB-8A, 8 A, 125 V (Mfr.: HAMAI ELECTRIC LAMP CO., LTD.)	8 A, 125 V, Normal acting fuse Φ6.35×30 mm
Fuse for F3	MGB-3A, 3 A, 250 V (Mfr.: HAMAI ELECTRIC LAMP CO., LTD.)	3 A, 250 V, Normal acting fuse Φ6.35×30 mm
Fuse for F4	MGB-5A, 5 A, 250 V (Mfr.: HAMAI ELECTRIC LAMP CO., LTD.)	5 A, 250 V, Normal acting fuse Φ6.35×30 mm
Fuse for F5	MGB-10A, 10 A, 125 V (Mfr.: HAMAI ELECTRIC LAMP CO., LTD.)	10 A, 125 V, Normal acting fuse Φ6.35×30 mm
Internal batteries	PE12V7F1 (Mfr.: Japan Storage Batteries Co., Ltd.)	Nominal voltage: 12 V Rated capacity (20-hour rate):7 Ah



- ◇ **When you use parts other than those recommended in the above table, contact BOC Edwards.**

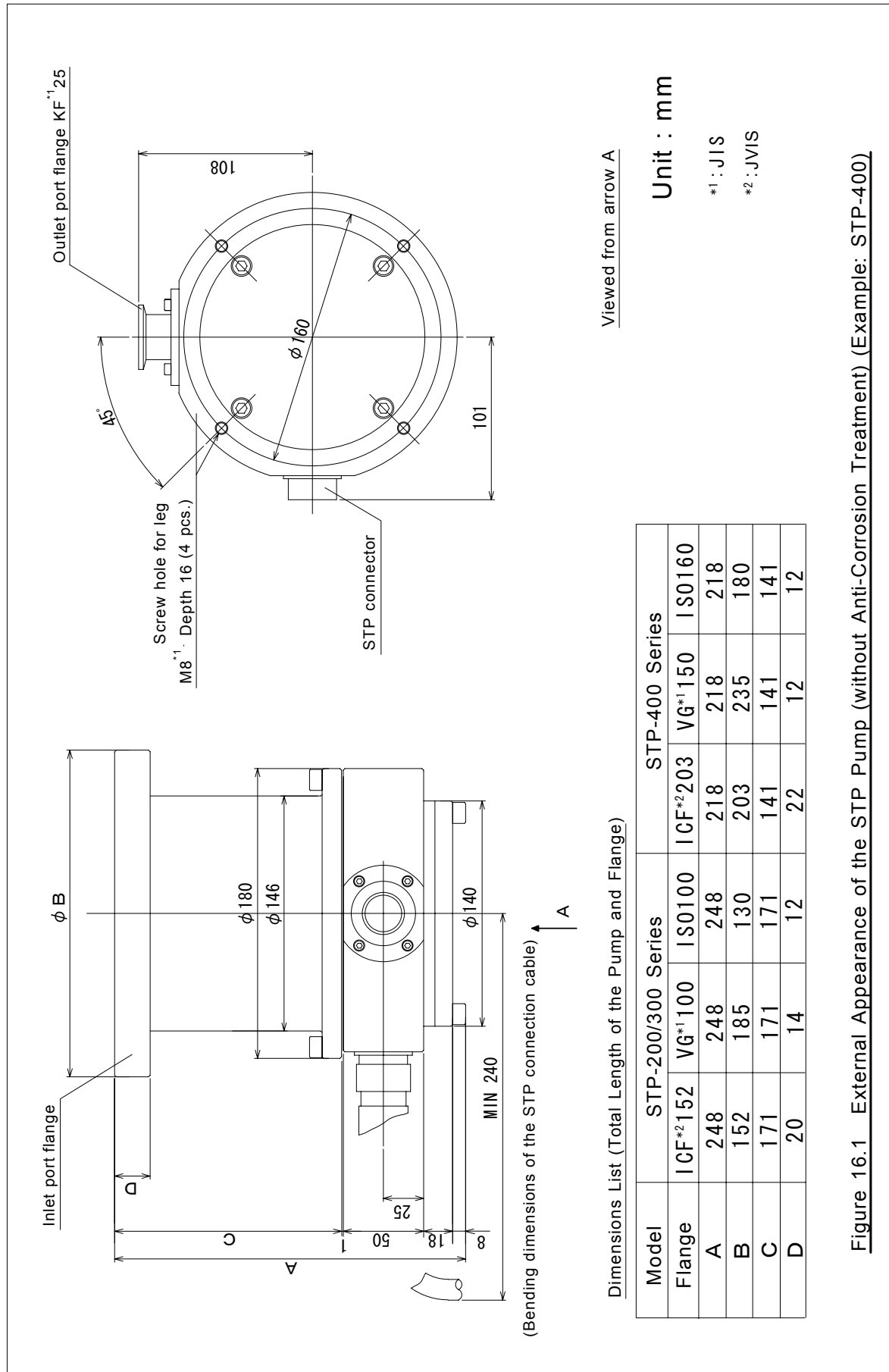
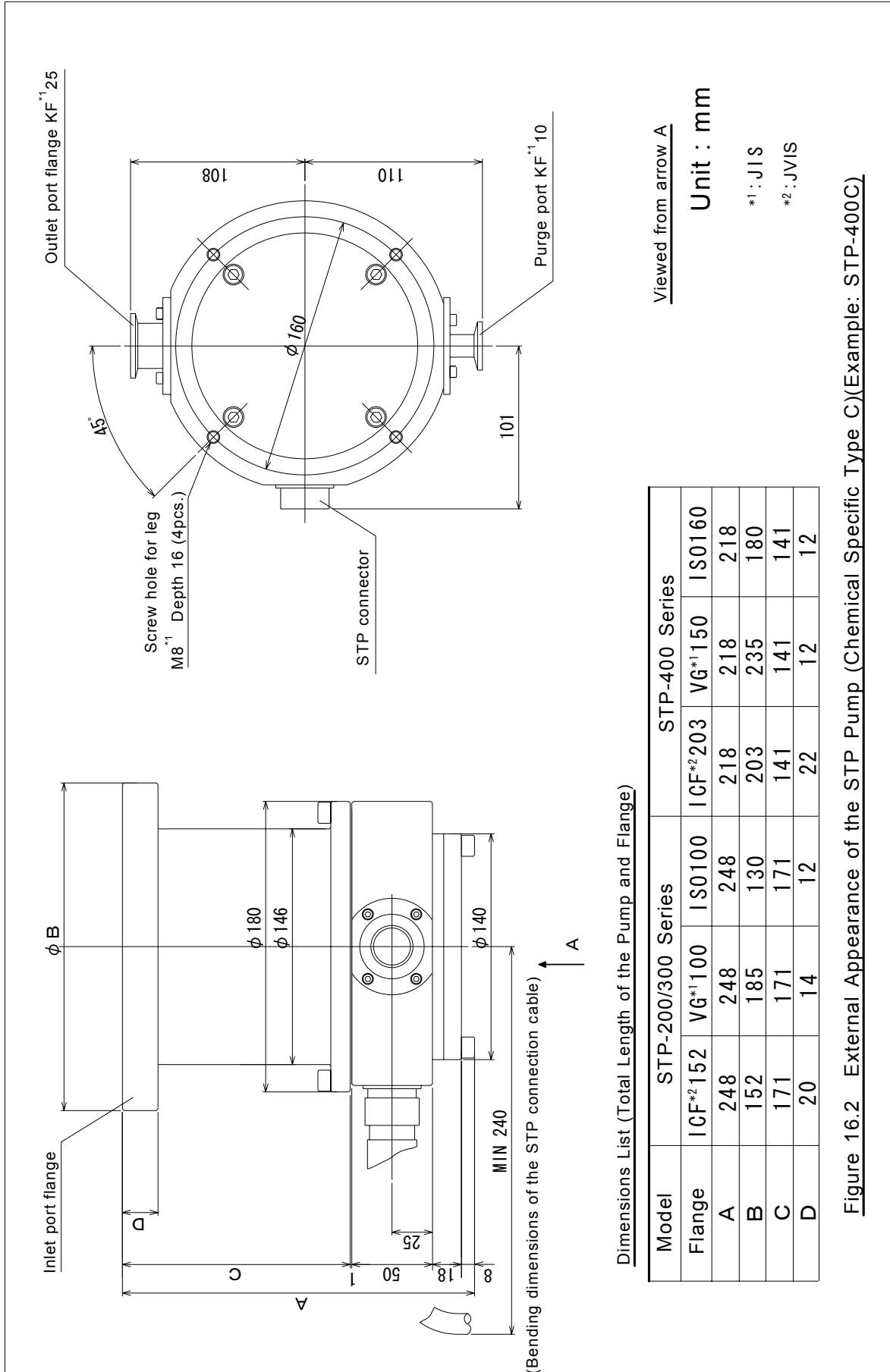


Figure 16.1 External Appearance of the STP Pump (without Anti-Corrosion Treatment) (Example: STP-400)



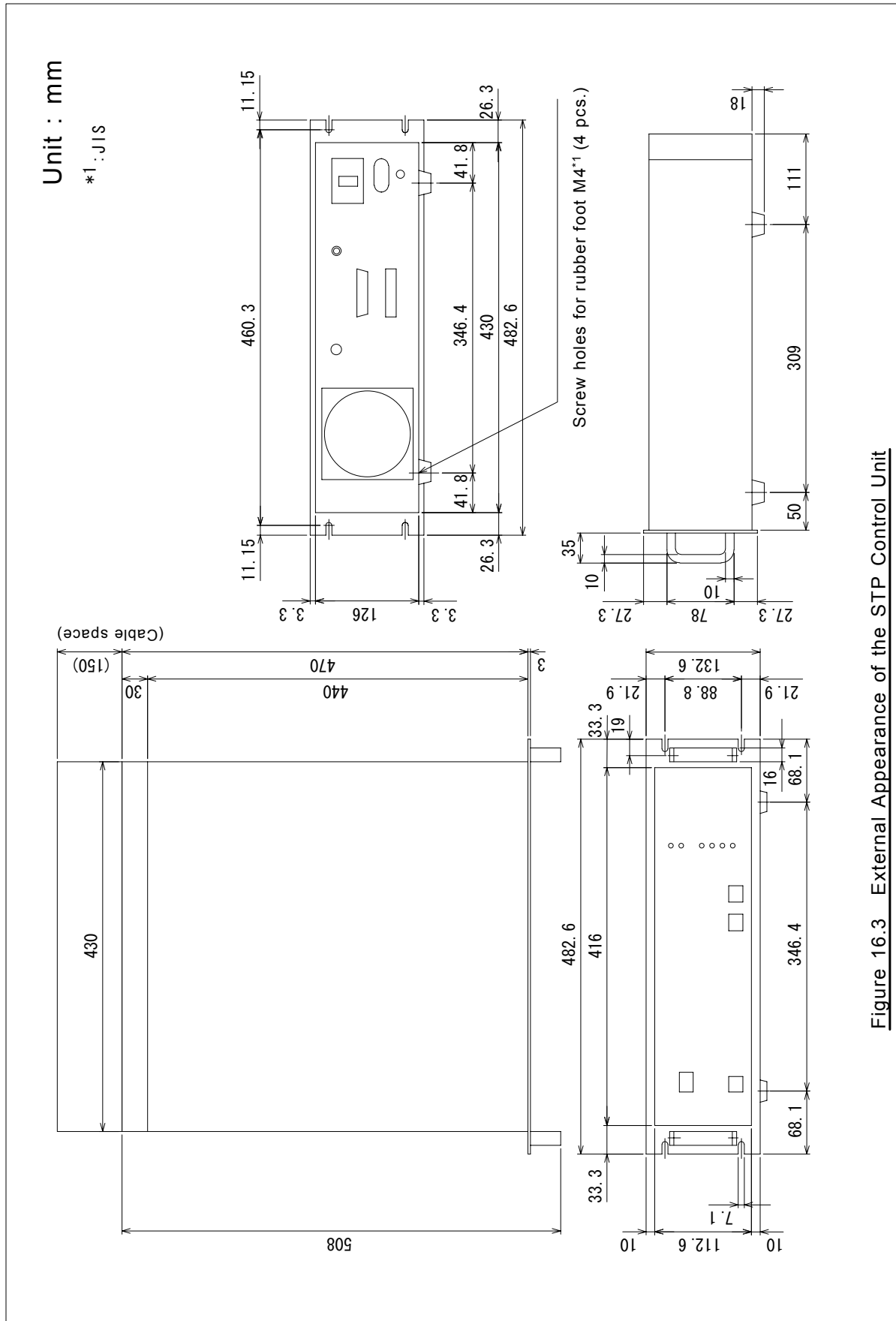


Figure 16.3 External Appearance of the STP Control Unit

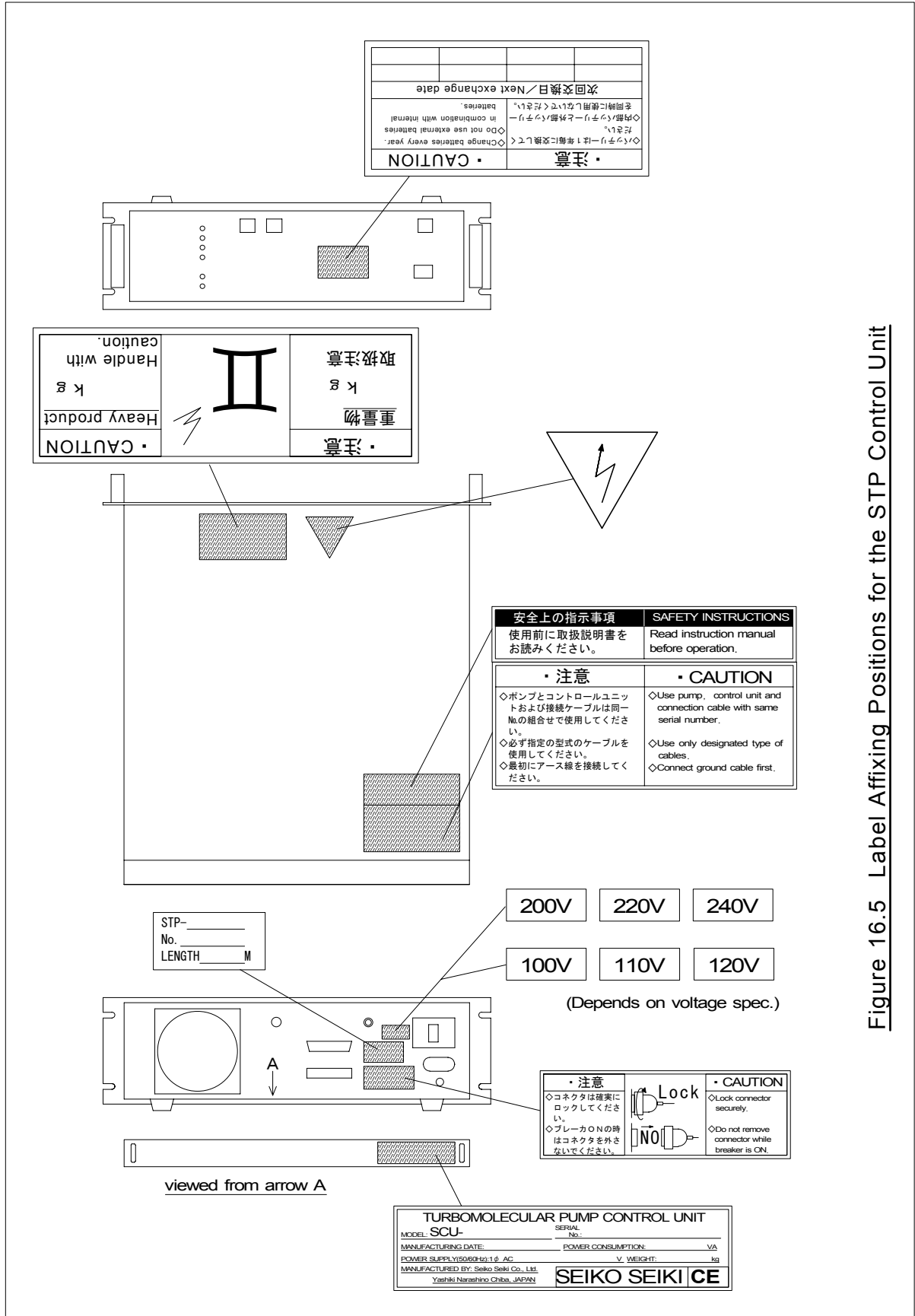
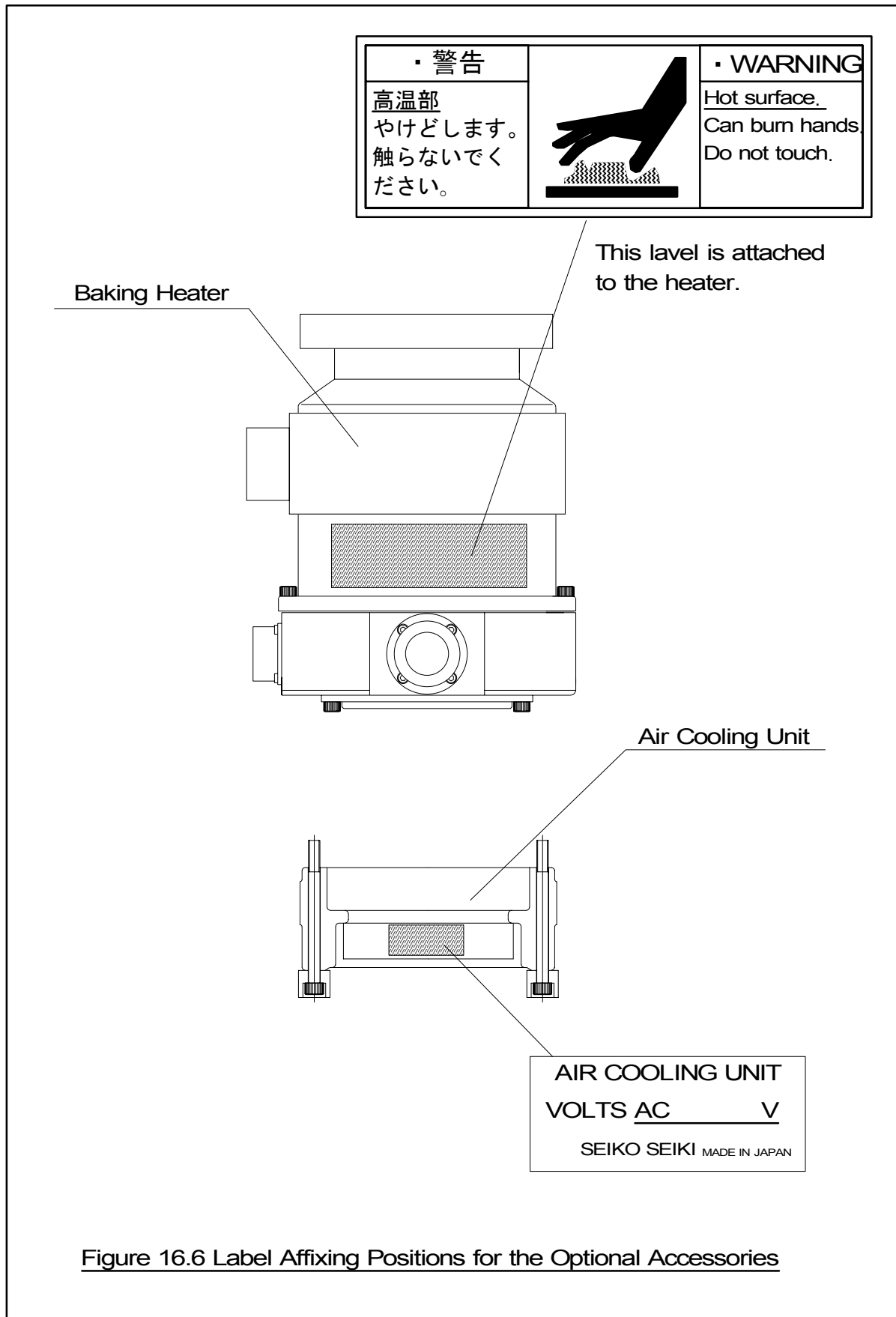


Figure 16.5 Label Affixing Positions for the STP Control Unit



UNIT CONVERSION TABLE

Length

m	cm	mm	inch
1	100	1.00×10^3	39.4
0.01	1	10.0	0.394
1×10^{-3}	0.10	1	39.4×10^{-3}
25.4×10^{-3}	2.54	25.4	1

Weight

g	kg	lb.
1	1.00×10^{-3}	2.20×10^{-3}
1×10^3	1	2.20
454	0.454	1

Pressure

Pa	Torr	kgf/cm ²
1	7.50×10^{-3}	1.02×10^{-5}
133	1	1.36×10^{-3}
9.81×10^4	736	1

For more information, contact to the nearest Service Office.

Manufacture:

BOC Edwards Japan Limited

2-4-1, Shibakoen, Minato-ku, Tokyo 105-0011 JAPAN

Telephone:	Domestic	03-5470-6530
	International	+81-3-5470-6530
Facsimile:	Domestic	03-5470-6521
	International	+81-3-5470-6521

Return of BOC Edwards Equipment - Procedure

INTRODUCTION

Before returning your equipment, you must warn BOC Edwards if substances you used (and produced) in the equipment can be hazardous. This information is fundamental to the safety of our Service Centre employees and will determine the procedures employed to service your equipment.

Complete the Declaration (HS2) and send it to BOC Edwards before you dispatch the equipment. It is important to note that this declaration is for BOC Edwards internal use only, and has no relationship to local, national or international transportation safety or environmental requirements. As the person offering the equipment for shipment, it is your responsibility to ensure compliance with applicable laws.

GUIDELINES

- Equipment is '**uncontaminated**' if it has not been used, or if it has only been used with substances that are not hazardous. Your equipment is '**contaminated**' if it has been used with any substances classified as hazardous under EU Directive 67/548/EEC (as amended) or OSHA Occupational Safety (29 CFR 1910).
- If your equipment has been used with radioactive substances, biological or infectious agents, mercury, polychlorinated biphenyls (PCB's), dioxins or sodium azide, you must decontaminate it before you return it to BOC Edwards. You must send independent proof of decontamination (for example a certificate of analysis) to BOC Edwards with the Declaration (HS2). Phone BOC Edwards for advice.
- If your equipment is contaminated, you must either:
 - Remove all traces of contamination (to the satisfaction of laws governing the transportation of dangerous/hazardous substances).
 - Or, properly classify the hazard, mark, manifest and ship the equipment in accordance with applicable laws governing the shipment of hazardous materials.

Note: Some contaminated equipment may not be suitable for airfreight.

PROCEDURE

1. Contact BOC Edwards and obtain a Return Authorisation Number for your equipment.
2. Complete the Return of BOC Edwards Equipment - Declaration (HS2).
3. If the equipment is contaminated, you must contact your transporter to ensure that you properly classify the hazard, mark, manifest and ship the equipment, in accordance with applicable laws governing the shipment of contaminated/hazardous materials. As the person offering the equipment for shipment, it is your responsibility to ensure compliance with applicable law. **Note: Equipment contaminated with some hazardous materials, such as semiconductor by-products, may not be suitable for airfreight - contact your transporter for advice.**
4. Remove all traces of hazardous gases: pass an inert gas through the equipment and any accessories that will be returned to BOC Edwards. Where possible, drain all fluids and lubricants from the equipment and its accessories.
5. Seal up all of the equipment's inlets and outlets (including those where accessories were attached) with blanking flanges or, for uncontaminated product, with heavy gauge tape.
6. Seal equipment in a thick polythene/polyethylene bag or sheet.
7. If the equipment is large, strap the equipment and its accessories to a wooden pallet. If the equipment is too small to be strapped to a pallet, pack it in a suitable strong box.
8. Fax or post a copy of the Declaration (HS2) to BOC Edwards. The Declaration must arrive before the equipment.
9. Give a copy of the Declaration (HS2) to the transporter. You must tell your transporter if the equipment is contaminated.
10. Seal the original Declaration in a suitable envelope: attach the envelope securely to the outside of the equipment package, in a clear weatherproof bag.

WRITE YOUR RETURN AUTHORISATION NUMBER CLEARLY ON THE OUTSIDE OF THE ENVELOPE OR ON THE OUTSIDE OF THE EQUIPMENT PACKAGE.

Return of BOC Edwards Equipment - Declaration

Return Authorisation Number:

You must:

- Know about all of the substances which have been used and produced in the equipment before you complete this Declaration
- Read the Return of BOC Edwards Equipment - Procedure (HS1) before you complete this Declaration
- Contact BOC Edwards to obtain a Return Authorisation Number and to obtain advice if you have any questions
- Send this form to BOC Edwards before you return your equipment

SECTION 1: EQUIPMENT

Equipment/System Name _____

Part Number _____

Serial Number _____

Has the equipment been used, tested or operated ?

 YES Go to Section 2 NO Go to Section 4

IF APPLICABLE:

Tool Reference Number _____

Process _____

Failure Date _____

Serial Number of Replacement Equipment _____

SECTION 2: SUBSTANCES IN CONTACT WITH THE EQUIPMENT
Are any substances used or produced in the equipment:

- Radioactive, biological or infectious agents, mercury, poly chlorinated biphenyls (PCBs), dioxins or sodium azide? (if YES, see Note 1) YES NO
- Hazardous to human health and safety? YES NO

Note 1 : BOC Edwards will not accept delivery of any equipment that is contaminated with radioactive substances, biological/infectious agents, mercury, PCB's, dioxins or sodium azide, unless you:

- Decontaminate the equipment
- Provide proof of decontamination

YOU MUST CONTACT BOC EDWARDS FOR ADVICE BEFORE YOU RETURN SUCH EQUIPMENT

SECTION 3: LIST OF SUBSTANCES IN CONTACT WITH THE EQUIPMENT

Substance name	Chemical Symbol	Precautions required (for example, use protective gloves, etc.)	Action required after a spill, leak or exposure

SECTION 4: RETURN INFORMATION

Reason for return and symptoms of malfunction _____

- If you have a warranty claim:
- who did you buy the equipment from ? _____
 - give the supplier's invoice number _____

SECTION 5: DECLARATION

Print your name: _____ Print your job title: _____

Print your organisation: _____

Print your address: _____

Telephone number: _____ Date of equipment delivery: _____

I have made reasonable enquiry and I have supplied accurate information in this Declaration. I have not withheld any information, and I have followed the Return of BOC Edwards Equipment - Procedure (HS1).

Note: Please print out this form, sign it and return the signed form as hard copy.

Signed: _____ Date _____

UNITED KINGDOM**CORPORATE HEADQUARTERS****BOC EDWARDS**

Manor Royal
Crawley
West Sussex
RH10 9LW
Tel +(44) 1293 528844
Fax +(44) 1293 533453

BOC EDWARDS

Wingates Industrial Estate
Great Bank Road
Westhoughton, Bolton
Lancashire
BL5 3SL
Tel +(44) 1942 652652
Fax +(44) 1942 652651

AMERICA (USA)**USA HEADQUARTERS****BOC EDWARDS**

One Edwards Park
301 Ballardvale Street
Wilmington, MA 01887
Tel +(1) 978 658 5410
Toll free (USA only) 1 800 848 9800
Fax +(1) 978 658 7969

3901 Burton Drive
Santa Clara, CA 95054
Tel +(1) 408 496 1177
Fax +(1) 408 496 1188

1810 West Drake Drive
Suite 101
Tempe, AZ 85283
Tel +(1) 602 777 7007
Fax +(1) 602 777 2244

11701 Stonehollow Drive
Suite 100
Austin, TX 78758
Tel +(1) 512 491 6622
Fax +(1) 512 491 0629

3501 Island Avenue
Philadelphia, PA 19153
Tel +(1) 215 365 8653
Fax +(1) 978 753 6846

BELGIUM**BOC EDWARDS**

Bergensesteenweg 709
B1600 Sint-Pieters-Leeuw
Brussels
Tel +(32) 2 363 0030
Fax +(32) 2 363 0064

BRAZIL**BOC DO BRASIL LTDA
DIVISÃO EDWARDS ALTO VACO**

Rua Bernardo Wrona 222
02710 São Paulo-SP
Tel +(55) 11 3952 5000
Fax +(55) 11 3965 2766

CANADA**BOC EDWARDS**

5975 Falbourne Street
Mississauga, Ontario L5R3W6
Canada
Tel +(1) 905 501 2558
Fax +(1) 905 501 1632

12055 Cote de Liesse
Dorval, Quebec H9P1B4
Canada
Tel +(1) 514 631 3501
Fax +(1) 514 631 3502

CHINA**BOC TRADING
(SHANGHAI) CO. LTD.**

23 Fu Te Road (N)
Wai Gao Qiao Free Trade Zone
Pudong
Shanghai, 200131
PRC China
Tel +(86 21) 5866 9618
Fax +(86 21) 5866 9993

FRANCE**BOC EDWARDS**

125 Avenue Louis Roche
92238 Gennevilliers, Cedex
Paris
Tel +(33) 1 47 98 24 01
Fax +(33) 1 47 98 44 54

GERMANY**BOC EDWARDS**

Ammerthalstraße 36
85551 Kirchheim
Munich
Tel +(49) 89 99 19 18 0
Fax +(49) 89 99 19 18 99

HONG KONG S.A.R.**BOC EDWARDS (ASIA)**

12 Chun Yat Street
Tseung Kwan O Industrial Estate
Tseung Kwan O, Kowloon
Hong Kong S.A.R.
Tel +(852) 2372 2640
Fax +(852) 2796 9095

INDIA**BOC EDWARDS**

DIVIN. OF BOC INDIA LIMITED
203 Surya Kiran Building
19 Kasturba Gandhi Marg
New Delhi - 110 001
India
Tel +(91) 11 851 0065
Fax +(91) 11 851 0245

ISRAEL**EDWARDS ISRAEL VACUUM LTD.**

5 Habarzel Blvd
Gat 2000 Industrial Zone
Qiryat Gat 82000
Tel +(972) 8 681 0633
Fax +(972) 8 681 0640

ITALY**BOC EDWARDS**

Via Carpaccio 35
20090 Trezzano sul Naviglio
Milan
Tel +(39) 02 48 4471
Fax +(39) 02 48 401638

JAPAN**HEADQUARTERS****BOC EDWARDS**

Shuwa Shiba Park Building A-3F
2-4-1 Shibakoen Minato-ku
Tokyo, 105-0011
Tel +(81) (0) 3 5470 6530
Fax +(81) (0) 3 5470 6521

KOREA**HEADQUARTERS****SONGWON EDWARDS LTD.**

5th FL. Daewoo Engineering Bldg.
Soonae-dong
Bundang-gu, Sungnam City
Kyungki-do, Korea
Tel +(82) 31 716 7070
Fax +(82) 31 738 1001-3

FACTORY & GV**SONGWON EDWARDS LTD.**

625-7 Upsong-dong
Chunan City
Chungchong Nam-do
Korea
Tel +(82) 41 621 7070
Fax +(82) 41 621 7700

SINGAPORE**BOC EDWARDS (ASIA)**

42 Loyang Drive
Loyang Industrial Estate
Singapore 508962
Tel +(65) 6546 8408
Fax +(65) 6546 8407

TAIWAN, R.O.C.**EDWARDS TECHNOLOGIES
LIMITED**

No. 434 Chung hua Road
Toufen Town, Miaoli County
Taiwan ROC
Tel +(886) 37 611422
Fax +(886) 37 611401

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<http://www.bocedwards.com>
info@bocedwards.com

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