T1800,T1200, T1000, T600, T100P

Instruction Manual

Date: 2007/06

T1800 V1.0

T1200 V1.0

T1000 V1.1

T600 V1.1

T100P V1.1

Dear customers:

Thank you for purchasing T1800 / T1200 / T1000 / T600 / T100P dry vacuum pumps manufactured by TOYOTA INDUSTRIES CORPORATION.

Please read through this manual for ensuring correct operation and handling and for ensuring a long service life.

T1000

T100P

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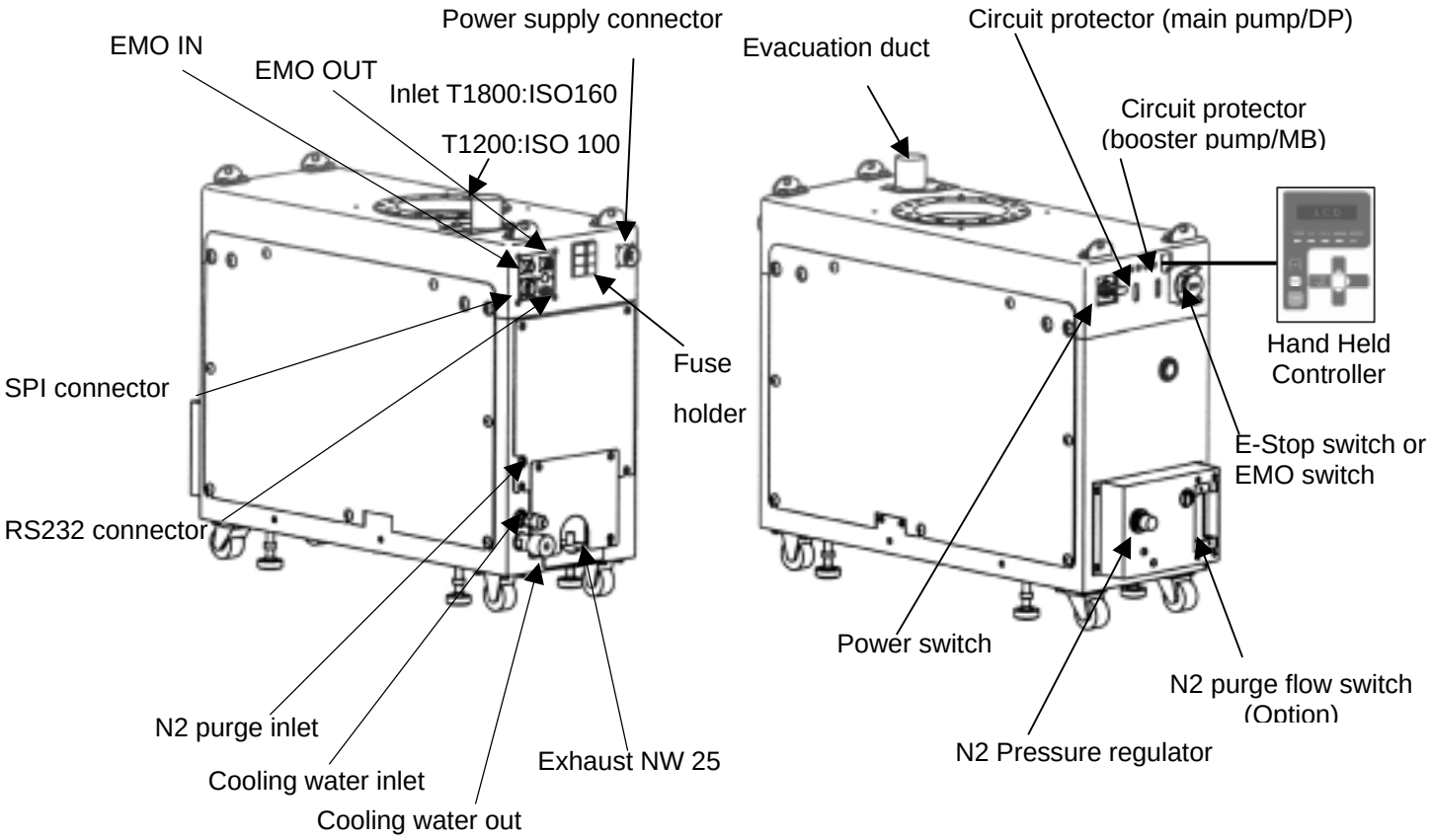
1. INTRODUCTION

1-1. Scope

This manual covers the T1800, T1200, T1000, T600, T100P vacuum pumps for the semiconductor equipment. The T1800, T1200, T1000, T600, T100P pumps are suitable for process chambers that employ noxious, activated gases. (Applications: PECVD, LPCVD, HDPCVD, MOCVD, Etching, Epitaxy, Ion Implant and Stripping)

⚠ WARNING	It is confirmed that gases with toxicity level below arsine concentration 4.7%, 21 slm (arsine 1 slm, nitrogen 20 slm) can be used. Do not use for higher toxicity gas.

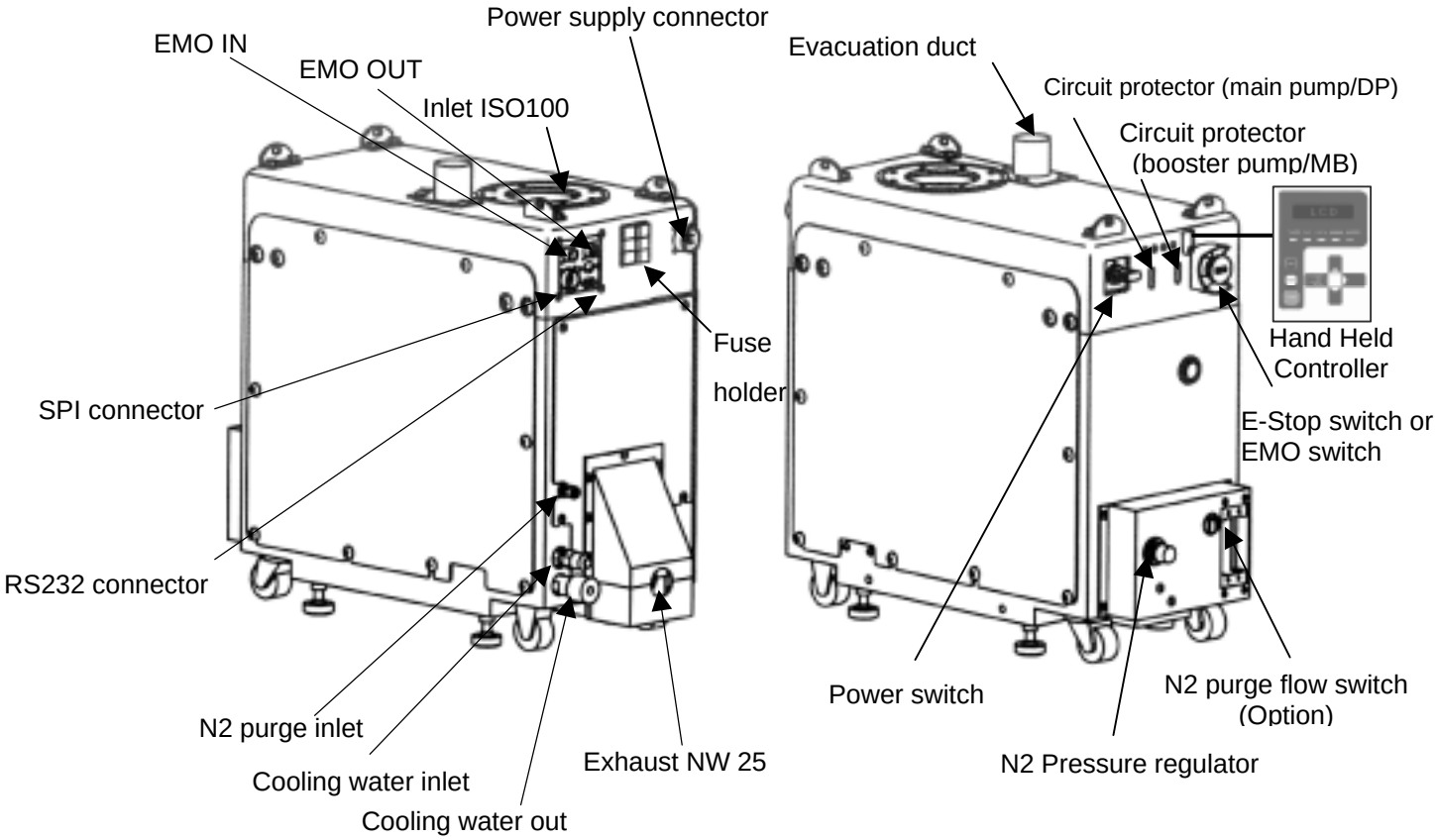
⚠ WARNING	Before pump inlet, dilute flammable atmospheres by 10% or less of the lower flammable limit of the gas, or conduct safety assessment based on pressure and concentration ratio of gases.



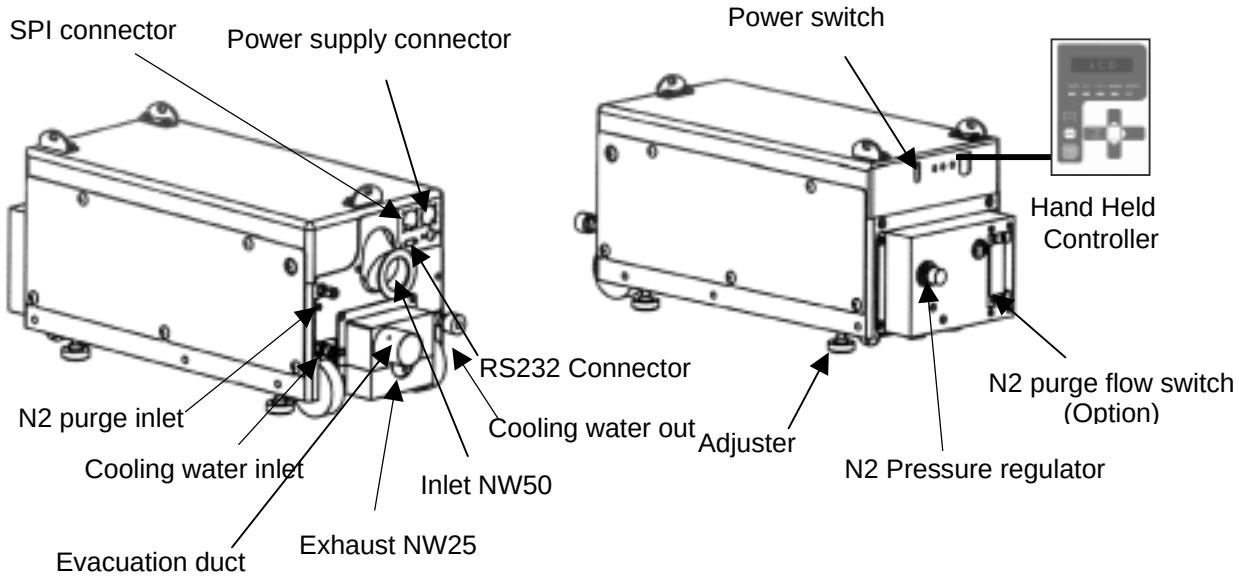
T1800, T1200

1. INTRODUCTION

1-1. Scope (continued)



T1000, T600



T100P

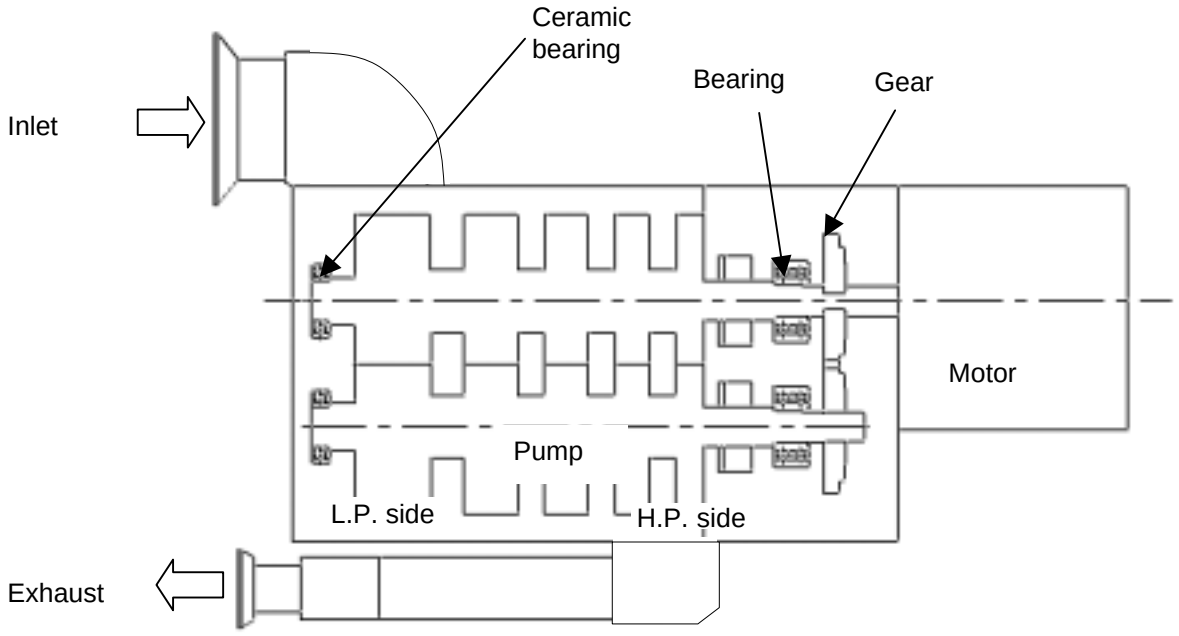
1. INTRODUCTION

1-2. Description

T1800, T1200, T1000, T600, T100P are roots type vacuum pumps that rotate a pair of synchronized, timing gears, and incorporate a roots type booster pump. Bearings and gears on the high pressure side are lubricated by fluoric type oil. Ceramic balls are used in the bearings on the low pressure side, and those bearings are lubricated by fluoric type grease.

The pump and motor are equipped with an indirect cooling system by cooling water, which enables thermal control by automatic switching of internal valve.

The pump has a N2 purge structure, and N2 is used for diluting various process gases and shaft seals.



1. INTRODUCTION

1-3. Technical Data

1-3-1. Technical data table

Item			Unit	T1800		T1200		T1000		T600		T100P	
Dimensions and weight		Dimensions (LxHxW)	mm	760×625×300				590×600×300				590×300×280	
		Weight	kg	240		230		220				110	
Performance		Maximum revolution (Default rpm setting)		Dry Pump	Booster Pump	Dry Pump	Booster Pump	Dry Pump	Booster Pump	Dry Pump	Booster Pump	Dry Pump	
			r/min	5250	5750	5250	5750	5250	5750	4500[1]	5250	5250	
		Peak pumping speed	m3/h	950-1800		600 - 1200		600 - 950		300 - 600		100	
			l/min	15800 - 30000		10000 - 20000		10000 - 15800		5000 - 10000		1670	
		Ultimate pressure (at Default rpm setting)		N_2 Purge 0slm	N_2 Purge 35slm	N_2 Purge 0slm	N_2 Purge 35slm	N_2 Purge 0slm	N_2 Purge 35slm	N_2 Purge 0slm	N_2 Purge 35slm	N_2 Purge 0slm	N_2 Purge 35slm
			Pa	0.13	0.93	0.13	0.93	0.13	0.93	0.13	0.93	1.2	5.3
			Torr	0.001	0.007	0.001	0.007	0.001	0.007	0.001	0.007	0.009	0.04
		Power consumption at ultimate pressure, (N2 purge 0 slm)	kW	1.7				1.6		1.3[1]		1.3	
Maximum continuous inlet pressure (at Default rpm setting)			MPa	0.65×10^{-4}		2.66×10^{-4}		1.33×10^{-4}		6.93×10^{-4}		6.67×10^{-3}	
			Torr	0.5		2		1		5.2		50	
Noise level（at ultimate pressure）			dB(A)	< 60		< 58						< 55	
Lubricant quantity			cm^3	220[2]								110[2]	
Inlet flange				ISO 160 Bolted		ISO 100 Bolted		ISO 100 Bolted		ISO 100 Bolted (Option NW80)		NW50	
Exhaust flange				NW40				NW25					
Environment		Ambient temperature	°C	15 to 30									
		Humidity	%	Max 90 (no condensation)									
UL classification		Pollution degree		2									
		Installation Category		II									
Utility	Cooling water	Connector	Inch	3/8								1/4	
		Type		Non-corrosive industrial water or treated soft water[3]									
		Flow Rate	L/min	Min. 3.0									
		Supply pressure	kPaG	Min300 Max700									
			Bar	Min3.0 Max7.0									
		Temperature	°C	10 to 25									
	Power supply	Number of phases		3									
		Input voltage	V	208[4]									
		Frequency	Hz	50/60									
		Full load current	A	24								12	
		Max. power capacity	kVA	9.2								4.6	
	N2 purge	Connector	Inch	1/4 (compression fitting)									
		Supply pressure	kPaG	Min300 Max700									
			Bar	Min3.0 Max7.0									
		Flow Rate	SLM	0-50[5]									
	Secondary evacuation	Flow Rate (SEMI F15 standard)	m^3/min	Min. 1.76 [6]				Min. 2.21 [6]				Min. 1.9 [6]	
		Static pressure in duct	PaG	Max -190				Max -199				Max -208	
		Connector	mm	ϕ 50									

1. INTRODUCTION

1-3. Technical Data (continued)

1-3-1. Technical data table (continued)

1) For T600, if dry pump temperature setting above 120°C is selected, dry pump rotational speed will be automatically adjusted by pump software to 5250rpm and power consumption at ultimate pressure will be 1.5kW.

2) The lubricant is added to the appropriate level at the factory. Never change the lubricant level.

3) Use cooling water that meets water quality standard of Japan Refrigeration and Air Conditioning Industry Association. See "*3-8-1. Cooling water characteristics*" for the water quality standard.

4) Voltage fluctuation allowance is ±10%.

5) Set up pump N2 purge flow according to the types of process.

6) Set up exhaust monitoring switch on secondary evacuation duct according to SEMI F15 requirements. Setting up of gas detector on the secondary exhaust line is recommended according to types of process gas. The exhaust monitoring switch must be connected to the process tool or facility gas supply interlock circuit so that process gas is shut-off in case the secondary evacuation requirements are not satisfied. If the pump is installed in a ventilated cabinet such as a pump garage, remove the pump exhaust flange cover and side panels. Verify that there is no potential to create flammable atmospheres.

The above utilities are required for the pump. Be careful as performance and reliability are not guaranteed unless the requirements listed are satisfied.

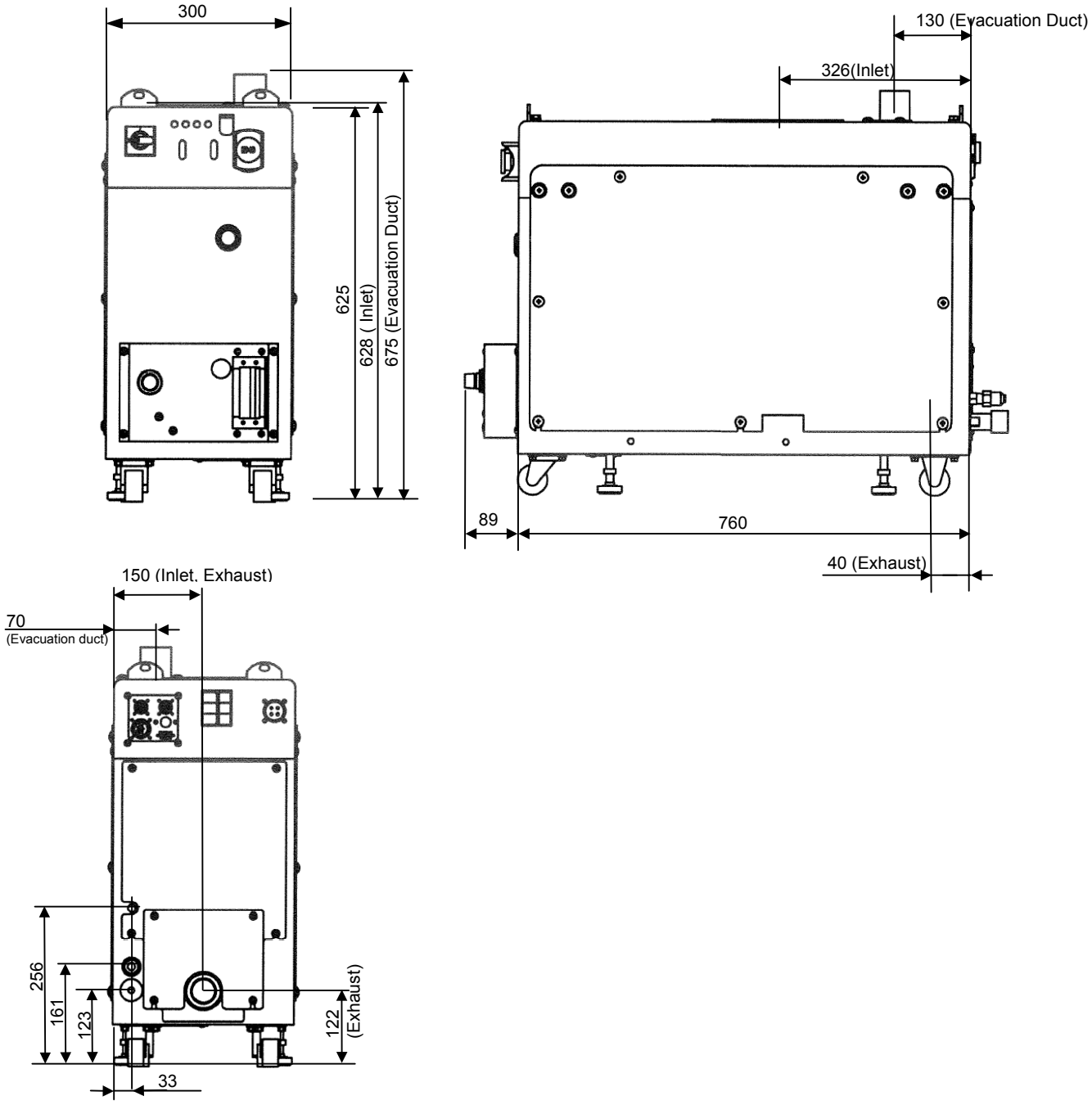
1. INTRODUCTION

1-3. Technical Data (continued)

1-3-2. Technical data drawing

T1800,T1200 Dimension Diagram

Unit: mm



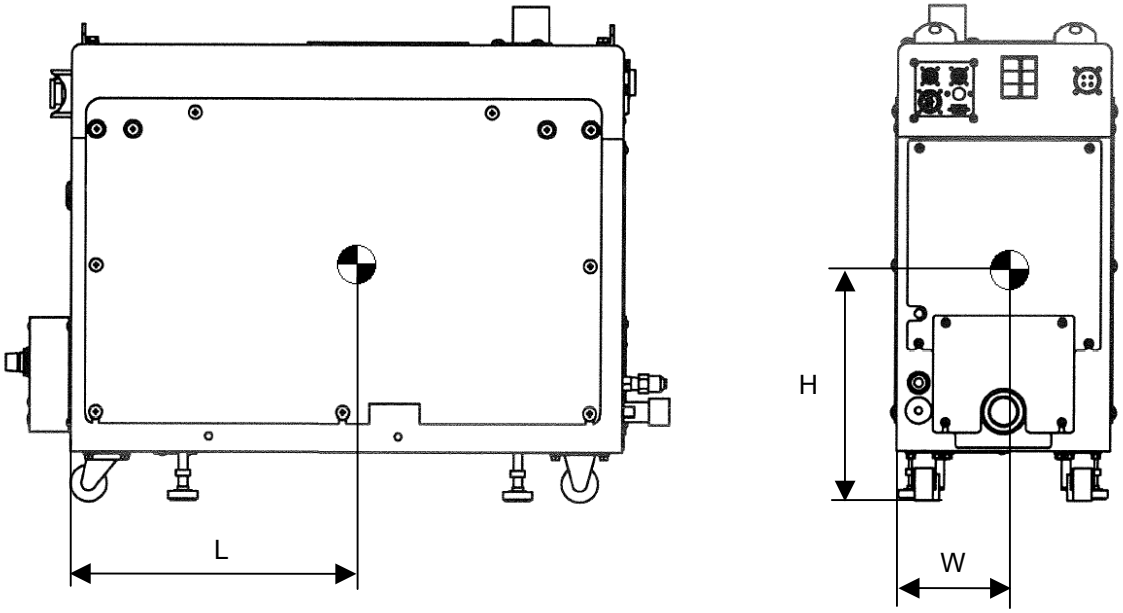
1. INTRODUCTION

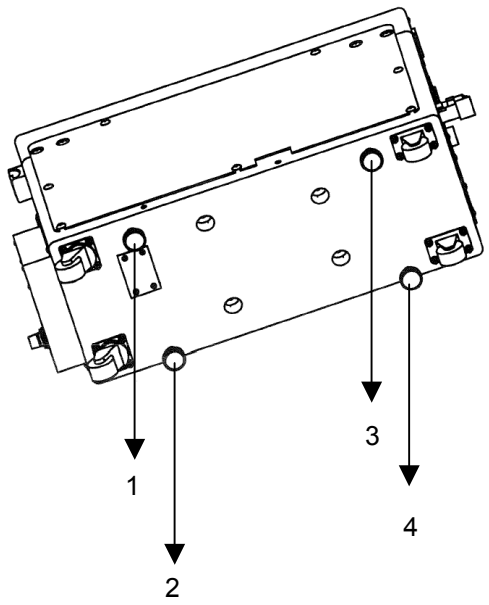
1-3. Technical Data (continued)

1-3-2. Technical Data drawing (continued)

Position of T1800 center of gravity

Unit: mm





T1800

Pump weight (kg)	Position of pump center of gravity		
	L (mm)	W (mm)	H (mm)
240	360	135.5	305

Weight distribution at adjusters				
Position	1	2	3	4
Weight (kg)	65	61	59	55

T1200

Pump weight (kg)	Position of pump center of gravity		
	L (mm)	W (mm)	H (mm)
230	335	134.5	303

Weight distribution at adjusters				
Position	1	2	3	4
Weight (kg)	64	60	55	51

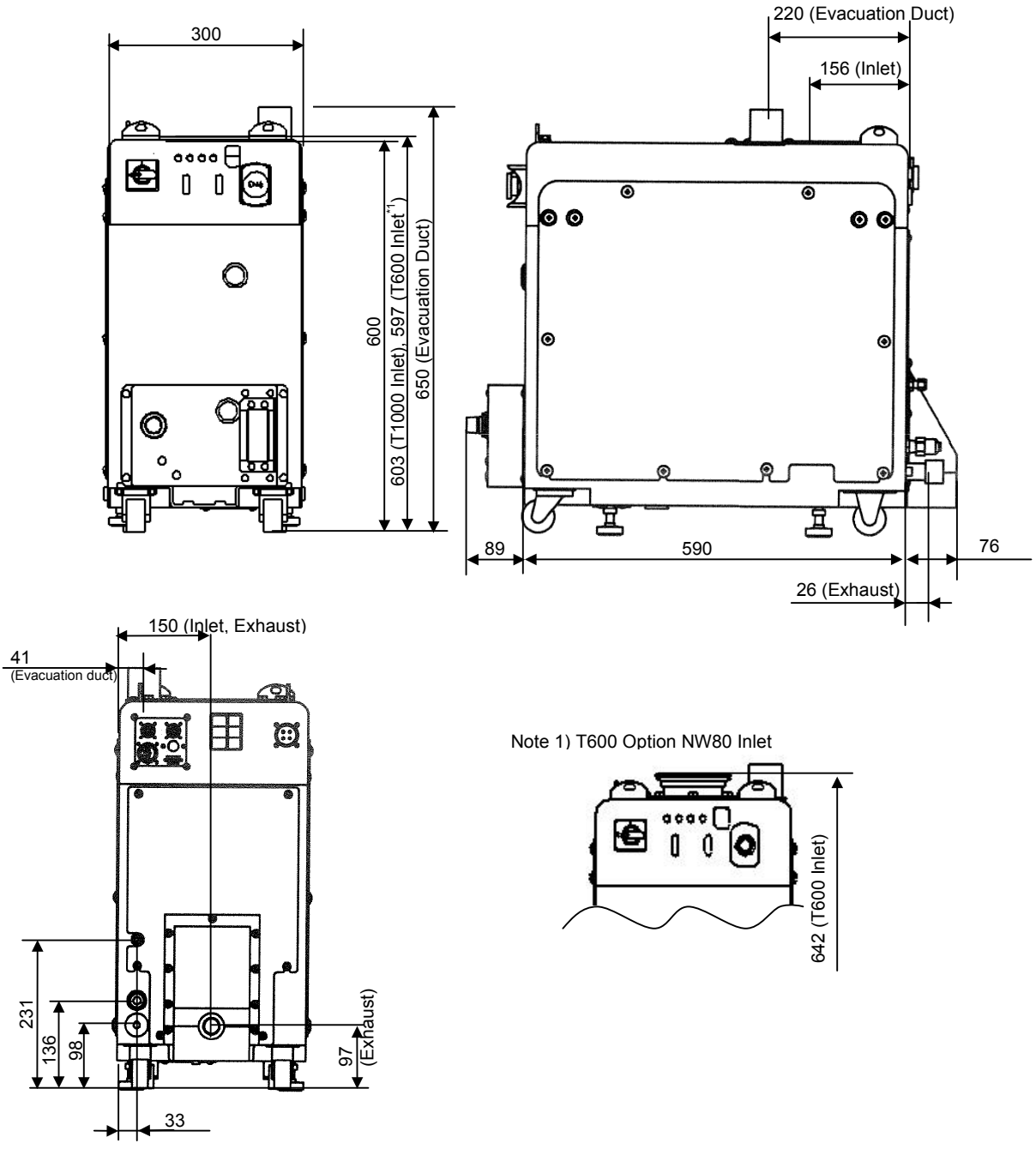
1. INTRODUCTION

1-3. Technical Data (continued)

1-3-2. Technical data drawing

T1000, T600 Dimension Diagram

Unit: mm



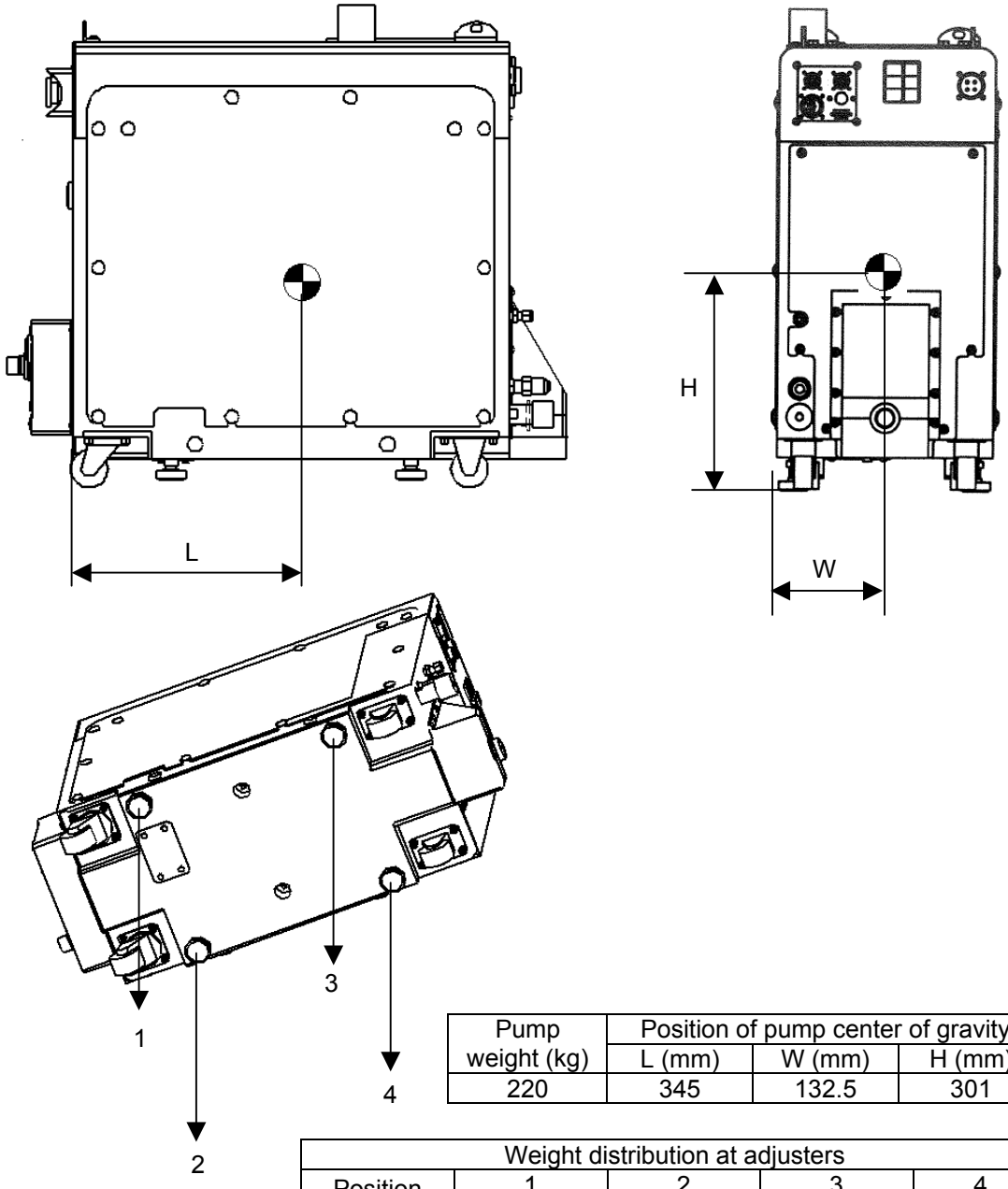
1. INTRODUCTION

1-3. Technical Data (continued)

1-3-2. Technical Data drawing (continued)

Position of T1000, T600 center of gravity

Unit: mm



Pump weight (kg)	Position of pump center of gravity		
	L (mm)	W (mm)	H (mm)
220	345	132.5	301

Weight distribution at adjusters				
Position	1	2	3	4
Weight (kg)	53.1	48.4	56.7	61.8

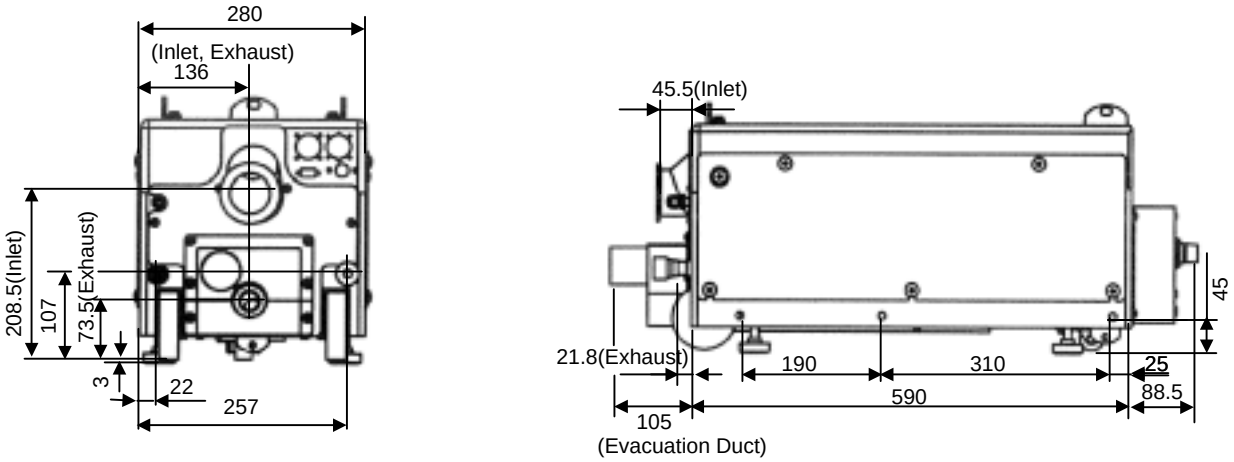
1. INTRODUCTION

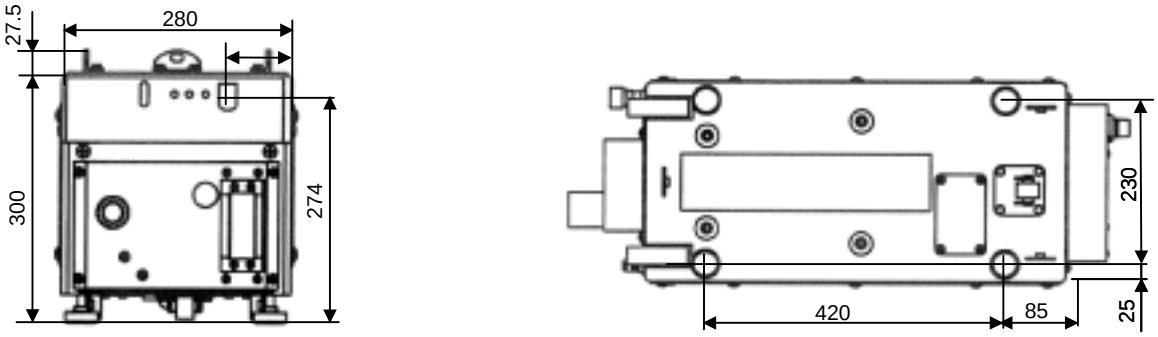
1-3. Technical Data (continued)

1-3-2. Technical data drawing

T100P Dimension Diagram

Unit: mm





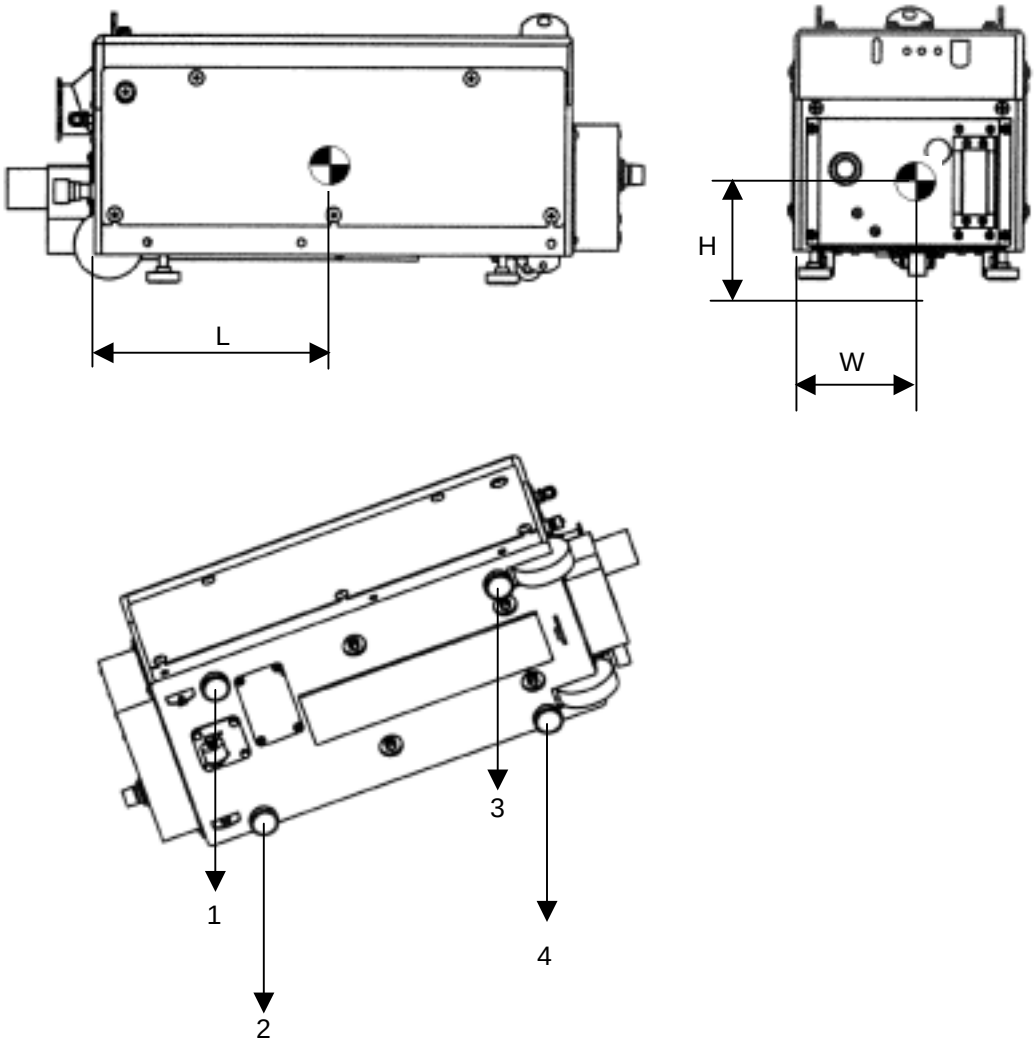
1. INTRODUCTION

1-3. Technical Data (continued)

1-3-2. Technical Data drawing (continued)

Position of T100P center of gravity

Unit: mm



Pump weight (kg)	Position of pump center of gravity		
	L (mm)	W (mm)	H (mm)
110	263	146	151

	Weight distribution at adjusters			
Position	1	2	3	4
Weight (kg)	27.0	33.2	25.9	23.9

1. INTRODUCTION

1-4. CE marking certificate

CE

EC DECLARATION OF CONFORMITY

We,

TOYOTA INDUSTRIES CORPORATION.
2-1, Toyoda-cho, Kariya-shi, Aichi-ken 448-8671, JAPAN

herewith declare, on our own responsibility that the vacuum pump listed below conforms to the relevant provisions.

Product Name:	Vacuum Pump,	Model: IPUP T100L,EC100L T100P, T600,T1000,T1200,T1800
Council Directives:	Low Voltage:	73/23/EEC
	EMC:	89/336/EEC, 92/31/EEC
Amendment Directive of above directives:		93/68/EEC
Applicable Standards:	Low Voltage:	SEMI S2-0200 EN61010-1:1993 + A2:1995
	EMC:	EN55011:1998;+A1:1999 +A2:2002(Group 1 Class A) EN61000-6-4:2001

Shinya Yamamoto

Shinya Yamamoto, Manager
Engineering Department
Date: 20/2 /2007

1. INTRODUCTION

1-5. SEMI S2 Certificate

GS3

Global Semiconductor Safety Services

CERTIFICATE OF COMPLIANCE

To SEMI S2-0703 and S8-0705 Guidelines

February 28, 2007

Company Name & Location	Toyota Industries Corporation 2-1, Toyota-Cho, Kariya-Shi Aichi-Ken, 448-8671 Japan
Place of Manufacturing	Japan
Document Number	2500268F2
Model	T100P, T600/T1000 and T1800
Investigated in accordance with	SEMI S2-0703 / S8-0705

Paul Breder, Technical Manager

Andrew Giles, Technical Manager

Intertek Global Semiconductor Safety Services

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2. SAFETY PRECAUTION

2-1. General

A dangerous voltage for the human body is used inside T1800, T1200, T1000, T600, T100P.

Damage is possible to human body or process tool.

Improper operation may possibly result in a fatal accident.

Thoroughly read this manual to prevent accidents before using the product.

2-2. Identified Label Symbols

Observe important safety precautions which are clearly identified by WARNING or CAUTION symbols.

Wear various protective gears when operating the product and comply with all warnings and dangers indicated by the following symbols.

 WARNING	A hazard that could cause injury or death if you don't follow the rules.
 WARNING	A hazard related to electrical that cause injury or death if you don't follow the rules.
 WARNING	A hazard related to temperature that causes injury or death if you don't follow the rules.
 CAUTION	A hazard that cause an accident resulting in injury or damage to the process.
	Refer to the references and follow the instructions.

2. SAFETY PRECAUTION

2-3. Safety Instruction

2-3-1. Power supply

T1800, T1200, T1000, T600, T100P are designed on condition that power is supplied from the process tool using a ground-fault interrupter (UL489 standard) with breaking capacity 10,000 AIC, rating of 30 A (T1800, T1200, T1000, T600) or 15 A (T100P).

Do not place pump where power-disconnecting devices become difficult to access.

2-3-2. *Emergency Off / E-STOP system*

－T1800, T1200, T1000, T600－

(1) If T1800, T1200, T1000, T600 EMO connector is connected to the process tool emergency off system and the emergency button on the pump is pushed, the electrical power of the pump is removed by process tool. In this case, please attach Emergency Off label above the button as shown below:

Emergency Off

(2) If T1800, T1200, T1000, T600 EMO connector is not connected to process tool emergency off system, pushing the emergency button will stop the pump but will not remove entire power from the pump. In this case, please attach E-STOP label above the button as shown below. To meet SEMI S2 requirements, the user is required to install a process tool EMO button, located within 10ft travel from the pump.

E-STOP

－T100P－

The T100P have no EMO device as they are designed as a built-in pump. The user is required to install an EMO unit within 10ft travel from the pump, which shuts off the power.

2. SAFETY PRECAUTION

2-3-3. Safety sensors

The T1800, T1200, T1000, T600, T100P pumps have a number of safety sensors to detect overload, over-temperature of pump, over-temperature of motor, over-pressure in exhaust line and lack of N2 purge flow.

Sensors	Function
Fuse (T1800, T1200, T1000, T600)	Preventing an accident caused by short circuit
Circuit protector	Overcurrent protection
Thermistors	Measurement and monitoring of pump body temperature
Temperature switches	Monitoring of motor over-temperature
Inverter	Overcurrent protection in case of overload
Exhaust pressure sensor	Measurement and monitoring of exhaust pressure
N2 purge flow meter	Measurement and monitoring of N2 purge flow
N2 purge flow switch (Option)	Monitoring of N2 purge flow

2. SAFETY PRECAUTION

2-3. Safety Instruction (continued)

2-3-4. Safety Interlock system (Option)

The N2 purge flow switch is optionally provided to stop the process gases immediately when N2 purge flow amount is below setpoint.

The N2 purge flow switch should be connected to the process tool's interlock circuit.

When the N2 purge flow is below the user-set value, the N2 flow switch will open dry contacts 13/14 on the SPI interface.

⚠ WARNING	In the worst case, gas leak from T1800, T1200,, T1000, T600, T100P is possible. Please connect suitable secondary evacuation and set up exhaust monitoring switch on secondary evacuation duct according to SEMI F15 standard. Setting up of gas detector on the secondary exhaust line is recommended according to types of process gas.

⚠ WARNING	It is confirmed that gases with toxicity level below arsine concentration 4.7%, 21 slm (arsine 1 slm, nitrogen 20 slm) can be used. Do not use for higher toxicity gas.

⚠ WARNING	Before pump inlet, dilute flammable atmospheres by 10% or less of the lower flammable limit of the gas, or conduct safety assessment based on pressure and concentration ratio of gases.

2. SAFETY PRECAUTION

2-4 Safety Precaution

Cautions related to safety are listed below.

The performance and safety of this product are guaranteed only when the pump is operated within the parameter ranges specified herein.


WARNING

If the customer makes any modification to the product, performance and safety are not guaranteed. In such cases, we will not be responsible for any failures.


WARNING

The circuit between the power supply connector and the main switch remains live even after power is turned off. An electric shock will occur if you touch the live area. When working with the cover open, be sure to disconnect the power cable from the power supply connector.


WARNING

Harmful voltage or current exists in the pump. When working with the cover open, be sure to turn the pump main switch off and disconnect the power cable from the power supply connector to avoid getting an electric shock.


WARNING

After turning the power off, voltages of 60 VDC or more remain in internal parts such as the FC inverter. When operating with cover open, wait 30 sec. after turning the power off. Also, wait 30 sec. when turning power on again.


WARNING

Only qualified, well-trained personnel can operate this product with its cover open for installation or other reasons


WARNING

This product does not require any daily inspection or maintenance. Never open the cover to prevent an electric shock or burning.

2. SAFETY PRECAUTION

2-4. Safety Precaution (continued)


WARNING

Never move the pump while the pump is running.


WARNING

When operation is needed soon after stopping the pump, wear gloves and other protective gear. Surface of mechanical parts inside the cover and output piping are as hot as 70°C or more. Pay special attention when working.


CAUTION

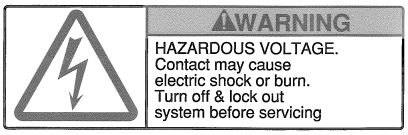
The oil level is adjusted at the factory before shipment. Never change the oil level.

Use shielded communication cables and connectors to prevent malfunctions caused by noise.

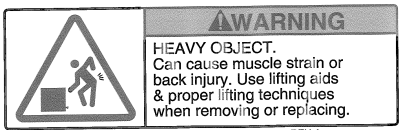
2. SAFETY PRECAUTION

2-4. Safety Precaution (continued)

The following warning labels

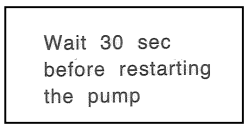


This is located on the side of the pump. This indicates that an electric shock may occur if you touch live internal parts. Always turn the main switch off and disconnect the power cable before beginning work.

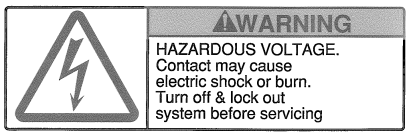


This is located on the upper face of the pump and indicates that attempts to lift it by hand may result in back injury. If it is necessary to lift the pump, use an appropriate device.

This is located on the evacuation flange cover, at the rear face of the pump. This indicates that some internal components become hot. Touching them with bare hands may result in burns. Wear gloves or other protective gear or wait until they have cooled down before beginning work.



This is below the main switch on the front face of the pump. Wait at least 30 seconds before turning on after turning off the main switch.



This is located near the fuse-holder, at the rear face of the pump. This indicates that an electric shock may occur if you touch live internal parts. Don't open the cover under load.

2. SAFETY PRECAUTION

2-4 Safety Precaution (continued)

The following warning labels (continued)

This label is located on the upper face of the pump.

Hazardous substances may be contained in the pump and remain around it if flammable, corrosive or toxic gases are used. Before removing the pump, please run the pump with only nitrogen purge for decontamination. And please remove remnants around the pump completely.

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3. INSTALLATION

3-1. General

Only qualified, well-trained personnel can install this product.

Confirm that all the parts listed in the attached option list are contained in the package.

3-2. Unpacking Precautions

When packed, the product weighs about 240kg (T1800),230kg(T1200), 220kg (T1000, T600), 110kg (T100P) or more.

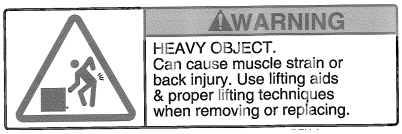
Preventive measures must be taken not to incline the pump during transportation. (acceptable angle of gradient: within ± 10°)

If the pump has been damaged upon unpacking, notify the transportation company and have them take the necessary action, or your service representative, as the case may be needed.

3. INSTALLATION

3-3. Transport Procedure

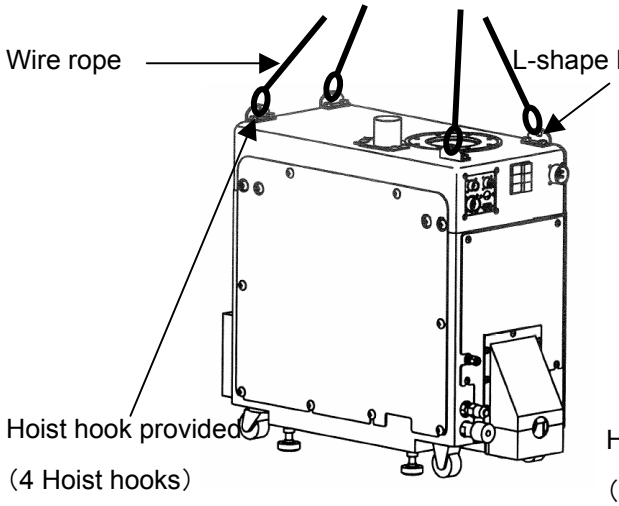
3-3-1. Transport by lifting up the pump



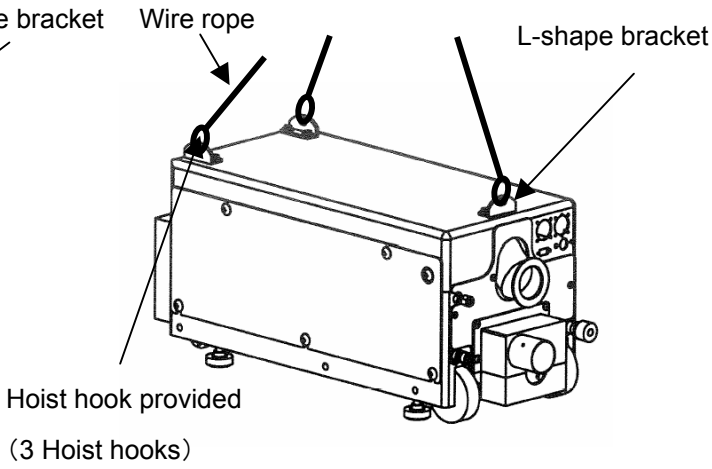
The pump itself weighs about 240kg (T1800), 230kg(T1200), 220kg (T1000, T600), 110kg (T100P). Use a hoist or other appropriate device when lifting it up.

Using the L-shape brackets screwed to the upper surface of the cover, you can hoist the pump as follows:

1. Insert the hoist hooks (provided) into each L-shape brackets.
2. Prepare wire ropes and hook them to the hoist.
3. Lift the pump using a hoist.



T1800,T1200,T1000,T600



T100P

Use the hoist and wire ropes after confirmation that they are suitable for the load.

Never work under a hoisted pump. Only authorized, qualified personnel are permitted to hoist the pump.

Preventive measures must be taken not to incline the pump during transportation. (acceptable angle of gradient: within ±10°)

3. INSTALLATION

3-3. Transport Procedure (continued)

3-3-2. Transport by wheeling the pump

－T1800,T1200, T1000, T600－

Two wheels and two free casters are provided on the bottom of the pump.

－T100P－

Two wheels and one free caster are provided on the bottom of the pump.

Use appropriate cart or moving equipment to move the pump.

Make sure that all four adjusters on the pump are DOWN to prevent any sliding of the pump on the cart or moving equipment. Move the cart at a speed of 4 km/h or less.

Do not move hurriedly to prevent rolling over. Move the pump at a speed of 4 km/h or less.

Pay attention not to trap your feet or body when moving the pump.

Confirm that all four adjusters on the bottom of pump are UP when moving the pump on it's wheels.

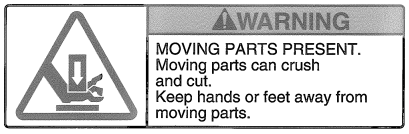
Never move the pump while it is running.

3. INSTALLATION

3-3. Transport Procedure (continued)

3-3-2. Transport by wheeling the pump (continued)

－Optional handle for T100P－



Pay attention so as not to trap your hands between the handle and cover when using or stowing the optional handle.（T100P）

WARNING

Never use the optional handle for hoisting the pump.（T100P）

WARNING

Never sit down on the handle.（T100P）

WARNING

Always operate the pump with the handle stowed away.（T100P）

Check that the handle is firmly locked before using it or after stowing it.（T100P）

Never use the handle for any purpose other than wheeling the pump.（T100P）

3. INSTALLATION

3-4. Installation Procedure

3-4-1. Installation precautions


WARNING

Install the pump horizontally. Before starting operation, pump inclination angle must be adjusted to be within angles of ±2 degrees with horizontality.
It cannot be operated at any angle or vertically.


WARNING

Before using the pump, be sure to fix it firmly to either the floor or the equipment using earthquake protection equipment.

Install the pump on a hard and flat surface.

Install the pump at the specified position using an appropriate moving method.

The pump performance will vary depending on the types of fittings and connectors used.

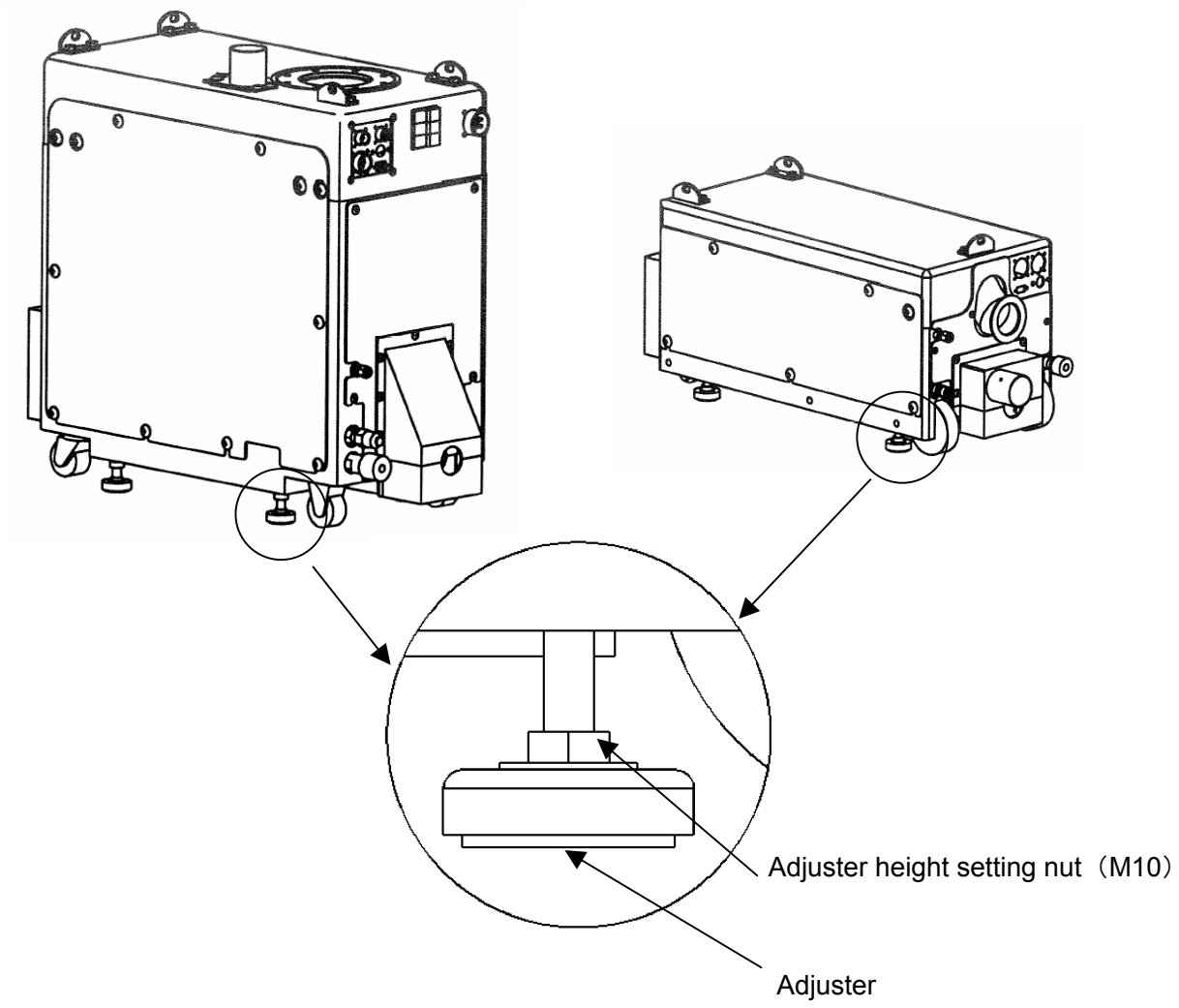
3. INSTALLATION

3-4. Installation Procedure (continued)

3-4-2. Installation procedure

Four adjusters are provided on the bottom of pump. Set the adjusters by observing the following instructions:

1. Turn the adjusters clockwise to lower them using an M10 spanner or the like.
2. Lower them until they contact the floor firmly and the wheels and free caster are floating. Adjust them to make the pump parallel with the floor.



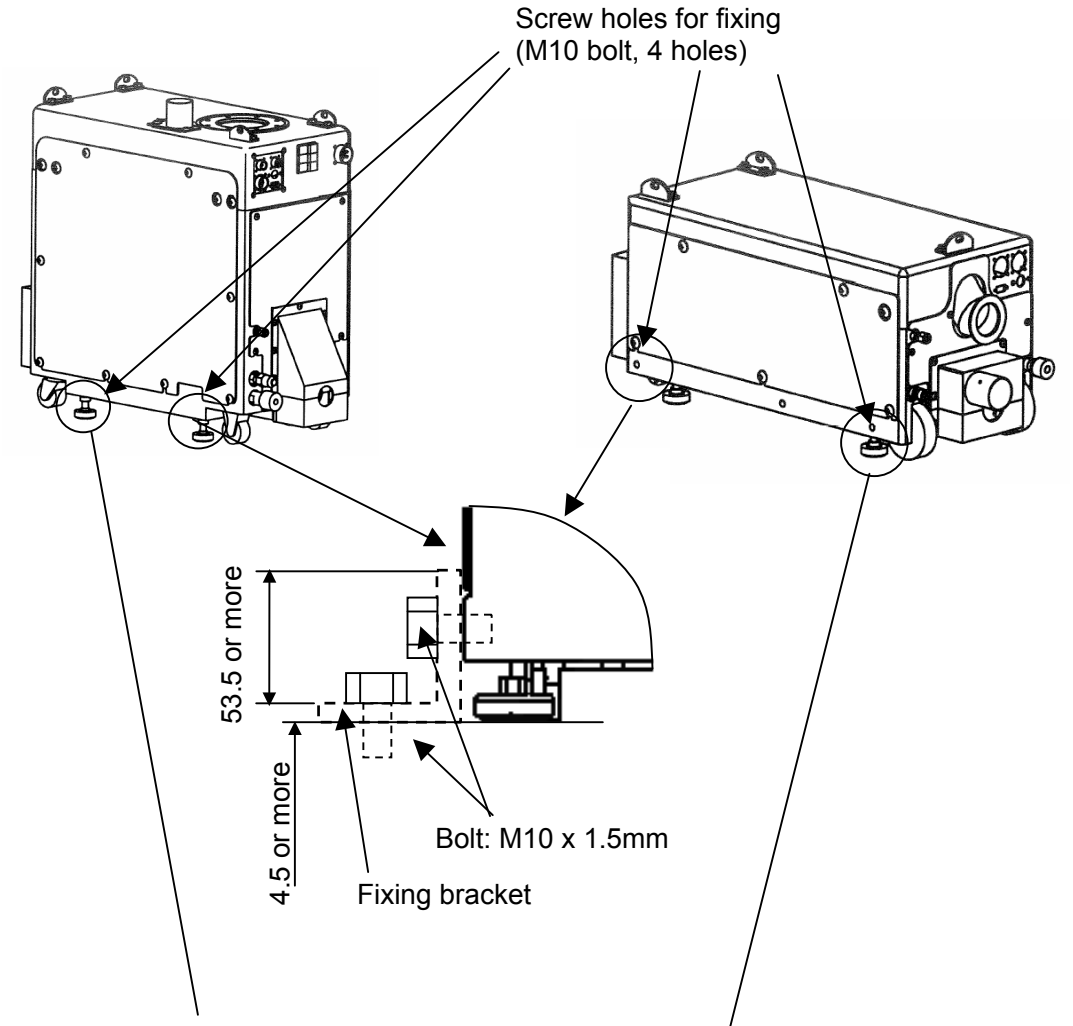
3. INSTALLATION

3-4. Installation Procedure (continued)

3-4-3. Fixing method

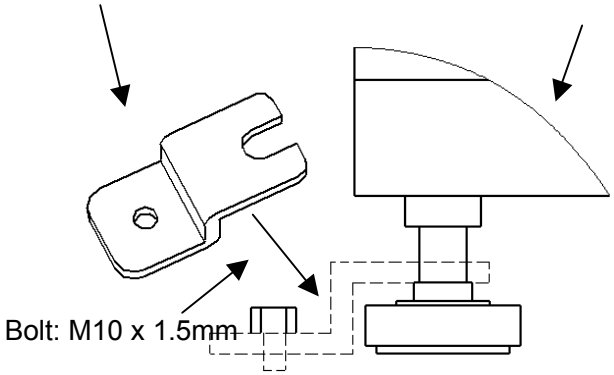
- Fixing to equipment

  Fix the pump to equipment using the fixing bracket like the following figure.



- Fixing to the floor

  Fix the adjusters' feet to the floor using the fixing bracket like the following figure.



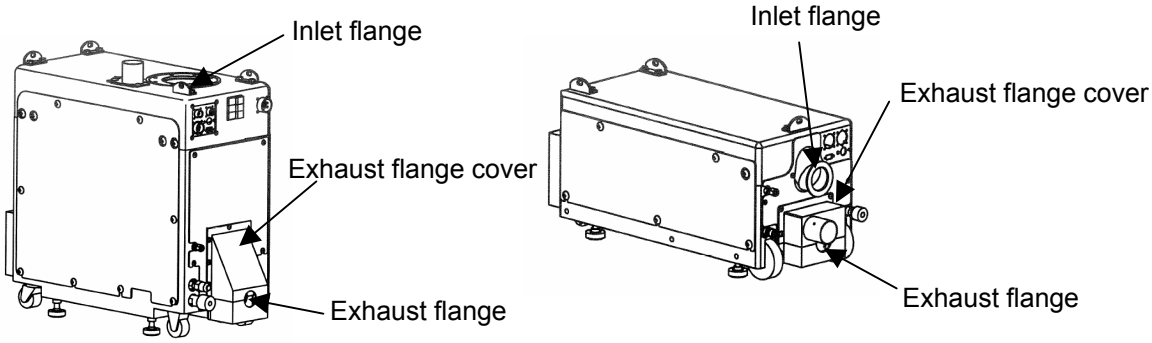
3. INSTALLATION

3-5. Piping

Specifications for the vacuum pump inlet and outlet are as listed below.

Connect them using appropriate vacuum parts.

Exhaust flange has a cover to prevent gas leakage at the outlet. The cover should be used after connecting the pipes.



	T1800	T1200, T1000	T600	T100P
Inlet Flange	ISO160 Bolted	ISO100 Bolted	ISO100 Bolted (Option NW80)	NW50
Exhaust Flange	NW40	NW25	NW25	NW25

Set piping heater or trap appropriately depending on type of process.

> WARNING
>
> Remove blank caps from the inlet and outlet of the pump. These protect the pump from contamination during transportation or storage. It is dangerous to leave them when operating the pump.

> WARNING
>
> Check if the vacuum accessory connected to the pump inlet can withstand 0.1MPa negative pressure against the atmospheric pressure.

> WARNING
>
> When using hazardous, flammable, or pyrophoric gases, please do not connect the secondary evacuation in the same exhaust line as the pump exhaust.

3. INSTALLATION

3-5. Piping (continued)

WARNING

Use an O ring for seal, which is compatible with process gas.

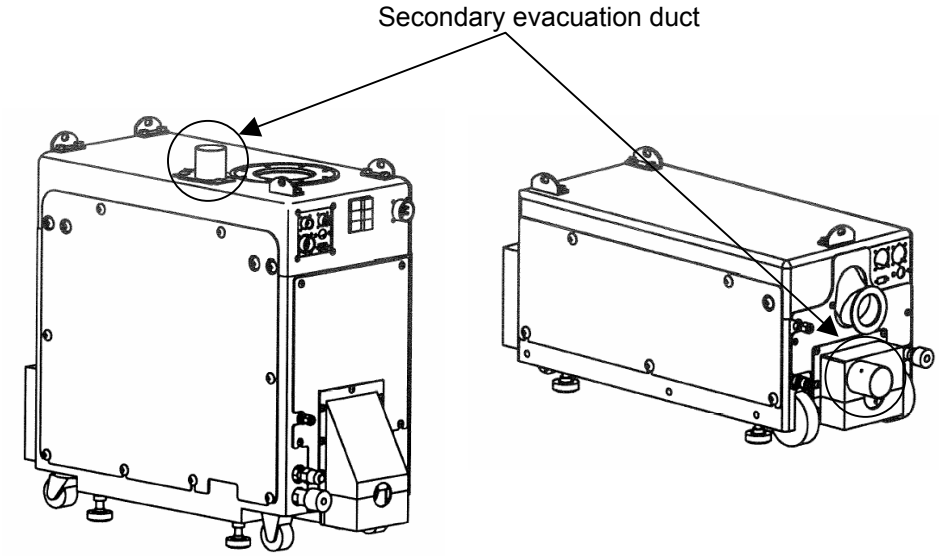
Check for leakage under vacuum after all pipes have been connected.

In case of leak checking with positive pressure, conduct leak check under pressure less than 0.02 MpaG.

- Secondary evacuation duct: Ø50mm

Secondary evacuation duct is provided on the pump enclosure.

Secondary evacuation should be implemented to prevent process gas leakage.



WARNING

In the worst case, gas leak from T1800, T1200,T1000, T600, T100P is possible. Please connect suitable secondary ventilation and set up exhaust monitoring switch on secondary evacuation duct according to SEMI F15 standard. Setting up of gas detector on the secondary exhaust line is recommended according to types of process gas.

3. INSTALLATION

3-6. Power Supply

3-6-1. Precautions

Connection of main power cable to the equipment must be performed by a qualified person.

With regard to the wiring method, careful study of power supply cord/cable is described in the NEC (National Electric Code) article 400. Consider your installation and usage.

Until all electrical connections are completed, keep the main switch OFF.

Electrical connections required for operation of internal parts are done at the factory before shipment.

An electronic circuit in the pump automatically corrects any power phase deviation.

3-6-2. Power supply standard

For the power source, see the table below.

Item	T1800, T1200, T1000, T600	T100P
Number of phases	3	
Voltage	208 V (acceptable range of variation: ±10%)	
Frequency	50/60 Hz	
Rated current	24A	12A
Max. power capacity	9.2 kVA	4.6 kVA
Cable outside diameter	AWG10/4 UL Style 2517	AWG14/4 UL Style 2587/2501
Conductor diameter	5.26 mm^2 and above	2.08mm^2 and above
Material of conductor	Copper	

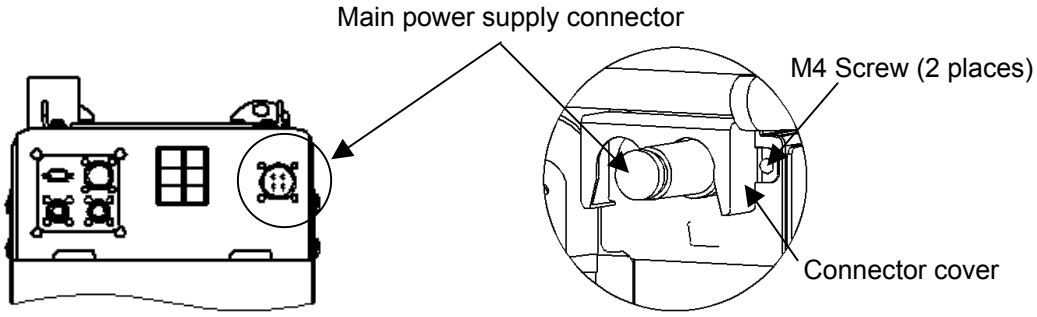
3. INSTALLATION

3-6. Power Supply (continued)

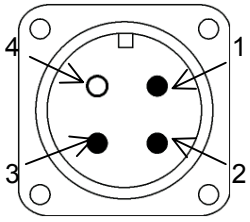
3-6-3. Electrical connection method

Location of power connector is shown below.

Connect the plug to the main power supply connector on the rear panel and fix by turning it clockwise. In case of T100P, install the connector cover with two M4 screws over the main power supply connector.



T1800,T1200, T1000, T600 T100P



No	Phase
1	L1
2	L2
3	L3
4	GND

Front view of main power supply connector

Connector Table

	T1800, T1200, T1000, T600	T100P
Receptacle	CE05-2A22-22PD-D	CE05-2A18-10PD-D
Female Plug	CE05-6A22-22SD-D-BSS	CE05-6A18-10SD-D-BSS
Clamp for Plug	CE3057−12A−X−D	CE3057−10A−X−D

Manufacturer: DDK

3. INSTALLATION

3-7. Signal

3-7-1. General

T1800, T1200,T1000, T600, T100P can be connected to equipment via SPI (Smart Pump Interface).

1. Remote operation by start signal from the equipment.
2. Output of operation condition (Run/Stop, Warning, Hazard, N2 flow failure)
3. Output of final valve interlock signal (Interlock signal for process gases)
4. Control of motor revolution speed

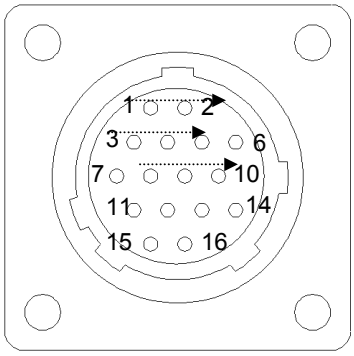
In addition, monitoring detailed information of pump is also possible by utilizing a monitoring system (option) using the external monitor output.

WARNING	Perform proper handling from the equipment according to signal outputs from pump.

WARNING	When the final valve interlock signal is generated, close the valve and stop the flow of process gases.

3-7-2. SPI signal wiring

The SPI connector is located on the rear panel of the pump.



Front view of SPI connector

	For all Models
Receptacle	CPC 206036-1
Female Plug	CPC 206037-1
Clamp for plug	206070-1
Pin for plug (Solder)	202237-1

Manufacturer: Tyco Electronics AMP

WARNING	Rated value of dry contact output of SPI is DC24V and 0.2A. If a voltage or current exceeding these values is supplied, the electronic circuits may be damaged.

3. INSTALLATION

3-7. Signal (continued)

3-7-3. SPI pin assignment

Function	Pin No.	Signal	Dry contact state	IN/OUT
Pump ON/OFF	1 2	COM Signal	• Pin 2 DC0V: Pump Off • Pin 2 DC24V Pump On	IN
Pump running	3 4	Signal COM	• Contact CLOSE: Pump On • Contact OPEN: Pump Off	OUT
DC24V Output(Option)	5 6	+24V COM	• DC +24V is always on when pump has power and circuit protector for 24V is on. *	OUT
Warning	7 8	Signal COM	•Contact CLOSE: Normal •Contact OPEN: Warning	OUT
Hazard	9 10	Signal COM	•Contact CLOSE: Normal •Contact OPEN: Hazard	OUT
N2 purge flow	11 12	Signal COM	•Contact CLOSE: N2 purge flow is correct. •Contact OPEN: N2 purge flow is low.	OUT
Final valve interlock	13 14	Signal COM	•Contact CLOSE: Pump ON And N2 flow is correct. •Contact OPEN: Pump off Or N2 flow is low. Or Dry pump temperature is lower than 120 °C when TempLowInterLock is activated.	OUT
Rotation speed	15 16	Signal COM	• DC: 0V: T1800,T1200,T1000 :MB 5750 rpm T600 :MB 5250 rpm T100P :DP 5250 rpm (Max rotation speed of T1000 and T600 can be changed via Handheld controller.) • DC: 10V: T1800,T1200,T1000: MB 3000 rpm T600 : MB 2500 rpm T100P : DP 1000 rpm	IN

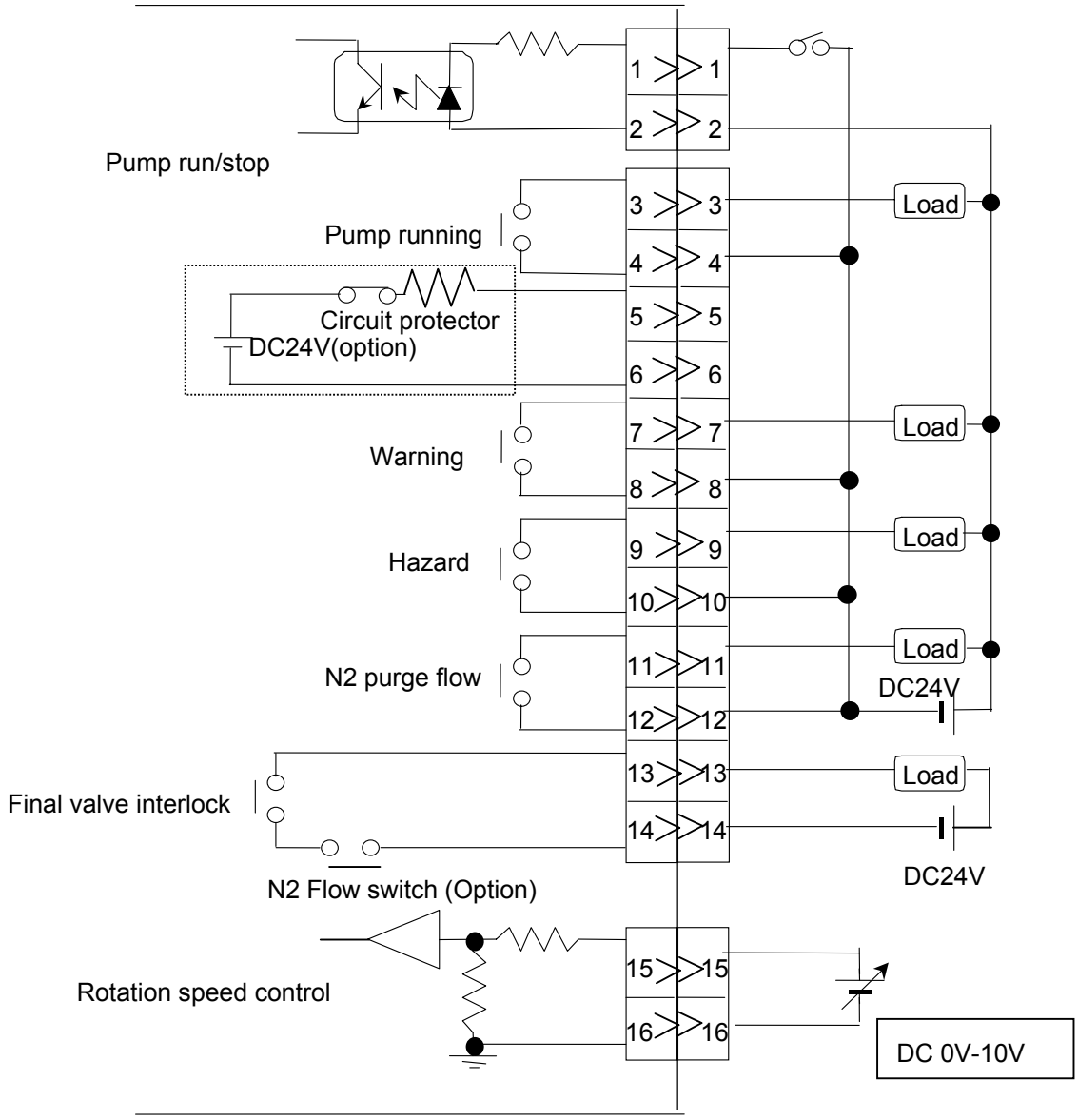
* DC+24V (option) can be utilized to operate the pump if process tool does not supply DC+24V to start or stop the pump.

Pump status	SPI contacts				
	3-4	7-8	9-10	11-12	13-14
Pump running	Close	Close	Close	Close	Close
Pump stopped	Open	Close	Close	Open	Open
Pump running + Warning	Close	Open	Close	Close	Close
Pump stopped + Hazard	Open	Close	Open	Open	Open
N2 purge low Warning	Close	Open	Close	Open	Close
N2 purge low + N2 interlock activated	Close	Open	Close	Open	Open
Power Off	Open	Open	Open	Open	Open

3. INSTALLATION

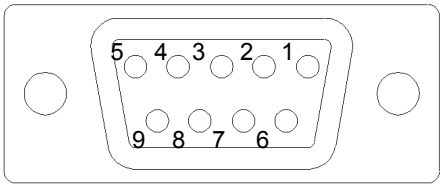
3-7. Signal (continued)

3-7-3. SPI pin assignment (continued)



3-7-4. External monitor output

The D-sub 9 pin female connector is located on the rear side of the pump for a pump monitoring system (option).



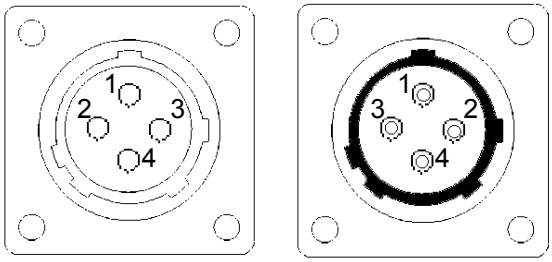
Front view of connector

3. INSTALLATION

3-7. Signal (continued)

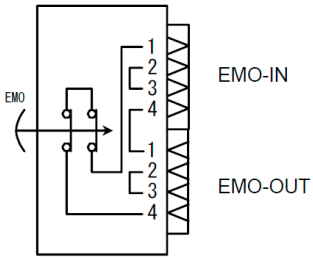
3-7-5. EMO connection (T1800,T1200,T1000, T600)

The EMO connector is located on the rear panel of the pump.

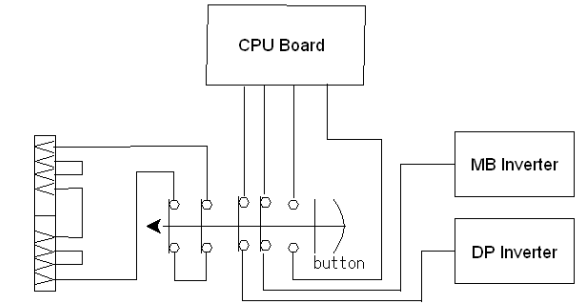


EMO-IN AMP:206061-1

EMO-OUT AMP:206430-1



EMO circuit (option)



OR E-Stop Circuit (option)

	EMO-IN	EMO-OUT
Receptacle	CPC 206061-1	CPC 206430-1
Female Plug	CPC 206060-1	CPC 206429-1
Clamp for plug	206062-1	206062-1
Pin for plug (Solder)	202237-1	202236-1

Manufacturer: Tyco Electronics AMP

> ⚠ The EMO button will not function independently. (A pump doesn't stop even if the EMO button is pushed.) The button is to be used as a part of an installed EMO device. Please incorporate it into an overall equipment emergency off system.

3. INSTALLATION

3-8. Cooling Water

3-8-1. Cooling water characteristics

Use cooling water with the following characteristics in order to prevent clogging and corrosion.

Type	Treated soft water or non-corrosive industrial water
Flow rate	3.0L/min and above
Water temp.	10°C to 25°C
Pressure	300 to 700 kPaG
IN/OUT P. difference	0.2 MPa and above
Particle size	0.03 mm^2 and below
pH value	6.0 ～ 8.0
Electric conductivity	500$\mu\Omega^{-1}$/cm and below
Chlorine ion, Cl^-	80ppm and below
Sulfate ion, SO_4^{2-}	200ppm and below
Total iron, Fe	0.3ppm and below
Alkalinity, $CaCO_3$	75ppm and below
Total hardness, $CaCO_3$	120ppm and below
Sulfur ion, S^{2-}	Shall not be detected.
Ammonium ion, NH_4^+	Shall not be detected.
Silica, SiO_2	50ppm and below
Manganese	0.2ppm and below

WARNING

If water having the above particle size is not available, install a filter on the IN side of the cooling water circuit. At this time, attention shall be paid so that the cooling water pressure does not drop below the specified range.

CAUTION

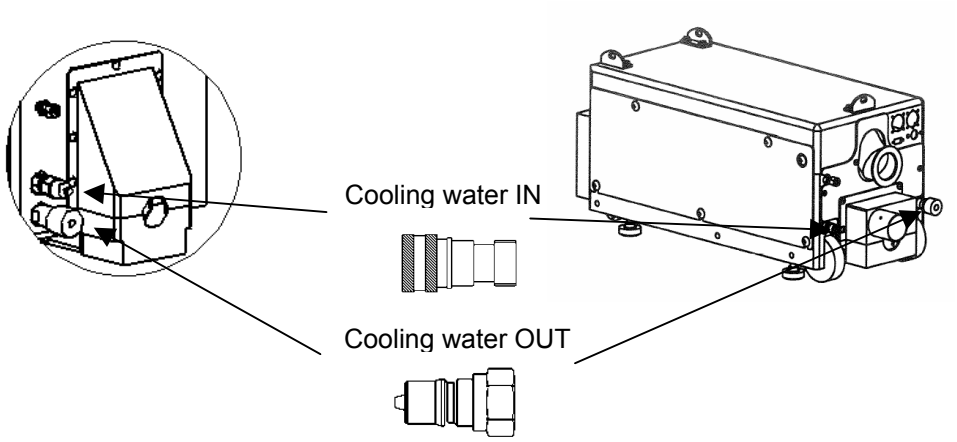
Do not let water flow until immediately before starting the pump. Opening the cooling water valve allows cooling water to flow through the electrical components and pump. If cooling water flows for a long time while the pump is stopped, condensation may occur in the electrical parts, causing short-circuiting.

3. INSTALLATION

3-8. Cooling Water (continued)

3-8-2. Connection to the cooling circuit

Using the coupling shown below, connect the pump to the cooling water.



Location	T1800, T1200, T1000, T600	T100P
Cooling water supply side	BH3-60 Brass (Option:SH3-62 SUS)	BH2-60 Brass (Option SH2-62 SUS)
Cooling water outlet side	BH3-61 Brass (Option:SH3-63 SUS)	BH2-61 Brass (Option SH2-63 SUS)

Manufacturer: Parker

WARNING

When multiple pumps are used at a time, connect the cooling water piping in parallel. If connected in series, malfunctions may occur because of high cooling water temperature of the downstream pump.

WARNING

Connect IN and OUT correctly. Otherwise, the pump will not be cooled down correctly, resulting in a problem.

CAUTION

To remove cooling water, wait until the pump is cooled down after the pump is stopped.

Install the drain tray under the pump in preparation for the cooling water leakage to comply with standard SEMI-S2 0200.
Installing a water leak detector is recommended.

3. INSTALLATION

3-9. N2 Purge

3-9-1. N2 purge characteristics

N2 purge shall have following characteristics.

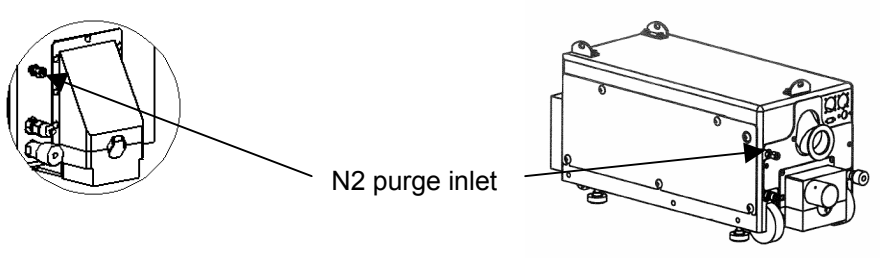
Type	Characteristics
Condensation point	22°C
Dust	1 µm or less
Oil	0.1 ppm or less
Pressure	0.3 to 0.7 MPaG (43 to101 PSIG)
Flow rate	0 to 50 SLM

N2 purge flow shall be appropriate according to the process to be used.

3-9-2. Connection of N2 purge

Connection type: 1/4 inch compression fitting

Connect a tube to the N2 purge inlet and fasten with a nut.



> ⚠ When connecting a tube, cut it at a right angle and remove any burrs from the edge.

3. INSTALLATION

3-9. N2 Purge (continued)

3-9-3. Valve mode

T1800, T1200,T1000, T600, T100P are provided with N2 valve and there are 3 modes for operation.

Selection can be made using the hand-held controller.

Mode	Operation
AUTO （Default）	Before starting operation: N2 valve is closed and N2 purge to the pump is not executed. When starting operation: N2 valve is opened and N2 purge starts. During operation stop: N2 valve is kept open during the set periods of time for N2 purge prolong, and N2 purge is executed. When the set periods of time for prolong is exceeded, N2 valve is automatically closed and N2 purge stops. Energy-saving effect is expected by stopping purge while the pump stops. When ExhaustPressH Hazard occurs, N2 valve is automatically closed to prevent increase of internal pressure.
ON	When the main switch is ON, N2 valve is always open and N2 purge is executed. When ExhaustPressH Hazard occurs, N2 valve is kept open.
OFF	N2 valve is always closed and N2 purge to the pump is not executed.

When the main switch is OFF, N2 valve is closed regardless of the valve mode.

3. INSTALLATION

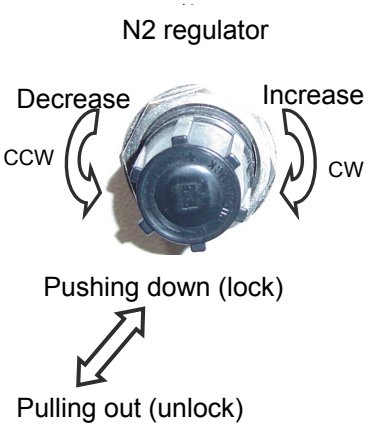
3-9. N2 (continued)

3-9-4. Adjustment of N2 purge

N2 flow can be adjusted by manipulating the N2 regulator on the front side of the pump.

Flow setting shall be performed after the pump running becomes stable.

1. Check that the N2 supply pressure is appropriate.
2. Check that the pump is running under stable condition.
3. Pull the knob to unlock.
4. Turn the knob from side to side to adjust the flow. The flow can be confirmed on the hand-held controller.
5. Push down the knob to lock.



3-9-5. Setting of N2 flow switch

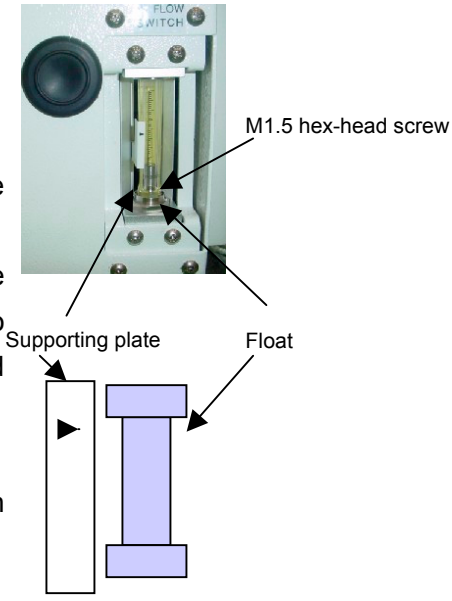
N2 flow switch (option) outputs mechanical relay signal and is connected to the final valve interlock circuit. If N2 flow is lower than the setting under the appropriate condition, the interlock stops the flow of process gases.

(When the N2 flow switch is activated, the pump does not produce Warning or Hazard but outputs the interlock signal to the equipment.)

Setting value shall be determined in consideration of fluctuation of N2 supply pressure to N2 purge flow.

Confirm that N2 supply pressure is appropriate.

1. Check that the pump is running under stable condition.
2. Manipulate the regulator to adjust N2 purge flow to the setting value. Adjust the height of supporting plate to the float position. (N2 purge flow can be confirmed on the hand-held controller.)
3. Remove the cover and loosen the hex-head screw.
4. Set the height of supporting plate in accordance with the height of float as shown on the right.



3. INSTALLATION

3-9. N2 (continued)

3-9-5. Setting of N2 flow switch(continued)

5. Tighten the hex-head screw and close the cover.
6. Manipulate the regulator and set the N2 purge flow to the original setting.

3. INSTALLATION

3-10. Operation Condition Setting

> ⚠ Before starting process, set the operation condition in accordance with your process condition. Running the pump under inappropriate condition does not secure the performance and reliability.

3-10-1. Default setting

	Method of setting	Default
Process Mode	Handheld controller	STANDARD
Selection of TempLowInterLock §	Handheld controller	NO
Revolution speed (T1000 , T600 booster / T100P dry pump)	Remote: External signal by SPI Local: Hand-held controller	5750rpm(T1800,T1200, T1000), 5250rpm(T600, T100P)
Revolution speed (T1000, T600 dry pump) §	Hand-held controller	5250rpm
Max revolution speed (booster) §	Hand-held controller	5750rpm(T1800, T1200,T1000) 5250rpm(T600)
Min revolution speed (booster) §	Hand-held controller	3000rpm(T1800, T1200,T1000) 2500rpm(T600)
Pump temperature setting	Hand-held controller	100ºC
N2 purge flow	Regulator	-
N2 valve control mode	Hand-held controller	AUTO
N2 purge prolong	Hand-held controller	30min
N2 warning	Hand-held controller	30slm
N2 purge flow switch setting (Option)	N2 purge flow switch (Option)	20slm
Maintenance warning	Hand-held controller	9000Hr
Temperature indication unit	Hand-held controller	ºC
Pressure indication unit	Hand-held controller	hPa
Buzzer	Hand-held controller	On
Selection of output signal for abnormal exhaust pressure	Hand-held controller	Hazard
Selection of output signal for pressure sensor failure	Hand-held controller	Warning
Selection of output signal for N2 flow sensor failure	Hand-held controller	Warning
Booster Hazard Temperature §	Hand-held controller	105 ºC
Selection of warning detection of abnormal booster temperature	Hand-held controller	YES
Cool-down running mode when stopping pump	Hand-held controller	OFF
Communication method	Hand-held controller	RS232
Monitoring ID	Hand-held controller	00

3. INSTALLATION

3-10. Operation Condition Setting (continued)

3-10-1. Default setting (continued)

§ These items can be set through changing Process Mode. (T1000, T600)

As for the settings by the hand-held controller, refer to “4. OPERATION”.

3. INSTALLATION

3-10. Operation Condition Setting (continued)

3-10-2. Setting items

1. Process Mode (T1000 and T600 only)

   Changing Process Mode for special process will make setting items set at once and increases settable items.

   Contact your service representative when changing Process Mode.

T1000 Process Mode List

Mode		STANDARD	CUSTOM	HIGH TEMP	HIGH FLOW	EPI
Password		783	—	48367	43569	374
TempLow InterLock	Default	OFF	OFF	ON	OFF	OFF
	ON/OFF	Not Changeable	Changeable	Changeable	Not Changeable	Not Changeable
Booster Revolution Speed	Default	5750	5750	5750	2000	3800
Min Booster Revolution Speed	Default	3000	3000	3000	2000	3000
	2000-3000	Not Changeable	Changeable	Not Changeable	Changeable	Not Changeable
Dry Pump Revolution Speed	Default	5250	5250	5250	5250	6000
Max Dry Pump Revolution Speed	Default	5250	5250	5250	5250	6000
	5250-6000	Not Changeable	Changeable	Not Changeable	Not Changeable	Changeable
Booster Hazard Temperature	Default	105	105	105	105	150
	105-160	Not Changeable	Changeable	Not Changeable	Not Changeable	Changeable
Dry Pump Temperature	Default	100	100	130	120	130
Booster Temp Warning	Default	ON	ON	ON	OFF	OFF

3. INSTALLATION

3-10. Operation Condition Setting (continued)

3-10-2. Setting items (continued)

1. Process Mode (T1000 and T600 only) (continued)

T600 Process Mode List

Mode		STANDARD	CUSTOM	HIGH FLOW
Password		783	—	43569
TempLow InterLock	Default	OFF	OFF	OFF
	ON/OFF	Not Changeable	Changeable	Not Changeable
Booster Revolution Speed	Default	5250	5250	5750
Max Booster Revolution Speed	Default	5250	5250	5750
	5250-6000	Not Changeable	Changeable	Changeable
Min Booster Revolution Speed	Default	2500	2500	2500
	2000-2500	Not Changeable	Changeable	Not Changeable
Dry Pump Revolution Speed	Default	4500	4500	6000
Max Dry Pump Revolution Speed	Default	4500	4500	6000
	4500-6000	Not Changeable	Changeable	Changeable
Booster Hazard Temperature	Default	105	105	150
	105-160	Not Changeable	Changeable	Changeable
Dry Pump Temperature	Default	100	100	130
Booster Temp Warning	Default	ON	ON	OFF

3. INSTALLATION

3-10. Operation Condition Setting (continued)

3-10-2. Setting items (continued)

2. TempLowInterLock (T1000, T600)
   This item can be changed when process mode is set to CUSTOM or HIGH TEMP mode. When this item is set to "YES", SPI Final Valve Interlock signal（SPI pin 13/14） stays "OPEN" during warm up. [It will close when pump temperature reaches to (Pump setting temperature – 10ºC).]
   During warm up, Handheld controller shows "<WARM UP>".
3. Pump revolution speed (T1800, T1200, T1000, T600 mechanical booster , T100P dry pump)
   Revolution speed of booster motor and dry pump motor can be set. By changing the revolution speed, ultimate pressure and pumping speed can be changed.（Revolution speed of dry pump of T1800/T1200/T1000/T600 is always stable, 5250 rpm, and cannot be changed by this item.）
4. Dry Pump revolution speed (T1000, T600)
   Revolution speed of dry pump motor can be changed when process mode is set to CUSTOM, EPI(T1000), CUSTOM or HIGH FLOW(T600).
5. Maximum Mechanical Booster revolution speed (T600 only)
   Revolution speed of booster motor of T600 can be set up to 6000rpm if CUSTOM or HIGH FLOW process mode is selected.
6. Minimum Mechanical Booster revolution speed (T1000, T600)
   Revolution speed of booster motor of T1000/T600 can be set to minimum 2000rpm if CUSTOM, HIGH FLOW(T1000), CUSTOM(T600) process mode is selected.
7. Dry Pump temperature setting
   Temperature of dry pump body can be controlled by the cooling water control.
   Control of dry pump temperature prevents byproduct deposition inside the pump.
   Setting temperature may vary according to the process condition.
8. N2 purge flow
   Dilution of process gases and N2 purge flow used for shaft sealing can be adjusted.
   Optimizing the amount of N2 purge prevents byproduct deposition inside the pump and discharges foreign materials.
   The amount of purge may vary according to the process condition.
9. N2 valve control mode
   N2 purge valve inside the pump can be controlled.
   Refer to "3-9-3 Valve mode".

3. INSTALLATION

3-10. Operation Condition Setting (continued)

3-10-2. Setting items (continued)

10. N2 purge prolong

    When N2 valve mode is “AUTO”, time to open the N2 valve after the pump stop can be set. Setting appropriate value, provides purging of internal process gases with N2 after the pump stop, and the operating life and restarting performance are improved. In addition, as the N2 purge prolong time is controlled, energy-saving effect is expected.

11. N2 purge warning

    Threshold level for N2 flow warning (for N2 flow sensor) can be set.

    The N2 purge flow shall be set according to each process. Also, fluctuation of N2 pressure shall be taken into consideration to determine the setting value.

12. N2 purge flow switch setting (Option)

    Threshold level for interlock output for N2 purge flow (for N2 flow switch) can be set.

    The N2 purge flow shall be set according to each process. Also, fluctuation of N2 pressure shall be taken into consideration to determine the setting value.

13. Maintenance warning

    Maintenance warning output for total running hour (Total Run Hour) can be set.

    Maintenance time shall be set according to your application.

14. Temperature indication unit

    Unit of temperature indicated on the hand-held controller can be set (Celsius or Fahrenheit).

15. Pressure indication unit

    Unit of pressure indicated on the hand-held controller can be set.

    Selectable units are hPa, Torr, and PSI.

16. Buzzer

    Buzzer sound at the time of Alarm (Warning or Hazard) can be set to ON or OFF

17. Selection of output signal for abnormal exhaust pressure

    Alarm output at the time of the occurrence of abnormal exhaust pressure can be selected.

    Hazard: Warning is generated when abnormal exhaust pressure occurs (pump is still running). If the abnormality continues, Hazard is generated (pump stops).

    Warning: Only Warning is generated at the time of abnormal exhaust pressure, and

3. INSTALLATION

3-10. Operation Condition Setting (continued)

3-10-2. Setting items (continued)

Hazard does not occur.

Not Applicable: No alarm is generated at the time of abnormal exhaust pressure.

3. INSTALLATION

3-10. Operation Condition Setting (continued)

3-10-2. Setting items (continued)

18. Selection of output signal for pressure sensor failure
    Alarm output at the time of exhaust pressure sensor failure can be selected.
    Hazard: Warning is generated when exhaust pressure sensor failure occurs (pump is still running). If the failure continues, Hazard is generated (pump stops).
    Warning: Only Warning is generated at the time of exhaust pressure sensor failure, and Hazard does not occur.
    Not Applicable: No alarm is generated at the time of failure of pressure sensor.
19. Selection of output signal for N2 flow sensor failure
    Alarm output at the time of N2 flow sensor failure can be selected.
    Hazard: Warning is generated when N2 flow sensor failure occurs (pump is still running). If the failure continues, Hazard is generated (pump stops).
    Warning: Only Warning is generated at the time of N2 flow sensor failure, and Hazard does not occur.
    Not Applicable: No alarm is generated at the time of failure of N2 flow sensor.
20. Mechanical booster Hazard Temperature (T1000, T600)
    Mechanical booster Hazard temperature can be changed if process mode CUSTOM, EPI(T1000) or CUSTOM(T600) is selected.
21. Selection of warning detection of abnormal booster temperature
    Presence/absence of warning for booster temperature can be selected.
    YES: Warning will occur at 90ºC booster temperature. Hazard will occur at setting value (default: 105ºC).
    NO: Hazard will occur at setting value (default: 105ºC).
22. Cool-down running mode when stopping pump
    Prolonged cool-down running modes can be selected.
    TEMP: Pump will slow down and continue to run until the temperature become low or maximum time is elapsed.
    TIME: Pump will slow down and continue to run until specified time is elapsed.
    OFF: Pump will not perform prolonged cool-down running.
23. Communication method
    Communication method of external monitoring output can be set.
    Selectable item is RS232C or RS485. The setting is for the pump monitoring system (option). If the option is not selected, do not change the setting.
24. Monitoring ID
    The setting is for the dry pump monitoring system (option). If the option is not selected, do not change the setting.

3. INSTALLATION

3-10. Operation Condition Setting (Continued)

3-10-3. Guide of operation condition

According to the type of process, perform proper settings of pump temperature and N2 purge flow rate. As for the settings of N2 warning and N2 interlock, settings shall be made in accordance with the stability of supplied N2 for set N2 flow.

＜Reference operation conditions＞

Process	Pump setting	
	Temp.	N2 purge flow rate
LP-CVD (Silicon Nitride)	120 ºC	50 slm
PE-CVD (Silicon Nitride)	120 ºC	50 slm
SA-CVD (BPSG,BSG,PSG)	120 ºC	50 slm
Metal-CVD (W,SiH4)	90 ºC	35 slm
Metal-Etch (Al)	120 ºC	50 slm
Epitaxial Silicon (Epi)	130 ºC	50 slm

∗ Above values are references. If you have any questions, please contact your service representative.

3-11. Storage Condition

1. If the pump is used for process, run the pump with N2 purge from the process chamber for more than 30 minutes so that process gases are exhausted.
2. Cap the inlet and outlet ports so that the sealed condition can be kept.
3. Use the adjuster so that the pump can be fixed and does not move.
4. Keep the pump within the permissible temperature range between −10°C and +60°C.
5. Keep the pump clean and dry for next usage.

WARNING

Never stack the pumps for storage. Pumps may fall.

4. Operation *Page*

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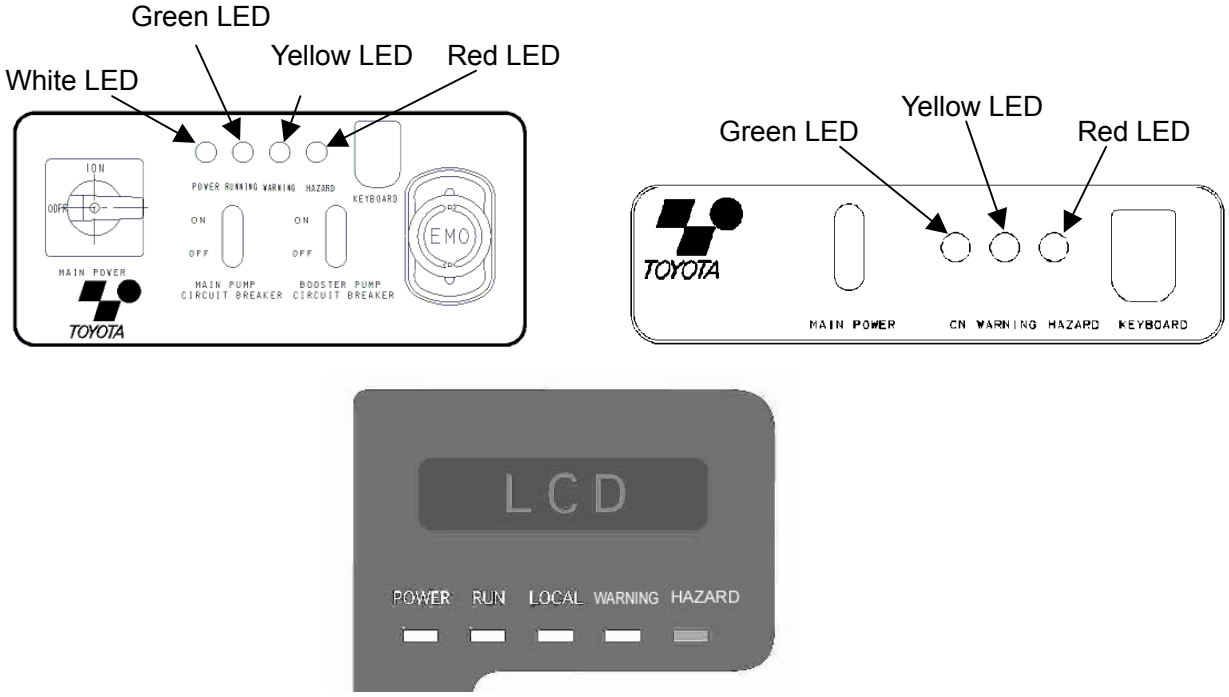
4.OPERATION

4-1. Indicator

On the front panel there are indicator LEDs that display the pump operating status.

Also, the hand-held controller is provided with indicator LEDs that display the pump operating status.

The indicator LEDs light up or go off according to the pump operating status when the pump main switch is ON.



Handheld Controller

Indicator LEDs ON and pump status

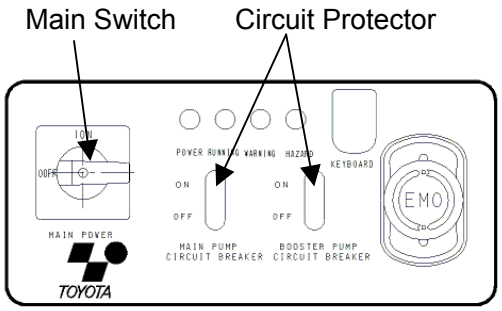
Pump status	LED		Hand-held Controller
	T1800 T1200 T1000 T600	T100P	
Pump Main Switch ON	White	Green	Power ON
Pump Running	Green	—	RUN ON
Warning is occurring. Pump keeps running. A buzzer sounds.	Yellow		WARNING ON
Hazard is occurring. The pump stops automatically. The pump cannot be restarted until the hazard is resolved and alarm is reset. A buzzer sounds.	Red		HAZARD ON
Local mode	—		LOCAL ON

4. OPERATION

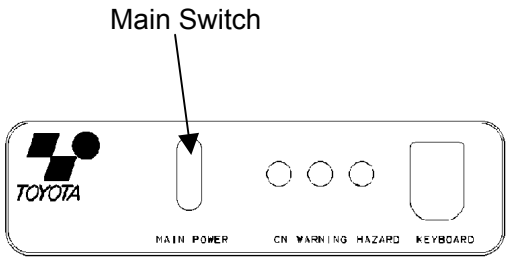
4-2. Main Switch

4-2-1. Power ON

- The main switch is located on the front panel.
- Make sure that the circuit protectors are ON. (Both circuits in case of T1800 T1200, T1000 and T600)
- When the main switch is turned ON, a white indicator LED (T1800,T1200, T1000, T600) or a green indicator LED (T100P) lights up.
- When the hand-held controller is in use, the POWER indicator LED lights up.



T1800, T1200, T1000, T600



T100P

> ⚠ To push the circuit protector (T1800, T1200, T1000, T600) or the main switch (T100P), do not use any object with a sharp point.

4. OPERATION

4-2. Main Switch (continued)

4-2-2. Power OFF

- Make sure that the pump stops.
- Turn OFF the main switch.
- The white indicator LED (T1800, T1200, T1000, T600) or the green indicator LED (T100P) goes off.

When unplugging the power connector, make sure that the main switch and main disconnect device are turned off.

When turning on the main switch again after turning it off, it is necessary to discharge inverter DC condenser. (Wait for more than 30 seconds after turning it off.) If the discharge is not enough, FC Alarm occurs and the pump does not run. In this case, turn the main switch off and wait for more than 30 seconds, before turning the main switch on again.

4. OPERATION

4-3. Operation Modes

The pump has the following operation modes:

- Remote mode using the SPI (Smart Pump Interface) of host systems
- Local mode using the hand-held controller

The following instructions can be issued via the SPI connector.

- Starting and stopping
- Control of motor revolution
- Monitoring of dry contact output status

The following operations can be performed using the hand-held controller:

- Start and stop of the pump (in local mode only)
- Setting and change of pump operation parameters (in local mode only)
- Checking the Alarm Log
- Stop of buzzer when Alarm occurs
- Reset of system when Alarm occurs

Operation when the pump starts

1. Motor revolution starts.
2. Signals from the sensor are processed and detections of abnormality starts.
3. N2 valve is opened and N2 purge starts. (When AUTO is selected for N2 purge mode.)
4. Total Run Hour count and Integral power consumption starts.

Operation when the pump stops(Cool-down running mode OFF)

1. Motor stops. (Slow stop) While the pump stops, RUN indicator LED blinks.
2. Various data counting stops.
3. When N2 prolong set time is past, N2 valve is closed and N2 purge stops.
   （When AUTO is selected for N2 purge mode. However, when Hazard such as ExhaustPressH occurs, N2 valve is automatically closed to prevent internal pressure from rising.）

4. OPERATION

4-3. Operation Modes (continued)

Operation when the pump stops(Cool-down running mode ON)

1. Motor speed down. (until reach setting temp or time.)

   While the motor speed down, RUN indicator LED blinks and buzzer on.

2. Motor Stops.

4. OPERATION

4-4. SPI (Smart Pump Interface) Operation

4-4-1. SPI connection

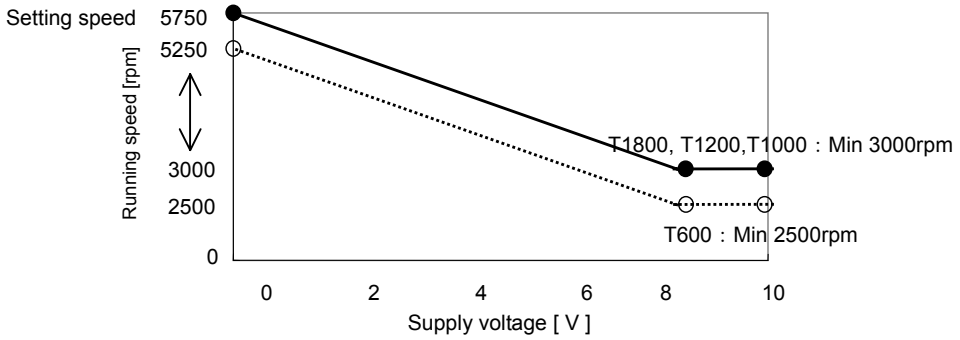
The SPI connector is located on the rear panel of the pump.

Connect and fix the SPI cable of the equipment to the SPI connector.

> CAUTION
>
> Rated value of dry contact output of SPI is DC24V and 0.2A. If a voltage or current exceeding these values is supplied, the electronic circuits may be damaged. Check that SPI output is within the above range.

4-4-2. Adjustment before SPI operation (T1800, T1200, T1000, T600)

- Apply 0 to 10 VDC voltage between SPI connector pins 15 and 16 to adjust the Booster Pump revolution.
- The Booster Pump revolution decreases as the voltage is increased between 0 VDC (5750 rpm T1000) and 8 VDC (3000 rpm T1000) while it remains constant at voltages between 8 VDC and 10 VDC.
- If no voltage is set between pins 15 and 16, the pump operates at default speed.

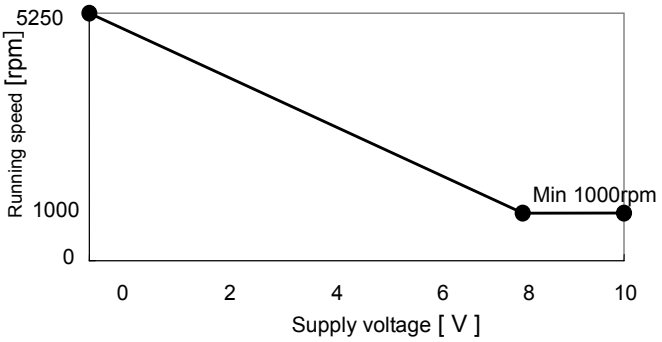


4. OPERATION

4-4. SPI (Smart Pump Interface) Operation (continued)

4-4-3. Adjustment before SPI operation (T100P)

- Apply 0 to 10 VDC voltage between SPI connector pins 15 and 16 to adjust the Dry Pump revolution.
- The Dry Pump revolution decreases as the voltage is increased between 0 VDC (5250 rpm) and 8 VDC (1000 rpm) while it remains constant at voltages between 8 VDC and 10 VDC.
- If no voltage is set between pins 15 and 16, the pump operates at 5250rpm.



4-4-4. SPI operation

Start of pump：Apply 24 VDC voltage between pins 1 and 2 to start the pump.
（Pin 1:Common, Pin 2:+24V）
Stop of pump：When the voltage between pins 1 and 2 becomes 0 VDC (voltage supply shut off), the pump stops.

> CAUTION
> When Alarm occurs, Alarm Reset cannot be executed from SPI. To achieve this, turn off the main switch and execute Alarm Reset. (To turn on the main switch again after turning it off, wait for more than 30 seconds.)

4. OPERATION

4-5. Hand-held Controller Operation

4-5-1. Hand-held controller connection

Connect the connector of the hand-held controller provided to the connector identified as KEYBOARD on the front panel of the pump.

4-5-2. Key functions

Key	Explanation	Function
	SET key	•Pressing this key on parameter set screen enters currently selected parameter.
	RUN key	•Starts pump.
	STOP key	•Stops pump. •Pressing this key in stop condition changes Operation mode. (Remote→Local)
	Buzzer stop Alarm Reset key	•Stops buzzer. •Resets Alarm.
	Menu Select key	•Goes to menu (Main, Detail, Setting). •Moves highlighted position to right in setting mode.
	Parameter Select key	•Changes indication items. •Changes digit at setting mode.

4-5-3. Hand-held controller operation

Make sure that the system is in local mode.

Start of pump ：Press the RUN key.

Stop of pump：Press the STOP key.

Alarm Reset ：When the cause of Alarm is solved and the Buzzer stop/Alarm Reset key is pressed, the buzzer stops.

CAUTION

If the hand-held controller is removed during operation in local mode, the pump stops. (T100P)

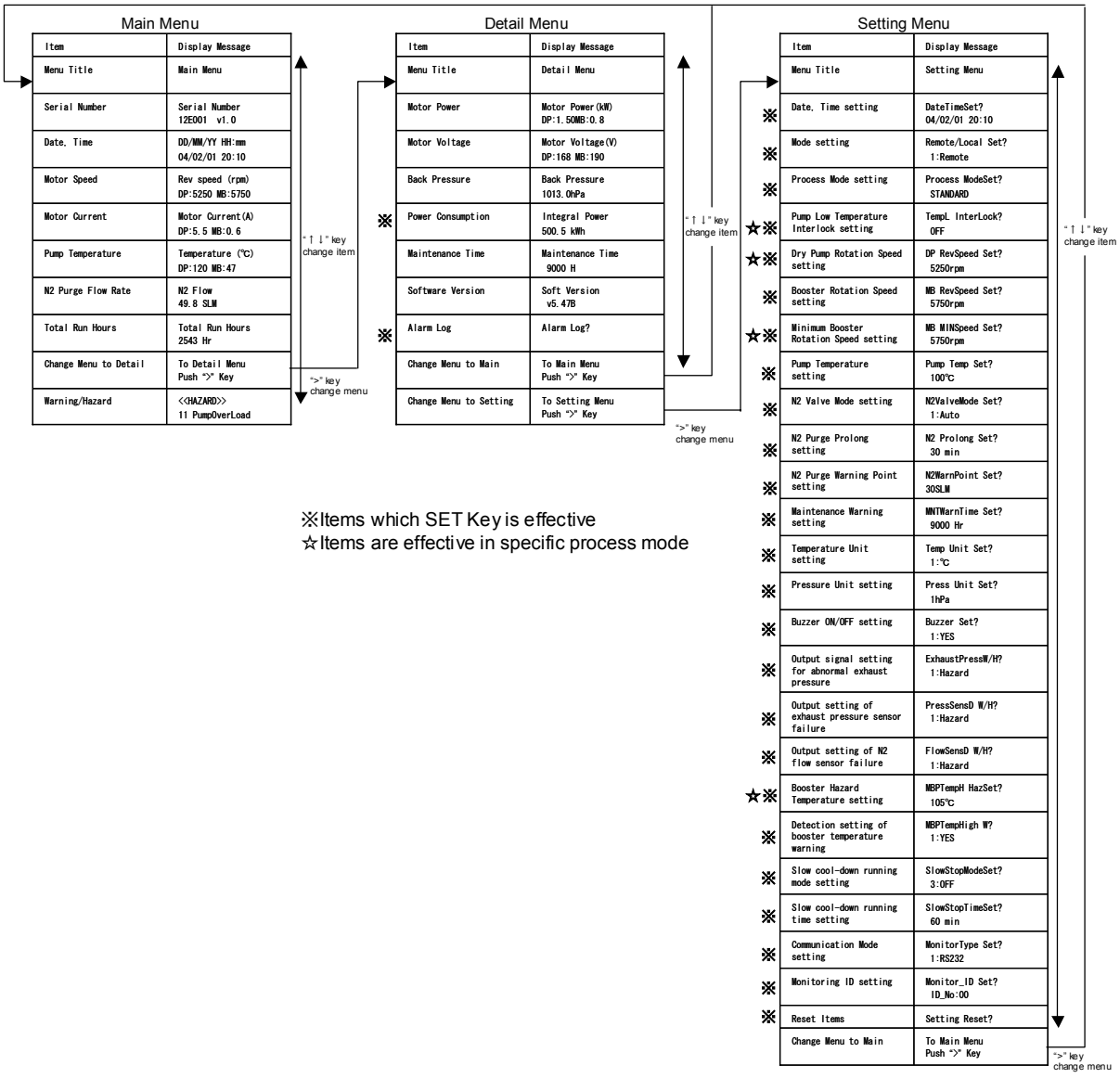
If an SPI signal to change to the remote mode is sent during operation in local mode, the system is automatically changed to remote mode and the operation continues.

4. OPERATION

4-5. Hand-held Controller Operation (continued)

4-5-4. Display menu structure

T1800, T1200, T1000, T600



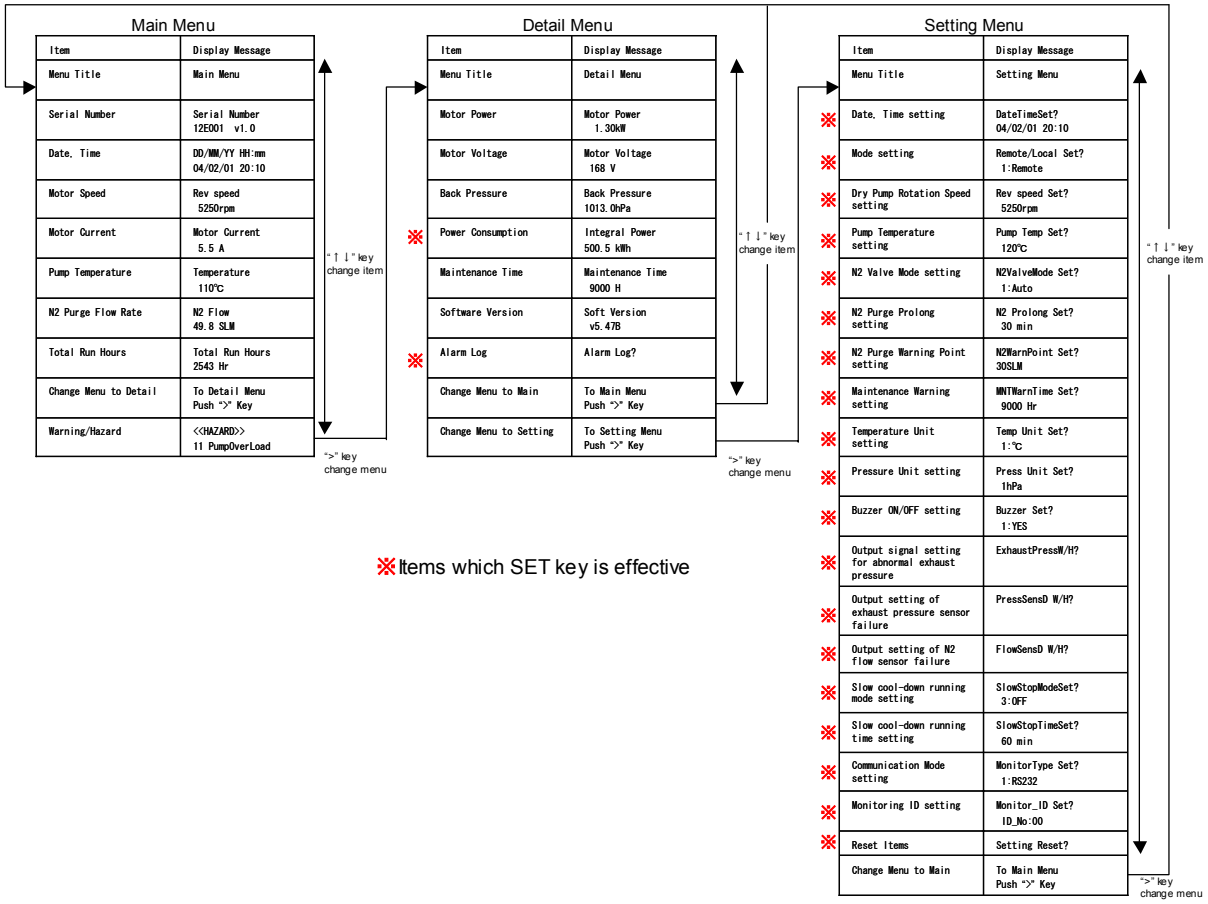
※Items which SET Key is effective
☆Items are effective in specific process mode

4. OPERATION

4-5. Hand-held Controller Operation (continued)

4-5-4. Display menu structure (continued)

T100P



※Items which SET key is effective

4. OPERATION

4-6. Changing Operation Modes

> ⚠ Upon power ON, the pump is set to local mode.

4-6-1. Changing to remote mode

Method 1: Apply 24 VDC voltages between pins 1 and 2 of SPI, which automatically causes transition to the remote mode.

Method 2: Select REMOTE on the hand-held controller.

Method 3: Disconnect the hand-held controller from the front panel connector, which automatically causes transition to the remote mode.

- After transition to the remote mode, the LOCAL indicator LED of the hand-held controller goes off.

> ⚠ Hand-held controller indicates the word “UNDER REMOTE CONTROL” when you push “RUN” or “STOP” key during pump running in remote mode.

4-6-2. Changing to local mode

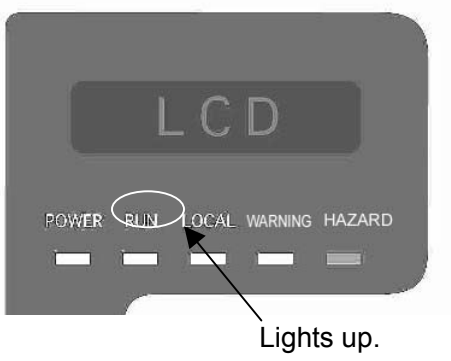
If the pump runs in remote mode, stop the pump.

Method 1: Select LOCAL on the hand-held controller display.

Method 2: Press the STOP key.

> ⚠ Changing operation mode from remote to local is not available by hand-held controller when the pump is running in remote mode.

- When the mode is changed to local mode, the LOCAL indicator LED of the hand-held controller lights up.



4. OPERATION

4-7. Setting using Hand-held Controller

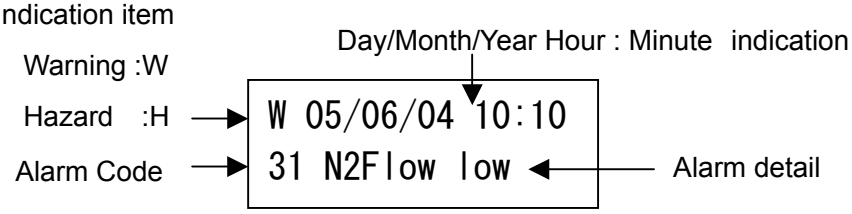
4-7-1. Checking the alarm log

•When abnormality occurs, checking Alarm Log helps to investigate causes.

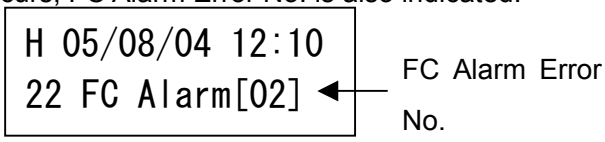
Check method

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Select Alarm Log parameter using UP and DOWN keys.		Alarm Log?
3	Press SET key to enter Alarm Log check mode.		W 05/08/04 10:10 31 N2Flow Low
4	Check the record using UP and DOWN keys.		W 15/06/04 02:20 11 PumpOverload
5	Press SET key to complete setting.		Alarm Log?

Indication item



When FC Alarm occurs, FC Alarm Error No. is also indicated.



Alarm Log can save up to 30 events.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-2. Updating the clock

- Internal clock can be updated.
  Based on the setting, Alarm Log and Integral Power Consumption are indicated.

Date changing method

No.	Operation Step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select date parameter using UP and DOWN keys.		DateTimeSet? 01/07/01 13:25
4	Press SET key to enter setting mode.		DD/MM/YY HH:mm 01/07/01 13:25
5	Shift highlighted value to desired one using Right key.		DD/MM/YY HH:mm 01/07/01 13:25
6	Change the value using UP and DOWN keys.		DD/MM/YY HH:mm 01/07/01 14:25
7	Press SET key to complete setting.		DD/MM/YY HH:mm? 01/07/01 14:25

Indicated values are in the order of day, month, year, hour, and minute.

The 24-hour system is used for the clock function.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-3. Operation mode setting

- Use the hand-held controller to change operation mode.
- Use the following procedure to change the operation mode.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select mode setting parameter using UP and DOWN keys.		Remote/LocalSet? 1:Remote
3	Press SET key to enter setting mode.		Remote/LocalSet? 1Rem/2Loc/3FLoc
4	Change the mode using Right key.		Remote/LocalSet? 1Rem/2Loc/3FLoc
5	Press SET key to complete mode change.		Remote/LocalSet? 2:Local

Choosing “3FLoc” (Super local mode) will keep pump in Local mode regardless of voltages between pins 1 and 2 of SPI.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting

4-7-4-1. Process Mode setting (T1000, T600)

Special settings can be set according to the process to be used.*

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select process mode setting parameter using UP and DOWN keys.		Process ModeSet? STANDARD
4	Press SET key to enter password.		Process ModeSet? 0000
5	Shift highlighted value to desired one using Right key.		Process ModeSet? 40000
6	Change the value using UP and DOWN keys.		Process ModeSet? 43569
7	Press SET key to complete change.		Process ModeSet? High Flow

* Refer to section 3-10-2 for more information.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-2. Pump Temperature Low Interlock setting (T1000, T600)

Selection of Pump Temperature Low Interlock can be set.*

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select process mode setting parameter using UP and DOWN keys.		TempL InterLock? 2:NO
4	Press SET key to enter input mode.		TempL InterLock? 1:YES/2:NO
5	Shift highlighted value to desired one using Right key.		TempL InterLock? 1:YES/2:NO
6	Press SET key to complete change.		TempL InterLock? 1:YES

* This item can be set if CUSTOM or HIGH TEMP process mode is selected.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-3. Dry pump revolution setting

The dry pump revolution speed (rpm) can be set.*

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select revolution setting parameter using UP and DOWN keys.		DP RevSpeed Set? 5250rpm
4	Press SET key to enter input mode.		DP RevSpeed Set? 5250rpm
5	Shift highlighted value to desired one using Right key.		DP RevSpeed Set? 5250rpm
6	Change the value using UP and DOWN keys.		DP RevSpeed Set? 5150rpm
7	Press SET key to complete change.		DP RevSpeed Set? 5150rpm

＊T1000 normal dry pump revolution speed is 5250 rpm and cannot be changed. This item can be set only when process mode CUSTOM or EPI is selected.

＊T600 normal dry pump revolution speed is 5250 rpm (above 120ºC temperature setpoint) or 4500 rpm (lower than 120ºC temperature setpoint) and cannot be changed. This item can be set only if process mode CUSTOM or HIGH FLOW is selected

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-4. Booster revolution setting (T1800, T1200, T1000, T600)

The booster revolution speed (rpm) can be set.*

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select revolution setting parameter using UP and DOWN keys.		MB RevSpeed Set?5750rpm
4	Press SET key to enter input mode.		MB RevSpeed Set? 5750rpm
5	Shift highlighted value to desired one using Right key.		MB RevSpeed Set? 5750rpm
6	Change the value using UP and DOWN keys.		MB RevSpeed Set? 5650rpm
7	Press SET key to complete change.		MB RevSpeed Set? 5650rpm

* T1800,T1200,T1000 Setting range is 3000 rpm to 5750 rpm.

T600 Setting range is 2500 rpm to 5250 rpm.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-5. Minimum Booster revolution setting (T1000, T600)

The minimum booster revolution speed (rpm) can be set.*

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select revolution setting parameter using UP and DOWN keys.		MB MINSpeed Set? 3000rpm
4	Press SET key to enter input mode.		MB MNSpeed Set? 3000rpm
5	Shift highlighted value to desired one using Right key.		MB MINSpeed Set? 3000rpm
6	Change the value using UP and DOWN keys.		MB MINSpeed Set? 2900rpm
7	Press SET key to complete change.		MB MINSpeed Set? 2900rpm

* This item can be set if CUSTOM, HIGH FLOW (T1000), CUSTOM(T600). process mode is selected.

T1000 Setting range is 2000 rpm to 3000 rpm.

T600 Setting range is 2000 rpm to 2500 rpm.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-6. Maximum Booster revolution setting (T1000, T600)

The maximum booster revolution speed (rpm) can be set.*

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select revolution setting parameter using UP and DOWN keys.		MB MINSpeed Set? 3000rpm
4	Press SET key to enter input mode.		MB MNSpeed Set? 3000rpm
5	Shift highlighted value to desired one using Right key.		MB MINSpeed Set? 3000rpm
6	Change the value using UP and DOWN keys.		MB MINSpeed Set? 2900rpm
7	Press SET key to complete change.		MB MINSpeed Set? 2900rpm

* This item can be set if CUSTOM(T1000), CUSTOM, HIGH FLOW(T600). process mode is selected.

T1000 Setting range is 5750 rpm to 6000 rpm.

T600 Setting range is 5250 rpm to 6000 rpm.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-7. Temp setting

Dry Pump temperature can be set.*

According to the process to be used, set appropriate temperature.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select temperature setting parameter using UP and DOWN keys.		Pump Temp Set? 100 °C
4	Press SET key to enter input mode.		Pump Temp Set? 100 °C
5	Shift highlighted value to desired one using Right key.		Pump Temp Set? 100 °C
6	Change the value using UP and DOWN keys.		Pump Temp Set? 110 °C
7	Press SET key to complete change.		Pump Temp Set? 110 °C

* Setting range is 80°C to 130°C.

Dry pump speed will be changed automatically when temperature setpoint of T600 is set to above 120°C. (Above 120°C: 5250rpm, Lower than 120°C: 4500rpm)

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-8. N2 valve mode setting

N2 valve control mode can be set.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select N2 valve mode setting parameter using UP and DOWN keys.		N2ValveMode Set? 1:AUTO
4	Press SET key to enter input mode.		N2ValveMode Set? 1AUTO/2ON/3OFF
5	Shift highlighted value to desired one using Right key.		N2ValveMode Set? 1AUTO/2ON/3OFF
6	Press SET key to complete change.		N2ValveMode Set? 2:ON

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-9. N2 purge prolong setting

Setting is available only when N2 valve mode is AUTO.

N2 purge prolong after pump stop can be set.*

According to the process to be used, set appropriate time.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select N2 purge prolong setting parameter using UP and DOWN keys.		N2Prolong Set? 00 min
4	Press SET key to enter input mode.		N2Prolong Set? 00 min
5	Shift highlighted value to desired one using Right keys.		N2Prolong Set? 00 min
6	Change using UP and DOWN keys.		N2Prolong Set? 01 min
7	Press SET key to complete change.		N2Prolong Set? 01 min

∗ Setting range is 0 min to 60 min.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-10. N2 Flow warning setting

N2 flow warning setting can be set.

When N2 flow is lower than the setting, N2 flow warning occurs.*

According to the process to be used, set appropriate value.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select N2 flow setting parameter using UP and DOWN keys.		N2 Flow Set? 45 SLM
4	Press SET key to enter input mode.		N2 Flow Set? 45 SLM
5	Shift highlighted value to desired one using Right key.		N2 Flow Set? 45 SLM
6	Change the value using UP and DOWN keys.		N2 Flow Set? 46 SLM
7	Press SET key to complete change.		N2 Flow Set? 46 SLM

∗ Setting range is 0 SLM to 80 SLM.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-11. N2 Flow Interlock setting *(If N2 flow switch option is not selected when ordered)*

N2 Flow Interlock setting can be set.

When N2 flow is lower than the setting, SPI pin 13/14 contact (Final valve interlock, refer to 3-7-3 SPI pin assignment) will be open.*

According to the process to be used, set appropriate value.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select N2 flow setting parameter using UP and DOWN keys.		N2 Interlock? 20 SLM
4	Press SET key to enter input value.		N2 Interlock? 20 SLM
5	Shift highlighted value to desired one using Right key.		N2 Interlock? 20 SLM
6	Change the value using UP and DOWN keys.		N2 Interlock? 21 SLM
7	Press SET key to complete change.		N2 Flow Set? 21 SLM

* Default setting is 20 slm. Setting can be changed from 20 SLM to 65 SLM without password. If changing N2 Flow interlock below 20 slm is required, password input is necessary. Contact your service representative with your application information.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-12. Maintenance warning setting

Maintenance warning time can be set.

When Total Run Hour exceeds the set time, maintenance warning occurs.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select maintenance warning setting parameter using UP and DOWN keys.		MNTWarnTime Set? 009000 Hr
4	Press SET key to enter input mode.		MNTWarnTime Set? 009000 Hr
5	Shift highlighted value to desired one using Right key.		MNTWarnTime Set? 009000 Hr
6	Change the value using UP and DOWN keys.		MNTWarnTime Set? 109000 Hr
7	Press SET key to complete change.		MNTWarnTime Set? 109000 Hr

∗ Setting range is 0 hr to 300000 Hr.

When 0 Hr is set, Warning does not occur regardless of the setting of Total Run Hour.

4. OPERATION

4.7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-13. Selecting output signal for abnormal exhaust pressure

Alarm output for abnormality in exhaust pressure can be selected.

NO.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select exhaust pressure setting parameter using UP and DOWN keys.		ExhaustPressW/H? 1:Hazard
4	Press SET key to enter input mode.		ExhaustPressW/H? 1Haz/2Warn/3NA
5	Shift highlighted value to desired one using Right key.		ExhaustPressW/H? 1Haz/2Warn/3NA
6	Press SET key to complete change.		ExhaustPressW/H? 2:Warning

When NA (NotApplicable) is selected, the pump does not activate exhaust pressure warning or hazard.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-14. Selecting output signal for exhaust pressure sensor failure

Alarm output for failure of exhaust pressure sensor can be selected.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select pressure sensor failure output setting parameter using UP and DOWN keys.		PressSensD W/H? 1:Hazard
4	Press SET key to enter input mode.		PressSensD W/H? 1Haz/2Warn/3NA
5	Shift highlighted value to desired one using Right key.		PressSensD W/H? 1Haz/2Warn/3NA
6	Press SET key to complete change.		PressSensD W/H? 2:Warning

When NA (NotApplicable) is selected, the pump does not activate warning or hazard for exhaust pressure sensor failure.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-15. Selecting output signal for N2 flow sensor failure

Alarm output for failure of N2 flow sensor can be selected.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select N2 flow sensor failure output setting parameter using UP and DOWN keys.		FlowSensD W/H? 1:Hazard
4	Press SET key to enter input mode.		FlowSensD W/H? 1Haz/2Warn/3NA
5	Shift highlighted value to desired one using Right key.		FlowSensD W/H? 1Haz/2Warn/3NA
6	Press SET key to complete change.		FlowSensD W/H? 2:Warning

When NA (NotApplicable) is selected, the pump does not activate warning or hazard for N2 flow sensor failure.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-16. Booster Hazard Temp setting (T1000, T600)

Booster Hazard temperature can be set.*

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select temperature setting parameter using UP and DOWN keys.		MBTempH HazSet? 105 °C
4	Press SET key to enter input mode.		MBTempH HazSet? 105 °C
5	Shift highlighted value to desired one using Right key.		MBTempH HazSet? 105 °C
6	Change the value using UP and DOWN keys.		MBTempH HazSet? 115 °C
7	Press SET key to complete change.		MBTempH HazSet? 115 °C

* This item can be set if CUSTOM, EPI(T1000), CUSTOM(T600).

process mode is selected.

Setting range is 105°C to 160°C.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-4. Operation condition setting (continued)

4-7-4-17. Selecting detection of booster temperature warning (T1000, T600)

Presence/absence of booster temperature warning can be set.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select booster temp. abnormality warning detection setting parameter using UP and DOWN keys.		MBPTempH W? 1:YES
4	Press SET key to enter input mode.		MBPTempH W? 1:YES/2:NO
5	Shift highlighted value to desired one using Right key.		MBPTempH W? 1:YES/2:NO
6	Press SET key to complete change.		MBPTempH W? 2:NO

When NO is selected, the pump does not activate mechanical booster temperature warning. (Hazard occurs.)

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-5. Setting of other functions

4-7-5-1. Buzzer setting

Buzzer sound, which is made at the time of occurrence of Hazard/Warning, can be set.

When OFF is set, buzzer does not sound when Hazard/Warning occurs.

（LEDs on main body and hand-held controller light up.）

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select buzzer setting parameter using UP and DOWN keys.		Buzzer Setting? 1:Yes
4	Press SET key to enter input mode.		Buzzer Setting? 1:Yes/2:No
5	Change the setting using Right key.		Buzzer Setting? 1:Yes/2:No
6	Press SET key to complete change.		Buzzer Setting? 2:No

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-5. Setting of other functions (continued)

4-7-5-2. Temperature indication unit setting

Unit of temperature indication can be set. (Celsius or Fahrenheit)

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select temperature indication setting parameter using UP and DOWN keys.		Temp Unit Set? 1: °C
4	Press SET key to enter input mode.		Temp Unit Set? 1: °C/2: °F
5	Change the setting using Right key.		Temp Unit Set? 1: °C/2: °F
6	Press SET key to complete change.		Temp Unit Set? 2: °F

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-5. Setting of other functions (continued)

4-7-5-3. Pressure indication unit setting

Unit of pressure indication can be set. （hPa, PSI, or Torr）

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select pressure indication setting parameter using UP and DOWN keys.		Press Unit Set? 1: hPa
4	Press SET key to enter input mode.		Press Unit Set? 1hPa/2PSI/3Torr
5	Change the setting using Right key.		Press Unit Set? 1hPa/2PSI/3Torr
6	Press SET key to complete change.		Press Unit Set? 2: PSI

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-5. Setting of other function (continued)

4-7-5-4. Communication method setting

Communication method to external monitor output can be set. (RS232C or RS485)

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select communication method setting parameter using UP and DOWN keys.		MonitorType Set? 1: RS232
4	Press SET key to enter input mode.		MonitorType Set? 1: RS232/2:RS485
5	Change the setting using Right key.		MonitorType Set? 1: RS232/2:RS485
6	Press SET key to complete change.		MonitorType Set? 1: RS485

Use this function when “dry pump monitoring system” (option) is in use.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-5 Setting of other function (continued)

4-7-5-5. Monitoring ID setting

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select monitoring ID setting parameter using UP and DOWN keys.		Monitor_ID Set? ID_No:00
4	Press SET key to enter input mode.		Monitor_ID Set? ID_No:00
5	Change the setting using Right key.		Monitor_ID Set? ID_No:01
6	Press SET key to complete change.		Monitor_ID Set? ID_No:01

Use this function when “dry pump monitoring system” (option) is in use.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-5. Setting of other functions (continued)

4-7-5-6. Indication of integral power consumption

The amount of integral power consumption during specified period can be indicated.

```
Integral Power
     XXXXX.X kWH
```

Automatically changed every 5 seconds

```
02/01/02 15:05→
     XXXXX.X kWH
```

Title and date-time of accumulation start are alternately indicated per 5 seconds.
In addition, the indication can be reset using the hand-held controller.

Resetting method of integral power consumption

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
3	Select the resetting parameter using UP and DOWN keys.		Integral Power xxxxx.xkWh
4	Press SET key to enter input mode.		Integral Reset? 1:Yes/2:No
5	Change the setting using Right key.		Setting Reset? 1:Yes/2:No
6	Press SET key to complete change.		Setting Reset?

From the time of resetting, counting of integral power consumption starts again.

> ⚠ As output values from the inverter are calculated, the obtained values may differ from the actual values.

4. OPERATION

4-7. Setting using Hand-held Controller (continued)

4-7-5. Setting of other functions (continued)

4-7-5-7. Setting Reset

Various setting values can be reset to default.

No.	Operation step	Key to be used	Indication
1	Go to Detail Menu.	(Refer to 4-5-4.)	Detail Menu
2	Go to Setting Menu.	(Refer to 4-5-4.)	Setting Menu
3	Select setting reset parameter using UP and DOWN keys.		Setting Reset?
4	Press SET key to enter input mode.		Setting Reset? 1:Yes/2:No
5	Change the setting using Right key.		Setting Reset? 1:Yes/2:No
6	Press SET key to complete change.		Setting Reset?

If “Yes” is selected while “Setting Reset” is displayed, the following items return to the default setting.

Item	T1800 T1200 T1000	T600	T100P
Revolution speed (rpm) *[1]	5750	5250	5250
Dry Pump temperature setting	100°C		
N2 valve mode	AUTO		
N2 purge prolong	30 min		
N2 flow warning setting	30 SLM		
Unit of Temperature	°C		
Unit of Pressure	hPa		
Buzzer	ON		
Output signal for abnormal exhaust pressure	Hazard		
Output of exhaust pressure sensor failure	Warning		
Output of N2 flow sensor failure	Warning		
Detection of booster temperature warning (T1000, T600)	YES		-
Communication method	RS232		

Note 1) T1800,T1200,T1000, T600: Booster Revolution speed
T100P: Dry pump speed

5. TROUBLESHOOTING *page*

5-1. Pump Does Not Start 101

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5-3. Other Troubles 104

5. TROUBLESHOOTING

5-1. Pump Does Not Start

When turning on the main switch again after turning it off, it is necessary to discharge inverter DC condenser. (Wait for more than 30 seconds after turning it off.) If the discharge is not enough, FC Alarm occurs and the pump does not run. In this case, turn the main switch off and wait for more than 30 seconds, before turning the main switch on again.

Make sure that both circuit protectors are ON. If one is OFF, the pump does not start.(T1800, T1000, T600)

Item	Occurrence condition	Warning	Hazard	Troubleshooting
White(T1800,T1200, T1000, T600), Green(T100P) LED on front panel does not light up.	Power failure	-	-	Check that input power is correct. Check that the main switch is ON. Check that fuse is not blown. Check that the EMO or E-stop button is not pressed.
Nothing is indicated on display of hand-held controller.	Power failure	-	-	Check that input power is correct. Check that the main switch is ON. Check that fuse is not blown.
	Connection failure	-	-	Check that hand-held controller is properly connected.
Pump does not start. （In Remote mode）	Power failure	-	-	Check that input power is correct. Check that the main switch is ON. Check that circuit breaker is ON. Check that fuse is not blown. Check that the EMO or E-stop button is not pressed.
	Signal failure			Check that signal cable is not broken. Check that 24 VDC is supplied between 1 and 2 of SPI connecter pins. Stop the signal for operation. After more than 1 minute, start sending the signal for operation again.
	Pump failure	-	-	Check that the system is not in Hazard condition.
Pump does not start. （In Local mode）	Power failure	-	-	Check that input power is correct. Check that the main switch is ON. Check that circuit breaker is ON. Check that fuse is not blown. Check that the EMO or E-stop button is not pressed.
	Signal failure			Check that hand-held controller is properly connected. Check that the RUN button is surely pressed.
	Pump failure			Check that the system is in Local mode. Check that a signal for operation in remote mode is not sent. Check that the system is not in hazard condition.
Pump Main Switch is turned OFF.	Power failure	-	-	Check that input power is correct. Check that fuse is not blown.

Even if the main switch is turned ON under the condition that a signal for remote mode is sent from SPI, the pump does not start running. First, stop the signal for operation, and then start sending signal for operation from SPI.

5. TROUBLESHOOTING

5-2. Warning/Hazard Messages

No.	Item	Occurrence condition	Warning	Hazard	Troubleshooting
11	Overload of pump PumpOverLoad	The actual revolution speed has been lower than instructed speed for a certain time.	○	○	Check that large amount of flow is not being aspirated. （No leakage from piping, valve or chamber） Check that there is no blockage in exhaust pipe.
12	High temperature PumpTempHigh	Pump temperature exceeds the warning limit.	-	○	Check that the amount of cooling water is normal. Check that cooling water temperature is not high. Check that connections of water supply and return are correct.
13	Failure to raise temp PumpTempLow	During operation of the pump, pump temperature has been low for a long time. (Failure of sensor)	○		Check that the amount of cooling water is normal. Check that cooling water temperature is not too low.
14	Breakdown of pump temperature sensor TempSensDown	Thermistor failure	○	○	Call your Service Representative for maintenance.
15	Abnormal amount of cooling water WaterShortage	Pump temperature has been exceeding the set temperature for a long time. （Incapable of temperature control）	○	-	Check that the amount of cooling water is normal. Check that cooling water temperature is not high. Check that connections of water supply and return are correct.
16	Overload of booster MBPOverLoad	The actual revolution speed has been lower than instructed speed for a certain time.	○	○	Check that large amount of flow is not being aspirated. （No leakage from piping, valve or chamber） Check that there is no blockage in exhaust pipe.
17	High temp of booster MBPTempHigh	Pump temperature exceeds the warning limit.	○	○	Check that the amount of cooling water is normal. Check that cooling water temperature is not high. Check that connections of water supply and return are correct.
18	Breakdown of booster temp sensor TempSensDown	Thermistor failure	○	○	Call your Service Representative for maintenance.
21	FC communication error FC Comm[**]	Inverter communication failure occurs.	○	-	Check that input power is correct. Turn off the main switch. After more than 1 minute, turn on the main switch again for check. Check that there is no source of noise.
22	FC Alarm FC Alarm [**]	Inverter failure occurs during operation.	-	○	See below.
	Unknown reason FC Alarm [00] , [99]	Motor does not run after operation signal is input.	-	○	Check that input power is correct. Turn off the main switch. After more than 1 minute, turn on the main switch again for check. Check that there is no source of noise. Check motor overload condition.
	Overcurrent in stationary time FC Alarm [01]	Inverter input current exceeds overcurrent detection level during stationary time.	-	○	
	Overcurrent in acceleration FC Alarm [02]	Inverter input current exceeds overcurrent detection level during acceleration.	-	○	
	Overcurrent in deceleration FC Alarm [03]	Inverter input current exceeds overcurrent detection level during deceleration.	-	○	
	Overcurrent by current sensor FC Alarm [04]	Inverter output current exceeds overcurrent detection level.	-	○	
	Excess voltage FC Alarm [05]	Direct voltage inside inverter rises.	-	○	
	Protection from heating FC Alarm [06]	Module temperature is abnormally high.	-	○	Check that the amount of cooling water is normal. Check that cooling water temperature is not high. Check that connections of water supply and return are correct.
	External trip FC Alarm [07]	External trip signal is received.	-	○	Check that input power is correct. Check that there is no source of noise.
	Electronic thermal FC Alarm [08]	The pump is running while inverter output current exceeds rated current.	-	○	Check that input power is correct. Check motor overload condition.
	Excess speed FC Alarm [10]	Detected speed exceeds limit speed.	-	○	Check that input power is correct. Turn off the main switch. After more than 1 minute, turn on the main switch again for check.
	Current sensor failure FC Alarm [12]	Abnormality in current sensor output is detected.	-	○	

	Warning for parameter change FC Alarm [13]	Inverter parameter is being changed.	-	○	Check that there is no source of noise.
	Prevention of restart FC Alarm [14]	Operation is already instructed at the time of power-on, temporary blackout, or reset.	-	○	
	RS485 communication error FC Alarm [16]	The number of communication blockings occurred exceeds the set number.	-	○	

5-2. Warning/Hazard Messages (Continued)

No.	Item	Occurrence condition	Warning	Hazard	Troubleshooting
23	MBP communication error MBP Comm[**]	Communication failure off booster inverter occurs.	○	-	Check that input power is correct. Turn off the main switch. After more than 1 minute, turn on the main switch again for check. Check that there is no source of noise.
24	MBP Alarm MBP Alarm [**]	Booster inverter failure occurs.	-	○	See below.
	Unknown reason MBP Alarm [00] , [99]	Motor does not run after operation signal is input.	-	○	Check that input power is correct. Turn off the main switch. After more than 1 minute, turn on the main switch again for check. Check that there is no source of noise. Check motor overload condition.
	Overcurrent in stationary time MBP Alarm [01]	Inverter input current exceeds overcurrent detection level during stationary time.	-	○	
	Overcurrent in acceleration MBP Alarm [02]	Inverter input current exceeds overcurrent detection level during acceleration.	-	○	
	Overcurren t in deceleration MBP Alarm [03]	Inverter input current exceeds overcurrent detection level during deceleration.	-	○	
	Overcurrent by current sensor MBP Alarm [04]	Inverter output current exceeds overcurrent detection level.	-	○	
	Excess voltage MBP Alarm [05]	Direct voltage inside inverter rises.	-	○	
	Protection from heating MBP Alarm [06]	Module temperature is abnormally high.	-	○	Check that the amount of cooling water is normal. Check that cooling water temperature is not high. Check that connections of water supply and return are correct.
	External trip MBP Alarm [07]	External trip signal is received.	-	○	Check that input power is correct. Check that there is no source of noise.
	Electronic thermal MBP Alarm [08]	The pump is running while inverter output current exceeds rated current.	-	○	Check that input power is correct. Check motor overload condition.
	Excess speed MBP Alarm [10]	Detected speed exceeds limit speed.	-	○	Check that input power is correct. Turn off the main switch. After more than 1 minute, turn on the main switch again for check. Check that there is no source of noise.
	Current sensor failure MBP Alarm [13]	Inverter parameter is being changed.	-	○	
	Prevention of restart MBP Alarm [14]	Operation is already instructed at the time of power-on, temporary blackout, or reset.	-	○	
	RS485 communication error MBP Alarm [16]	The number of communication blockings occurred exceeds the set number.	-	○	
31	Abnormal N2 flow N2 Flow low	The amount of N2 flow has been lower than set value for a certain time.	○	-	Check that the flow amount of N2 is normal.
32	Abnormal exhaust pressure ExhaustPressH	Exhaust pressure has been raised for a certain time.	○	○	Check that there is no blockage in exhaust pipe. Check that large amount of flow is not being aspirated. （No leakage from piping, valve or chamber）
33	Excessive amount of cooling water ExcessWater	Pump temperature has been lower than set temperature for a long time. (Incapable of temperature control)	○	-	Check that the amount of cooling water is normal. Check that cooling water temperature is not too low.
36	Abnormal N2 flow sensor N2 SenseDown	Flow sensor failure	○	○	Call your Service Representative for maintenance.

37	Abnormal pressure sensor PressSensDown	Pressure sensor failure	○	○	Call your Service Representative for maintenance.
51	Maintenance MainteTime	TotalRunHour has passed the maintenance time.	○	-	Call your Service Representative for maintenance. To use the system continuously, change the maintenance warning time.
90	RAM battery failure Battery Low	RAM failure	○	-	Out of battery. Call your Service Representative for maintenance.
91	DC24V failure DCBoardBreak	24V power source failure	-	○	Call your Service Representative for maintenance.
94	E-Stop Switch	E-Stop button was pressed.	-	○	E-Stop button was pressed.

When not recovered, call your Service Representative.

5-3. Other Troubles

Item	Occurrence condition	Warning	Hazard	Troubleshooting
Vacuum failure	Abnormal piping	-	-	Check that there is no leakage from intake piping. Check that there is no blockage in exhaust pipe. Check that there is no blockage in inlet filter.
	Abnormal revolution speed			Check that revolution speed is normal. Remote: Check voltage between pins 15 and 16. (0V, 5750rpm at maximum) Local: Check that setting on the hand-held controller is correct.
Coupling for cooling water cannot be connected.	Connection failure	-	-	Check that a correct coupling is being used.
	Abnormal temperature	-	-	Wait until the pump is cooled down before connection.

When not recovered, call your Service Representative.

6. MAINTENANCE *Page*

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6-2. Fuse Replacement 106
6-2-1. Phenomenon 107
6-2-2. Replacement procedure 107
6-3. Maintenance Intervals 107
6-4. Pump Removal & Return Procedure 108
6-5. Pump Disposal 109
6-6. Application Form for Returning 110

6. MAINTENANCE

6-1. General

T1800, T1200, T1000, T600, T100P do not need daily maintenance and daily cleaning.

When using process gas, there is a possibility of gas contamination in a pump enclosure to all parts.

Special attention should be paid to the parts (inlet flange, exhaust flange, inside of case, shaft, and O ring) that touch gas.


WARNING

The above-mentioned parts may be contaminated by process gas. The condition of contamination and by-product materials vary according to processes. In case a customer decontaminates the pump for a certain reason, please be sure to perform decontamination according to the process gas used.


CAUTION

Only qualified, well-trained personnel can perform maintenance on this product.

6-2. Fuse Replacement (T1800, T1200, T1000, T600)

Fuse: Manufactured by HINODE ELECTRIC CO., LTD. 660CF-30 (UL recognized 30A, Fast acting fuse)


WARNING

Replace a fuse only after determining why it blew. If the cause is unclear, do not replace the fuse. Contact your Service Representative.


WARNING

Before replacement, be sure to cut the main power supply off, with a lockout/tagout device in compliance with OSHA requirements.


WARNING

Replace with the specified fuse. Use of any fuse other than that specified may cause a malfunction or serious injury.

6. MAINTENANCE

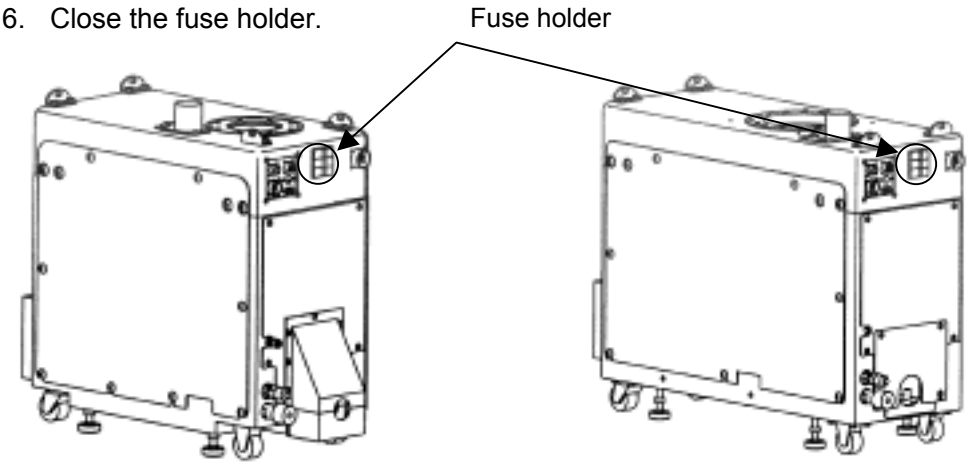
6-2. Fuse Replacement (Continued)

6-2-1. Phenomenon

T1800, T1200, T1000, T600 are protected by fast-acting fuses (each phase: 1, total: 3). When each fuse blows, pump cannot be started.

6-2-2. Replacement procedure

1. Turn off and lockout the circuit breaker that supplies power to the pump. The circuit breaker is located on the process tool power supply rack.
2. Turn off the main power switch and disconnect the power cable after checking that the power supply is surely turned off.
3. Open the fuse holder on the rear side of the enclosure.
4. Remove the blown fuse.
5. Insert the new fuse.
6. Close the fuse holder.



T1000, T600 T1800,T1200

6-3. Maintenance Intervals

- Overhaul is recommended every 9000 hours. Maintenance time warning can be set with the hand-held controller. When the set maintenance time is reached, the pump automatically notifies the operator of the warning information.

- When the item “Total Run Hour” on the hand-held controller exceeds “Maintenance Time”, the pump should be returned for maintenance.

6. MAINTENANCE

6-4. Pump Removal & Return Procedure

1. Use appropriate personal protective equipment including respirator or self contained breathing apparatus. Ambient air testing during pump removal is recommended.
2. After turning process gases off, run the pump with only nitrogen supplied from process chamber for 30 minutes to remove any residual gases from the pump. If this is not possible, set pump N2 valve mode to ON and run N2 purge for 30 minutes, refer to section 4-7-4-8 for instructions.
3. Turn off and lockout the circuit breaker that supplies power to the pump. The circuit breaker is located on the process tool power supply rack.
4. Turn off and lockout the facility N2 purge valve that supplies N2 purge to the pump. Slowly unscrew and disconnect the N2 purge line from the pump.
5. Disconnect all facility connections from the pump.
6. Install seals in the inlet and outlet flanges of the pump with o-rings, blank caps and clamps/bolts.
7. Copy the Application Form for Returning pump on the next page and enter the necessary items.
8. Send the Application Form for Returning pump to your Service Representative by facsimile.
9. Put the original application in an envelope, attach the envelope to the packed pump and return it together with the pump.

WARNING	When the pump is disassembled, hazardous substances may be adhering to the exhaust outlet. Follow the instructions of your company's safety department.
WARNING	Be sure to include information of any gases and chemical information used on the Application Form for Returning the Pump. If this information is not included, the maintenance may be refused.
CAUTION	Preventive measures must be taken not to incline the pump during transportation. (Tolerance: within plus or minus 10 degrees)

6. MAINTENANCE

6-5. Pump Disposal (Continued)

If disposing of the pump (or if disposing of by-products generated in processing), please decontaminate to follow the regulation in effect in your area. If you have any questions about how to dispose of a part (excluding the disposal of by-products generated in processing), please contact your service representative.

6. MAINTENANCE

6-6. Application Form for Returning

Customer
Co. name:
Division:
Name:
Tel No.:
FAX No:

Process Information
Process:
Date of failure:

Pump Information
Model Name: Serial No.:
Reason:

Chemical Information
- ♦Are any polluting materials used? Yes □ No □
- ♦Corrosive Yes □ No □
- ♦Flammable Yes □ No □
- ♦Explosive Yes □ No □
- ♦Radioactive Yes □ No □
- ♦Bio. active Yes □ No □
- ♦Others Yes □ No □

Special Note:

Notice:
Enter all materials and byproducts used accurately without omissions.

Process Gases Information (Write down the gases that the pump discharged.)

No.	Substance	Chemical symbol	Handling precautions	Action against contact with body
1				
2				
3				
4				
5				

Covenant
I conducted an appropriate survey on the above subjects and entered the related information correctly without omitting anything. As for the product, the transportation procedure specified on the preceding page was strictly observed.

Date: **Signature:**

7. APPENDIX

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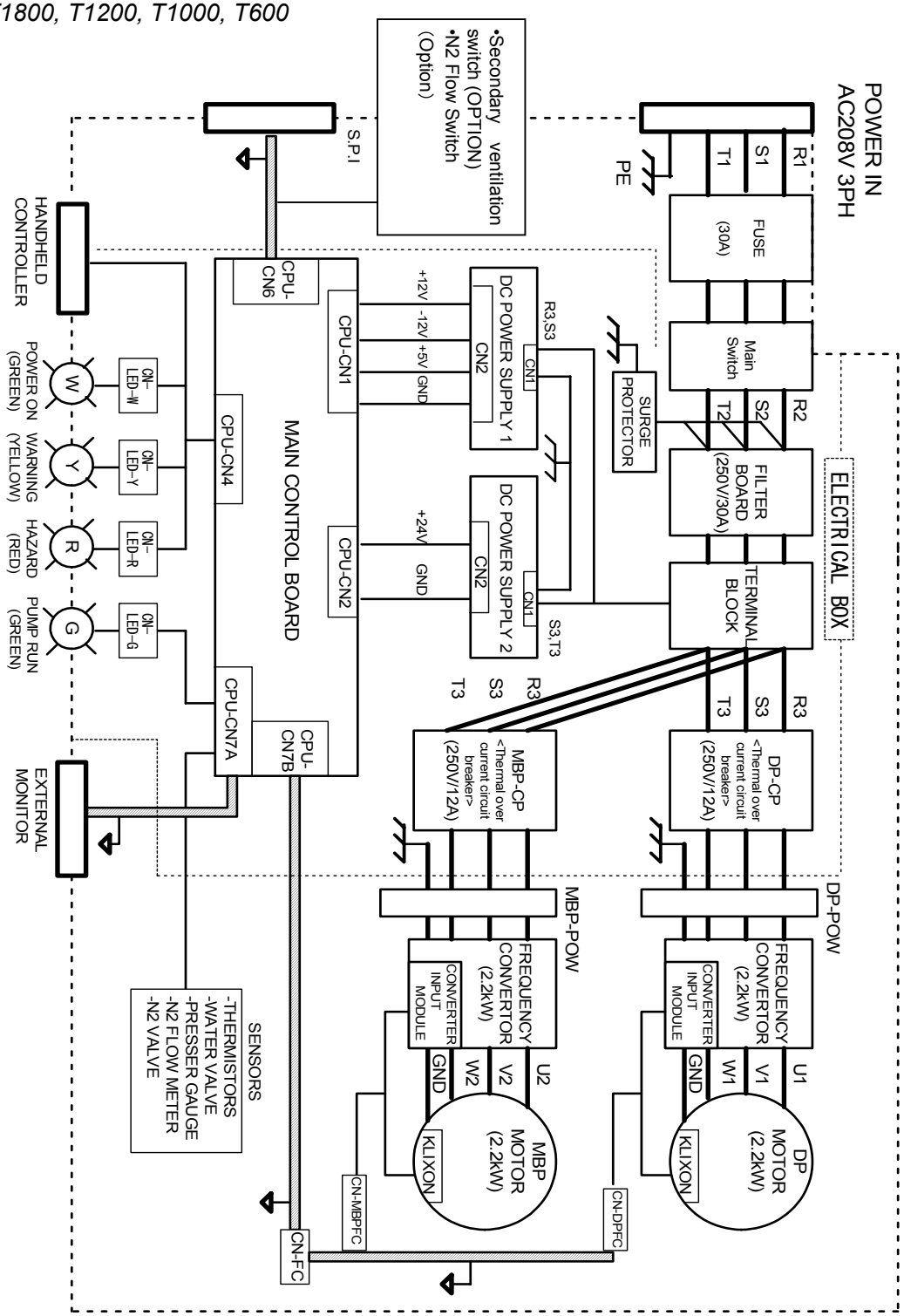
7. APPENDIX

7-1. Electrical Circuit Diagram

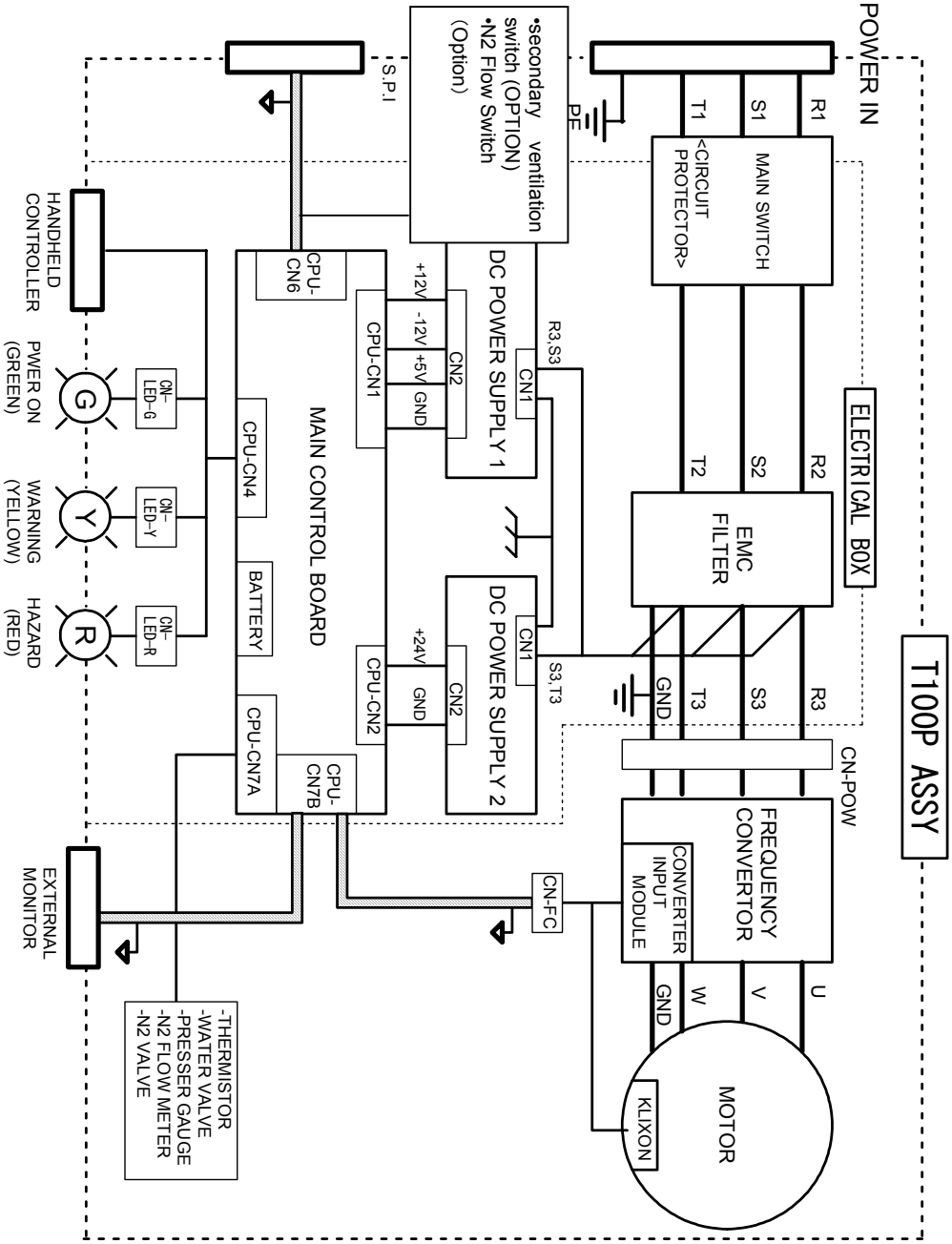
7-1-1.T1800, T1200, T1000, T600



7. APPENDIX

7-1. Electrical Circuit Diagram (continued)

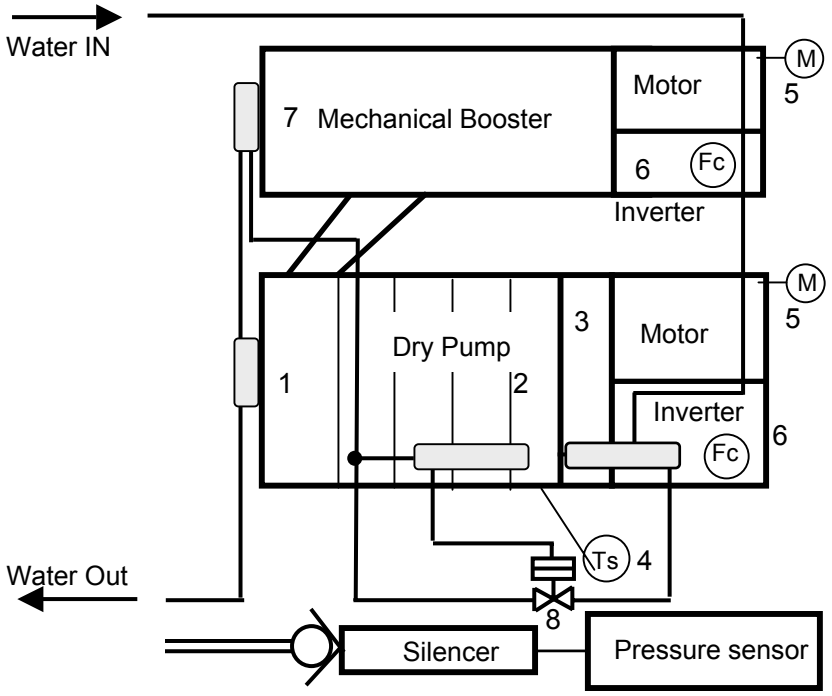
7-1-2. T100P



7. APPENDIX

7-2. Cooling Circuit Diagram

7-2-1. T1800, T1200, T1000, T600



Ts Temperature sensor M Motor temperature sensor

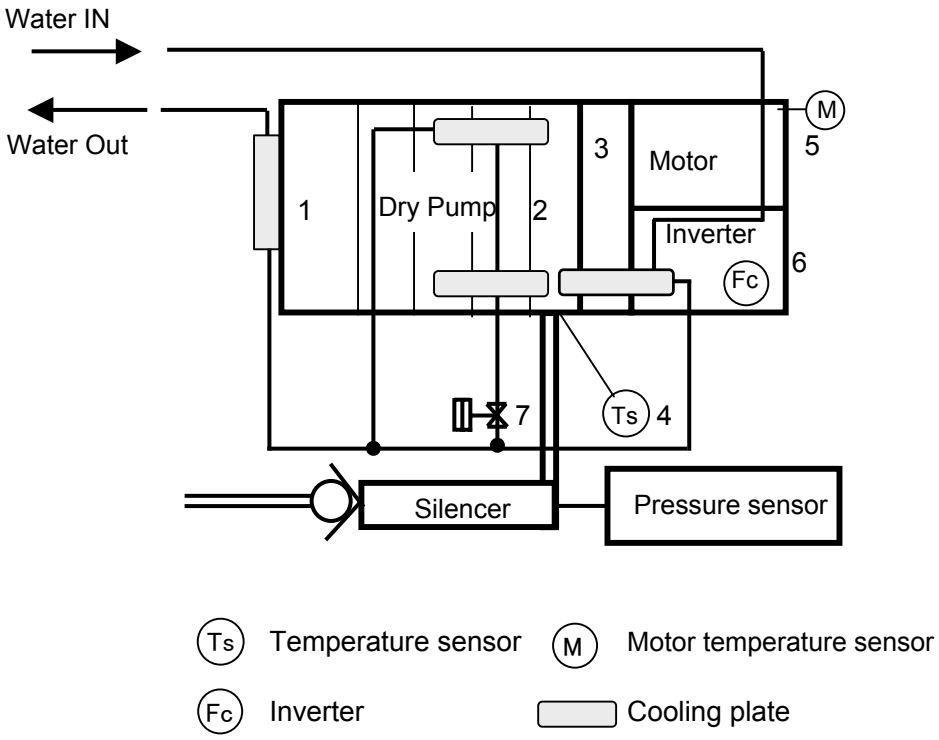
Fc Inverter Cooling plate

	Part name		Part name
1	Dry Pump low pressure area	5	Motor temperature sensor
2	Dry Pump high pressure area	6	Inverter
3	Gear box	7	Mechanical Booster
4	Dry Pump temperature sensor	8	Solenoid Valve

7. APPENDIX

7-2. Cooling Circuit Diagram (Continued)

7-2-2. T100P

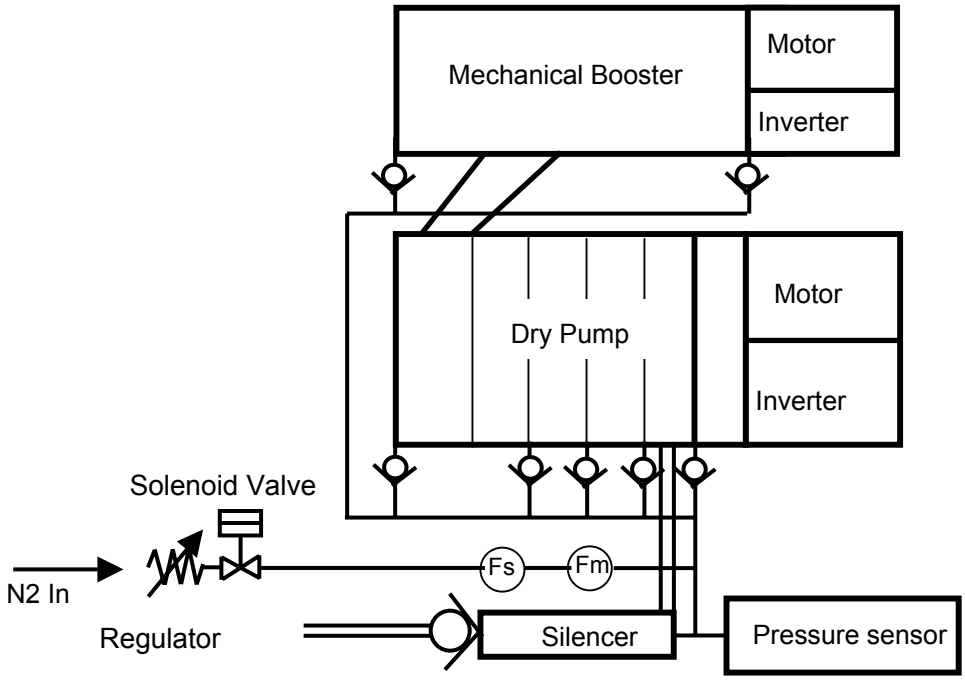


	Part name		Part name
1	Dry Pump low pressure area	5	Motor temperature sensor
2	Dry Pump high pressure area	6	Inverter
3	Gear box	7	Solenoid Valve
4	Dry Pump temperature sensor		

7. APPENDIX

7-3. N2 Purge Diagram

7-3-1. T1800, T1200, T1000, T600



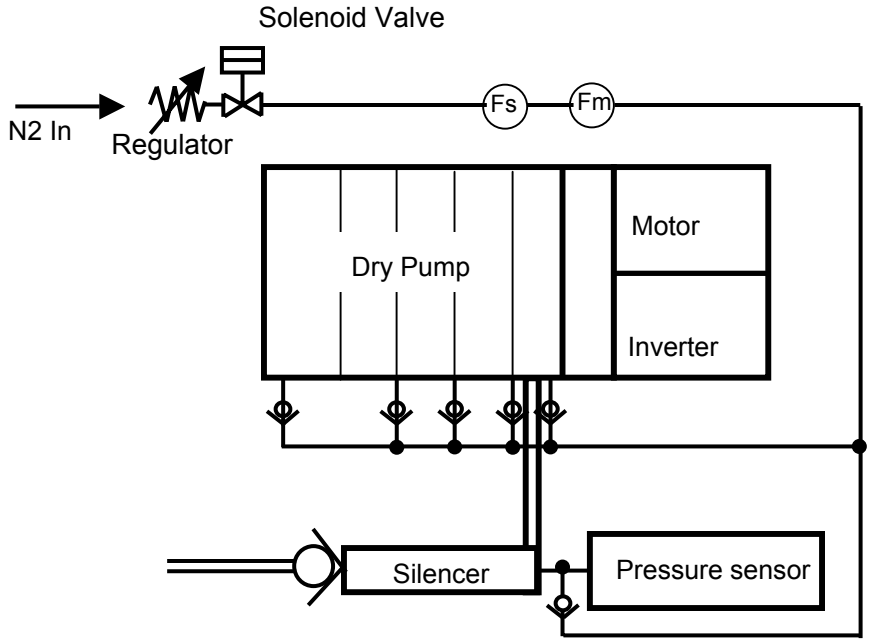
Fm N2 Flow Meter

Fs N2 Purge Flow Switch (Option)

7. APPENDIX

7-3. N2 Purge Diagram (continued)

7-3-2.T100P



Fm N2 Flow Meter Fs N2 Purge Flow Switch (Option)

7. APPENDIX

7-4. Material Safety Data Sheet

7-4-1. Lubricant

製品安全データシート　Material Safety Data Sheet

FOMBLIN® SV-RP

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日本語版作成日 : November 8, 2004　英文作成日/Date of Preparation : March 15, 2003

Ref : fom0403e

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担当部名	フッ素化学品部
DIVISION	OPERATIONS-FLUOROCHEMICAL
担当者名	杉谷　佳郎
NAME	YOSHIO SUGITANI
TEL	03-3224-7226
FAX	03-3224-7218

製造元
COMPANY IDENTIFICATION

会社名: Company:	SOLVAY SOLEXIS
住所: Address:	Viale Lombardia 20 20021 – Bollate (MI)
電話番号: Telephone Number:	02-3835-1
FAX 番号: Fax Number:	02-3835-2367

緊急時通話
Emergency Calls

電話番号: Telephone Number:	02-3835-1

1)物質の特定
COMPOUND IDENTIFICATION

製品名: Trade Name:	**FOMBLIN® SV-RP**
化学分類 Chemical Family:	パーフルオロポリエーテルをベースにした製品 Preparation based on perfluoropolyethers

2)組成 / 成分情報
COMPOSITION / INFORMATION ON INGREDIENTS

製品の性質
Composition of the preparation

パーフルオロポリエーテル
Perfluoropolyether
防錆添加剤
Antirust additive

7. APPENDIX

7-4. Material Safety Data Sheet (continued)

7-4-1. Lubricant (continued)

製品安全データシート　Material Safety Data Sheet

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EC 指示規則88/379(3 項セクション6) で報告された濃度以上において、暴露値のある物質やEC 指示規則67/548 によって危険と分類された物質

Substances with established exposure limits or classifiable as dangerous according to EC Directive 67/548 and following amendments, in concentration equal or higher than that reported in EC Directive 88/379 (item 3, sect. 6):

名前 Name	濃度 Conc.	CAS 番号 CAS N°	記号 Symbol	危険区分 Risk Phrases
なし none				

3)危険有害性
HAZARDS IDENTIFICATION

人体に対する有害性 **Adverse human health effects**	適正な作業衛生環境基準に従って、適正な取扱いをする場合、本製品には人体への危険性は認められない。 The product, when properly handled, according to the good working and hygienic practices, is not dangerous for the human health.
環境に対する影響 **Environmental effects**	適正な作業衛生環境基準に従って、適切な取扱いをする場合、本製品には環境への危険性は認められない。 The product, when properly handled, according to the good working and hygienic practices, is not dangerous for the environment.
物理的化学的危険性 **Physical and chemical hazards**	加熱や火災による熱分解により、有毒腐食性ガスが発生する場合、本製品は危険性がありうる。 Harmful effects in case of thermal decomposition, due to heating or fire, for the emission of toxic and corrosive gases.

4)応急措置
FIRST-AID MEASURES

暴露による下記症状
Symptomatology following exposure

眼球接触 Eye contact	充血 Redness
皮膚接触 Skin contact	皮膚の赤変 Redness
摂取 Ingestion	腹痛、吐き気、嘔吐 Abdominal pains, nausea, vomit.
吸入 Inhalation	なし Not applicable

応急措置
First Aid Measures

眼球接触 Eye contact	ふんだんな水で少なくとも 15 分間、目を洗い流す。 Wash with plenty of water for at least 15 minutes.
皮膚接触 Skin contact	水と石鹸でよく洗う。 Wash with water and soap.

7. APPENDIX

7-4. Material Safety Data Sheet (continued)

7-4-1. Lubricant (continued)

摂取 Ingestion	コップ数杯の水を飲ませる。 Give some glasses of water to drink. 嘔吐させる。 Induce vomiting. 痛みが継続する場合には、医師に相談する。 Seek medical advice in case of persistent pain.
吸入 Inhalation	なし Not applicable

5)火災時の措置
FIRE FIGHTING MEASURES

特別危険性 **Specific hazards**	本製品は、不燃性および不爆発性である。 The product is not flammable and not explosive. 本製品の加熱は、熱分解により有毒腐食性蒸気を発生する恐れがある。 The heating of the product may cause decomposition with emission of toxic and corrosive vapors.
特別事項 **Specific methods**	炎と安全な距離を保ち、風上にいる。 Stay upwind and at safety distance from flames. 製品が火に包まれた場合、安全な状態にすることが可能であれば、容器を移動させること。 In case of surrounding fire, remove the containers, when possible to do so in safe conditions. 引火した場合、散水して容器を冷やし続けること。 In case of fire keep containers cool by spraying with water.
消火剤 **Extinguishing media**	水、粉末、泡、化学消火剤、炭酸ガス Water, powders, foams, chemicals, CO_2.
消火時の保護具 **Protection of fire-fighters**	自給式呼吸器具 Self-contained breathing apparatus. 腐食性蒸気より皮膚や目を保護する防護服 Protective clothing for skin and eyes against corrosive vapors.

6)漏出時の措置
ACCIDENTAL RELEASE MEASURES

注意事項 **Personal precautions**	早急に漏出を止めて、安全な状態にする。 Stop the release as soon as possible, in safe conditions. 発火源や熱源と漏出した製品との接触を避ける。 Avoid the contact of the released product with glowing surfaces and flames. 漏出した製品が熱分解した場合に限り危険性がありうる。 Possible risk only in case of thermal decomposition of the released product.
環境対策 **Environmental precautions**	漏出した製品の下水路、地上水、地下水、土壌への放出を避ける。 Avoid the discharge of the released product in sewage systems, in surface and underground waters, in the soil.
洗浄方法 **Methods for cleaning up**	漏出した製品を土壌、砂、おが屑などで吸収し、適当な容器に回収して廃棄する。 Absorb the released liquid with earth, sand or sawdust and collect it in suitable containers for disposal.

7. APPENDIX

7-4. Material Safety Data Sheet (continued)

7-4-1. Lubricant (continued)

製品安全データシート　Material Safety Data Sheet

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7)取扱い及び保管
HANDLING AND STORAGE

取扱い
HANDLING

注意事項 **Precautions**	製品を分解温度以上に加熱しない。 Avoid heating the product above its decomposition temperature.
技術上の措置 **Technical measures**	作業所の換気を良くし、また、洗眼浴や非常シャワーなどの水道設備を完備する。 Provide working areas with adequate ventilation systems and with water-wash facilities (eye bath and emergency showers).

保管
STORAGE

保管条件 **Storage conditions**	熱源より遠ざける。 Keep away form heat sources. 可燃物、爆発物より遠ざける。 Keep away from combustible and explosive materials. 相溶性のない物質(10 項参照)より遠ざける Keep away from incompatible substances (see sect.10)
包装 **Packaging**	本製品は通常ポリエチレン容器に保管する。 Product usually stored in polyethylene containers.
包装材料として適するもの **Recommended materials**	プラスチック、ガラス、内面処理された金属容器 Plastic, glass, lined metal

8)暴露防止措置 / 保護具
EXPOSURE CONTROLS / PERSONAL PROTECTION

暴露限界値
Exposure limits

熱分解による副生成物の許容濃度限界値
(ACGIH 2003):
Threshold limits of by-products from thermal decomposition
(ACGIH 2003):

フッ化水素 **HF**	TLV/CEILING	2.6 mg/mc	3 ppm
カルボニルフロライド **COF_2**	TLV/STEL	13.5 mg/mc	5 ppm

技術的措置 **Engineering Measures**	特に狭い場所では、適切な換気設備を確保する。 Ensure adequate ventilation, especially in confined areas.

個人用保護具
PERSONAL PROTECTIVE EQUIPMENT

呼吸保護 **Respiratory protection**	火災の場合に自給式呼吸器具を使用し、通常使用時には必要ない。 Not necessary in normal use, self-contained breathing apparatus in case of fire.
目の保護 **Eye protection**	安全眼鏡 Safety goggles.
手の保護 **Hand protection**	ゴム製手袋 Rubber gloves.

7. APPENDIX

7-4. Material Safety Data Sheet (continued)

7-4-1. Lubricant (continued)

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皮膚と体の保護	作業着あるいはゴム製エプロン
Skin and body protection	Worksuit or rubber apron.
衛生上の措置	取扱い中には、飲食や喫煙をしない。
Hygiene measures	Do not drink, eat and smoke during handling.

9)物理的化学的性質
PHYSICAL AND CHEMICAL PROPERTIES

物理的状態:	液体
Physical state:	liquid
色:	無色
Color:	colorless
臭い:	無臭
Odor:	odorless
融点:	なし
Melting point:	not applicable
沸点:	
Boiling point:	> 270 ℃.
分解温度:	
Decomposition temperature:	> 290 ℃.
引火点:	不燃性
Flashpoint:	not flammable
爆発性:	不爆発性
Explosion properties:	not explosive
酸化性:	酸化性なし
Oxidizing properties:	not oxidizer
蒸気圧:	
Vapour pressure:	10^{-8} mmHg (20 ℃)
密度:	
Density:	1.85 ～ 1.93 g/ml
水への溶解性:	不溶
Solubility in water:	not soluble
有機溶剤への溶解性:	フッ素系溶剤に可溶
Solubility in organic solvents:	soluble in fluorinated solvents

10)安定性 / 反応性
STABILITY AND REACTIVITY

安定性:	通常の使用条件、保管状態において安定である。
Stability:	The product is stable in normal conditions of use and storage.
回避事項:	本製品を分解温度以上に加熱しない。
Conditions to avoid:	Avoid heating the product above decomposition temperature.
	火炎との接触を避ける。
	Avoid contact with flames.

7. APPENDIX

7-4. Material Safety Data Sheet (continued)

7-4-1. Lubricant (continued)

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回避物質 **Materials to avoid:**	100℃以上で本製品をルイス酸（$AlCl_3$, SbF_5,CoF_3）と接触させない。 Lewis acids ($AlCl_3$, SbF_5, CoF_3) above 100℃. 100℃以上で本製品の細かい粉末状のマグネシウム、アルミニウム、およびそれらの合金と接触させない。 Fine powdered magnesium, aluminium and their alloys above 100℃.
危険な分解生成物: **Hazardous decomposition products:**	本製品は分解すると、有毒腐食性のガス HF、COF_2などを発生することがあり、分解は金属によって促進される。 The product may decompose with emission of HF and COF_2, which are toxic and corrosive gases; metal promote the decomposition.

11)毒性情報
TOXICOLOGICAL INFORMATION

侵入経路 **Penetration routes**	液体製品の接触または摂取。 Contact or ingestion of the liquid product. 熱分解からのガスの吸入。 Inhalation of gases from thermal decomposition.

人体に対する有害性
Adverse effects for the Human Health
短期または長期におよぶ暴露後の遅延性および急性効果
Delayed and/or immediate effects after short and/or prolonged exposure:

急性毒性: Acute toxicity:	知見なし no known effect
局部作用 / 刺激性: Local effects / irritating power:	刺激性なし;分解生成物は皮膚や目や粘膜に強い刺激を与えることがある。 not irritant; decomposition products may cause severe irritation to skin, eyes and mucosae.
感作性: Sensitization:	知見なし no known effect
慢性毒性: Chronic toxicity:	知見なし no known effect
癌原性 Carcinogenicity:	本製品は、国立及び国際的な研究機関で、癌原性の可能性がある物質として記載されていない。 The product is not listed as potential carcinogen by National and International Agencies or Competent Authorities.
変異原性 Mutagenicity:	本製品は、国立及び国際的な研究機関で、変異原性の可能性がある物質として記載されていない。 The product is not listed as potential mutagenic by National and International Agencies or Competent Authorities.
生殖毒性 Reproduction toxicity:	本製品は、国立及び国際的な研究機関で、生殖毒性の可能性がある物質として記載されていない。 The product is not listed as potential reprotoxic agent by National and International Agencies or Competent Authorities.

毒性実験データ
Experimental toxicological data

経口毒性 LD_{50} – oral	> 2000 mg/Kg	Species: ラット rat

7. APPENDIX

7-4. Material Safety Data Sheet (continued)

7-4-1. Lubricant (continued)

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経皮毒性		ラット
LD_{50} – dermal	> 2000 mg/Kg	Species: rat
慢性毒性	無毒性量	ラット
Chronic Toxicity	NOAEL = 1000 mg/kg/d. (oral, 28 d.)	Species: rat
皮膚炎	刺激性なし	ウサギ
Irritation – skin	non irritant	Species: rabbit
目の炎症	刺激性なし	ウサギ
– eye	non irritant	Species: rabbit
感作性	感作性なし	モルモット
Sensitization (skin)	non sensitizing	Species: Guinea pig
変異原性	陰性(エイムス試験)	
Mutagenicity	Negative(Ames test)	Species:

12)環境情報
ECOLOGICAL INFORMATION

環境への影響
Environmental effects

– 拡散性:	データなし	
– Mobility:	no available data	
– 残存性 / 分解性:	データなし	
– Persistence / degradability:	no available data	
– 生物蓄積:	データなし	
– Bioaccumulation:	no available data	
生態安定性データ	データなし	
Ecostability data	no available data	
生態毒性データ	データなし	
Ecotoxicity data	no available data	
–魚	水への最大溶解度以上	ニジマス
LC_{50} – fish	> max. solubility in water	Species: rainbow trout
–甲殻類	水への最大溶解度以上	大ミジンコ
EC_{50} – crustaceans	> max. solubility in water	Species: daphnia magna
–バクテリア	水への最大溶解度以上	シュードモナスプチダ
IC_{50} – bacteria	> max. solubility in water	Species: pseudomonas putida
注意事項	本製品は、作業管理基準に従い、環境を汚染しないように使用する。	
EVALUATION	Use the product according to the good working practices, avoiding polluting the environment.	

13)廃棄上の注意
DISPOSAL CONSIDERATIONS

廃棄物の処理	フッ素系化合物用に設計された高温ゴミ焼却炉を用いた熱分解設備へ廃製品を送る。
Waste treatment	Send the waste product to thermal destruction, using high-temperature incinerators designed to burn fluorine compounds.

7. APPENDIX

7-4. Material Safety Data Sheet (continued)

7-4-1. Lubricant (continued)

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容器の取扱い **Packaging treatment**	可能な場合は、容器をよく洗って再使用する。 Reuse, when possible, the containers, after thorough washing. 使用済容器を各地方自治体の法規により認められた埋立業者に送る。 Send the waste containers to authorized landfills, according to local laws and regulations.

14)輸送情報
TRANSPORT INFORMATION

特別危険性 **Specific hazards**	製品は輸送上危険性はない。 Product not dangerous for transportation.
容器情報 **Packaging information**	製品は、通常各種容量のポリエチレン容器で出荷される(ドラム、タンク)。 Product usually shipped in polyethylene containers of different capacities (drums, tanks).

国際輸送分類
INTERNATIONAL TRANSPORT CLASSIFICATION

U.N.番号: U.N. Number:	指定なし not assigned
容器等級: Packaging group:	指定なし not assigned
陸上、鉄道、海上、航空輸送 Road, rail, sea, air-Transportation	該当せず。 not classified

15)取締規制情報
REGULATORY INFORMATION

EC 規則(指示 67/548 とその修正条項)
EC Regulations (Directive 67/548 and following amendments)

分類
Classification

分類: Classification type:	なし not required
危険等級: Hazard class:	なし none

ラベル情報
Labelling

製品名: Trade Name:	**FOMBLIN® SV-RP**
危険マーク: Hazard Symbol:	なし none
危険区分 Risk phrases (R)	なし none
安全区分 Safety phrases (S)	なし none

7. APPENDIX

7-4. Material Safety Data Sheet (continued)

7-4-1. Lubricant (continued)

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TSCA 規則
TSCA Status
全ての成分は、有毒物質規制法(TSCA)の化学目録 8(b)に登録済である。
All components are listed on the Toxic Substances Control Act — Section 8(b) Chemical Inventory
国際規則
International Regulations
全ての成分は、下記各国の化学目録に登録済である。:
All components are listed on the chemical inventories of the following countries:

16)その他の情報
OTHER INFORMATION
参考文献
BIBLIOGRAPHY
—内部データ
— internal data

この安全データシートは、指示規則 2001/58/EC に準拠し、作成したものである。
Safety Data Sheet according to Directive 2001/58/EC

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The Company is not responsible for damages caused by the use of the product in applications for which it was not intended or for conditions of use outside its control.

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The English version of the Agreement shall be controlling in all respects.

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