SERVICE MANUAL SAS55,75SD,RD-5E/6E · SMS55,75ESD,ERD,75RD-5E/6E

AIRMAN

CONFIDENTIAL

SC

SERVICE MANUAL

MOTOR COMPRESSOR

SAS55SD-5E/6E
SAS55RD-5E/6E
SAS75SD-5E/6E
SAS75RD-5E/6E
SMS55ESD-5E/6E
SMS55ERD-5E/6E
SMS75ESD-5E/6E
SMS75ERD-5E/6E
SMS75RD-5E/6E
(50Hz/60Hz)

PROAIR AS SERIES
[DIRECT COUPLING TYPE]

HOKUETSU INDUSTRIES CO., LTD.

Preface

This service manual explains about the cautions for maintenance jobs and is to serve a guide for the electric system, and troubleshooting for service personnel.
In the fundamental matters and other things already mentioned in the “Instruction Manual” and the “Parts Catalogue” are omitted to avoid duplication. Therefore, for the operation and handling of this unit, we request you to refer to the “Instruction Manual” and “Caution Plates”, and further for the structure and components of the unit, please refer to the “Parts Catalogue” separately to be supplied with the unit.

If you should find any description which does not coincide with the “Instruction Manual” and “Parts Catalog”, we request you to make sure to start the job after clarifying it.

Service personnel is required to safely take quick and proper countermeasures as well as to use correct technology of maintenance in case of field services and periodical maintenance. It is important that service personnel should have proper and sufficient knowledge about the structure and function of the unit and should be well familiar with such technique mentioned in them.

Regarding the part numbers mentioned in this manual, we request you to refer to the Parts catalogue separately supplied together with the unit, because the parts numbers in this manual are sometimes changed.

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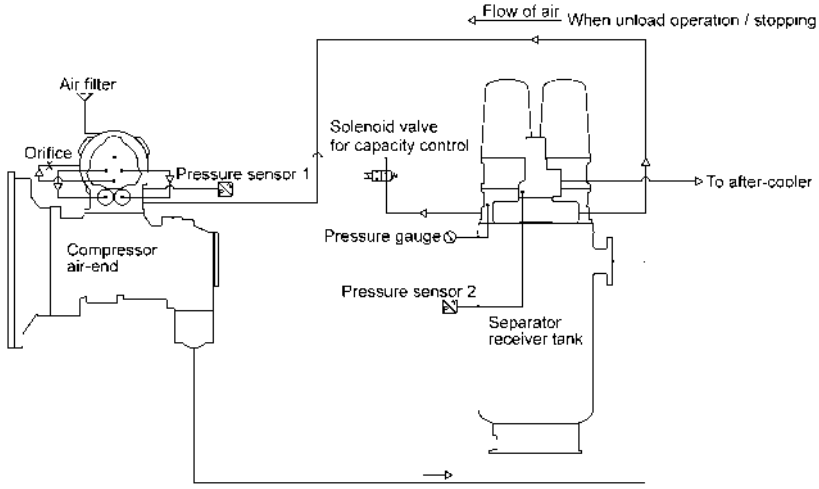
※ For the details of specifications, operation and installation, see Instruction Manual.

1. Overview

1.1 Capacity Control

1.1.1 2-Point control type



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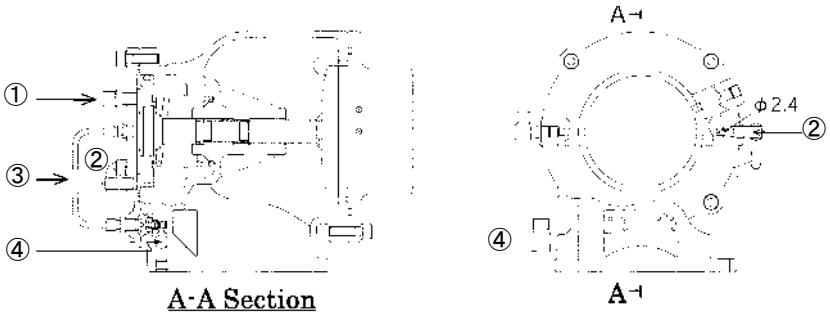

①Unloader valve control pressure.

②Unloader pressure relief circuit /Auto relief air release circuit.

③Vacuum relief valve.

④Vacuum relief circuit of the compressor air-end.

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Conditions	Conditions of solenoid valve for capacity control (SV1)	Unloader valve
Start/Purge operation	Open	At a little open
Full-load	Close	At fully open
Stop	Open	At fully closed

Conditions	Function
Start	When it starts, solenoid valve for capacity control (SV1) opens and compressed air flows into unloader valve. Then, unloader valve is kept slightly open so that it reduces starting load. Starting unload operating time. ・Discharge air temperature higher than 10℃(※0℃): 15 seconds ・Discharge air temperature less than 10℃(※0℃): 60 seconds
Full-load	After practicing the starting unloader, solenoid valve for capacity control (SV1) is closed to block the passage between air receiver tank to unloader valve. Thus unloader valve is fully opened and then full load operation starts.

1. Overview

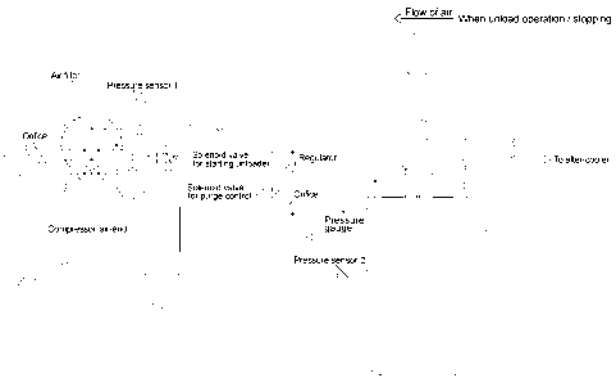
Conditions	Function
Purge operation	When air consumption decreases and discharge pressure exceeds set value (unloading operation starting pressure PH), solenoid valve for capacity control (SV1) opens so that compressed air in air receiver tank can be sent to unloader activation chamber. Thus, unloader valve is closed and at the same time compressed air in receiver tank is relieved to atmosphere through air filter and the pressure is lowered. Consequently power is saved. When air consumption increases and the pressure drops till set value (full load recovering pressure PL), solenoid valve for capacity control (SV1) closes to re-start loaded operation. Further, during unloaded operation, inside of compressor air-end becomes so highly vacuum that it causes vacuum noise. For prevention of this noise, the compressed air in the receiver tank is returned to compressor air-end.
Stop	When stopping, the solenoid valve for capacity control (SV1) is opened. Compressed air from the receiver tank flows into unloader activation chamber then is released to the atmosphere through external piping and air filter.

The temperature of the ※mark apply from the following SER.NO.

●SAS55SD-5E/6E :0075～/0063～ ●SMS55ESD-5E/6E :0058～/0058～

●SAS75SD-5E/6E :0070～/0064～ ●SMS75ESD-5E/6E :0059～/0069～

1.1.2 Regulator control type



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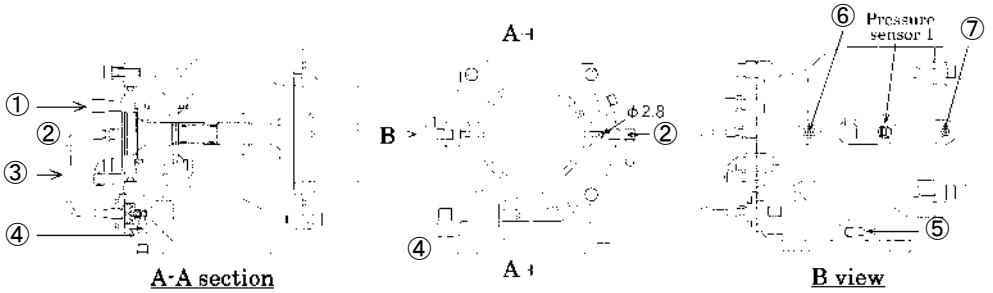

①Unloader valve control pressure
②Unloader pressure relief circuit/Auto relief air release circuit
③Vacuum relief valve
④Vacuum relief circuit of the compressor air-end
⑤Solenoid valve(SV4) connected To NC poet.
⑥Solenoid valve(SV4) connected To COM poet.
⑦Solenoid valve(SV4) connected To NO poet.

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Conditions	Conditions of solenoid valve for purge control (SV1)	Solenoid valve for starting unloader (SV4)	Unloader valve
Start/Purge operation	Open	Switching COM—NC	At a little open
Full-load	Close	Switching COM—NO	At fully open
Stop	Open	Switching COM—NO	At fully closed

Conditions	Function
Start	When it starts, solenoid valve for purge control (SV1) opens and compressed air flows into unloader valve. Simultaneously, solenoid valve for starting unloader (SV4) switches from COM to NC and the unloader spring chamber is connected to the unloader secondary chamber. As a result, the pressure of spring chamber becomes negative. Then, unloader valve is kept slightly open so that it reduces starting load.
Full-load (Suction port closing operation)	After practicing the starting unloader, solenoid valve for purge control (SV1) is closed to block the passage between air receiver tank to unloader valve. Thus unloader valve is fully opened and then full load operation starts. Solenoid valve for starting unloader (SV4) switches from COM to NO then the spring chamber is connected to the unloader primary chamber. During loaded operation, according to fluctuations of the air consumption, the air volume will be automatically controlled continuously within 0—100% by the regulator.

1. Overview

Conditions		Function
Purge operation	Normal purge ※2	If the air consumption decreases and the load rate, calculated from the intake negative pressure of the main compressor unit detected by the pressure sensor 1, falls below the configured value (load factor for the selection of purge operation b), the device will enter a state of standby for purge operation. When this state is maintained for the configured amount of time (time required for confirmation of purge operation U ※2), the solenoid valve for purge control (SV1) operation will be opened, and while the compressed air within the receiver tank will flow in to the unloader and close off the unloader valve, the compressed air within the receiver tank will be released into the atmosphere through the air filter thus lowering the pressure and reducing the power. When air consumption increases and the pressure drops till set value (Purge cancellation pressure PL), solenoid valve for purge control (SV1) closes to re-start loaded operation. Further, during unloaded operation, inside of compressor air-end becomes so highly vacuumed that it causes vacuum noise. For prevention of this noise, the compressed air in the receiver tank is returned to compressor air-end.
	Urgent purge	In cases when the air consumption has suddenly decreased and the service pressure (detected by the pressure sensor 2) has increased to reach the configured value (Purge starting pressure PH), purge operation will be started similar to normal purge in order to prevent the service pressure from increasing. The deactivation of purge operation will be deactivated similar to with normal purge.
Stop		When stopping, the solenoid valve for purge control (SV1) is opened. Compressed air from the receiver tank flows into released to the atmosphere through air filter. Solenoid valve for starting unloader (SV4) switches from COM to NO.

※1 Starting unload time

Discharge air temperature	Starting unload time
Higher than 10℃(※0℃)	15 seconds
Less than 10℃(※0℃)	60 seconds

The temperature of the ※mark apply from the following SER.NO.

- ●SAS55RD-5E/6E :0075～/0063～
- ●SAS75RD-5E/6E :0070～/0064～
- ●SMS55ERD-5E/6E :0058～/0058～
- ●SMS75ERD-5E/6E :0059～/0069～
- ●SMS75RD-5E/6E :0061～/0066～

※2When the “Time required for confirmation of purge operation U” of air volume is set at 0, perform suction port closing mode operation instead of purge control mode operation. In this case, auto start/stop operation is cancelled. But when service pressure rises up to “Urgent purge starting pressure F”, purge control operation starts.

※3When pressure differential △P is 0.05MPa between service pressure P (switched to purge operation under purge control) and full load recovering pressure PL, purge control operation will not start.
(In this case, purge cancellation pressure PL should be lowered for enlarging pressure differential △P.)

1. Overview

1.2 Motor Specifications

1.2.1 Motor for compressor (Totally-enclosed fan cooled type)

(1)55kWclass

Model	Unit	SAS55SD,RD-5E SMS55ESD,ERD-5E		SAS55SD,RD-6E SMS55ESD,ERD-6E	
Motor model		Mitsubishi Electric SF-PRF			
Power nominal output	kW	55			
Frequency	Hz	50		60	
Rated voltage	V	200	400	200/220	400/440
Rated current	A	224	112	214/198	107/99
Poles	P	4			
Insulation class		F			
Coil resistance (20℃)	Ω	0.0123	0.0490	0.0123	0.0490

※ Rated current includes service factor (SF: 1.1) and it is mentioned on motor serial plate.

※ Data of coil resistance in the table are mentioned in test results report of electric motor. So use this data for reference purpose.

(2)75 kW class

Model	Unit	SAS75SD,RD-5E SMS75ESD,ERD,RD-5E		SAS75SD,RD-6E SMS75ESD,ERD,RD-6E	
Motor model		Mitsubishi Electric SF-PRF			
Power nominal output	kW	75			
Frequency	Hz	50		60	
Rated voltage	V	200	400	200/220	400/440
Rated current	A	294	147	282/260	141/130
Poles	P	2			
Insulation class		F			
Coil resistance (20℃)	Ω	0.00907	0.0363	0.00907	0.0363

※ Rated current includes service factor (SF: 1.1) and it is mentioned on motor serial plate.

※ Data of coil resistance in the table are mentioned in test results report of electric motor. So use this data for reference purpose.

1.2.2 Motor for cooling fan (Totally-enclosed fan cooled type)

Model	Unit	SAS55･75SD,RD-5E SMS55･75ESD,ERD,75RD-5E		SAS55･75SD,RD-6E SMS55･75ESD,ERD,75RD-6E	
Motor model		NIDEC SEZZ-21P54EELZ			
Power nominal output	kW	1.5			
Frequency	Hz	50		60	
Rated voltage	V	200	400	200･220	400･440
Rated current	A	12.2	6.1	7.5･8.5	3.7･
Poles	P	4			
Insulation class		E			
Coil resistance (20℃)	Ω	1.980	7.92	1.980	7.92

※ Rated current is mentioned on motor serial plate.

※ Data of coil resistance in the table are mentioned in test results report of electric motor. So use this data for reference purpose.

1. Overview

1.3 Warning / Abnormality Display

Trouble code

1. “Trouble code” lamp flashes whenever it happens.
2. Next, pushing “Trouble code” switch, following signals are displayed on screen.
3. Trouble display is re-set by pressing “Trouble code” switch longer (2 seconds).

Item		Indi-cation	Sensor	Time lag	Setting	Setting
Warning	Discharge air temperature H	A-1	Thermistor	1 second	105℃	※4 90 seconds after starting unloader finishes
	Air filter clogging	A-2	A connect	10 seconds		Usually
	Warning: Dryer ※1	A-3	B connect	1 second		After dryer starts
	Intake air temperature (Too high)	A-4	Thermistor	120 seconds	52℃	After starting unloader finishes
	Discharge air temperature HH ※2	A-5	Thermistor	1 second	108℃	Usually
	Separator discharge air temperature H	A-6	Thermistor	1 second	105℃	
	3000Hr maintenance ※5	A-8				
Abnormality	Discharge air temperature E	E-1	Thermistor	1 second	110℃	※4 90 seconds after starting unloader finishes
	Reverse phase connection	E-2	B connect	1 second		Usually
	Abnormality: Dryer ※1	E-3	B connect	1 second		After dryer starts
	Overload	E-4	B connect	1 second		Usually
	Separator discharge air temperature E	E-5	Thermistor	1 second	110℃	
	Discharge air temperature sensor disconnected ※3	E-6	Thermistor	5 seconds		※4 90 seconds after starting unloader finishes
	Separator discharge air temperature sensor disconnected ※3	E-7	Thermistor	5 seconds		After starting unloader finishes
	Emergency stop due to excessive rise of discharge air temperature	E-8	Thermistor	1 second	120℃	※4 After starting unloader finishes

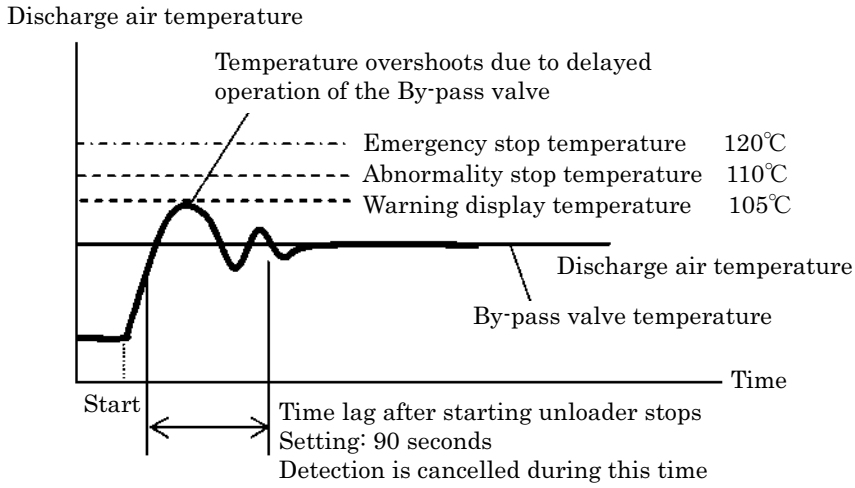
※1. Dryer warning / abnormality: Warning and abnormality can be changed by setting at the operating panel. (for details, refer to 3.4.1 & 3.4.2) (Factory default settings: “Abnormality”)

※2. The discharge air temperature HH is displayed only with 2-Point control type.

※3. Resistance detecting disconnection is -20℃ or equivalent.

※4. The operation of the discharge air temperature detection timing are as follows:

When reactivating the compressor, in cases when the temperature within the receiver tank is high, due to the time lag of the By-pass valve, the discharge air temperature overshoots and increases.
The following operation is designed to prevent warning or abnormality from being issued at this time.
However, for cases when the discharge air temperature has suddenly increased due to a decrease in the oil volume, etc. an emergency stop temperature (E-8) is added to enable shutdown without a time lag.



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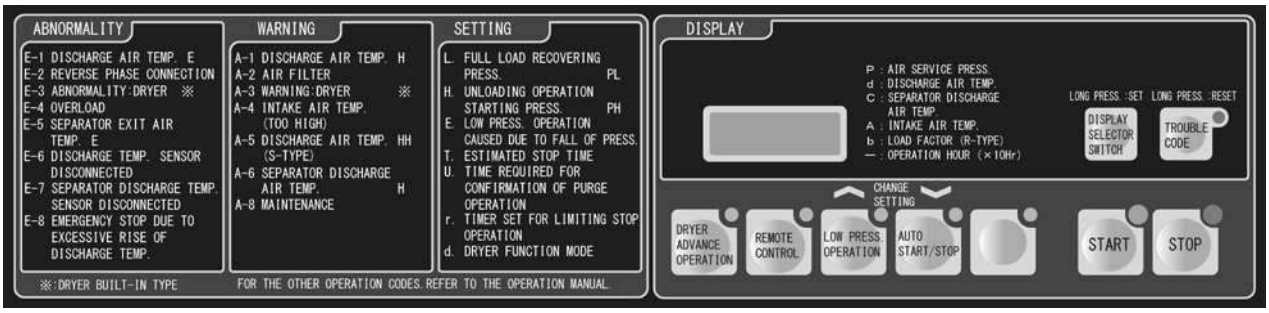
※5. The maintenance warning to 3000Hr apply from the following SER.NO.

- ●SAS55SD(RD)-5E/6E :0075～/0063～
- ●SAS75SD(RD)-5E/6E :0070～/0064～
- ●SMS55ESD(ERD)-5E/6E :0058～/0058～
- ●SMS75ESD(ERD)-5E/6E :0059～/0069～
- ●SMS75RD-5E/6E :0061～/0066～

1. Overview

After 3000Hr maintenance,reset to the trouble code switch and long press (longer than 2 seconds).

When the maintenance time of the setting is 0Hr can not be reset. Please reset to re-input the maintenance time, refer to section 3.4.



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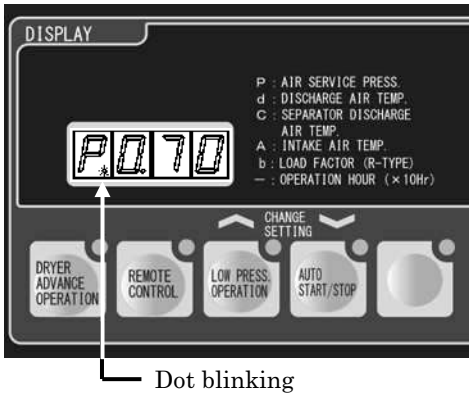
■Display

No.	Item	Indication	
		Code	Unit
1	Air service pressure	P	MPa
2	Discharge air temperature	d	℃
3	Separator discharge air temperature	C	℃
4	Intake air temperature	A	℃
5	Load factor ※6	b	%
6	Operation hour	No mark	×10Hr

Whenever “Display selector switch” switch is ON, display is switched to : 1 → 2 → 3 → 4 ····· → 1 ···

※6. The load factor is displayed only with the regulator control type.



- When power is supplied, “Air service pressure” is displayed.
- With the 2-Point control type, when A.C.C.S. (pressure range automatic adjustment control) is function, the dot on the bottom right of “P.” will blink to indicate that power saving operation is active.

2. Maintenance

2.1 Cautions on Maintenance Job

2.1.1 Preparations before maintenance job

(1) How to perform maintenance job

It is important to perform maintenance jobs, always considering what kinds of equipments, tools, materials and oils should be used, what portions or parts of the machine should be inspected or adjusted or disassembled, and also what is the important points of the maintenance jobs.

(2) Prevention of oil overflow

In order to prevent oil from overflowing in case of compressor oil change and removal or installation of oil piping, make sure to prepare an oil reservoir. And also if an excessive oil flow is expected beforehand, it is necessary to empty the receiver tank beforehand.

[Follow the designated regulations to dispose of compressor oil.]

(3) On removal or installation of parts or assemblies

In case of removing complicated parts or components, mark the match mark for reinstallation.

(4) Use genuine parts

Make sure to use genuine parts when changing parts. Otherwise, it degrades performance and it shortens machine life.

(5) Equipments to be prepared beforehand

① Measuring instruments－Thickness gauge, torque wrench (Preset type or spanner type)
② General tools
③ Jigs, special tools and eyebolt (Bolt M16 2 pieces and M10 one piece or more)
④ Literature (Instruction manual, parts catalog and manual etc...)
⑤ Replacement parts
⑥ Auxiliary materials

Item	Name	Application
Cleaning agent	System purge (NCH Japan K.K.) Cosmo hydro clean (COSMO OIL LUBRICANTS CO., LTD.)	Compressor air-end
Seal tape	Gaflon threaded sealing tape	Screwing section (THREEBOND 1212 is used together)
Grease	EPNOC AP(N)1	O-ring
Lubricant	NICHIMOIY LAP spray or equivalent	Threaded sheet surface and sleeve nuts of wedge joints
Sealant for screwing-in	LOCTITE No. 242 or 243	Unloader orifice installation portion
Thread locking	LOCTITE No. 242 or 243	・Bolts that fix the plates which suppress bearing of compressor air-end ・Bolts that fix the plates which suppress pulley of compressor air-end
Sealant	LOCTITE No.620	Oil seal axis of compressor air-end collar
	LOCTITE No.620	Oil seal insertion surface of the oil seal cover (Inner surface of the cover)
Compressor oil	LONG-LIFE HP	Inside the cylinder (Fill before the first operation after disassembly and assembly; 5L)
Diesel oil for cleaning		Cleaning
Thinner		Degreasing. Cleaning
Waste		

⑦ Equipments
Hot oil bath or bearing heater
Chain block
Impact wrench

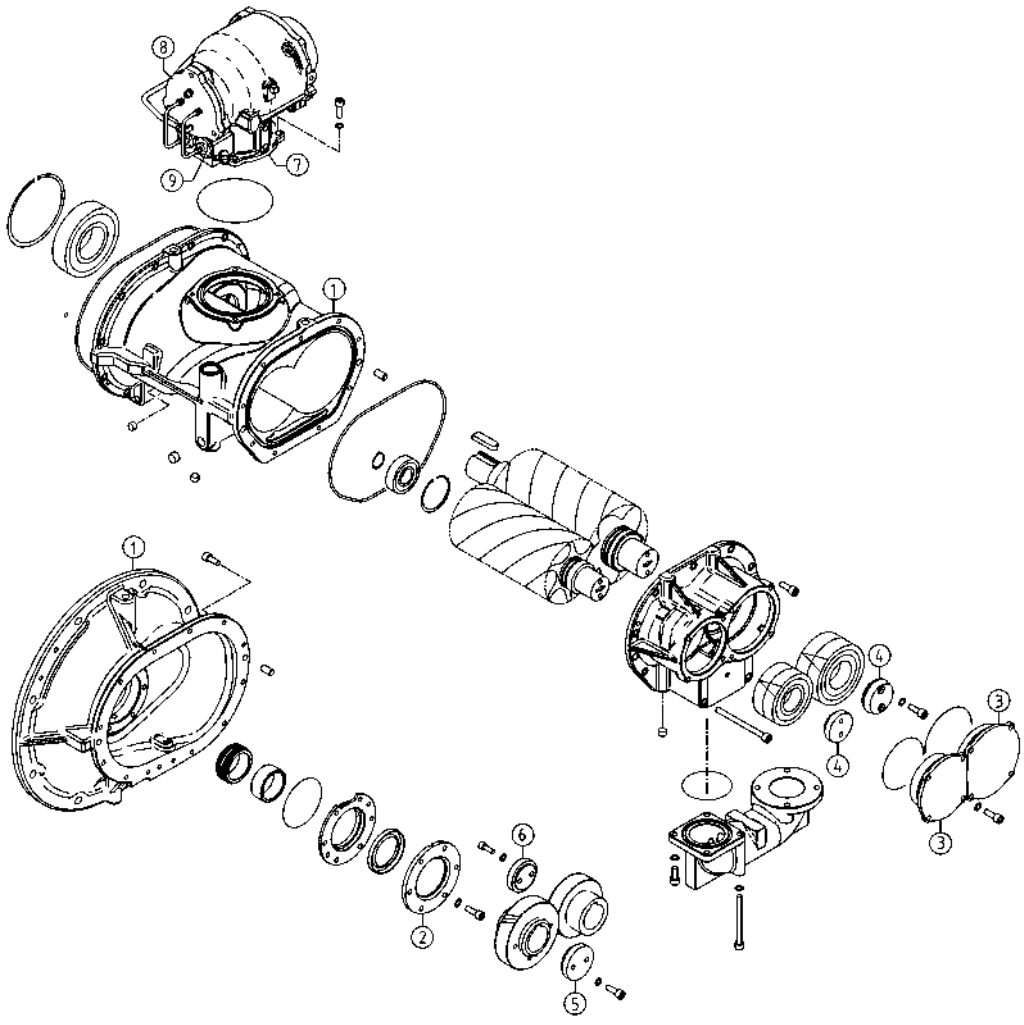
2.1.2 Cautions during disassembly and assembly

① For the disassembly location, be sure to select a location that is free of dust and large enough to perform the task.
② Hove to clean and remove dust from disassemble equipment.
③ Be sure to clean the inside of the machine before removing the nylon tubes and oil pressure / fuel hoses, etc. Furthermore, in order to prevent dirt or other foreign objects from entering inside the machine after such components have been removed be sure to take measures by such as provisionally placing lids on the openings.
④ When disassembling the components that have been removed, once the exterior has been sufficiently cleaned, place the dissembled component on a clean sheet of paper or cloth and make sure that the component does not get dirty or scratched.
⑤ Briskly clean the components with diesel oil (washing oil) after reviewing the degree of discoloration and dirt. However, refrain from soaking rubber components, etc. in the diesel oil.
⑥ As the parts or components are precision-made, do not damage them by falling or colliding.
⑦ For consumable items such as the oil seals, O-rings, filters, and oils, be sure to replace such with new items upon reassembly.
⑧ Apply **"EPNOC AP(N)1"** on O-rings used for sliding parts and parts those might be twisted when tightening (O-rings at pressure control valve piston, compressor oil refilling port, etc.). **Refrain from applying grease** to the sliding section of the oil seals as doing so will fill the screw grooves of the lip and impair its sealing ability.
⑨ Apply entire the outer of a jig with compressor oil and use it when installing oil seal. Avoid any inclination occurred during installing of oil seal.
⑩ When reassembling, pace the parts according to the assembling turn and check to prepare all parts. (without any part left unused.)
⑪ If there are any contact parts used, use parts assemblies.
⑫ Make sure to check tightening torque and clearance when assembling the disassembled parts.
⑬ When stop disassembling halfway, it is cause to occur rust or soil them by humidity or rubbish. If it is necessary to stop disassembling job on the way, make sure to protect them against rust and dirt.
⑭ After finishing assembling job, make sure to check following.
・Oil leakage
・To check tightening torque of every bolt
・The direction of rotation
・Part left behind to assembling
・Check oil level
⑮ When performing test operations, be sure to start with slow speed operation in order to prevent burn-in.
⑯ When will perform disassembling or assembling by several person, hove to obey suggestion of leader. And when go to next progress, to check safety to call out to each other.

2.2 Tightening

2.2.1 Tightening torque

Tightening place		Bolt diameter (mm)	Width of across flat (mm)	Tightening torque N·m (kgf·cm)
Compressor air-end	①Cylinder and discharge casing socket bolt	10	8 (Hexagon haul)	49.0(485)
	②Oil seal cover socket bolt	10	8 (Hexagon haul)	49.0(485)
	③End cover socket bolt	10	8 (Hexagon haul)	25.0(245)
	④Bearing pushing plate socket bolt [Male・Female]	10	8 (Hexagon haul)	49.0(485)
	⑤Drive gear pushing plate socket bolt	10	8 (Hexagon haul)	49.0(485)
	⑥Driven gear pushing plate socket bolt	10	8 (Hexagon haul)	64.0(653)
	⑦Unloader socket bolt	10	8 (Hexagon haul)	49.0(485)
	⑧Unloader cover socket bolt	10	8 (Hexagon haul)	49.0(485)
	⑨Cover for vacuum relief valve socket bolt	4	3 (Hexagon haul)	2.9 (29)
Separator casing socket bolt		10	8 (Hexagon haul)	49.0(485)
Level gauge bolt		14	22	6.0 (61)



SC15008

2. Maintenance

2.2.2 General bolts and nuts tightening torque

When reassembling or rebuilding, tighten bolts and nuts, according to the following torque values in the table.

Kind / Strength and sorting / Torque / Screw nominal diameter (mm)	Low or Middle carbon steel bolt (SS400B etc…)	High tensile strength bolt (SCM435 etc…)	
	4.6—6.8 (4T—6T)	8.8—12.9 (7T—12T)	
	Hexagon bolts	Socket bolts	Hexagon bolts
	N·m (kgf·cm)	N·m (kgf·cm)	
6	5.0 (51)	10.0 (100)	
8	12.0 (124)	25.0 (245)	
10	25.0 (245)	49.0 (485)	
12	43.0 (425)	85.0 (845)	
14	68.0 (675)	135.0 (1,350)	
16	106.0 (1,055)	210.0 (2,100)	
18	145.0 (1,450)	290.0 (2,900)	
20	205.0 (2,050)	410.0 (4,100)	
22	280.0 (2,800)	560.0 (5,600)	
24	345.0 (3,450)	710.0 (7,100)	
Using place	Bonnet, flame etc…	Compressor air-end, receiver tank and other designation part	

IMPORTANT

- The above torque values in the table shall be applicable for the bolts and nuts used for machine.
- In general, the above torque values are applicable for the bolts and nuts used for compressor, but such parts used for special portions need be tightened according to the specified torque values indicated. (Please refer to the next and following pages)
- When tightening parts or components, make sure to remove rust and dust.

2.2.3 Structure of compressor air-end

【Standard clearance when assembling compressor air-end】

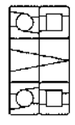
Standard clearance when assembling compressor air-end(mm)	
Clearance of discharge portion A	0.07~0.11
Clearance of suction portion B	0.19~0.63
Clearance of circumferences CM/CF	0.06~0.09

Note - Discharge clearance A should be measured with geared portion of rotor place downward against discharge port

【Tightening torque】

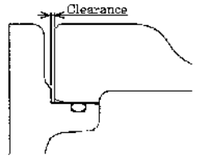
Tightening torque(N·m)	
E	25.0
※3 F	49.0
※3 G	49.0
※3 H	49.0
※3 I	64.0
J	49.0

【Assembly of bearing at discharge side】



When assembling bearings at discharge side of male and female screw rotor, install bearings in the same directions of the marks shown above.

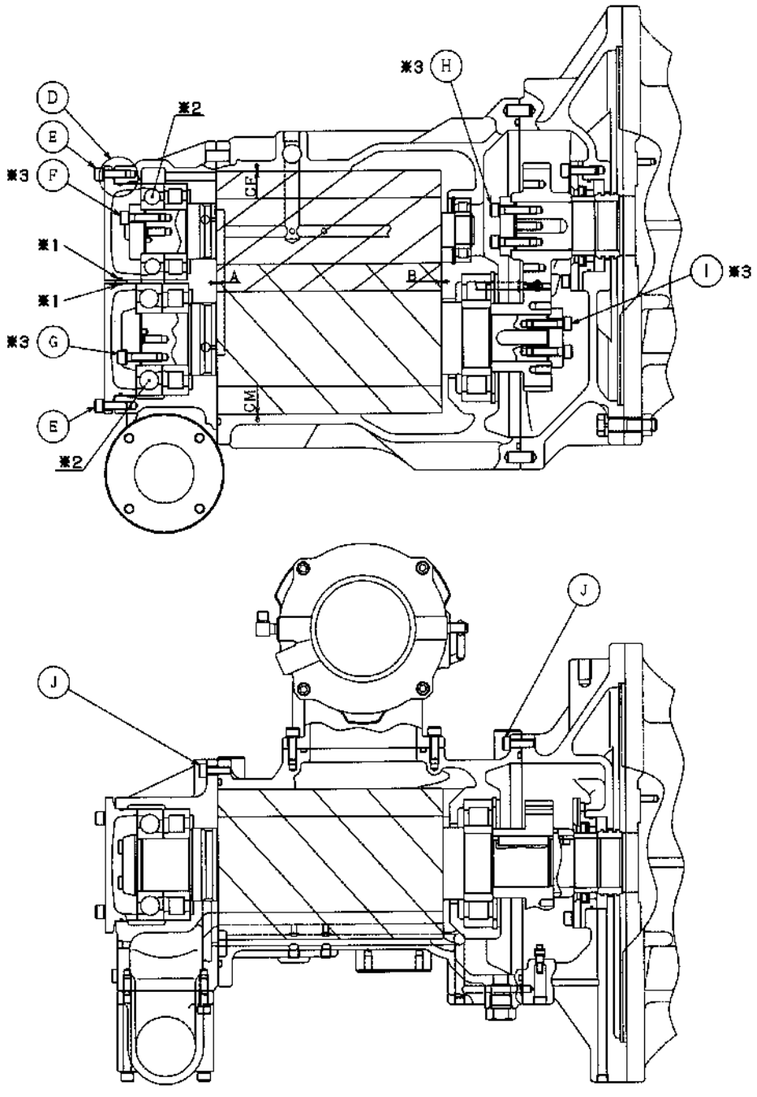
【Clearance between discharge casing and end cover】



Note : Make sure that thickness gauge of 0.3mm can be inserted into the above clearance between discharge casing and end cover as shown above. (both male and female)

Ⓓ detail

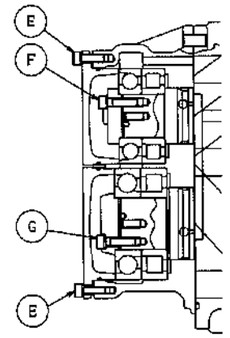
【Sectional view】



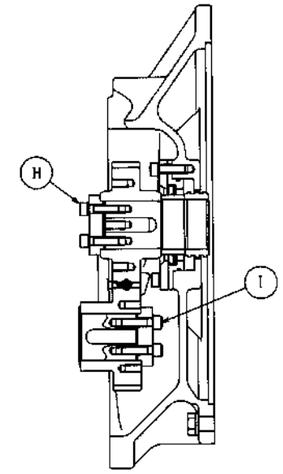
Note :

1. When assembling check and make sure that no foreign matters such as dust, burrs and chips exist.
2. O-ring ※1 : This O-ring should be installed, slightly coated with lithium base grease after checking and making sure that no dust is sticking on it.(Do not apply grease on other O-rings to inhibit false recognition of oil leakage.)
3. As the inner clearance of the roller bearing marked ※2 is an incompatible clearance, be sure to replace the inner and outer bearings as a set.
4. When incorporating the parts marked with 3, completely assembled by applying "Loctite 242 or 243" after degreasing the male screw part and female screw part completely.
5. When assembling, confirm that there is backlash of image immediately gear. (0.05 to 0.20 mm on design value P.C.D.)
6. When starting first operation after it is assembled it is necessary to fill 5 liter compressor oil.

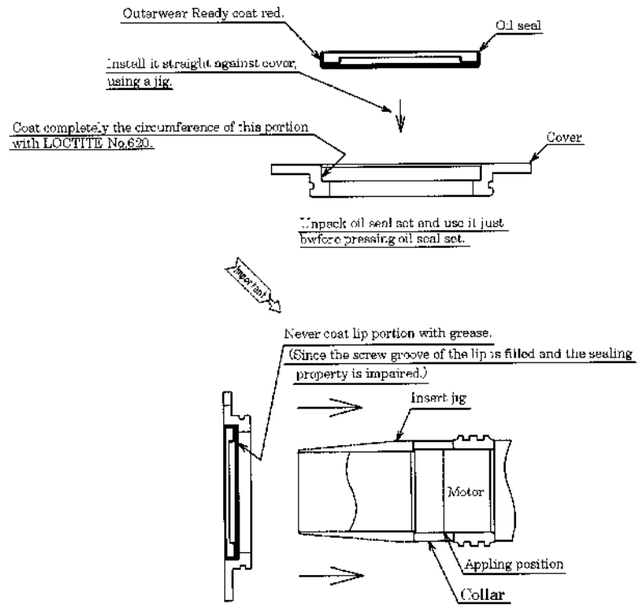
【Fixing of bearing at discharge side】



【Fixed drive,driven gear】



【Detail of assembling oil seal and collar】



Note : 1. Degrease internal circumference of collar and rotor shaft before installing to rotor shaft.
2. Install the collar after thinly applying LOCTITE No.620 a full-circle on to the end of rotor fits the colar.
Make sure to wipe out any sealant that comes out after installing oil seal
3. Install oil seal to rotor shaft, using insert jig the external circumference of which is completly coated with compressor oil and preventing the oil seal from inclining against the shaft.

SC15063E-1

2.2.4 Special tools

[55kW class]

No.	Part name	Part NO.	Q'ty	Remarks
1	Plate	00817 00200	1	Disassembly tool for rotor and discharge casing

[75kW class]

No.	Part name	Part NO.	Q'ty	Remarks
1	Plate	00817 00201	1	Disassembly tool for rotor and discharge casing

Unloader piston Teflon ring installation tool

No.	Part name	Part NO.	Q'ty	Remarks
1	Pipe	00817 00196	1	Insertion (φ28)
2	Pipe	00817 00197	1	Correction (φ28)
3	Pipe	00817 00198	1	Insertion (φ120)
4	Pipe	00817 00199	1	Correction (φ120)

Oil seal installation tool

No.	Part name	Part NO.	Q'ty	Remarks
1	Pipe	00817 00178	1	Oil seal installer (Rotor shaft insert)
2	Plate	00817 00179	1	Oil seal installer (Oil seal cover insert)

2.2.5 Terminal tightening torque

Should be tighten terminal of electromagnet switch, thermal relay other electric equipment etc. according to following torque.

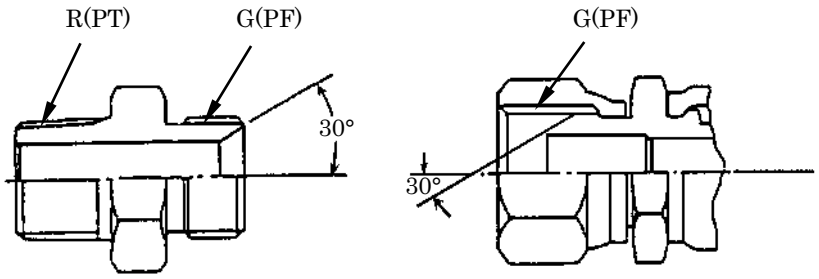
Screw size	Tightening torque
	N・m (kgf・cm)
M4	1.5 (15)
M5	2.9 (30)
M6	4.9 (50)
M8	9.8 (100)
M10	17.2 (175)
M12	34.0 (350)

2.2.6 Tightening torque for hose, joint etc…

(1) Union joint

Should be tighten union joint according to following torque.

Parallel thread for pipe		
Screw size G (PF)	Tool width across flat (mm)	Tightening torque N·m (kgf·cm)
1/4	19 (17)	25 (250)
3/8	22 (19)	50 (500)
1/2	27 (22)	59 (600)
3/4	36 (30)	120 (1,200)
1	41 (36)	140 (1,400)
1 1/4	50	170 (1,700)
1 1/2	60	210 (2,100)

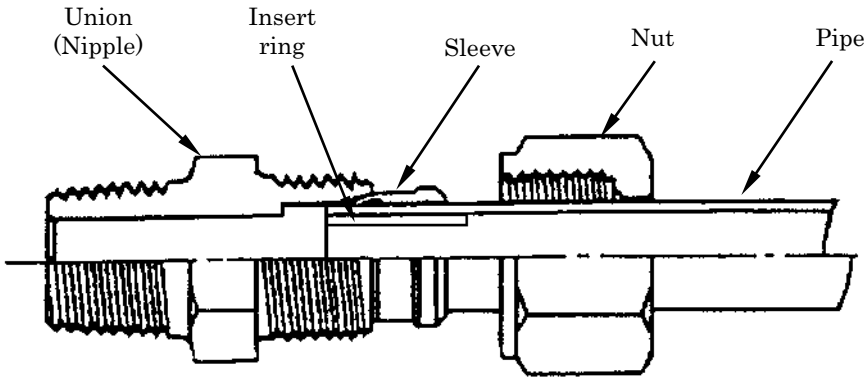


TXT104

IMPORTANT	● Excessively tightening of union nut can cause excessive wedging action so that union nut can be broken. So tighten the nut, according to the specified torques. ● Damaged seating surface can cause oil leakage. So take special care when disassembling and reassembling.

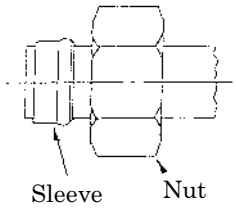
(2) Bite type union

Pipe have two kind of pipe, one is copper and other one is steel. The bite type union used for this pipe is to seal completely high pressure oil. Because the cutting edge of sleeve bites the steel pipe firmly and it is constructed to endure shock pressure and vibration. Therefore, this union is widely used for many hydraulic devices. But bear in mind that oil leak will occur if you are not familiar with the structure and usage of the union. Fit it according to the following steps.

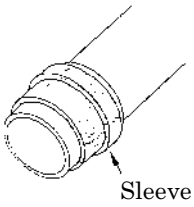


1) Check and confirm the pipe

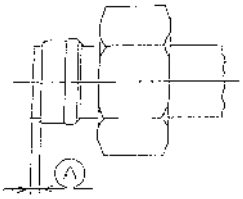
① Check whether this pipe is provided with insert ring, sleeve and nut.



② Check the direction of the sleeve and make sure it is not caulked diagonally.



③ Visually make sure that there is a clearance of a few millimeters from the end of pipe to the sleeve (size A). 3—4mm is recommended

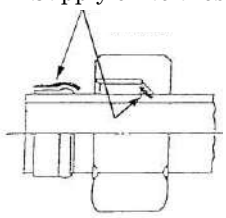


IMPORTANT	● When retightening the nut after loosening the tightened nut, mark “match-mark” on the location of the nut with white chalk before loosening it and then remove it. When tightening it again, tighten the nut a bit more tight than the position tightened before.

2) Coat pipe and nipple with lubrication oil

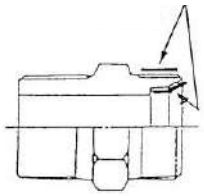
① Coat the sleeve and nut of pipe with lubricant (NICHIMORI LAP spray or equivalent)

Supply oil to these points



② Coat the threaded portion and seat face of nipple with lubricant

Supply oil to these points

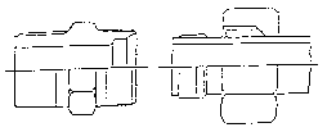


IMPORTANT	● When tightening it without coating lubricant, galling could take place. Therefore, the sleeve turns together. So then it can cause oil leak.

3) Tightening steps

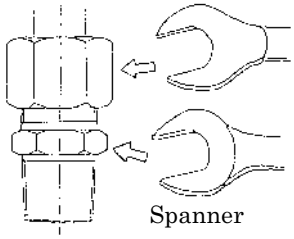
① Tighten the pipe to the nipple.
Make sure to tighten the pipe nut with a hand till the nipple "Stop" position.

Tighten the nut with a hand



② Tighten the nut of pipe by one spanner with holding the nipple by another spanner

Continue to tighten the nut and when you will find sharp torque ruse point, tighten it 1/4 more to make the inside sleeve curves.

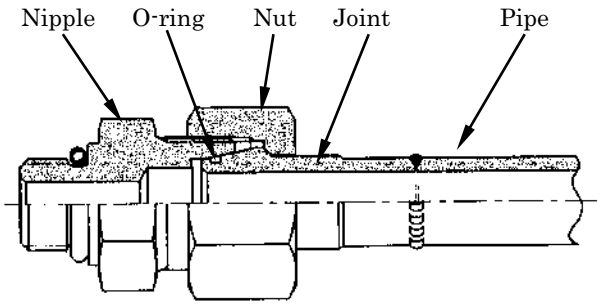


Spanner

4) Copper pipe and steel pipe tightening torque (for reference only) Unit: N·m (kgf·cm)

Nominal diameter (ϕ)	Tightening torque		Nominal diameter (ϕ)	Tightening torque	
	Copper pipe	Steel pipe		Copper pipe	Steel pipe
6	7.8 (80)	21.6 (220)	15	78.5 (800)	
8	10.3 (105)	29.4 (300)	20	157 (1,600)	
10	26.5 (270)	39.2 (400)	25	206 (2,100)	
12	52 (530)		35	245 (2,500)	373 (3,800)

(3) O-ring sheet type



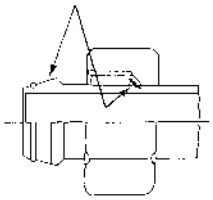
SC15108-1

1) Check and confirm the pipe

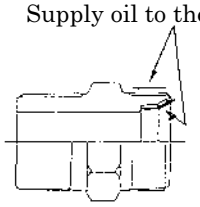
① Check the O-ring (for end of joint) for any damage or twist. Use O-ring of specified size and material.

② Coat the O-ring with lubricant (NICHIMORI LAP spray or equivalent) and install it in the groove of the joint for O-ring.

Supply oil to these points



Supply oil to these points



SC15119E

2) Coat pipe and nipple with lubrication oil

① Coat the threads of nuts and joint of pipes with lubricant (NICHIMORI LAP spray or equivalent).

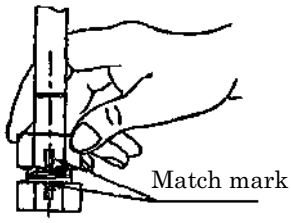
② Coat the threaded portion and seat face of nipple with lubricant (NICHIMORI LAP spray or equivalent).

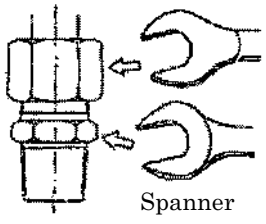
3) Tightening steps

① Tighten the pipe to the nipple.
Tighten the pipe nut with a hand, and further tighten it till it touches the tapered portion (finger tight position).

② Mark a match mark on nut and nipple with a chalk.

③ Prepare two spanners. While holding the nipple with one spanner, tighten the nut further one-quarter (1/4) turn from finger tight position with the other spanner.





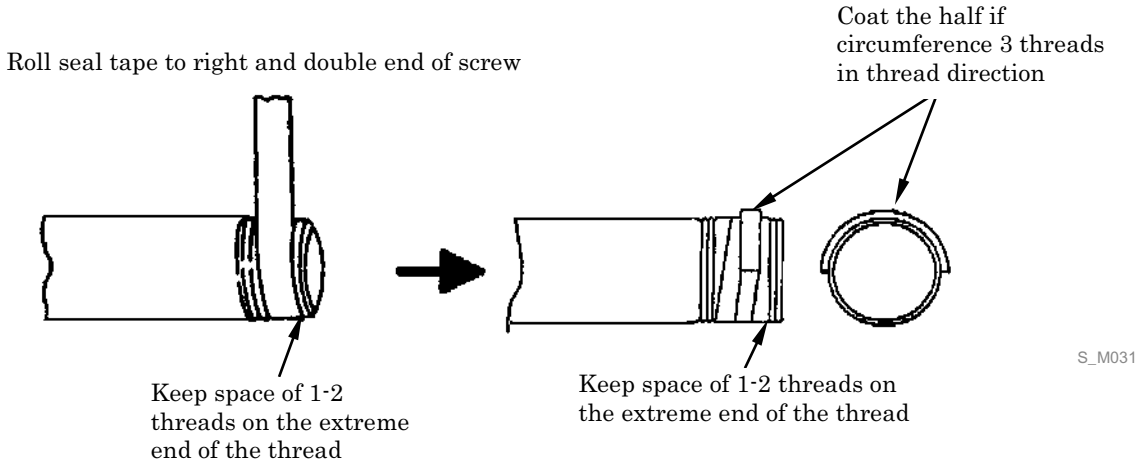
SC15107

IMPORTANT	● Sometimes the nut becomes loose owing to vibration or any other operating conditions. Periodically check it for any looseness. If any looseness noticed, turn it again 1/4 further after the finger tight position.

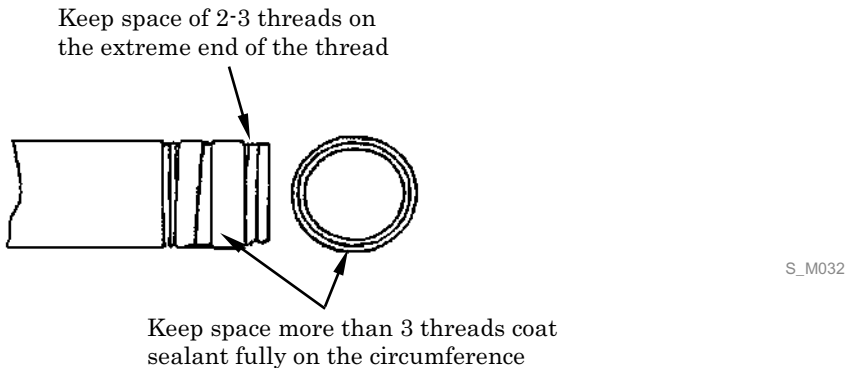
(4) Pipe tapered threads

Sealing tapes are used to prevent any leakage of oil, water, fuel and air by stopping the space between female and male threads of metal pipe and fittings (PT thread for pipe). Be noted that how to seal varies upon the diameter of thread.

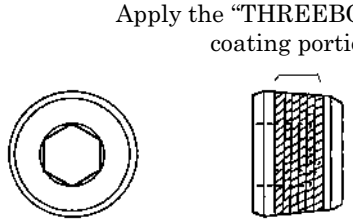
1) How to seal for tube screw less than R 1 (25A) of screw diameter
   ① Wipe out oil and fat content with wasted cloth.
   ② Roll seal tape (Gaflon threaded sealing tape).
   ③ Coat sealant "THREEBOND 1212" on the seal tape which is attached. According to the figure below.



2) How to seal for tube screw of larger than R 1 1/4 (32A) of thread diameter
   ① Wipe out oil and fat content with wasted cloth.
   ② Roll seal tape (Gaflon threaded sealing tape). [same as previous clause]
   ③ Coat sealant "THREEBOND 1212" on the seal tape which is attached. According to the figure below.



3) Concerning components with screw portions coated with a sealant
Components with their screw portions coated with a sealant are to be screwed in upon applying a sealant (THREEBOND 1212).



SC14002

4) Standard tightening torque of piping PT screw (Reference value)

Unit: N·m (kgf·cm)

Nominal diameter	Tightening torque	Nominal diameter	Tightening torque	Nominal diameter	Tightening torque
1/8	11 (110)	3/4	65 (660)	2	216 (2,200)
1/4	22 (220)	1	108 (1,100)	2 1/2	270 (2,750)
3/8	32 (330)	1 1/4	129 (1,320)	3	323 (3,300)
1/2	43 (440)	1 1/2	162 (1,650)		

※Over torque tightening could lead to deforming of threads and resulting in oil leakage.
(2 threads should be left as standard)

(5) Nylon tube

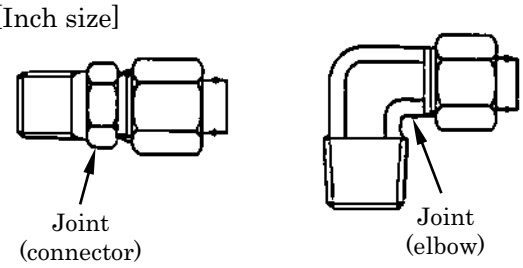
Size of nylon tubes used for this machine is expressed in inch.
Inch size …… It is use spanner when tightening sleeve nad nut to piping.

1) Tightening for joint of nylon tube and sleeve nut
Following chart is for tightening torque of each size joint and sleeve nut.

2) Tightening torque of Joint

Screw size R (PT)	Tightening torque N·m (kgf·cm)
1/8	7.8 (80)
1/4	13 (130)
3/8	23 (230)
1/2	28 (290)

[Inch size]



TXT106
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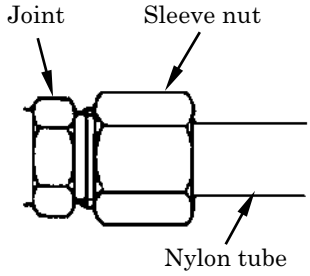
IMPORTANT

- Tightening torque is specified for each size thread. Be sure that there is no relation between the size of width across flats of screwing tool and the tightening torque.
- Please coat the joint part of threading area with sealing agent "THREEBOND 1212" before screwing in.

3) Tightening sleeve nut

Installing new nylon tube, sleeve and sleeve nut, attach the nylon tube firmly to the joint connector and tighten the sleeve nut till proper revolutions by hand, and them tighten the sleeve nuts till proper turns, using a tightening tool such as spanner.

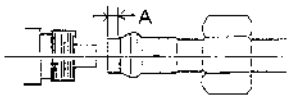
Tube nominal diameter	Tool width across flat (mm)	Sleeve nuts proper tightening turns (turn times)	Tightening torque N·m (kgf·cm)
1/8	8	1/2—1	3.8 (39)
3/16	10	1/2—1	6.3 (64)
1/4	12	1/2—1	6.4 (65)
3/8	17	1/2—1	18.0 (180)
1/2	19	1/2—1	23.0 (230)



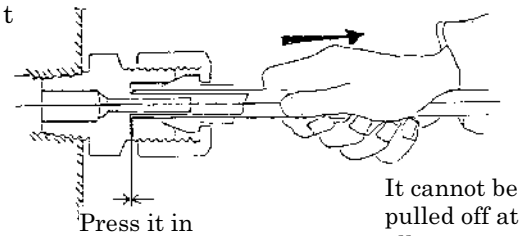
ΓXT107

Before installing nylon tube, check the size of A.

If you do not use caulking tool, check the size of A again a



After having tightened it, make sure to confirm that the t



SCTXT050

IMPORTANT	● In order to tighten sleeve nut correctly, keep the correct tightening turns of sleeve nut in accordance with the nut turning constant times. The optimum turning times mean the revolutions times after tightening the nuts fully by hand. The tightening torque of above chart is referent value.

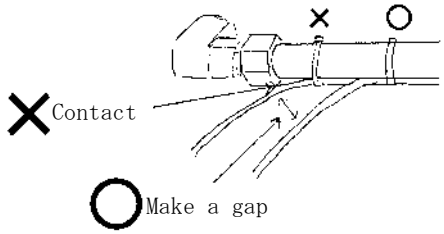
(6) How to install hose

Pay attation followig part when install nylon tube and hose.

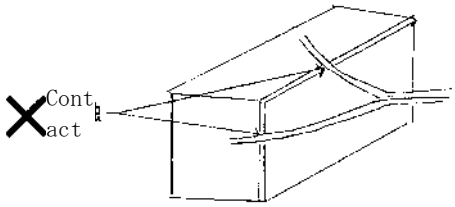
1) Nylon tube

① Check 1/8 and 3/16 size nylon tubes for any break. (Pipe for pressure gauge)

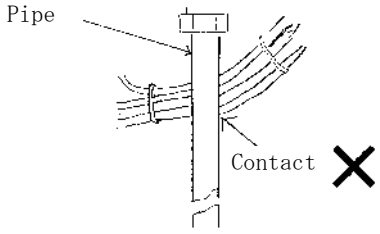
② Connect nylon tube, preventing it from contacting any edge of copper pipe and steel pipe nut.



③ Make connection of nylon tube, taking care not to touch the edge of bracket and plate etc.



④ Make connection of nylon tube, taking care not to touch any copper or steel pipe.
(If it is avoidably impossible, use it, being protected by felt)

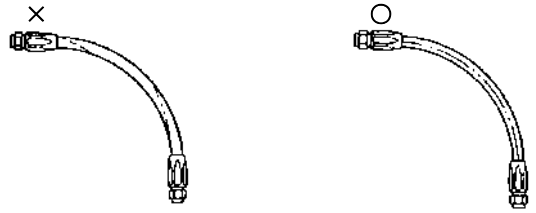


S_M121

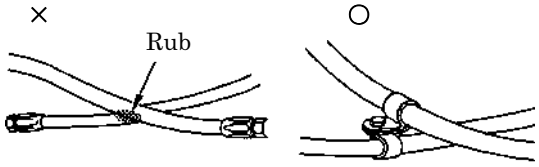
2) Hose

① Authentic hose when replacing it. If not, it will cause oil leakage, break and disconnection, and it leads to fire.

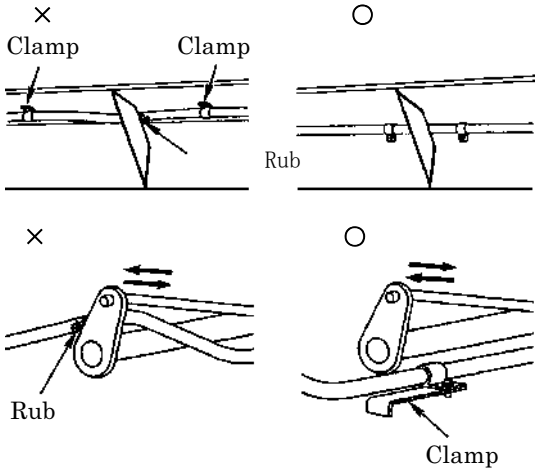
② Never use hose twisted. Twisted hose will cause oil leakage, break and fitting disconnection when they are loaded with high pressure, vibration and shock. The printed mark on outside surface of hose is a guide for prevention of twisted connection.



③ Avoid contact between hose. If the hose is rubbing each other continuously, it causes damages and also burst on hose.



④ Take care not to make hose touch sharp edge or moving part of the unit or component.



2. Maintenance

2.3 Periodic Inspection / Maintenance List

Periodical Inspection and maintenance (A):

In case that total operation hours per one year are less than 3,000 hours

[A: It refers to the inspection items of dryer.]

Inspection items		Inspection points	Maintenance interval							Remarks
			Daily	1 month	Every 1 year	Every 2 years	Every 4 years	Every 6 years	Every 8 years	
Indication of each gauge			○							See the item "Operating method"
Compressor oil level		Check	○							Oil level to be between red lines at loaded operation.
Refrigerant pressure gauge	A	Check	○							In the range 0.70 to 1.15MPa
Separator receiver tank drain		Drain	○ (Every week)							
Dustproof air filter		Check / clean	○							
Safety valve		Check performance		○						
Air-filter element		Clean		○						
Strainer at draining portion of dryer drain	A	Clean		○						Status confirmation of drain discharge Clean it depending on its conditions
Dustproof air filter		Change			○					
Scavenging orifice strainer		Clean			●					
Scavenging orifice O-ring		Check			●					Re-usable after check, if normal.
Cooling fan (For cooler)		Check / clean			●					When it is heavily stained, clean it as soon as possible.
Rubber hose		Check			●					
Nylon tube		Check			●					
Coil of main motor		Insulation resistance			●					More than 1MΩ at DC500V Mega.
Ventilating fan in starter panel		Change			●					Re-usable after check, if normal.
Coil for the cooling fan motor of the cooler		Insulation resistance			●					More than 1MΩ at DC500V Mega.
Inverter for the cooling fan motor of the cooler		Check / clean			●					
Air-filter element		Change				○				
Compressor oil		Change				※4○				
Oil filter		Check / change				●				
O-ring of oil filler		Change				●				
Oil separator element		Change				●				
Nylon tube		Change				●				
Oil cooler/ After cooler		Clean				●				When it is heavily stained, clean it as soon as possible.
Oil level gauge		Change				●				When it is heavily stained, change it as soon as possible.
Condenser of dryer	A	Clean				●				Removal of debris and dust
Dryer fan motor	A	Check				●				
Bearing of main motor		Change					●			
Bearing of cooling fan motor		Change					●			Re-usable after check, if normal.

2. Maintenance

Inspection items		Inspection points	Maintenance interval							Remarks
			Daily	1 month	Every 1 year	Every 2 years	Every 4 years	Every 6 years	Every 8 years	
Oil seal for compressor air-end		Change					●			
Consumable part of unloader		Change					●			
Consumable part of vacuum relief valve		Change					●			Built-in components of unloader.
Rubber hose		Change					●			
Consumable part of pressure control valve		O-ring Check / change					●			
		Piston Check / change					●			Re-usable after check, if normal.
Discharge air temp. / Separator discharge air temp. / Ambient temp. sensor		Check					●			Re-usable after check, if normal.
Solenoid valve		Change					●			Re-usable after check, if normal.
Compressor for freezing dryer	A	Change					●			Re-usable after check, if normal.
Fan control pressure switch for dryer	A	Change					●			Re-usable after check, if normal.
Collar for oil seal for compressor air-end		Check					●			Re-usable after check, if normal.
		Change					※3●	※2●	※1●	
Bearing of compressor air-end		Change					※3●	※2●	※1●	
Smoothing capacitor of the inverter for the cooling fan		Change							●	Re-usable after check, if normal.

Regarding the items or parts marked ○ in the table of periodical maintenance customers or users should perform periodical maintenance of the items or parts marked ○ by themselves.
For such items or parts marked ●, contact our office nearby or distributor because technical knowledge is required.
Also the maintenance interval in the table shall be based on the normal operation conditions.
Regarding the periodical maintenance between inspection period and operation hours, maintenance or inspection should be performed, roughly according to 250 hours/month, 3,000 hours/year, 6,000 hours/2 years, 12,000 hours/4 years, 18,000 hours/6 years and 24,000hours/8 years.

※1 shows the interval time of bearing replacement for the compressor of the pressure of 0.70MPa.
※2 shows the interval time of bearing replacement for the compressor of the pressure of 0.85MPa.
※3 [SAS series only]
Shows the interval time of bearing replacement for the compressor of the pressure of 0.93MPa.(2-point control type)
Shows the interval time of bearing replacement for the compressor of the pressure of 0.90MPa.(Regulator control type)
※4 Please make sure to use the AIRMAN genuine dedicated oil “LONG-LIFE HP”.
However, in case AIRMAN dedicated oil is un-acquirable, using the recommendation oil of a statement in 5.3, and please reduce by half all the periods those are suggested in the table of periodic inspection/ maintenance.

- Only main components are mentioned in the table.
- Maintenance interval means that periodical maintenance should be repeatedly carried out.
- Use AIRMAN genuine parts and recommended oil for replacement.

＊ When such parts which are not mentioned in the table need inspection and or maintenance, contact our office nearby or distributor.

2. Maintenance

Periodical Inspection and maintenance (B):

In case that total operation hours per one year are less than 6,000 hours

[A: It refers to the inspection items of dryer.]

Inspection items		Inspection points	Maintenance interval							Remarks
			Daily	1 month	Every 1 year	Every 2 years	Every 4 years	Every 6 years	Every 8 years	
Indication of each gauge			○							See the item "Operating method"
Compressor oil level		Check	○							Oil level to be between red lines at loaded operation.
Refrigerant pressure gauge	A	Check	○							In the range 0.70 to 1.15MPa
Separator receiver tank drain		Drain	○ (Every week)							
Dustproof air filter		Check / clean	○							
Safety valve		Check performance		○						
Air-filter element		Clean		○						
Strainer at draining portion of dryer drain	A	Clean		○						Status confirmation of drain discharge Clean it depending on its conditions
Dustproof air filter		Change			○					
Air-filter element		Change			○					
Compressor oil		Change			※4○					
Scavenging orifice strainer		Clean			●					
Scavenging orifice O-ring		Check			●					Re-usable after check, if normal.
Cooling fan (For cooler)		Check / clean			●					When it is heavily stained, clean it as soon as possible.
Oil filter		Check / change			●					
Oil separator element		Change			●					
Rubber hose		Check			●					
Nylon tube		Check			●					
Coil of main motor		Insulation resistance			●					More than 1MΩ at DC500V Mega.
Ventilating fan in starter panel		Change			●					Re-usable after check, if normal.
Coil for the cooling fan motor of the cooler		Insulation resistance			●					More than 1MΩ at DC500V Mega.
Inverter for the cooling fan motor of the cooler		Check / clean			●					
Oil cooler/ After cooler		Clean			●					When it is heavily stained, clean it as soon as possible.
Condenser of dryer	A	Clean			●					Removal of debris and dust
Dryer fan motor	A	Check			●					
O-ring of oil filler		Change				●				
Nylon tube		Change				●				
Consumable part of pressure control valve		O-ring Check / change				●				
		Piston Check / change				●				Re-usable after check, if normal.
Consumable part of unloader		Change				●				
Consumable part of vacuum relief valve		Change				●				Built-in components of unloader.

2. Maintenance

Inspection items		Inspection points	Maintenance interval							Remarks
			Daily	1 month	Every 1 year	Every 2 years	Every 4 years	Every 6 years	Every 8 years	
Oil level gauge		Change				●				When it is heavily stained, change it as soon as possible.
Bearing of main motor		Change					●			
Bearing of cooling fan motor		Change					●			Re-usable after check, if normal.
Oil seal for compressor air-end		Change					●			
Rubber hose		Change					●			
Discharge air temp. / Separator discharge air temp. / Ambient temp. sensor		Check					●			Re-usable after check, if normal.
Solenoid valve		Change					●			Re-usable after check, if normal.
Compressor for freezing dryer	A	Change					●			Re-usable after check, if normal.
Fan control pressure switch for dryer	A	Change					●			Re-usable after check, if normal.
Collar for oil seal for compressor air-end		Check					●			Re-usable after check, if normal.
		Change					※3●	※2●	※1●	
Bearing of compressor air-end		Change					※3●	※2●	※1●	
Smoothing capacitor of the inverter for the cooling fan		Change							●	Re-usable after check, if normal.

Regarding the items or parts marked ○ in the table of periodical maintenance customers or users should perform periodical maintenance of the items or parts marked ○ by themselves.
For such items or parts marked ●, contact our office nearby or distributor because technical knowledge is required.
Also the maintenance interval in the table shall be based on the normal operation conditions.
Regarding the periodical maintenance between inspection period and operation hours, maintenance or inspection should be performed, roughly according to 500 hours/month, 6,000 hours/year, 12,000 hours/2 years, 24,000 hours/4 years, 36,000 hours/6 years and 48,000hours/8 years.

※1 shows the interval time of bearing replacement for the compressor of the pressure of 0.70MPa.
※2 shows the interval time of bearing replacement for the compressor of the pressure of 0.85MPa.
※3 [SAS series only]
shows the interval time of bearing replacement for the compressor of the pressure of 0.93MPa.(2-point control type)
shows the interval time of bearing replacement for the compressor of the pressure of 0.90MPa.(Regulator control type)
※4 Please make sure to use the AIRMAN genuine dedicated oil “LONG-LIFE HP”.
However, in case AIRMAN dedicated oil is un-acquirable, using the recommendation oil of a statement in 5.3., and please reduce by half all the periods those are suggested in the table of periodic inspection/ maintenance.

- Only main components are mentioned in the table.
- Maintenance interval means that periodical maintenance should be repeatedly carried out.
- Use AIRMAN genuine parts and recommended oil for replacement.

＊ When such parts which are not mentioned in the table need inspection and or maintenance, contact our office nearby or distributor.

2. Maintenance

2.4 Inspection / Maintenance

Perform this job of inspection and maintenance safely, referring to the instruction manual for routine inspection/maintenance.

Herewith only such items which are not mentioned in the instruction manual supplied together with each unit shall be explained.

2.4.1 Inspection of motor and bearing replacement procedure

(1) Inspection of insulation resistance of motor coil

IMPORTANT	● Make sure to switch off power supply switch. ● Make sure to separate cables from contactor (Inverter model: inverter terminal block). ● Never touch any terminal of each cable because insulation resistance will be reduced if touched.

1. Insulation between ground and motor body

① Separate motor cable from contactor.

② Measure insulation resistance between each phase and motor body.

Main motor

Measure insulation resistance between U1 and U2 terminal and motor body, between V1 and V2 terminal and motor body and also between W1 and W2 terminal and motor body.

Cooling fan motor

Make U4, V4 and W4 terminal short-circuited and measure insulation resistance between each phase and motor body.

③ Results of measurements:

In case it is more than 1MΩ, normal.

In case it is less than 1MΩ, abnormal.

2. Check coiled wires for disconnection (For reference)

① Separate motor cable from contactor.

② Measure coil resistance of each phase, using a resistance tester.

Main motor

Measure coil resistance between U1 and U2 terminal, V1 and V2 terminal and W1 and W2 terminal.

Cooling fan motor

Measure coil resistance between U4 and V4 terminal, V4 and W4 terminal and W4 and U4 terminal.

③ Results of measurements:

For the coil resistance of each motor, refer to 1.2.

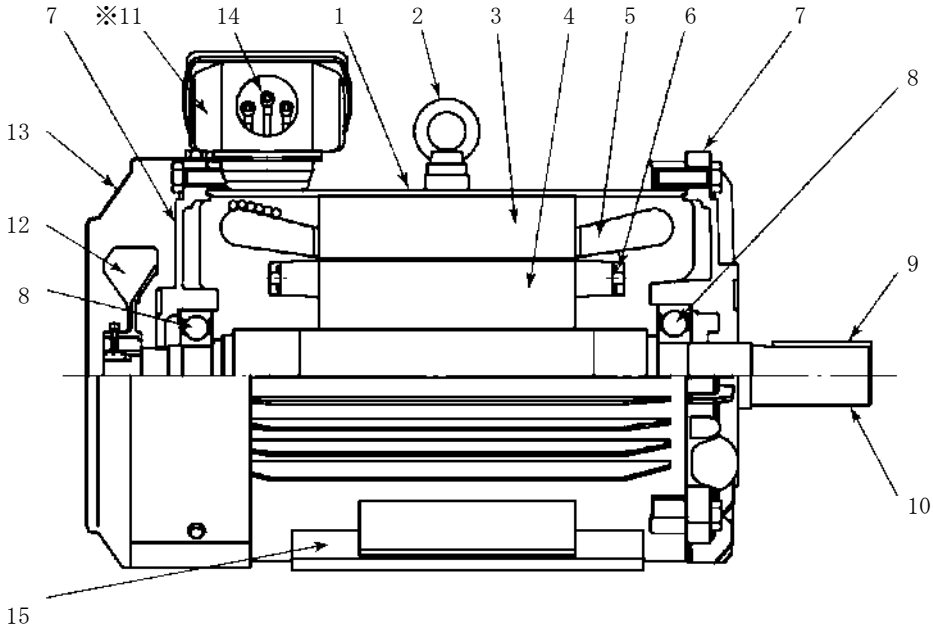
In case it is infinite (∞), abnormal (disconnection).

(2) Replacement of motor bearing

1. Main motor

Replace the motor bearing in the manner outlined below. The following is an explanation of a method that does not involve removing the rotor (for such as on-site replacement).

<Cross Section>



SC15061

No.	Component Name	No.	Component Name
1	Stator frame	9	Shaft end key
2	Eye bolt	10	Shaft
3	Stator core	※11	Terminal junction box (Not equipped as our company standard)
4	Rotor core	12	Outer fan
5	Stator winding	13	Outer fan cover
6	End ring fan	14	Round type crimp terminal
7	Bearing bracket	15	Mount leg part
8	Bearing		

<Precautions during disassembly>

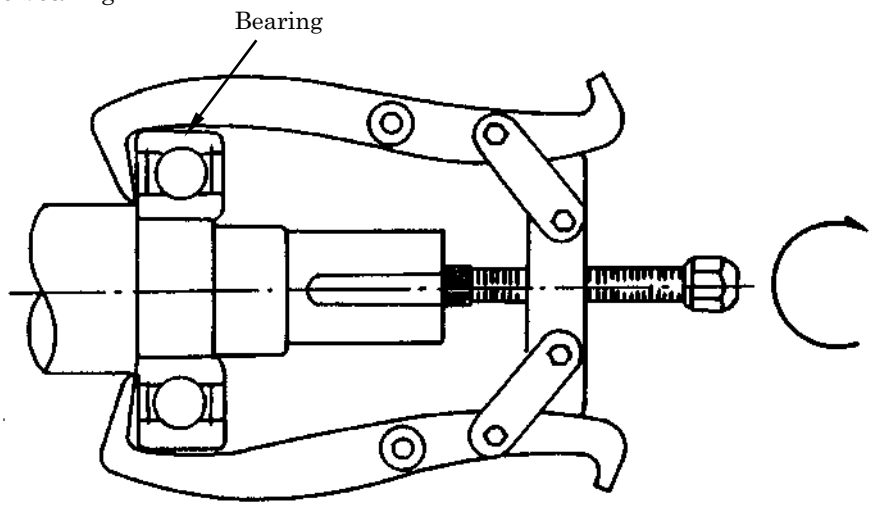
- Be sure to perform the task of replacement at one end at a time either on the loaded side or the non-loaded side. If both sides are disassembled at the same time, the stator and the rotor could come into contact and cause scratches on the outer perimeter or damage the windings.
- Be sure to clean the assembly location, working benches, and tools. Hands and cloths should also be kept clean and blankets being used should be those that are free of loose fibers.
- Thoroughly clean the entire motor. Make sure that the components that have been removed are sufficiently cleaned and washed before they are reassembled.
- Check the insertion surfaces of such as the shaft and bearing housing for scratches or rut, etc. Remove any sharp edges of the insertion surface, and after thoroughly removing any metal chippings or dust, clean components with benzene and let sit to dry.

[Loaded side bearing]

① Remove the bearing bracket attachment bolt and lightly strike this with a plastic hammer to remove the bearing bracket.

② Remove the bearing from the shaft by using a gear puller, etc. as illustrated below.

<Remove the bearing>



TXT079

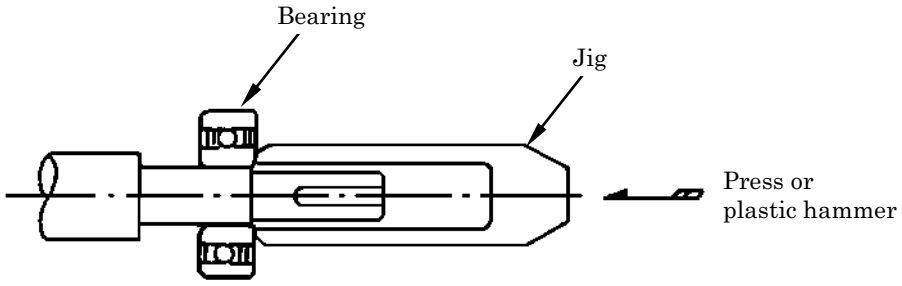
③ The bearing is assembled using a bearing heater or a press fitting jig, etc.
(Make sure that the heated temperature of the bearing heater is around 90°C and does not exceed 100°C.)

④ Always be sure to apply force to the inner ring when inserting the bearing by striking the jig with a plastic hammer, etc.

⑤ Assemble the bearing such that the stamping of the bearing number faces the outer side of the motor.

⑥ Assemble the bearing bracket and the bearing cover by reversely going through the steps of disassembly and evenly fasten the bolts.

<Install the bearing>



TXT080

IMPORTANT	● Never hammer directly the bearing with a metal hammer for inserting the bearing. ● Never hold the bearing outer ring with a metal pad and insert it by hammering. ● As the bearings use non-contact rubber seals and long-life heat-resistant grease, make an inquiry when these are to be replaced.

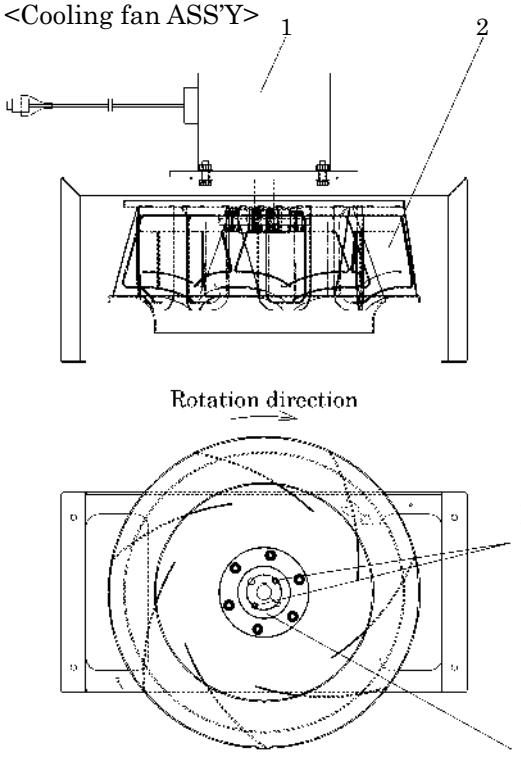
[Non-loaded side bearing]

① Remove the fan cover and the fan.
② Remove the bearing bracket attachment bolt and lightly strike this with a plastic hammer to remove the bearing bracket.
③ Remove the preload spring.
④ Remove the motor bearing, using such tool as gear puller.
⑤ The bearing is assembled using a bearing heater or a press fitting jig, etc.
(Make sure that the heated temperature of the bearing heater is around 90°C and does not exceed 100°C.)
⑥ Always be sure to apply force to the inner ring when inserting the bearing by striking the jig with a plastic hammer, etc.
⑦ Assemble the bearing such that the stamping of the bearing number faces the outer side of the motor.
⑧ Assemble the bearing bracket, fan and the bearing cover by reversely going through the steps of disassembly and evenly fasten the bolts.
※Be careful not to forget to assemble the preload spring when attaching the bearing bracket.

2.Cooling fan motor

Cooling fan motor "1" constitutes ASS'Y construction with cooling fan "2". The motor is IS motor (※) which equips rotor using permanent magnet. Be sure to take care not to adsorb extraneous material when deconstruction. We recommend you to request maker for removing cooling fan ASS'Y when replacing fan motor bearing.

<Cooling fan ASS'Y>



Cooling fan assembly weight
・Cooling fan motor "1" : Approximately 20kg
・Cooling fan "2" : Approximately 10kg
・Motor bracket : Approximately 7kg
Total approximately 37kg

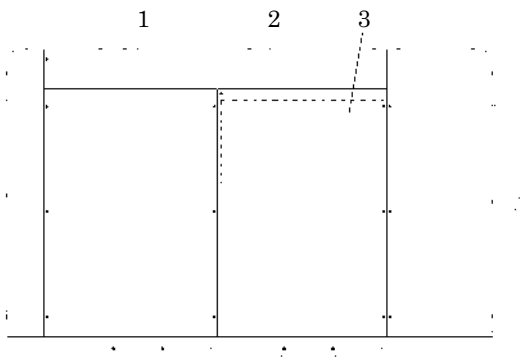
Cooling fan and motor shaft are fixed with bushing.

SC15009E

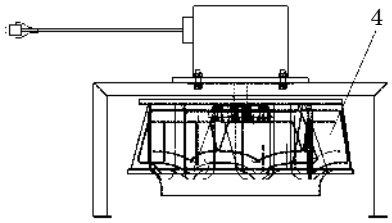
※IS motor : Induction-Synchronous Motor

High efficiency motor which works as induction motor when starting and as synchronous motor when operation. It has both features of induction motor and synchronous motor.

2.4.2 Check and change cooling fan



SC15010



SC15011

<Inspection procedures>

●Be sure to switch the power “OFF” before performing tasks and in order to prevent the power supply from being switched back on by accident while performing the tasks, place a sign stating “Performing Maintenance – DO NOT SWITCH ON” by the power supply.

①Remove the rear cover“1”and“2”.

②You can check cooling fan “4” by removing fan guard fix bolt “3” (M6-9 poles).

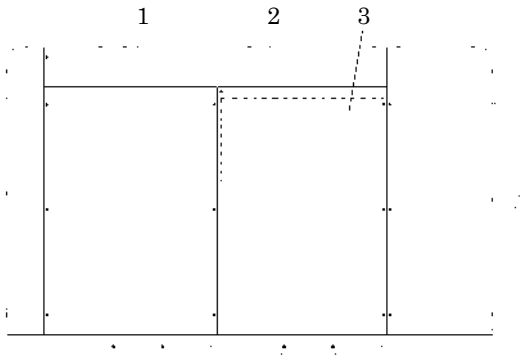
③Check cooling fan “4” whether deformation/crack is there or not. If there is, please replace it.

④Clean dust that stuck on the fan by air blowing.

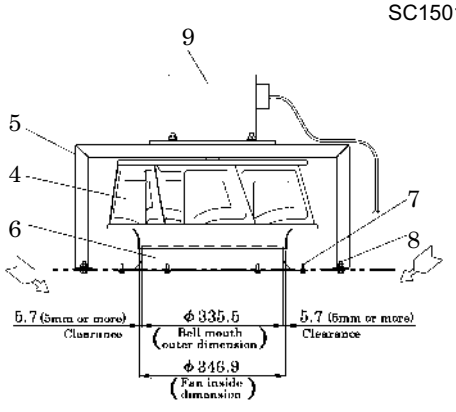
●If too much dust is stuck on the fan, the fan will get unbalanced and the abnormal vibration due to such unbalance may cause crack to it. More often clean the fan even before scheduled maintenance interval, when the machine is used in especially dusty environment.

Measure when abnormality at the cooling fan is found

Cooling fan and motor need balance adjustment, so we recommend you to request maker for removing cooling fan ASS’Y (United with motor) when replacing cooling fan.



SC15010



Mounting dimension details

SC15012E

<How to replace>

①Remove the rear cover“1”・“2”and fan guard.
Remove fix bolt “3” (M6-9 poles).

②Remove bellmouth (outer ring) “6” by loosening fix bolt (M6-6 poles) “7” from support cooler side.

③Remove fan motor wire (connector) from the connector of starting board.

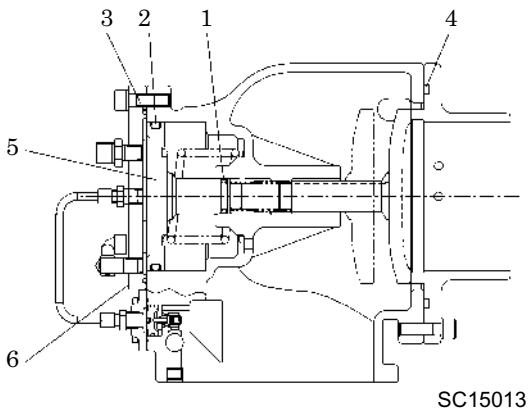
④Remove frame fix bolt “8” (M8-4 poles) for fan motor bracket “5”. Then remove cooling fan “4” which united with cooling fan motor “9” from the machine.
※Cooling fan ASS’Y weight : About37kg

⑤After replacing, please assemble by a reverse procedure to deconstruction.
Caution: be careful not to deform cooling fan.

⑥When setting bellmouth “6”, be sure to adjust the gap between bellmouth “6” and cooling fan “4” to 5mm or more.

2.4.3 O-ring replacement of the unloader and vacuum relief valve

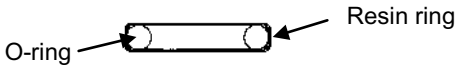
(1) O-ring replacement of the unloader.



SC15013

<Note of the O-ring replacement>

- ●Apply a thin coat of grease on the O-rings when replacing the O-rings “1” and “2”.
  ※Remove piston “5”. Otherwise it rises up by a spring tension when removing cover “6”.
- ●Although O-rings “1” and “2” are of the type where a resin ring is layered on top of an O-ring (commonly referred to as a Teflon ring), as the resin is easily stretched and likely to catch on the bushing which could lead to deformation, please attach these by following the steps outlined below



SC15215

<O-ring “1”・“2” mounting procedures>

- ●Attach it by using insertion/correction jig tool as follows.
- ●Refrain from wearing gloves when performing this task.

<Procedures>

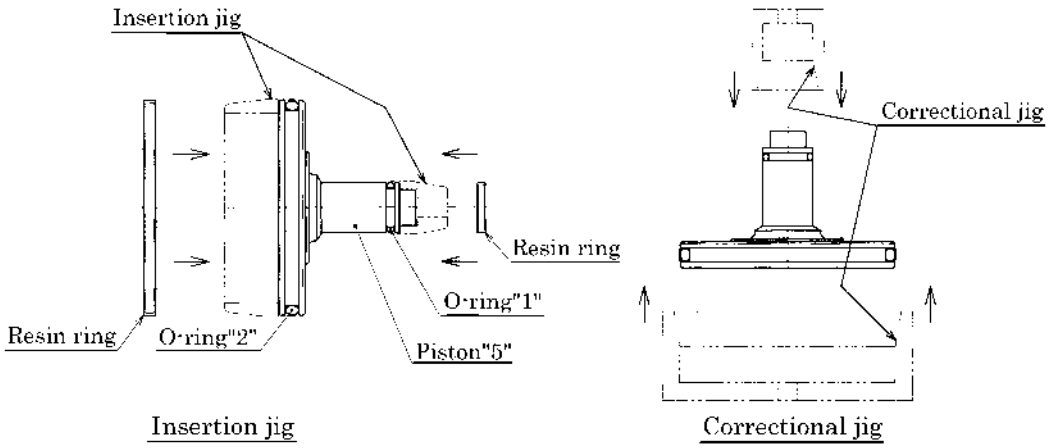
①Apply grease on the O-ring “1” and attach this to the O-ring groove on the shaft of the piston “5”.

②Apply a thin coat of grease to the inner perimeter of resin ring and to the outer perimeter of insertion jig tool. Then attach insertion jig tool. Attach resin ring on the O-ring “1” mentioned by procedure ①.

③Apply a thin coat of grease to the inner perimeter of the correctional jig and insert this into the piston “5” to correct the resin ring. Gradually insert the resin ring while correcting it to prevent it from catching on the correctional jig.

④After insertion, pull out the correction tool and make sure that the resin ring has been properly attached. If the ring has been subject to deformation, make corrections by reshaping the ring again with the correction tool.

⑤Attach O-ring “2” by same procedure.

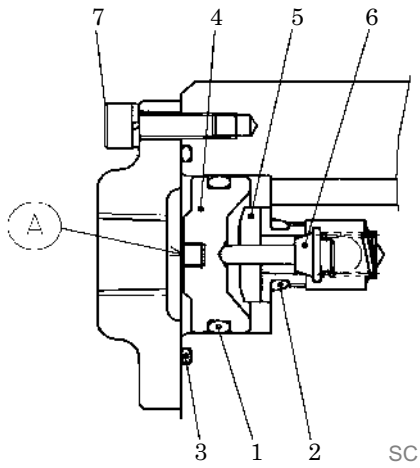


PC16018E

[Insertion and correctional jig]

		O-rings“1”	O-rings“2”
Insertion jig	Part NO.	00817 00196	00817 00198
Correctional jig	Part NO.	00817 00197	00817 00199

(2) O-ring replacement of the vacuum relief valve (Built in unloader)



SC16007

●Apply a thin coat of grease on the O-rings when replacing the O-rings "1" and "2".

※Extract piston "4" by screwing in a bolt "7" in to portion Ⓐ (M4×0.7 internal threads).

※When reassembling needle valve "6", set it perpendicularly and securely tighten valve seat "5"

[Cover fixing bolt "7"]

: 3 mm

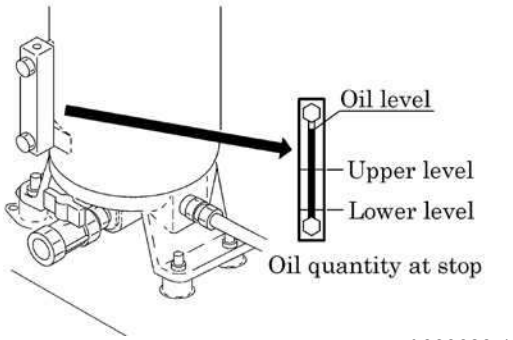
: 2.9 N·m(29kgf·cm)

IMPORTANT	● When reassembling, apply sufficient grease to O-ring Slot/O-ring and sliding surface. Use EPNOC AP(N)1 grease or equivalent. Grease of poor quality will deteriorate the material.

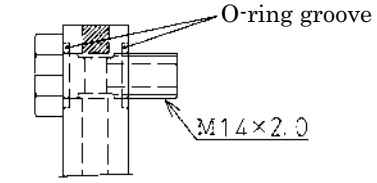
2.4.4 Clean / change oil level gauge

① If the oil level gauge is dirty and the oil volume cannot be confirmed, remove the level gauge and spray the inside with an automotive brake cleaner (with components of 40—45% toluene and 25—30% hexane) a several times.

② Replace the level gauge when its replacement cycle has been reached.



A080628-1



Oil level gauge SC16058

<Caution on replacing oil level gauge>

There is a direction in which the oil level gauge is to be attached. Be sure to attach the oil level gauge such that the red line (Upper and lower level line) is at the bottom.

●Fasten the level gauge attachment bolts with the torque listed below. Failure to fasten the bolts according to the specified torque may cause damage or oil leakage.

●When attaching O-ring, be sure to check there is no extraneous material on O-ring gap or O-ring itself. Then apply lithium generic grease to O-ring and assemble it.

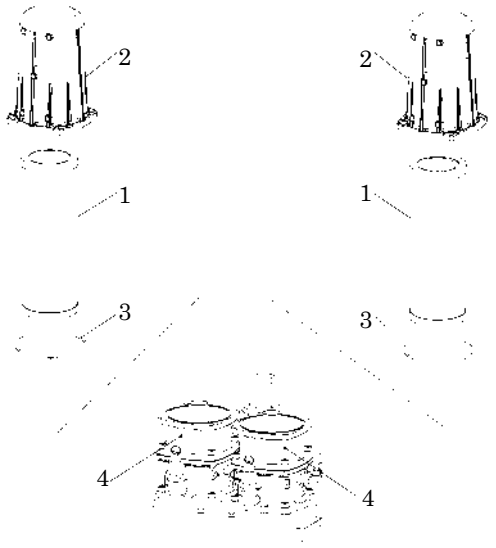
: 22mm

: 6 N·m(61kgf·cm)

It is normal if the level of compressor oil is between the red lines (Up-Low limit) during full-load condition.

2.4.5 Change oil separator

- When consumption of the oil is still unusual even after cleaning strainer in the scavenging orifice, change the oil separator with a new one.
- When replacing the oil separator, be sure to also replace the O-ring.



SC15062

75kW

<Procedures>

①In order to pull out the oil separator “1”, remove the (8-M10) attachment bolts of the separator cover “2”.

②Replace the oil separator “1”. Assemble packing that is attached inside oil separator “1” after apply compressor oil on to its seal surface.

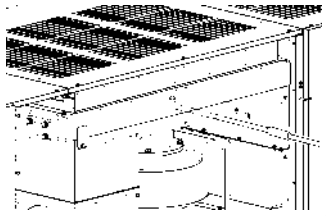
③When assembling O-ring “3”, make sure there is no contamination in the O-ring groove on separator casing “4”. Replace O-ring “3” by a new one.

④Attach the oil separator “1” vertically so that the unit is not tilted.

: 8 mm

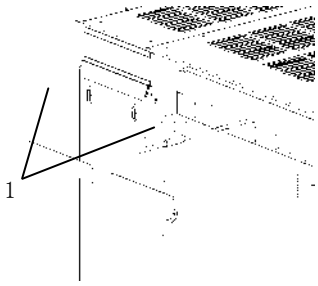
: 49 N·m(485kgf·cm)

2.4.6 Clean oil cooler / aftercooler



A140659

Machine rear side



A140583

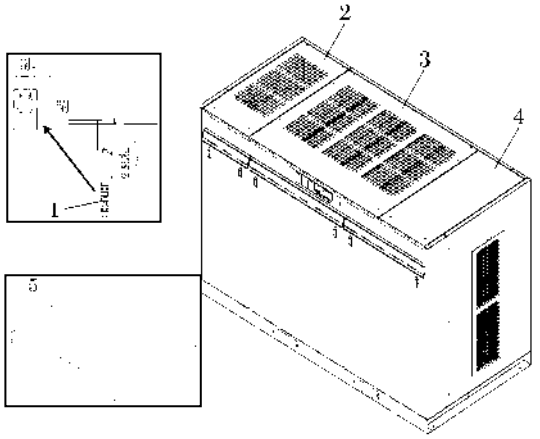
Machine front side

<Procedures>

① Remove the rear cover and clean the fin of the oil cooler and after cooler by blowing compressed air from the bottom to remove film or dust. Clean the remaining dirt using a brush.

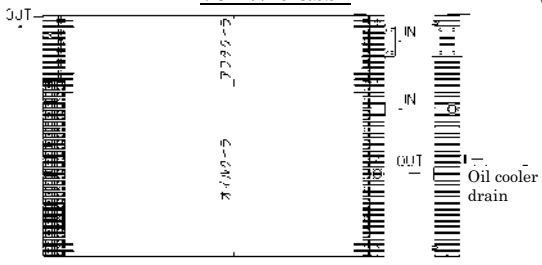
② If dirt or dust cannot be easily removed by taking off only the rear cover, also remove front inspection cover "1" to clean the oil cooler and after cooler. Before you start cleaning, cover the starter panel to block dirt and dust from entering.

- In case of heavy contamination, remove the cooler and clean it using steam.
- When cleaning it, contact our office nearby or distributor.



SC15019

75kW class



SC15022

75kW class

<Cooler remover procedure>

①Open the oil cooler drain valve "1" within the unit and transfer the oil within the cooler to the separator receiver tank.

②Remove the top covers "2", "3", and "4". And duct "5".

③Remove the pipes (2 for the oil circuit / 2 for the air circuit・oil cooler drain).

④Remove cooler (oil cooler/aftercooler) by using a tool like nylon sling.

⑤Clean the cooler that has been removed using steam. If the cooler is especially dirty, use a neutral detergent and remove the dirt with a brush.

⑥After attaching the cooler, assemble the unit by reversely going through the steps for disassembly.

⑦If the oil inside the cooler has been removed, be sure to add oil.

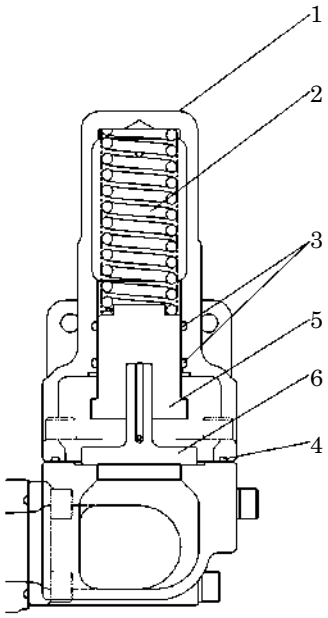
Model	Cooler weight(kg)
55kW class	60.4
75kW class	72.1

IMPORTANT	● When cleaning the cooler, be careful not to damage its fins. Blow compressed air at right angle to the cooler.

2.4.7 Maintenance adjustment of pressure control valve

(1) Maintenance procedures

If the discharge pressure falls below 0.39MPa during operation, perform a maintenance adjustment of the pressure control valve by following the steps outlined below.
As it is possible that the O-ring has deteriorated or hardened, replace the O-ring even if the replacement cycle has not yet been reached.



SC15023

<Procedures>

①After making sure that the compressed air within the pipes has been completely discharged, remove the body "1" and replace the spring "2" and the O-rings "3" and "4".
② During assembly, be sure to assemble the unit upon applying a sufficient amount of grease on the O-ring "3" and the piston "5"
③Be careful not to get grease on the sliding surface of the piston "5" and the valve "6".
④After completing the assembly, making sure that there is nothing abnormal during operation.

[Pressure control valve set pressure]

: 0.39 $^{+0.10}_{-0.05}$ MPa

[Spanner size of the body "1"]

: 8 mm

: 49 N·m(485kgf·cm)

IMPORTANT	● When reassembling, apply sufficient grease to O-ring groove/O-ring and sliding surface. Use EPNOC AP(N)1 grease or equivalent. Grease of poor quality will deteriorate the material.

⚠ WARNING	● When deconstructing pressure control valve, be sure to loosen fix bolt (4 poles) for body "1" gradually and equally so as to prevent sudden rising up of body "1" by spring tension.

2.4.8 Discharge air temperature sensor and separator discharge air temperature sensor

(1) Checking the function

Check the function according to the following procedures.

① During operation, remove the sensor cable connected to the controller.

② Make sure to confirm that the unit is stopping and the lamp indicating abnormality glows.

(2) Checking the temperature and resistance

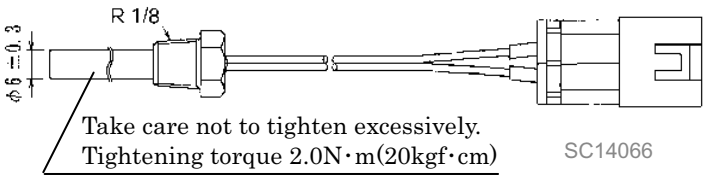
Check and confirm resistance value per each temperature, according to following.

① Separate the cable between controller and sensor.

② Confirm the relations between temperature and resistance according to the following table.

Features of temperature and resistance

Temperature (℃)	Resistance (Ω)	Permissible value (%)
20	11,620	±10
35	6,270	±9
50	3,560	±8
65	2,120	±7
80	1,310	±6
95	840	±5
110	560	±4
115	490	±4



2.4.9 Intake air temperature sensor

(1) Checking the function

Check ambient temperature by display screen after selecting intake air temperature display screen by pressing selector switch three times. Then check and confirm that intake air temperature around machine is equal to the temperature value displayed.

(2) Checking the temperature and resistance

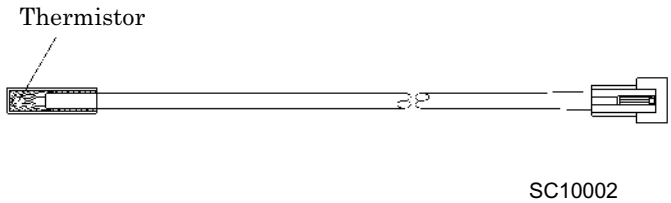
Check and confirm resistance value per each temperature, according to following.

① Separate the cable between controller and sensor.

② Confirm the relations between temperature and resistance according to the following table.

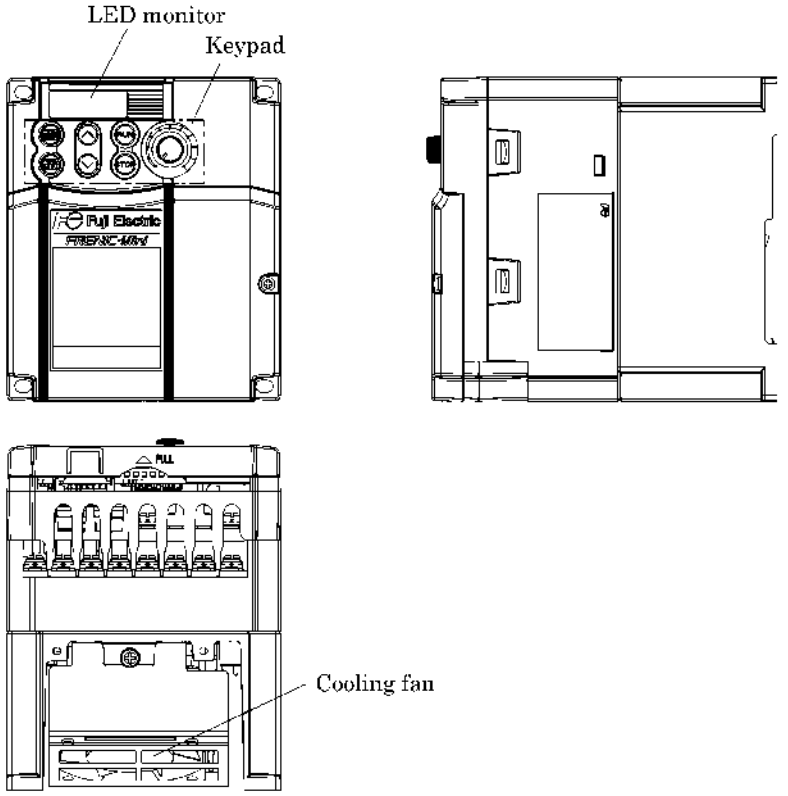
Features of temperature and resistance

Temperature (℃)	Resistance (Ω)	Permissible value (%)
0	15,000	±5
10	9,765	
20	6,517	
30	4,448	
40	3,100	



2.4.10 Inverter for cooling fan

【Excerpted from inverter manufacturer's instruction manual】



SC15025E

<linspection / cleaning>

Check part		Check item	How to inspect	Evaluation criteria
Keypad		1) Check that the display is clear. 2) Check that there is no missing part in the displayed characters.	1), 2) Visual inspection	1), 2) The display can be read and there is no fault.
Structure such as frames and covers		Check for: 1) Abnormal noise or excessive vibration 2) Loose bolts (at clamp sections) 3) Deformation or breakage 4) Discoloration caused by overheat 5) Contamination or accumulation of dust or dirt	1) Visual or auditory inspection 2) Retighten 3), 4), 5) Visual inspection	1), 2), 3), 4), 5) No abnormalities
Cooling system	Cooling fan	Check for: 1) Abnormal noise or excessive vibration 2) Loose bolts 3) Discoloration caused by overheat	1) Visual or auditory inspection Rotate by hand (Be sure to do it after powering-off) 2) Retighten 3) Visual inspection	1) Smooth rotation 2),3) No abnormalities
	Ventilation path	Check the heat sink, intake and exhaust ports for clogging and foreign materials.	Visual inspection	No abnormalities

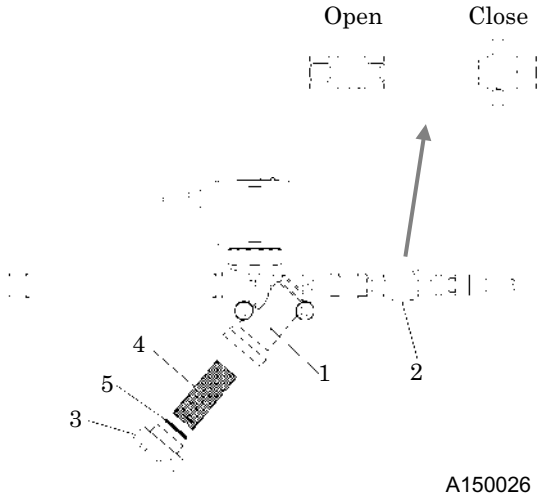
2. Maintenance

Remove dust accumulating on the inverter with a vacuum cleaner. If the inverter is stained, wipe it off with a chemically neutral cloth.

※ Inverter constituted a main circuit capacitor and electrolytic capacitor on printed board. If above mentioned parts are broken, it is necessary to return the inverter to original maker for repair or replacement. Cooling fan is not equipped.

WARNING	● Before proceeding to the maintenance and inspection, turn OFF the power and wait at least five minutes. Make sure that the LED monitor is turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped below the safe level (+25 VDC or below). **Electric shock may occur.**

2.4.11 Clean the strainer in the solenoid valve for draining condensate in dryer



A150026

<Procedures>

①When cleaning the Y type strainer “1” for dryer draining condensate solenoid valve, close drain valve “2”.

②Remove nut “3” of Y type strainer, and pull out screen “4”.

③Clean the screen and inside of Y type strainer.

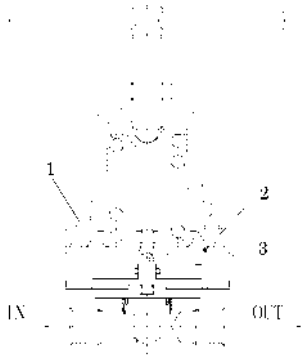
●Then, when installing the nut “3”, check O-ring “5” and replace it immediately if it is found damaged.

: 27 mm

: 23 - 27 N･m (235 - 275kgf･cm)

※Drain valve “2” should be always kept “OPEN” except when it is to be cleaned.

2.4.12 Change diaphragm of regulator (Regulator control type only)



PC15028

<Procedure>

①Demount regulator assembly. And loosen screw “3” (6 pieces) and disassembled it.

②Replace diaphragm “4” with new ones.

③Retighten screw “3” (6 pieces) equally in whole circumference so that the stem “5” is straight.

: 4 N·m(40kgf･cm)

④After replacing, adjust pressure by referring item 3.4.3.

3. Electrical System

3.1 Functions

3.1.1 Specifications

(1) Function of controller

Item	Contents		
Capacity control system	2-Point control (S type)	According to air consumption, air quantity will be regulated automatically to 0 or 100 %. When discharge air exceeds setting pressure (Unload starting pressure), compressed air in separator receiver tank will be purged into air and discharge pressure will be lowered to about 0.1MPa. Then power consumption of compressor will be lowered to about 20 % of full load operation.	
	Regulator control (R type)	According to air consumption, air quantity will be regulated automatically to 0 - 100 % steplessly. When discharge air exceeds setting pressure (Unload starting pressure), compressed air in separator receiver tank will be purged same as the case of 2-point control system. Then power consumption of compressor will be lowered to about 20 % of full load operation.	
Operation panel indicator	Display indicator	・Air service pressure ・Discharge air temperature ・Separator discharge air temperature ・Intake air temperature ・Load factor(Regulator control type only) ・Operation hour	
	Operation mode	・Start ・Stop ・Dryer advance operation ・Remote control ・Low pressure operation (When this mode is selected regulator control type turns to 2-point control.) ・Auto start/stop	
	Trouble lamp indicator (flicker)	Warning	・Discharge air temperature H (105℃) ・Air filter clogging ・Warning: Dryer (Dryer built-in type only) ・Intake air temperature (52℃) ・Discharge air temperature HH (108℃) [2-Point control only] ・Separator discharge air temperature H (105℃) ・3000Hr maintenance※1
		Abnormality (Emergency stop)	・Discharge air temperature E (110℃) ・Reverse phase connection ・Abnormality: Dryer (Dryer built-in type only) ・Overload ・Separator discharge air temperature E (110℃) ・Discharge air temperature sensor disconnected ・Separator discharge air temperature sensor disconnected ・Emergency stop due to excessive rise of discharge air temperature (120℃)
Remote side lamp indicator	・Operating ・Abnormal indicator lamp ・Remote selection signal		
Adjusting range of pressure	Full load recovering pressure (Purge cancellation pressure)	Initial setting and range of set values see 3.4.1	
	Unload starting pressure (Purge starting pressure)	Initial setting and range of set values see 3.4.1	

To the next page

3. Electrical System

From the previous page

Item	Contents
Auto-start / stop predicted stop time	・60 seconds (20～180 seconds)
Y-operating time	・10 seconds (0—15 seconds)
Starting unload time	・Discharge air temperature higher than 10℃ (※20℃) for 15 seconds / less than 10℃(※20℃) for 60 seconds

Contents of ※1 and ※2 apply from the following SER.NO.

- ●SAS55SD(RD)-5E/6E :0075～/0063～
- ●SAS75SD(RD)-5E/6E :0070～/0064～
- ●SMS55ESD(ERD)-5E/6E :0058～/0058～
- ●SMS75ESD(ERD)-5E/6E :0059～/0069～
- ●SMS75RD-5E/6E :0061～/0066～

(2) Function of each output relay

Symbol	Function	Symbol	Function
RY0	·It switches ON by operation Insulation for electromagnet contactor	RY6	·External trouble signal (Remote) ON at emergency
RY1	·For dryer operation Switching it ON, it starts dryer operation. Switching it OFF, it stops	RY7	·External operation signal (Remote) It switches ON by operation
RY2	·Capacity control signal Switching it ON, it starts full load operation. Switching it OFF, it starts unload operation	RY8	·Warning indicator lamp (Remote) ON at warning
RY3	·For draining condensate in dryer ON to drain / OFF to stop	RY9	·For Y operation electromagnet contact Switching it ON, it starts Y operation
RY4	·Auxiliary	RYA	·For Δ operation electromagnet contact Switching it ON, it starts Δ operation
RY5	·Remote selection signal When it is switched ON, remote mode operation is selected, and when OFF, operation mode at machine side is elected.		

3.1.2 Operation modes

Item	Contents
A.C.C.S. (Automatic capacity control for pressure width)	The unloaded starting pressure is automatically controlled “UP” or “DOWN”, according to air consumption. Thus power is saved. (2-Point control)
Purge control	When the discharge pressure exceeds the pressure at which purge starts, solenoid valve for capacity (purge) control opens to relieve the air in tank to atmosphere and the purge operation starts. During this operation mode, the little air taken in through unloader valve and the air volume discharged from separator receiver tank are so well balanced. Then the tank pressure drops to purge stabilized pressure and so the back pressure loaded to the rotors is a bit, and thus consumption increases and the pressure loaded on the consumer drops till full load recovering pressure **(Regulator control type: purge cancellation pressure)**, it releases or rests the purge operation, and it starts full load operation.
Dryer advance operation	Pushing start button, dryer starts first, and then unit start 3 minutes later. ·When dryer is in disorder, it releases this mode. ·When dryer gets troubled during dryer advance operation, this unit starts at the time. **(Interior setting of controller is to be performed only when warning signal is set.)**

To thebnext page

From the previous page

<table>
<tr><th>Item</th><th>Contents</th></tr>
<tr><td>Condensate elimination operation</td><td>When discharge temperature exceeds the dew point temperature according to ambient temperature or when purge operation passes longer than 2 minutes in total, it accomplishes elimination of condensate caused at start-up and it prevents emulsification of oil. Thus, it can shorten condensate elimination operation and it prevents so frequently repeated start-stop operation.
[Draining dryer]
・After completing the starting of unloaded operation, the dryer drain will be discharged for 8 seconds when the service pressure is less than 0.2MPa or 1 second when the service pressure is greater than 0.2MPa.
・When operation, it detects total time of full load operation. When discharge interval reachs about 22 – 90 seconds which comply with ambient temperature, it activates a solenoid valve for 5 seconds so as to drain condensate.
This enables draining condensate securely and preventing useless air discharge.
・When unit stops, solenoid valve works four seconds to drain condensate from dryer so that freezing in winter and rust gathering can be prevented.</td></tr>
<tr><td>Low pressure operation
(2 stages pressures selection function)</td><td>When two units are wired to the remote control terminal plate, both units can be selected for use as one service unit and the other stand-by unit or they can be operated alternatively between them. (When low pressure operation is selected regulator control type turns to 2-point control.)</td></tr>
<tr><td>Auto start/stop operation</td><td>When this mode operation starts, it first performs condensate elimination operation. Later, when air consumption decreases, controller calculates predicted stop time, according to rate of drop of service pressure. Then when the calculated time is less than the predicted time, it stops.
[Conditions of judgment of auto start-stop mode operation]
・Discharge air temperature should reach dew point. (Condensate elimination operation should have been already completed.)
・Continuous operation time in the state above the dew point temperature should exceed the stop restriction time (that is settable between 5 to 60 minutes).
In order to re-start this mode operation, pressure at service side should drop to full load recovering pressure (Regulator control type: purge cancellation pressure / Inverter control type: control pressure) and pressure of receiver tank is lower than 0.1MPa or more than 90 seconds after stopping it restarts.</td></tr>
<tr><td>Remote control operation</td><td>Wired to the remote control terminal plate, start/stop operation can be done remotely.
For your information, also it is possible to stop operation at machine side.
<table>
<tr><th rowspan="2">Remote control switch</th><th colspan="2">Machine side</th><th colspan="2">Remote control</th></tr>
<tr><th>Start</th><th>Stop</th><th>Start</th><th>Stop</th></tr>
<tr><td>OFF</td><td>○</td><td>○</td><td>×</td><td>×</td></tr>
<tr><td>ON</td><td>×</td><td>○ ※1</td><td>○ ※2</td><td>○</td></tr>
</table>
※1 If stopped at machine side, remote control mode is reset.
In case remote control mode is selected again, remote control switch ON.
※2 Remote start can be done while remote start contact is OFF → (ON continuous). Therefore, while remote start contact is ON, it will not start even after pushing ON start button on the operation panel.</td></tr>
<tr><td>Momentary stop restart operation</td><td>In the event that the machine stops because of an instantaneous power failure, the machine starts its operation automatically in about 30 seconds if such power failure lasts for approximately 2.5 to 4 seconds.
(With the dip switch of the controller, it is possible to alter the configuration such that operation is not automatically resumed after power restoration.)</td></tr>
</table>

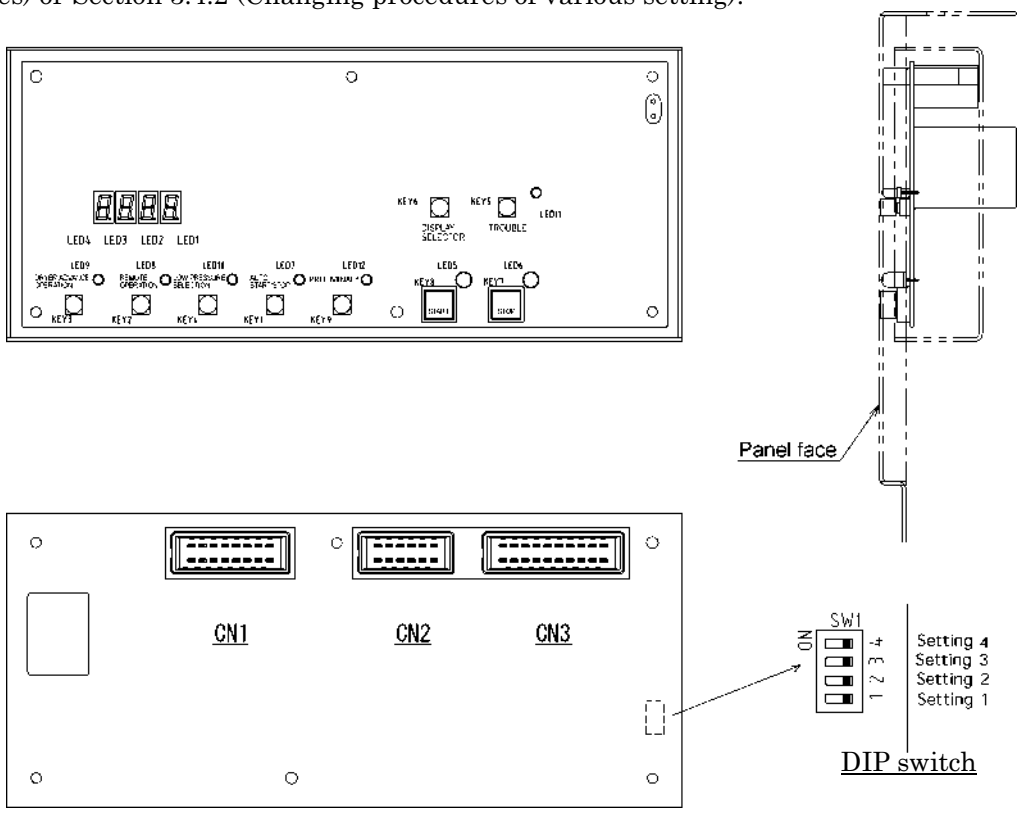
3.1.3 Controller

(1) Appearance

[2-Point control type] Part number : 46870 60302

[Regulator control type] Part number : 46870 60402

※ The control controllers 55kW class and 75kW class are common. Configuration of the model type is performed on the operation panel after the controller has been attached to the actual unit and the power has been turned on. (Model type set A 3: 55kW 4: 75kW)
For detailed information concerning the operation, refer to Section 3.4.1 (Table of various set values) or Section 3.4.2 (Changing procedures of various setting).



SC13114

< Internal setting >

The following settings can be done by DIP switch on board.

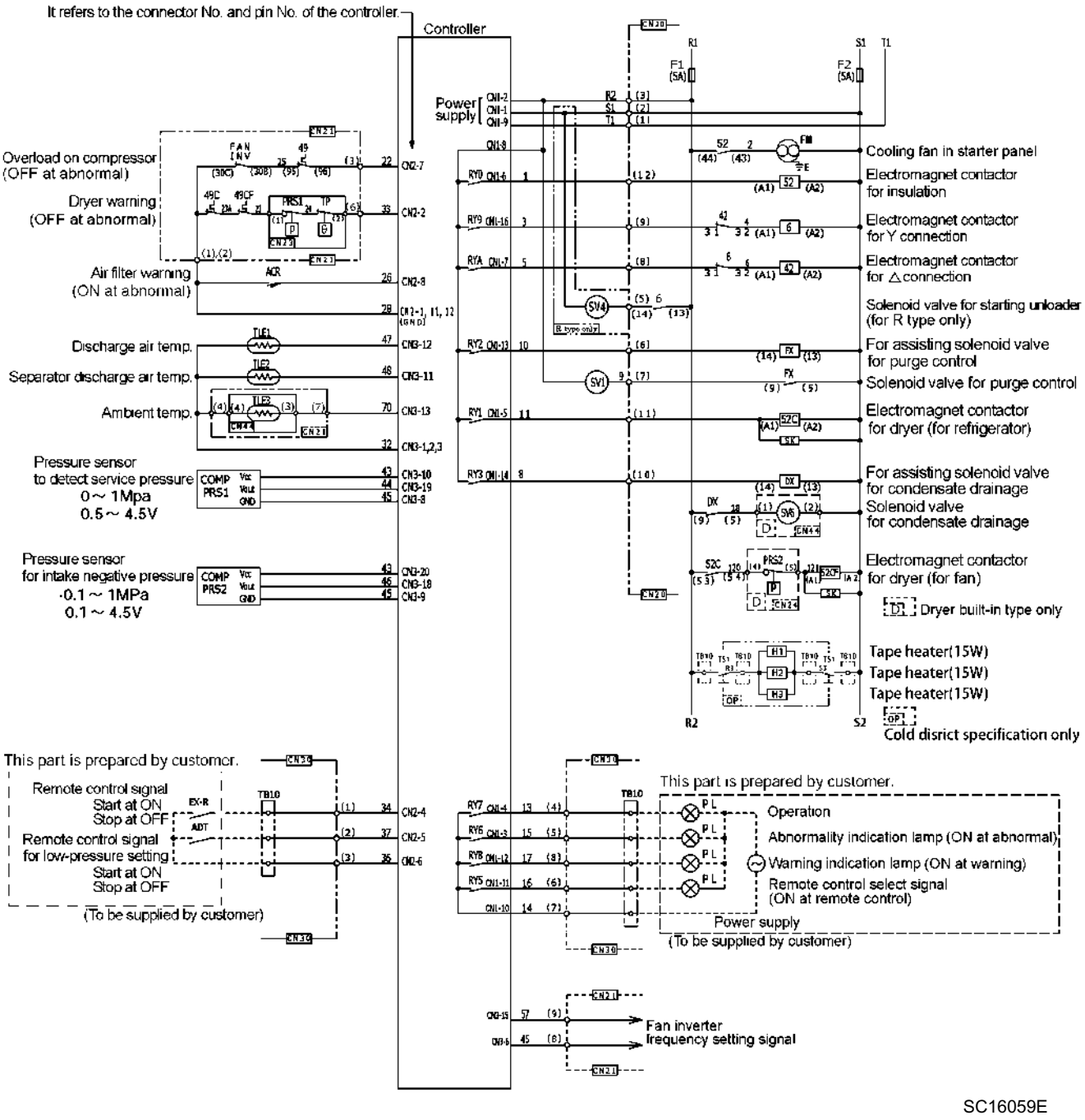
No..	Item	Details	Initial setting
Setting 1 Setting 2	Selection of capacity control system	・Setting 1: OFF Setting 2: OFF・・・2-Point control ・Setting 1: ON Setting 2: OFF・・・Regulator control	Set by the specification
Setting 3	Setting of momentary stop restart	In the event that the machine stops because of an instantaneous power failure, the machine starts its operation automatically in about 30 seconds if such power failure lasts for approximately 2.5 to 4 seconds. OFF: Setting is ineffective ON: Setting is effective	ON
Setting 4	※1	—	OFF

※ Switching of the dryer warning / abnormality is performed with operations of the operation panel for altering set values. For detailed information concerning the operation, refer to Section 3.4.1 (Table of various set values) or Section 3.4.2 (Changing procedures of various setting). The default setting is “shutdown on abnormality.”

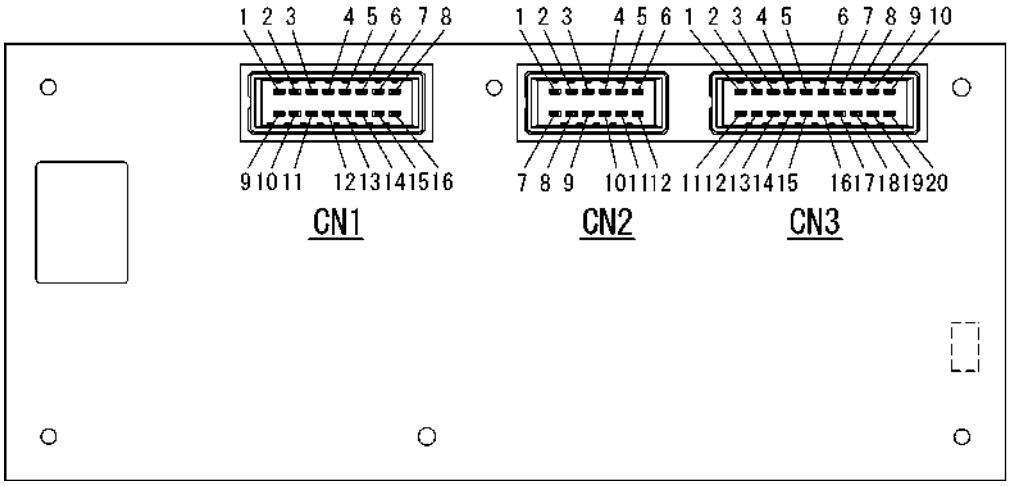
※1 Setting 4 is unused

3. Electrical System

(2) Exterior connection drawing



(3) Position of connector pins and circuit voltage



SC10034

No.		Item	Circuit voltage (V)	Remark
CN1 For power supply	1	S1 (Power supply for controller)/ solenoid valve SV4 power supply for starting unloader R1 (Solenoid valve power supply for starting unloader) (Regulator control type only)	AC200·200·220	
	2	R1 (Power supply for controller)	AC200·200·220	
	3	Remote abnormality indicator lamp	AC100-220	Supplied by customer
	4	Remote operation indicator lamp	AC100-220	Supplied by customer
	5	Electromagnet contactor of dryer	AC200·200·220	
	6	electromagnet contactor for insulation	AC200·200·220	
	7	Electromagnet contactor for Δ connection	AC200·200·220	
	8	R1(Power supply for controller)	AC200·200·220	
	9	Power supply T1 (for detection of phase loss)	AC200·200·220	
	10	Remote indicator lamp power supply common	AC100-220	Supplied by customer
	11	Remote selection signal	AC100-220	Supplied by customer
	12	Remote warning indicator lamp	AC100-220	Supplied by customer
	13	For assisting solenoid valve for capacity control	AC200·200·220	
	14	For assisting solenoid valve for draining condensate	AC200·200·220	
	15	Blank	-	
	16	Electromagnet contactor for Y connection	AC200·200·220	

3. Electrical System

No.		Item	Circuit voltage	Remark
CN 2	1	GND	-	Connected to CN2-11, 12 inside controller
	2	Dryer abnormality	Normal : DC12V [between CN2-1, 11 and 12] Abnormal : 0V [between CN2-1, 11 and 12]	Abnormal : OFF (B connect) Time lag : 1 second
	3	Blank	-	-
	4	Remote start switch	During operation (ON) : DC12V (between CN2-1) During stop condition (OFF) : 0V (between CN2-1)	Supplied by customer
	5	Remote low pressure operation signal	During low pressure operation (ON) : DC12V (between CN2-1) During normal operation : 0V (between CN2-1)	Supplied by customer
	6	Remote operation signal GND	During operation : DC12V (between CN2-4)	Supplied by customer
	7	Thermal relay for main motor Electronic thermal for cooling fan	Normal : DC12V	Abnormal : OFF (B connect)
	8	Air filter indicator	Normal : 0V	
	9	Blank	-	-
	10	Blank	-	-
	11	GND	-	Connected to CN2-1, 12 inside controller
	12	GND	-	Connected to CN2-1, 11 inside controller

3. Electrical System

No.		Item	Circuit voltage	Remark
CN 3 For sensor	1	Sensor GND	-	Connected to CN3-2, 3 inside controller
	2	Sensor GND	-	Connected to CN3-1, 3 inside controller
	3	Sensor GND	-	Connected to CN3-1, 2 inside controller
	4	Blank	-	-
	5	Blank	-	-
	6	Inverter for cooling fan	-	inverter frequency setting signal (GND)
	7	Blank	-	-
	8	Pressure sensor GND	-	Internal ground connection (Service pressure sensor)
	9	Pressure sensor GND	-	Internal ground connection (Intake negative pressure sensor)
	10	Pressure sensor power supply	DC5V (between CN3-8)	Service pressure sensor
	11	Separator discharge air temperature sensor	Less than DC5V (between CN3-1)	Detect abnormality Resistance 110℃ (560±22Ω)
	12	Discharge air temperature sensor	Less than DC5V (between CN3-1)	Detect abnormality Resistance 110℃ (560±22Ω)
	13	Intake air temperature sensor	-	Detect intake air temperature 52℃ (2,050±15Ω)
	14	Blank	-	-
	15	Inverter for cooling fan	Less than DC5V	inverter frequency setting signal
	16	Blank	-	-
	17	Blank	-	-
	18	Pressure sensor output	DC0.1～4.5V (between CN3-9)	Intake negative pressure -0.1MPa：0.1V Intake negative pressure 0.98MPa：4.5V
	19	Pressure sensor output	DC0.5～4.5V (between CN3-8)	Service pressure 0MPa :0.5V Service pressure 0.98MPa :4.5V
	20	Pressure sensor power supply	DC5V(between CN3-9)	Intake negative pressure sensor

3.1.4 Checking indication of warning, abnormalities and also checking emergency stop

	Item	Trouble code	How to check	Normal function
Warning	Discharge air temperature H	A-1	Remove the sensor from controller and load resistance of 640±30Ω(105℃) to controller with variable resistor.	Trouble code lamp flickers.
	Air filter clogging	A-2	During operation, short-circuit the cable connected to the air filter indicator.	Trouble code lamp flickers.
	Warning: Dryer ※1	A-3	During operation, trip thermal relay by hand. (Be careful about electric shock.)	Trouble code lamp flickers.
	Intake air temperature (Too high)	A-4	Remove the sensor from controller and load resistance of 2,050±15Ω(52℃) to controller with variable resistor.	Trouble code lamp flickers.
	Discharge air temperature HH ※2	A-5	Remove the sensor from controller and load resistance of 590±25Ω(108℃) to controller with variable resistor.	Trouble code lamp flickers.
	Separator discharge air temperature H	A-6	Remove the sensor from controller and load resistance of 640±30Ω(105℃) to controller with variable resistor.	Trouble code lamp flickers.
	3000Hr maintenance ※3	A-8	Unable to check because output from the controller software.	—
Abnormality / Emergency stop	Discharge air temperature E	E-1	Remove the sensor from controller and load resistance of 560±22Ω(110℃) to controller with variable resistor.	Trouble code lamp flickers and unit stops.
	Reverse phase connection	E-2	After cutting power supply, change R phase for T phase. After cutting power supply, remove T phase.	When power is supplied, trouble code lamp flickers, and unit will not start even by pushing start button.
	Abnormality: Dryer ※1	E-3	During operation, trip thermal relay by hand. (Be careful about electric shock.)	Trouble code lamp flickers and unit stops.
	Overload	E-4	Main motor During operation, trip thermal relay by hand. (Be careful about electric shock.) Cooling fan motor Overload protection is conducted by electronic thermal and unable to check.	Trouble code lamp flickers and unit stops. —
	Separator discharge air temperature E	E-5	Remove the sensor from controller and load resistance of 560±22Ω(110℃) to controller with variable resistor.	Trouble code lamp flickers and unit stops.
	Discharge air temperature sensor disconnected	E-6	During operation, remove the sensor from controller. (Be careful about electric shock.)	Trouble code lamp flickers and unit stops.
	Separator discharge air temperature sensor disconnected	E-7	During operation, remove the sensor from controller. (Be careful about electric shock.)	Trouble code lamp flickers and unit stops.
	Emergency stop due to excessive rise of discharge air temperature ※4	E-8	Remove the sensor from controller and load resistance of 430±20Ω(120℃) to controller with variable resistor.	Trouble code lamp flickers and unit stops.

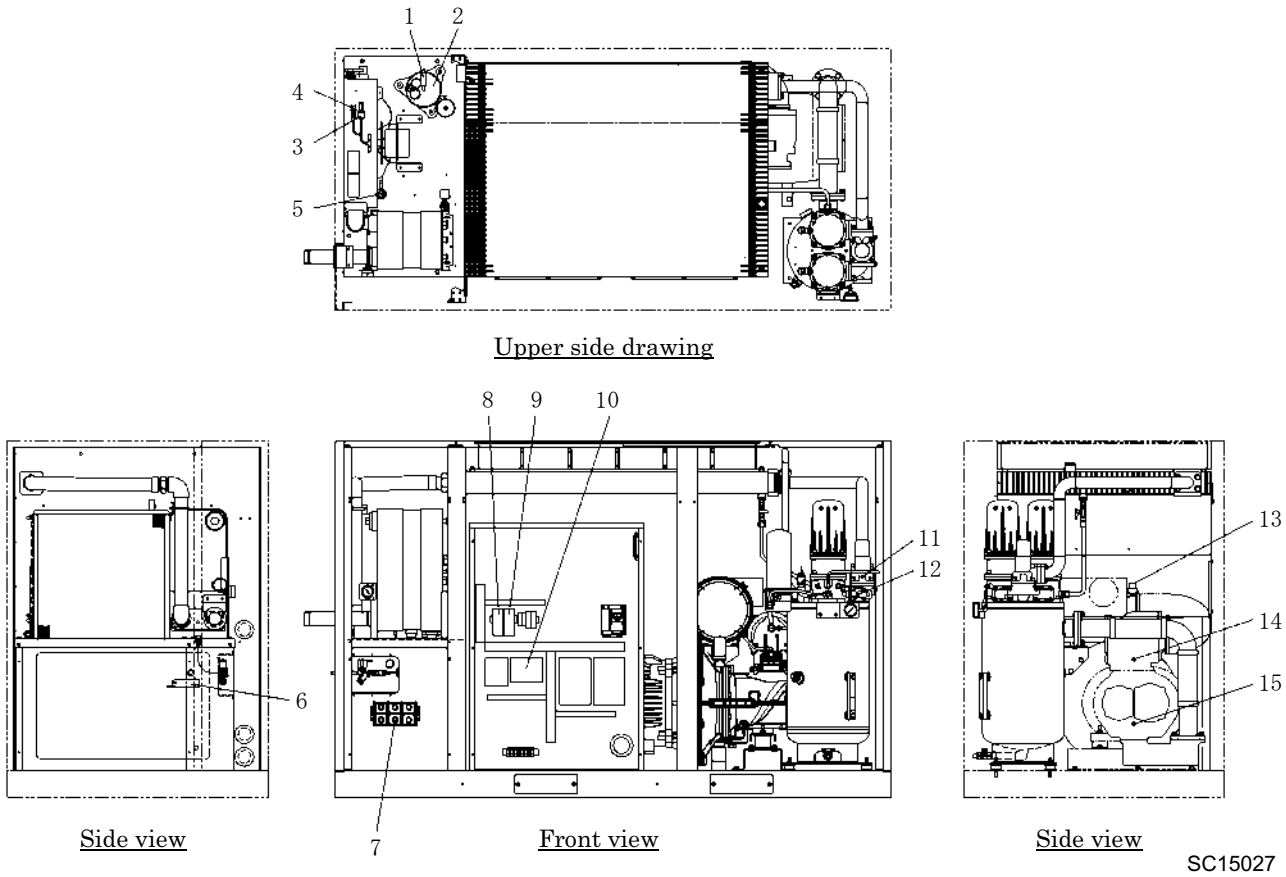
● Refer to 1.3 trouble codes table for time lag and detection time.

※1 Dryer warning / abnormality: Warning and abnormality can be changed by setting at the operating panel. (for details, refer to 3.4.1 & 3.4.2) (Factory default settings: “Abnormality”)

※2 The discharge air temperature HH is displayed only with 2-Point control type.

3. Electrical System

Sensor and switches



SAS75SD (Dryer built-in Type)

1.Bimetal thermostat (TTH)	9.Thermal relay for dryer cooling fan (49CF)
2. Interrnal thermostat (ITH) (Built in motor winding of condenser)	10.Thermal relay for main motor(49)
3. High pressure switch (PRS1)	11.Pressure sensor (Defect service pressure) (PRS1)
4. Fan control pressure switch (PRS2)	12. Separator discharge air temperature sensor (TLE2)
5. Capacity control valve (CCV)	13. Air filter indicator (ACR)
6. Intake air temperature sensor(TLE3)	14. Pressure sensor (Defect intake negative pressure) (PRS2)
7. Connection of power supply	15. Discharge air temperature sensor (TLE1)
8. Thermal relay for freezing dryer(49C)	

3. Electrical System

3.2 Electrical Parts

3.2.1 Specifications

(1) Starter and solenoid valve

[55kW class]

Symbol	Name	Maker	Model	Remarks
42, 52	Electromagnet contactor	MITSUBISHI Electric	S-N150 AC200V 2a2b	42: For Δ operation 52: For insulation (Surge damping value built in)
6	Electromagnet contactor	MITSUBISHI Electric	S-N80 AC200V 2a2b	For Y operation (Surge damping value built in)
49	2E Thermal relay (Main motor)	MITSUBISHI Electric	TH-N120TAHZKP RC=125A(100～150A)	Thermal set value : 129/124/114A
52C (49C)	Electromagnet contactor	MITSUBISHI Electric	MSO-T20 AC200V 1a1b RC15A(12～18A)	For dryer (Surge damping value built in) Thermal set value : 12/12/12A
52CF (49CF)	Electromagnet contactor	MITSUBISHI Electric	MSO-T10 AC200V 1a RC=1.3A(1.0～1.6A)	Fan for dryer condenser (Surge damping value built in) Thermal set value : 1.5/1.5/1.5A
F1,F2	Fuse holder	Sakazume	FHC-15 (AC250V, 15A)	
	Fuse	Not specified	φ6.4×30 (AC250V, 5A)	
SV1	Solenoid valve	SMC	VX2332D-03-2GR1-X759	For capacity (purge) control
SV4	Solenoid valve	CKD	AG4X7908	For starting unload (R type only)
SV6	Solenoid valve	SMC	VXK2110A-02-2GR1	For draining condensate
FX, DX	Relay	IDEC	RU2S-C-A200 (AC200V, 2C) (Socket SM2S-05D) (Spring SFA-502P)	FX: For assisting solenoid valve for capacity (purge) control DX: For assisting solenoid valve for draining condensate
FAN INV	Inverter for cooling fan (200V class)	Fuji Electric	FRN2.2C2S-2HH (200Vclass) AC200V,3φ,2.2kW	Electronic thermal set value (Inverter protection) Rated current 11.0A Overload current rating 150% 1 minute 200% 0.5 seconds
	Inverter for cooling fan (400V class)	Fuji Electric	FRN2.2C2S-4J (400Vclass) AC400V,3φ,2.2kW	Electronic thermal set value (Inverter protection) Rated current 5.5A Overload current rating 150% 1 minute 200% 0.5 seconds
FM	Cooling fan	SANYO DENKI	109S025UL AC230V	Ventilating fan for starting panel
TB10	Terminal block	IDEC	BN15MW	19P with cover

3. Electrical System

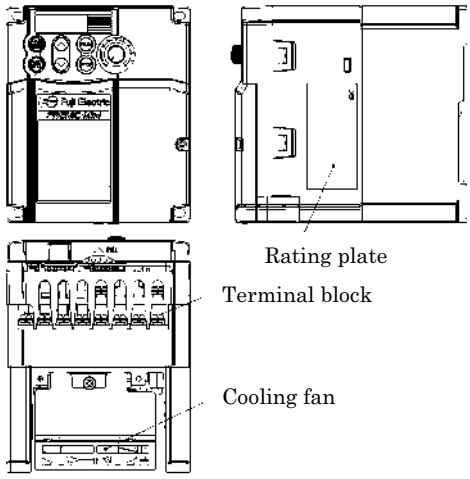
[75kW class]

Symbol	Name	Maker	Model	Remarks
42, 52	Electromagnet contactor	MITSUBISHI Electric	S-N180 AC200V 2a2b	42: For Δ operation 52: For insulation (Surge damping value built in)
6	Electromagnet contactor	MITSUBISHI Electric	S-N95 AC200V 2a2b	For Y operation (Surge damping value built in)
49	2E Thermal relay (Main motor)	MITSUBISHI Electric	TH-N220HZKPSR RC=150A(100～150A)	Thermal set value : 170/163/150A
52C (49C)	Electromagnet contactor	MITSUBISHI Electric	MSO-T25 AC200V 1a1b RC22A(18～26A)	For dryer (Surge damping value built in) Thermal set value : 15/15/15A
52CF (49CF)	Electromagnet contactor	MITSUBISHI Electric	MSO-T10 AC200V 1a RC=1.3A(1.0～1.6A)	Fan for dryer condenser (Surge damping value built in) Thermal set value : 1.5/1.5/1.5A
F1,F2	Fuse holder	Sakazume	FHC-15 (AC250V, 15A)	
	Fuse	Not specified	φ6.4×30 (AC250V, 5A)	
SV1	Solenoid valve	SMC	VX2332D-03-2GR1-X759	For capacity (purge) control
SV4	Solenoid valve	CKD	AG4X7908	For starting unload (R type only)
SV6	Solenoid valve	SMC	VXK2110A-02-2GR1	For draining condensate
FX, DX	Relay	IDEC	RU2S-C-A200 (AC200V, 2C) (Socket SM2S-05D) (Spring SFA-502P)	FX: For assisting solenoid valve for capacity (purge) control DX: For assisting solenoid valve for draining condensate
FAN INV	Inverter for cooling fan (200V class)	Fuji Electric	FRN2.2C2S-2HH (200Vclass) AC200V,3φ,2.2kW	Electronic thermal set value (Inverter protection) Rated current 11.0A Overload current rating 150% 1 minute 200% 0.5 seconds
	Inverter for cooling fan (400V class)	Fuji Electric	FRN2.2C2S-4J (400Vclass) AC400V,3φ,2.2kW	Electronic thermal set value (Inverter protection) Rated current 5.5A Overload current rating 150% 1 minute 200% 0.5 seconds
FM	Cooling fan	SANYO DENKI	109S025UL AC230V	Ventilating fan for starting panel
		Omron	R87T-A6A07H	Ventilating fan for starting panel (SMS75:single hanging type.
TB10	Terminal block	IDEC	BN15MW	19P with cover

SMS series with earth leakage breaker

Symbol	Name	Maker	Model	Remarks
ELCB	Earth leakage circuit breaker	MITSUBISHI Electric	NV400-SEW AC100-440V 30mA 3P 400AF/400AT	(200Vclass with earth leakage breaker) With terminal cover(TCL-4SW3)

3.2.2 Inverter for cooling fan[Outline drawing]

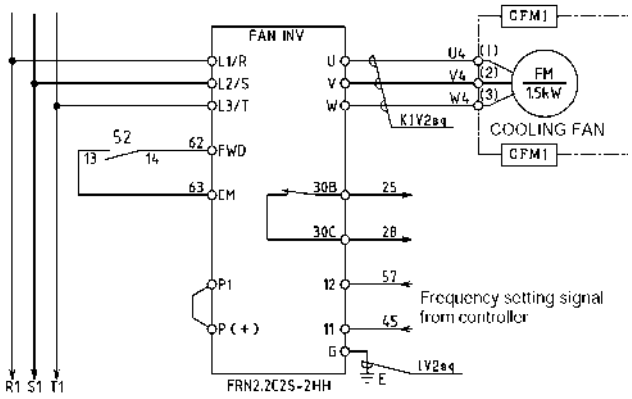


SC15028

Model	Inverter model	Part number
55kW class	FRN2.2C2S-2HH ※(200Vclass)	46879 69302
75kW class		46879 69202

※400V class has also been setting.

[Inverter input / output]



SC15029E-1

(1) List of functions

Pin No.	Line No.	Connection	Function
L1/R	R1	Terminal block R terminal	AC200V input
L2/S	S1	Terminal block S terminal	AC200V input
L3/T	T1	Terminal block T terminal	AC200V input
FWD	62	Electronic magnet contactor for insulation 14 terminal	When "ON" between FWD-CM, a starting signal will be input to the inverter for cooling fan and a voltage will be output to the motor from terminals U, V, and W.
CM	63	Common	
U	U4	Cooling fan	Output to the cooling fan
V	V4	Cooling fan	Output to the cooling fan
W	W4	Cooling fan	Output to the cooling fan
30B	25	Controller CN2-7 terminal	When electronic thermal of inverter operates, it activates overload lamp of monitor panel ON and makes emergency stop.
30C	28	Common	

To the next page

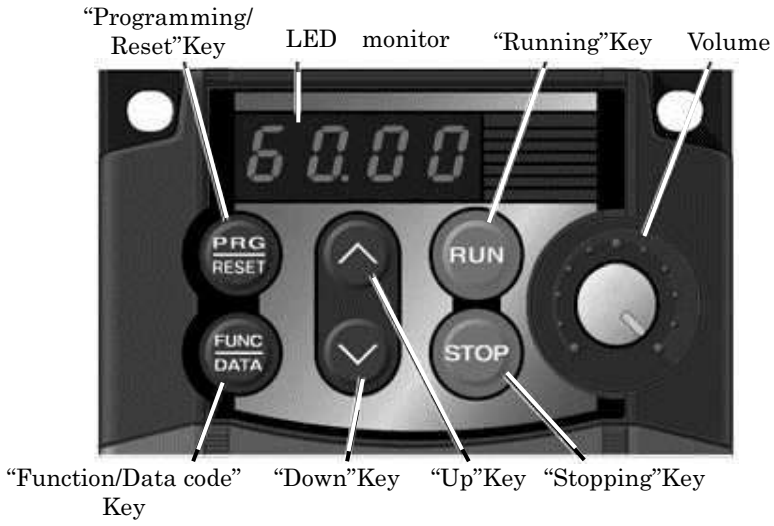
From the previous page

Pin No.	Line No.	Connection	Function
E	-	Earth	
12	57	Controller CN3-15 terminal	It outputs frequency setting signal from controller to cooling fan inverter.
11	45	Common	Earth

3. Electrical System

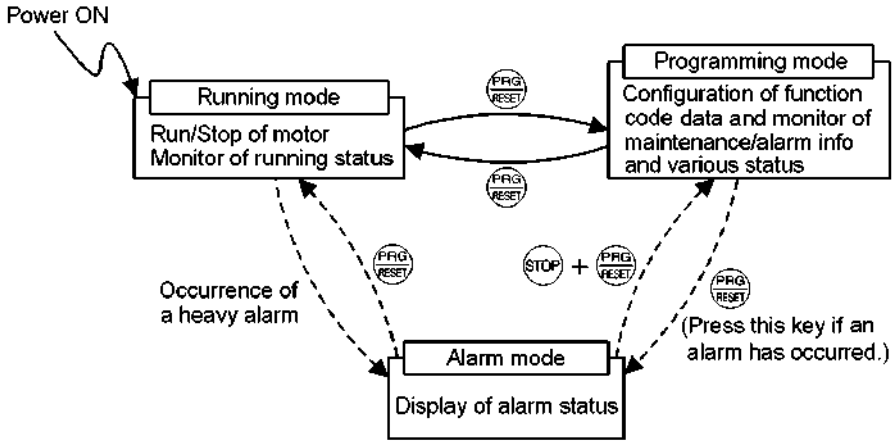
[Operation mode flow]

【Excerpted from inverter manufacturer's instruction manual】



SC15030

※Running Key/Stopping key can not be used because it is not connected to controller.



SC15031E

■Running mode : Run-stop command can be set at general operation. Also running status during real time can be monitored.

■Programming mode : This mode allows you to configure function code data and check a variety of information relating to the inverter status and maintenance.

■Alarm mode : If an alarm condition arises, the inverter automatically enters alarm mode. In this mode, you can view the corresponding alarm code and its related information on the LED monitor.

3. Electrical System

[Alarm code]

Code	Name	Code	Name
OC1	Instantaneous overcurrent	OL1 / OL2	Overload of motor 1 / Overload of motor 2
OC2		OLU	Inverter overload
OC3		Er1	Memory error
OU1	Overvoltage	Er2	Keypad vommunications error
OU2		Er3	CPU error
OU3		Er6	Operation protection
LU	Undervoltage	Er7	Tuning error
Lin	Input phase loss	Er8	RS-485 communications error
OPL	Output phase loss	ErF	Data saving error during undervoltage
OH1	Heat sink overheat	Err	Mock alarm
OBH	Braking resistor overheat	CoF	PID feedback wire break
		Ero	Positioning control error

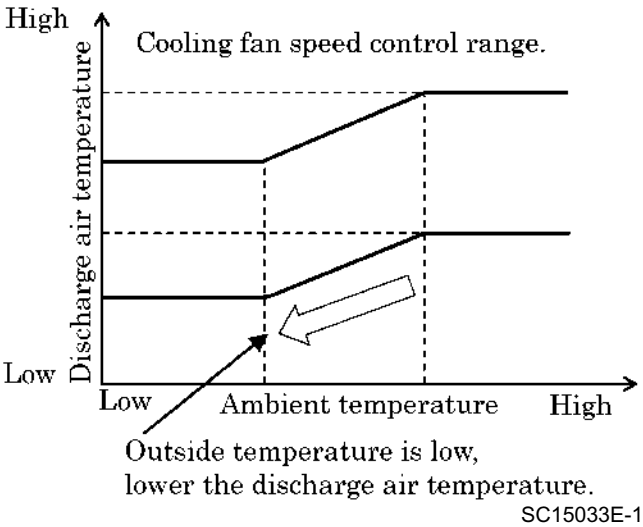
SC15032E

※For the details of alarm codes, refer inverter manual.

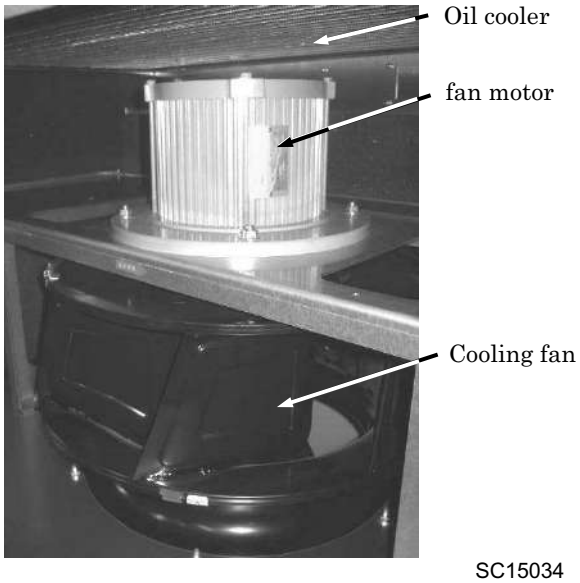
[The oil temperature control of the cooling fan for inverter]

The ambient temperature and discharge air temperature will be detected and calculated with the controller and operate the cooling fan at the optimal rotational speed.

※Discharge air temperature will be regulated suitably not to be under dew point according to ambient temperature.



SC15033E-1



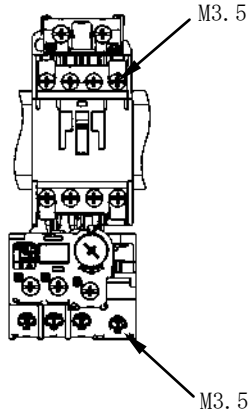
SC15034

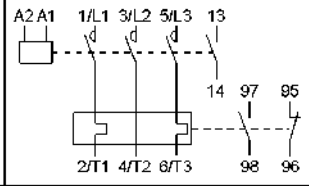
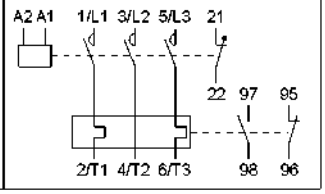
3.2.3 Sensor / switch

Name	Symbol	Trouble code	Maker	Remarks
Air filter indicator	ACR	Air filter clogging	Nippon Donaldson	6.2kPa DC12—24V A contact
Thermo sensor	TLE1	Discharge air temperature	Shibaura Electronics	560±22(Ω) at 110℃
	TLE2	Separator discharge air temperature	Shibaura Electronics	560±22(Ω) at 110℃
	TLE3	Intake air temperature	Shibaura Electronics	2,050±15(Ω) at 52℃
Pressure sensor	PRS1	Detect service pressure	SAGINOMIYA	DC0.5—4.5V (0—0.98MPa)
	PRS2	Detect intake negative pressure	SAGINOMIYA	DC0.1—4.5V (-0.1—0.98MPa)

3.2.4 Electromagnet switch

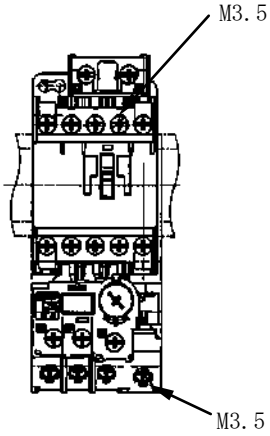
MSO-T10

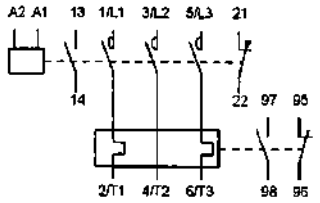


Auxiliary contact	Structure of contacts
1a	
1b	

SC15109E

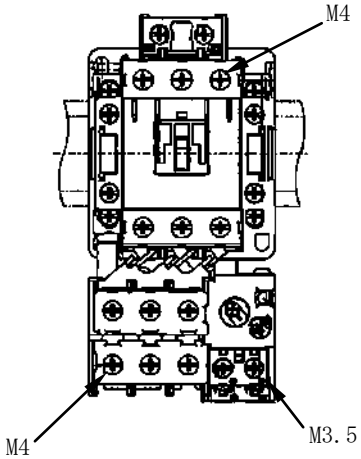
MSO-T20

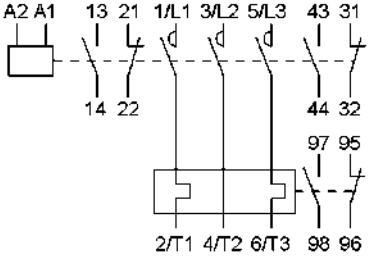


Auxiliary contact	Structure of contact
1a1b b	

SC15158E

MSO-T25

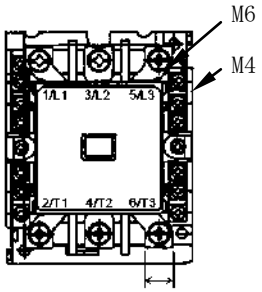


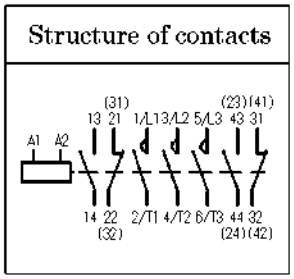
Auxiliary contact	Structure of contact
2a2b	

SC15159E

3.2.5 Electromagnet contactor

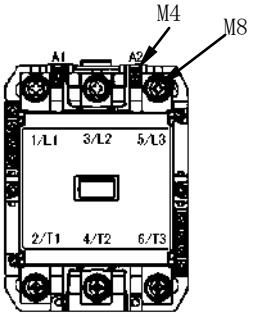
S-N80,N95

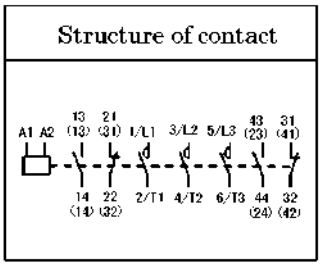




SC13071-1E

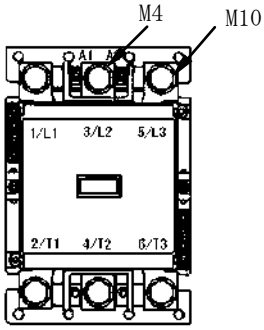
S-N150

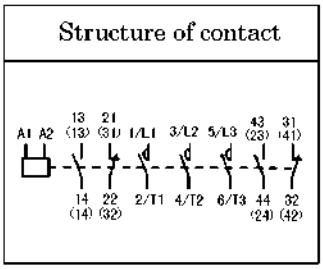




S_M134E

S-N180

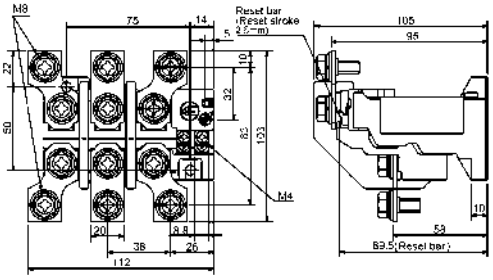


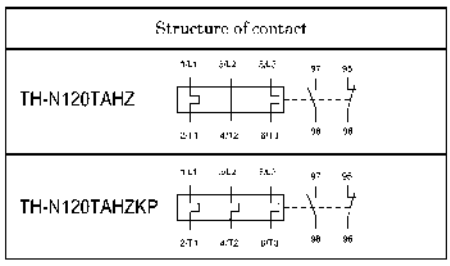


S_M135E

3.2.6 Thermal relay

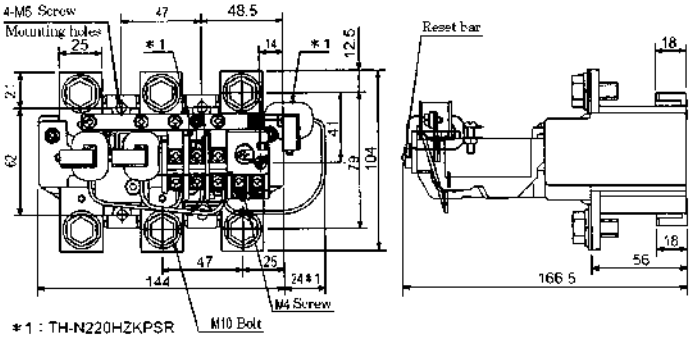
TH-N120TAHZKP

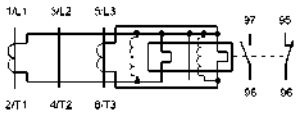
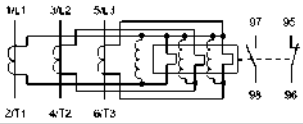




SC09013E

TH-N220HZKPSR

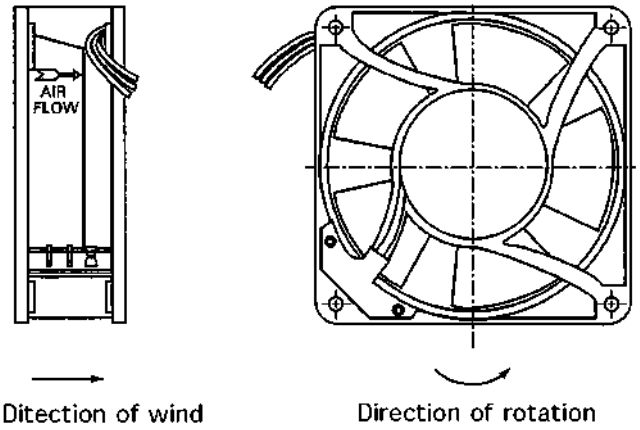


Structure of contact	
TH-N220HZSR	
TH-N220HZKPSR	

SC15036E

3.2.7 Cooling fan in the starter panel

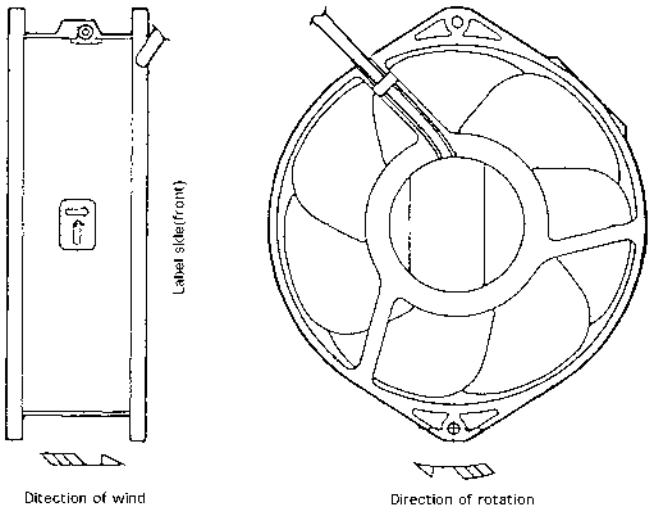
SAS,SMS55·75



Model	SANYO DENKI 109S025UL	
Frequency (Hz)	50	60
Voltage (V)	AC230V	
Input power (W)	14	12

SC14060E

SMS75(Single hanging type)



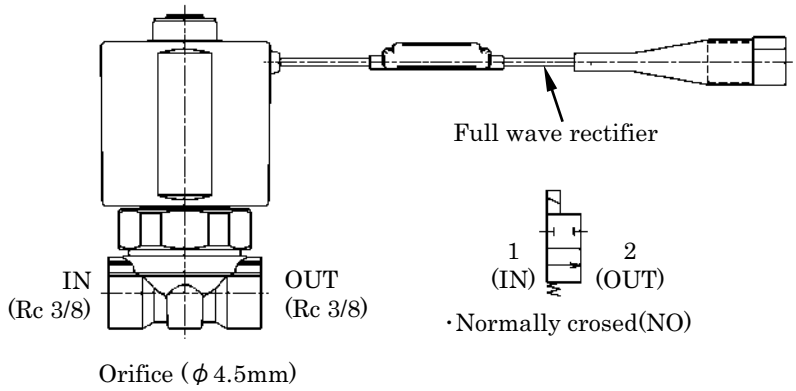
Model	Omron R87T-A6A07H	
Frequency(Hz)	50	60
Voltage(V)	AC230V	
Input power(W)	36	35

SC14054 E -1

3.2.8 Solenoid valve

(1)For capacity (purge) control(SV1)

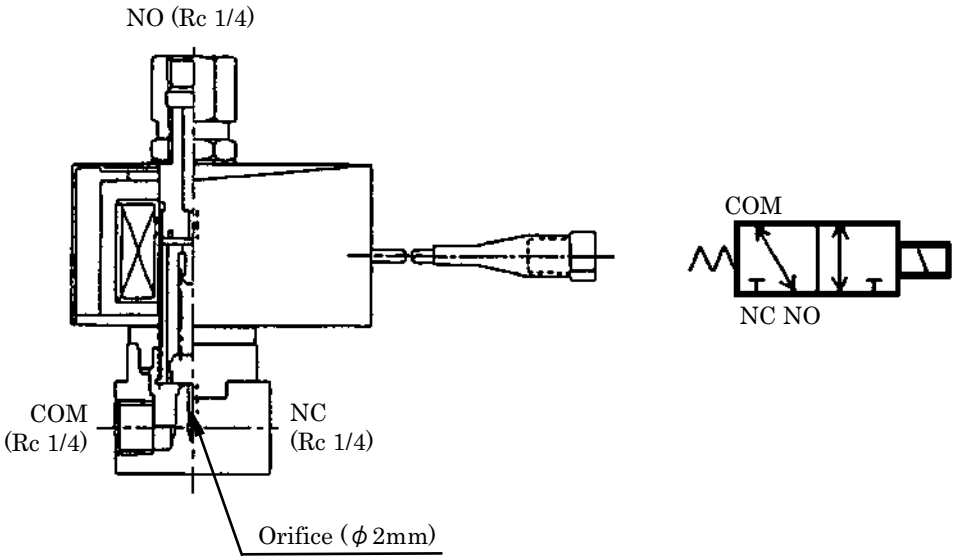
Parts number:46811 29300



SC13074E

(2)For stating unlod (SV4)(Regurator controltype only)

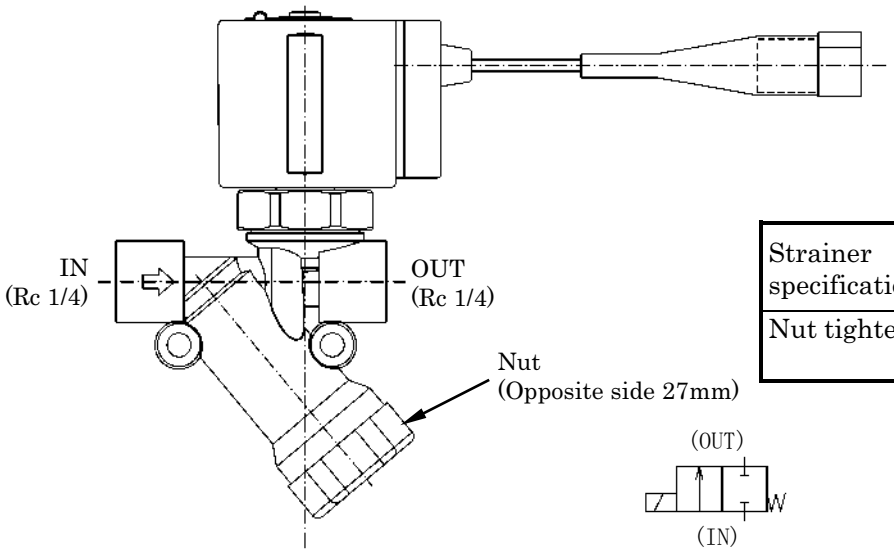
Parts number:46811 13300



S_M120E

(3) For draining condensate in dryer : (SV6) (Strainer built-in)

Part number : 46811 30800



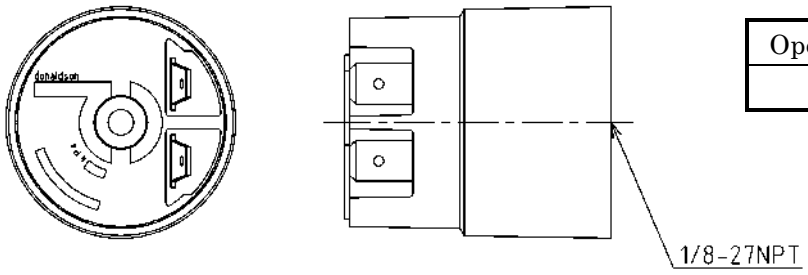
Strainer specification	Mesh	100
	Material	SUS
Nut tightening torque (N・m)		23—27

SC15037

Diameter of orifice (φ2mm)　　・Opened while electricity is supplied

3.2.9 Air filter indicator

Part number : 32148 03000



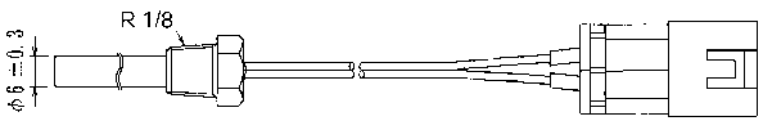
Operating resistance	6.2kPa
Contact type	A contact

SC10016-1E

3.2.10 Thermo sensor

(1) Discharge air temperature sensor and separator discharge air temperature sensor

Part number : 44364 08200

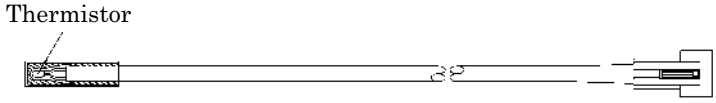


SC14066

※ For the relation between temperature and resistance, refer to 2.4.8.

(2) Intake air temperature sensor

Part number : 44364 06800

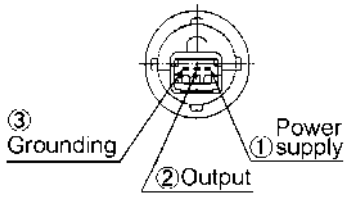


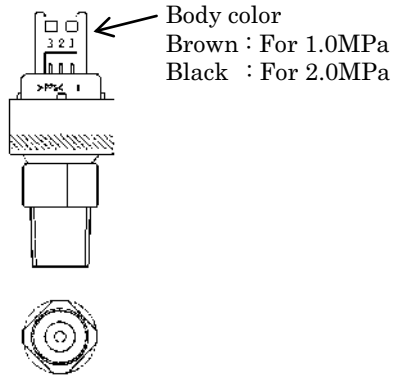
SC10002

※ For the relation between temperature and resistance, refer to 2.4.9.

3.2.11 Pressure sensor

Part number : 44328 20600





PC08035E

Trouble diagnosis of pressure sensor itself

Check and confirm that output voltage between

②• ③ is DC0.5±0.1V when DC5V is applied between

①• ③ terminals at an atmospheric pressure.

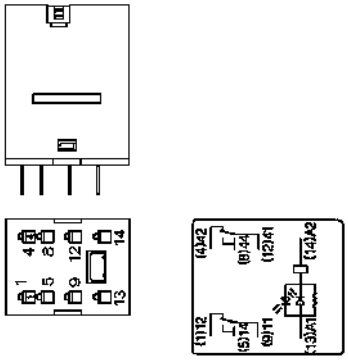
Pressure and output voltage (for reference only)

	For 1.0MPa
①VCC	Power supply DC5V
②VOUT	Pressure Output 0MPa (0kgf/cm²) DC0.5V 0.1MPa (1kgf/cm²) DC0.9V 0.6MPa (6kgf/cm²) DC2.9V 0.69MPa(7kgf/cm²) DC3.3V 0.98MPa(10kgf/cm²) DC4.5V
③GND	Grounding

3.2.12 Relay

FX / DX Relay : For assisting solenoid valve for capacity (purge) control / For assisting solenoid valve for draining condensate

Part number : 46177 08000



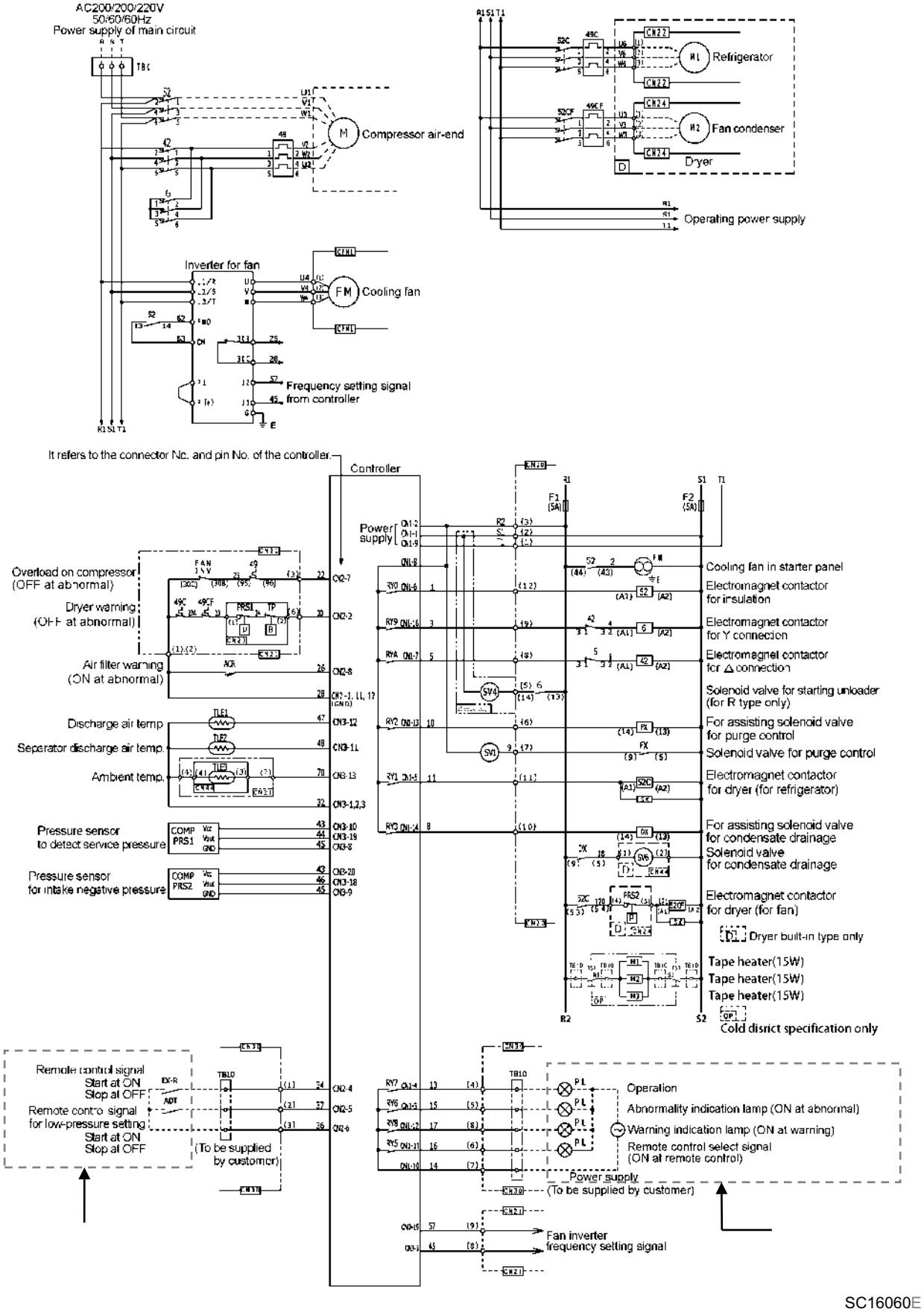
SC12073

Model	IDEC RU2S-C-A200
Rated voltage	AC200-220V
Coil resistance	14.08kΩ

3. Electrical System

3.3 Electrical Wiring Diagram

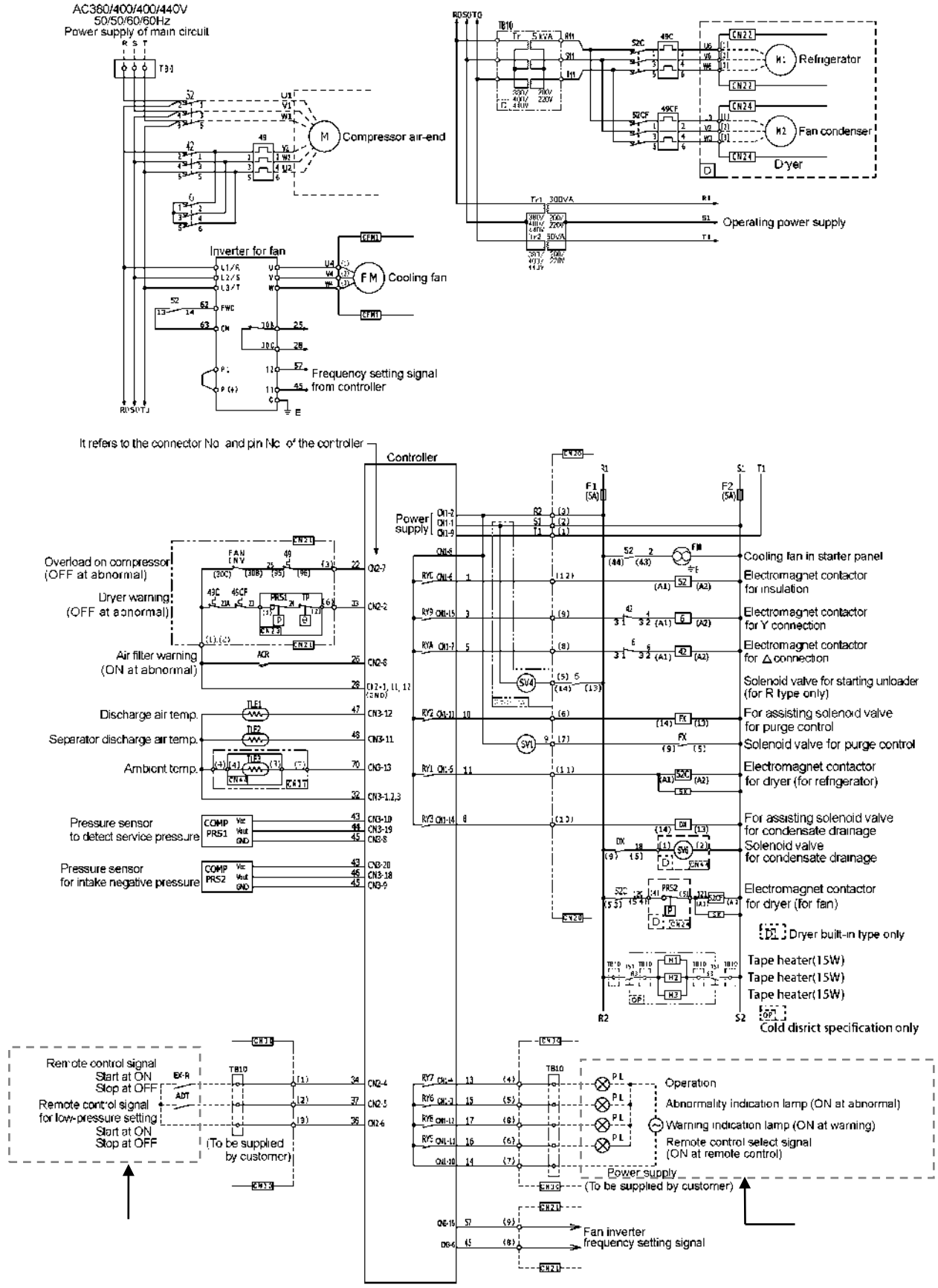
3.3.1 55･75kW class[200/220V]



SC16060E

3. Electrical System

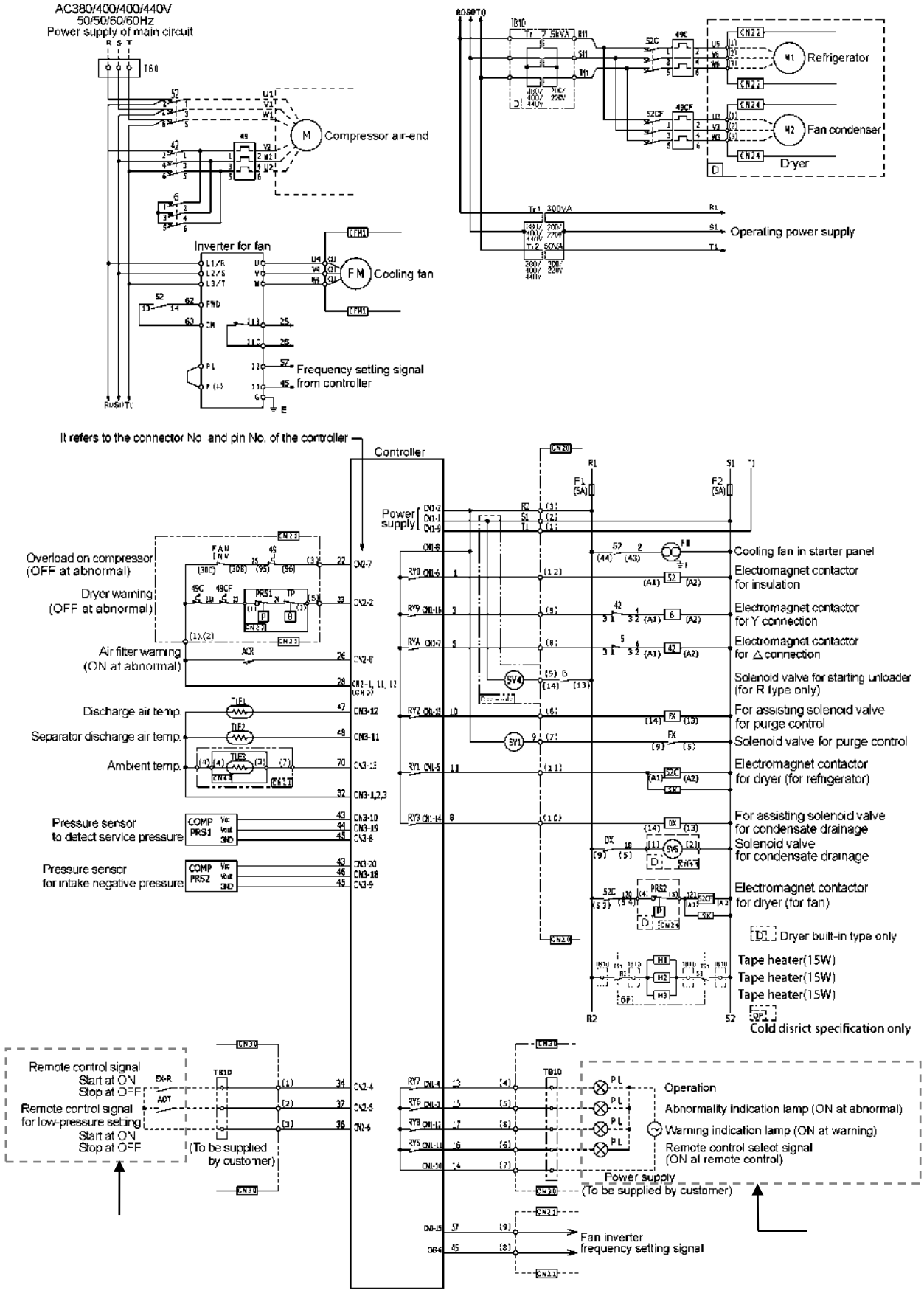
3.3.2 55kW class[380/400V/440V]



SC16061E

3. Electrical System

3.3.3 75kW class[380/400V/440V]



SC16062E

3. Electrical System

3.4 Various Setting Methods

3.4.1 Table of various set values

(1) SAS series [2-Point control type]

The following set values can be altered and adjusted.
However, as far as unloading (purge) operation starting pressure is concerned, never adjust operation at higher pressure than specified initial setting value.

※1In case of operation at higher pressure than each specified set value would lead to motor overloading and motor burning and parts.

NO.	Item	Indi-cation	Initial set value classified by working pressure			Range of set values	
			0.70MPa [STD. spec.]	0.85MPa [Factory opt.]	0.93MPa [Factory opt.]	Set value	Pressure (MPa)
1	Full load recovering pressure PL	L	60 (0.60MPa)	70 (0.70MPa)	78 (0.78MPa)	40 to 95	0.4 to 0.95
2	Unloading (purge) operation starting pressure PH ※	H	Max.70 (0.70MPa)	Max.85 (0.85MPa)	Max.93 (0.93MPa)	Full load recovering pressure +4 to 99	Full load recovering pressure +0.04 to 0.99
3	Low pressure operation caused due to fall of pressure	E	4 (0.04MPa)			2 to 20	0.02 to 0.2
4	Estimated stop time	T	60 (60 seconds)			20 to 180 seconds	—
5	Time required for confirmation of purge operation	U	20 (20 seconds)			5 to 60 seconds	—
6	Timer set for limiting stop operation	r	5 (5 minutes)			5 to 60 minutes	—
7	—	b	20 (20%)			Invalid	—
8	Star operation time	y	10 (10 seconds)			0 to 15 seconds	—
9	Dryer function mode	d	0			0: Abnormal stop with dryer available 1: Abnormal warning with dryer available 2: Dryer unavailable・—	—
10	ACCS operating function	c	1			1: ACCS function enabled 0: Invalid	—
11	—	F	84 (0.84MPa)			Invalid	—
12	Terationimer for judging long time unloading operation	J	60 (60 seconds)			60 to 300	—
13	Model setting	A	3 or 4			3 55kW 4: 75kW	—
14	Maintenance warning time※2	o	300 (3,000Hr)			0～300	—

※2 The maintenance warning time apply from the following SER.NO.

●SAS55SD-5E/6E ：0075～/0063～

●SAS75SD-5E/6E ：0070～/0064～

3. Electrical System

[Regulator control type]

The following set values can be altered and adjusted.

However, as far as unloading (purge) operation starting pressure is concerned, never adjust operation at higher pressure than specified initial setting value.

※1In case of operation at higher pressure than each specified set value would lead to motor overloading and motor burning and parts.

NO.	Item	Indi-cation	Initial set value classified by working pressure			Range of set values	
			0.70MPa [STD. spec.]	0.85MPa [Factory opt.]	0.90MPa [Factory opt.]	Set value	Pressure (MPa)
1	Purge cancellation pressure PL	L	60 (0.60MPa)	70 (0.70MPa)	75 (0.75MPa)	40 to 95	0.4 to 0.95
2	Unloading (purge) operation starting pressure PH ※	H	Max.70 (0.70MPa)	Max.85 (0.85MPa)	Max.90 (0.90MPa)	Purge cancellation pressure +4 to 99	Purge cancellation pressure +0.04 to 0.99
3	Low pressure operation caused due to fall of pressure	E	4 (0.04MPa)			2 to 20	0.02 to 0.2
4	Estimated stop time	T	60 (60 seconds)			20 to 180 seconds	—
5	Time required for confirmation of purge operation	U	20 (20 seconds)			5 to 60 seconds (At 0 set, purge operation is cancelled)	—
6	Timer set for limiting stop operation	r	5 (5 minutes)			5 to 60 minutes	—
7	Load factor for the selection of purge operation	b	20 (20%)			10 to 50%	—
8	Star operation time	y	10 (10 seconds)			0 to 15 seconds	—
9	Dryer function mode	d	0			0: Abnormal stop with dryer available 1: Abnormal warning with dryer available 2: Dryer unavailable・—	—
10	—	c	1			Invalid	—
11	Urgent purge starting pressure	F	84 (0.84MPa)	98 (0.98MPa)		—	—
12	Terationimer for judging long time unloading operation	J	60 (60 seconds)			60 to 300	—
13	Model setting	A	3 or 4			3: 55kW 4: 75kW	—
14	Maintenance warning time※2	o	300 (3,000Hr)			0～300	—

※2 The maintenance warning time apply from the following SER.NO

●SAS55RD-5E/6E ：0075～/0063～

●SAS75RD-5E/6E ：0070～/0064～

(2) SMS series[2-Point control type]

The following set values can be altered and adjusted.

However, as far as unloading (purge) operation starting pressure is concerned, never adjust operation at higher pressure than specified initial setting value.

※1In case of operation at higher pressure than each specified set value would lead to motor overloading and motor burning and parts.

NO.	Item	Indi-cation	Initial set value classified by working pressure		Range of set values	
			0.70MPa [STD. spec.]	0.85MPa [Factory opt.]	Set value	Pressure (MPa)
1	Full load recovering pressure PL	L	60 (0.60MPa)	70 (0.70MPa)	40 to 95	0.4 to 0.95
2	Unloading (purge) operation starting pressure PH ※	H	Max.70 (0.70MPa)	Max.85 (0.85MPa)	Full load recovering pressure +4 to 99	Full load recovering pressure +0.04 to 0.99
3	Low pressure operation caused due to fall of pressure	E	4 (0.04MPa)		2 to 20	0.02 to 0.2
4	Estimated stop time	T	60 (60 seconds)		20 to 180 seconds	—
5	Time required for confirmation of purge operation	U	20 (20 seconds)		5 to 60 seconds	—
6	Timer set for limiting stop operation	r	5 (5 minutes)		5 to 60 minutes	—
7	—	b	20 (20%)		Invalid	—
8	Star operation time	y	10 (10 seconds)		0 to 15 seconds	—
9	Dryer function mode	d	0		0: Abnormal stop with dryer available 1: Abnormal warning with dryer available 2: Dryer unavailable・—	—
10	ACCS operating function	c	1		1: ACCS function enabled 0: Invalid	—
11	—	F	84 (0.84MPa)		Invalid	—
12	Terationimer for judging long time unloading operation	J	60 (60 seconds)		60 to 300	—
13	Model setting	A	3 or 4		3 55kW 4: 75kW	—
14	Maintenance warning time	o	300 (3,000Hr)		0～300	—

※2 The maintenance warning time apply from the following SER.NO

●SMS55ESD-5E/6E :0058～/0058～

●SMS75ESD-5E/6E :0059～/0069～

3. Electrical System

[Regulator control type]

The following set values can be altered and adjusted.

However, as far as unloading (purge) operation starting pressure is concerned, never adjust operation at higher pressure than specified initial setting value.

※1In case of operation at higher pressure than each specified set value would lead to motor overloading and motor burning and parts.

NO.	Item	Indi-cation	Initial set value classified by working pressure		Range of set values	
			0.70MPa [STD. spec.]	0.85MPa [Factory opt.]	Set value	Pressure (MPa)
1	Purge cancellation pressure PL	L	60 (0.60MPa)	70 (0.70MPa)	40 to 95	0.4 to 0.95
2	Unloading (purge) operation starting pressure PH ※	H	Max.70 (0.70MPa)	Max.85 (0.85MPa)	Purge cancellation pressure +4 to 99	Purge cancellation pressure +0.04 to 0.99
3	Low pressure operation caused due to fall of pressure	E	4 (0.04MPa)		2 to 20	0.02 to 0.2
4	Estimated stop time	T	60 (60 seconds)		20 to 180 seconds	—
5	Time required for confirmation of purge operation	U	20 (20 seconds)		5 to 60 seconds (At 0 set, purge operation is cancelled)	—
6	Timer set for limiting stop operation	r	5 (5 minutes)		5 to 60 minutes	—
7	Load factor for the selection of purge operation	b	20 (20%)		10 to 50%	—
8	Star operation time	y	10 (10 seconds)		0 to 15 seconds	—
9	Dryer function mode	d	0		0: Abnormal stop with dryer available 1: Abnormal warning with dryer available 2: Dryer unavailable・—	—
10	—	c	1		Invalid	—
11	Urgent purge starting pressure	F	84 (0.84MPa)	98 (0.98MPa)	—	—
12	Terationimer for judging long time unloading op	J	60 (60 seconds)		60 to 300	—
13	Model setting	A	3 or 4		3: 55kW 4: 75kW	—
14	Maintenance warning time	o	300 (3,000Hr)		0～300	—

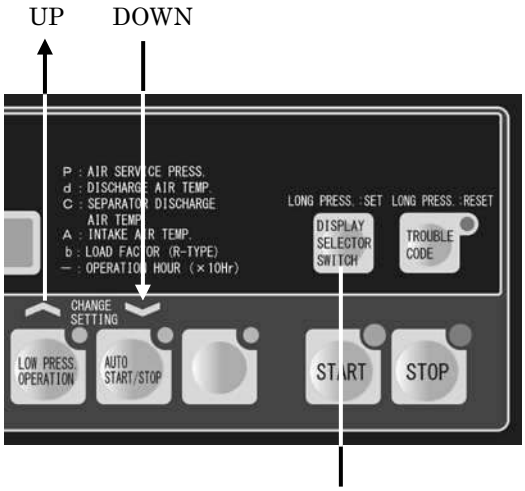
※2 The maintenance warning time apply from the following SER.NO

- ●SMS55ERD-5E/6E ：0058～/0058～
- ●SMS75ERD-5E/6E ：0059～/0069～
- ●SMS75RD-5E/6E ：0061～/0066～

3.4.2 Changing procedures of various setting

[How to change initial setting values and switch indication]

(1) 2-Point control type



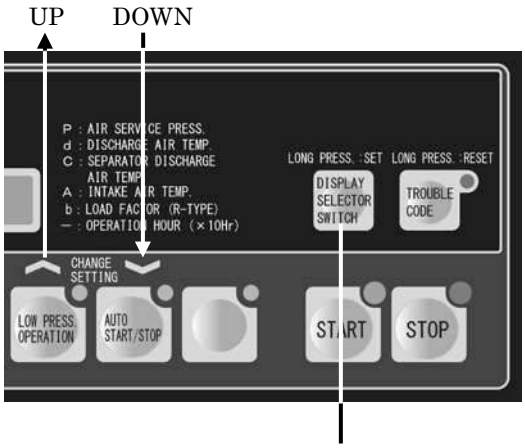
・Hold down (more than 2 seconds) to switch to data setting mode
・After setting data, press this button to confirm and move to the next setting

A140489E

<Procedures>

① Power up the compressor.
② Hold down the Display Selector Switch (more than 2 seconds) to switch to data setting mode. [L.] is shown on the digital monitor.
③ After switching to data setting mode, for each press on Display Selector Switch, L. (Full load recovering pressure PL) is switched to H. (Unloading (purge) operation starting pressure PH), to E. (Low pressure operation caused due to fall of pressure), to T. (Estimated stop time), to U. (Time required for confirmation of purge operation), to r. (Timer set for limiting stop operation), to b. (-), to y. (Star operation time), to d. (Dryer function mode setting), to c. (ACCS operating function), to F. (-), to J. (Terationimer for judging long time unloading operation), to A. (Model setting), to o. (Maintenance warning time),and to L. (Full load recovering pressure PL), according to the set orders.

(2) Regulator control type



・Hold down (more than 2 seconds) to switch to data setting mode
・After setting data, press this button to confirm and move to the next setting

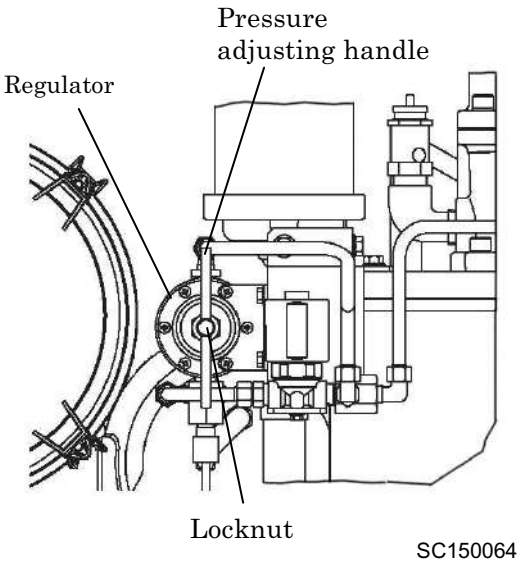
A140489E

<Procedures>

① Power up the compressor.
② Hold down the Display Selector Switch (more than 2 seconds) to switch to data setting mode. [L.] is shown on the digital monitor.
③ After switching to data setting mode, for each press on Display Selector Switch, L. (Purge cancellation pressure PL) is switched to H. (Unloading (purge) operation starting pressure PH), to E. (Low pressure operation caused due to fall of pressure), to T. (Estimated stop time), to U. (Time required for confirmation of purge operation), to r. (Timer set for limiting stop operation), to b. (Load factor for the selection of purge operation), to y. (Star operation time), to d. (Dryer function mode setting), to c. (-), to F. (Urgent purge starting pressure), to J. (Terationimer for judging long time unloading operation), to A. (Model setting), to o. (Maintenance warning time), and to L. (Purge cancellation pressure PL), according to the set orders.

3.4.3 Adjustment of service pressure(Regulator control type only)

Procedure of the service pressure value setting is followings.



<Procedures>

① After starting operation, set to "0" the time for time required for confirmation of purge operation.
＊In case that purge control function is released, auto start/stop mode operation will be cancelled.
② Loosen locknuts of regulator.
③ Close the stop valve slowly until the valve is completely closed. Then adjust the pressure adjusting handle of regulator until pressure indication at operation panel meets the value of unload pressure detailed in the table below.
(Clockwise rotation increases the service pressure.)
(For selection of service pressure and load factor.)
④ Tighten the locknut.
⑤ Then, set to more than "0" the time for time required for confirmation of purge operation so that purge control operation can be made available.

Service pressure list

SAS series	Service pressure (MPa)	0.70 [STD.spec]	0.85 [Factory opt.]	0.90 [Factory opt.]
	Unload pressure (MPa)	0.75	0.93	0.98
SMS series	Service pressure (MPa)	0.70 [STD.spec]	0.85 [Factory opt.]	-
	Unload pressure (MPa)	0.80	0.93	-

<How to check state of service pressure setting>

① When service pressure is raised by gradually closing service valve, it is switched to purge control operation.
② Next, open the stop valve gradually, to lower service pressure. Then it releases purge control operation mode and it will be switched to full load operation.

CAUTION	● As the service pressure is adjusted before shipment, do not readjust it during the normal operation. ● Operation at higher pressure than specified set value would lead to motor overloading and motor burning and parts.

4. Troubleshooting

4.1 How to Proceed Diagnosis

When performing failure diagnosis, pay special attention to the followings, observing general cautions.

4.1.1 Safety caution

(1) Removing such cap and/or plug for receiver tank, fuel tanks and pipes where pressure is loaded, stop the machine and relieve all the interior pressure. Install measuring instruments connected firmly.

(2) When doing the job with co-worker(s) together, make sure to give signal to the other person(s) and do not allow other persons to come near to the job site.

(3) Take care not to touch hot portions and not to be involved in turning portions.

4.1.2 Caution during failure diagnosis

(1) Do not make haste to disassemble the unit

If the unit is disassembled urgently.

①You may disassemble the other portions which are not related with the trouble.

②The cause of trouble may be missing.

The unnecessary reparations require more spare parts and man-hours, and reparation costs will increase more. What is worse, you will lose reliance or trust from clients, operators and users. Therefore, it is absolutely necessary to investigate the trouble more carefully in advance and to follow the required procedures for failure diagnosis.

(2) Ask the clients about the trouble in details

In order to prevent misunderstanding and incorrect judgment about the trouble, it is necessary to ask users or operators about the following questions.

①Is there any other disorder than the trouble he has informed?

②Anything abnormal occurred before this trouble?

③Did this trouble happen unexpectedly? Or the unit had been operated in bad conditions before?

④When and how did this trouble occur?

⑤Had he repaired the unit before this trouble occurred?

⑥Did he not experience similar trouble before?

(3) Inspection items before starting diagnosis

Sometimes such trouble may be caused owing to routine mishandling of the unit. Before starting failure diagnosis, check the following items.

①Check whether compressor oil is lacking or dirty.

②Check each cable connection for any disconnection.

③Check the other portions for any damage.

(4) Confirmation of trouble

Discuss with user(s) and/or operator(s) sufficiently about the trouble. As a result, judge whether their judgment is based on the numerical comparison or sentimental basis. Make him (them) understand well the reparation or correction you have finished.

Then check and confirm by yourself the cause of the trouble.

Note) Never proceed any investigation or measurement which may cause further greater damage.

(5) Procedures of diagnosis

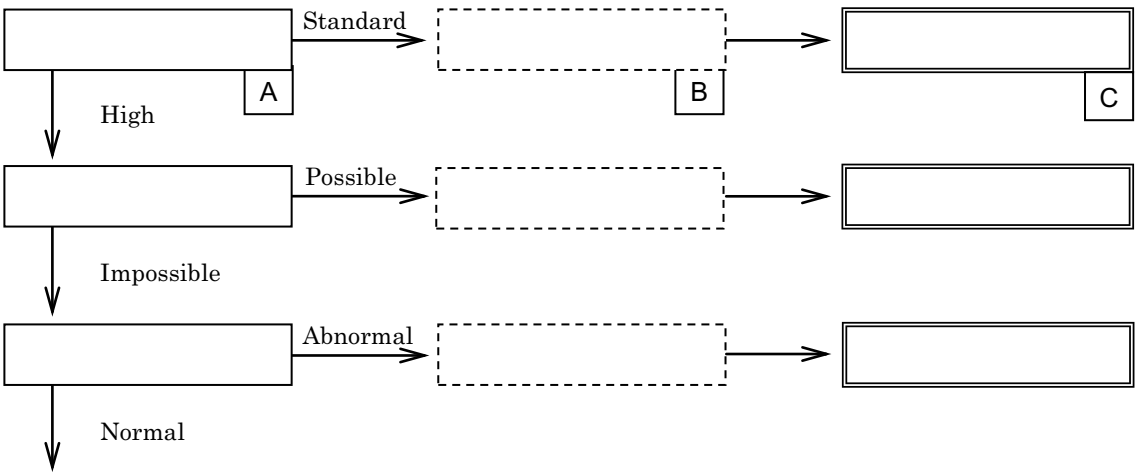
When you become well experienced, you can find out the cause easily during the process of confirmation (4). But easy understanding could cause unexpected failure. So check and judge it according to the following procedures.

①Check the easiest thing or portion first.
②Investigate the most possible cause.
③Check the other things connected to the trouble.
④Check for the possibility of any other troubles.
⑤Start proper and careful investigation on this trouble.

(6) Prevention of repeated occurrence of similar trouble

Even if you have repaired the trouble, unless you get rid of the fundamental cause of the trouble, it will repeatedly occur. Therefore, perform full investigation of the trouble, and it is absolutely necessary to remove the basis of the trouble.

4.1.3 How to use failure diagnosis table



① In troubleshooting column [ ] The item in the column.
This item is mentioned confirmation of abnormal phenomena.

② In troubleshooting column [ ] The item in the column.
The cause is mentioned shows the cause of the said trouble.

③ In troubleshooting column [ ] The item in the column.
The measures and/or treatment shows the measures and or treatment the said cause.

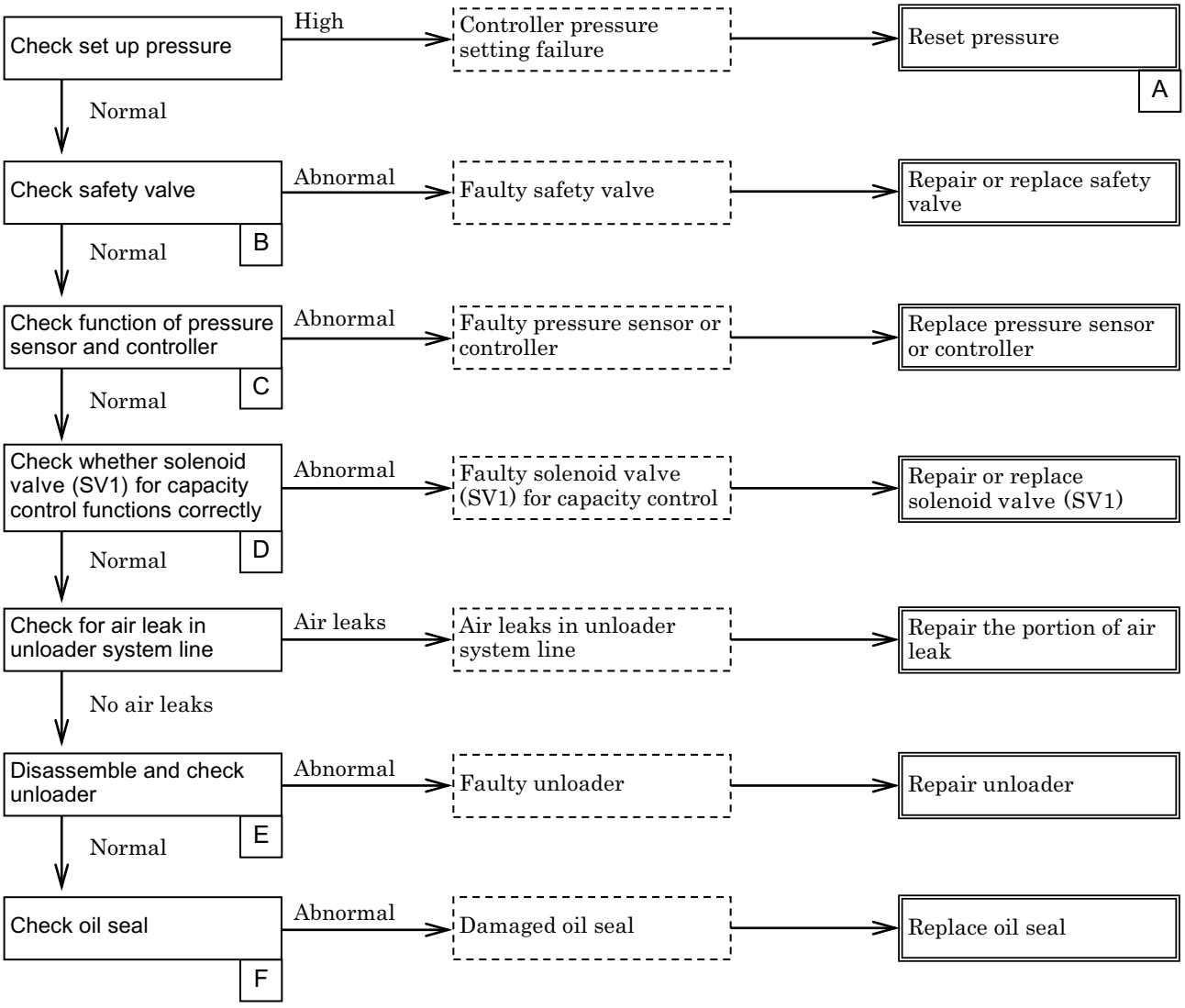
④ [A] under each column shows the explanation of the column.

4. Troubleshooting

4.2 Failure of Capacity Control System

4.2.1 Safety valve blows off.

(1) 2-Point control type

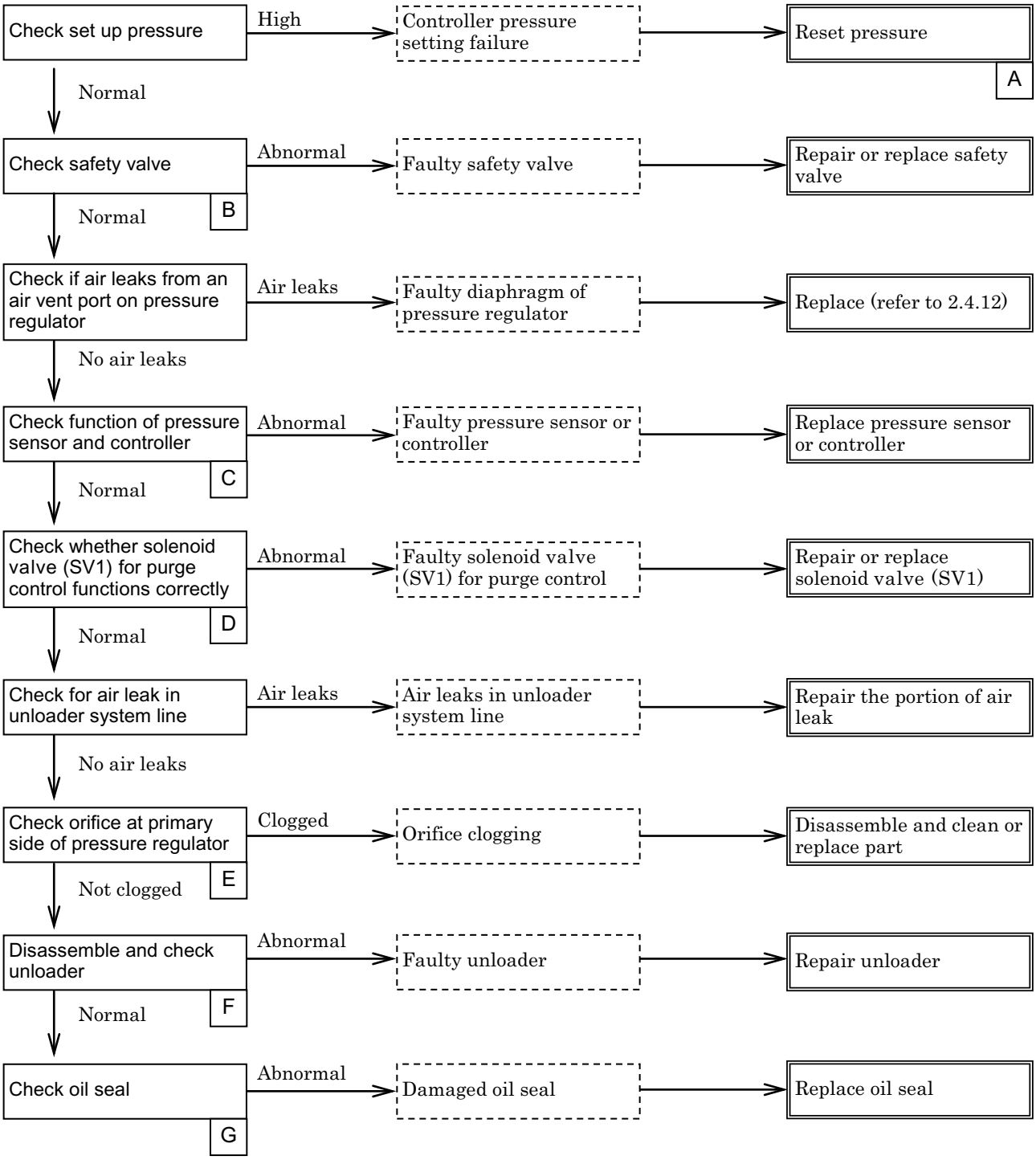


4. Troubleshooting

<table>
<tr><th>Mark</th><th>Item</th><th>Cause & Explanation</th><th>Countermeasures & Remarks</th></tr>
<tr><td>A</td><td>Set pressure</td><td colspan="2">Setting methods…refer to 3.4.1&3.4.2</td></tr>
<tr><td>B</td><td>Check safety valve</td><td colspan="2">Check if there is an incorrect pressure setting at safety valve.
<table>
<tr><td>Specifications of service pressure (MPa)</td><td>0.70
[STD. spec]</td><td>0.85
[Factory opt.]</td><td>0.93
(SAS series)
[Factory opt.]</td></tr>
<tr><td>Set pressure for safety valve(MPa)</td><td colspan="3">1.0MPa</td></tr>
</table></td><td></td></tr>
<tr><td>C</td><td>Check function of pressure sensor and controller</td><td colspan="2">Check if the pressure sensor functions properly. If it does not indicate proper signal, the pressure sensor is faulty.
If the pressure sensor is correct, check if the solenoid valve (SV1) shows correct volume control signal.
・When it starts…no conductivity is found
・About 15 seconds after it starts…conductivity is found (Cancellation of starting unloader operation)
・When pressure is higher than purge starting pressure…no conductivity is found
If it is not changed to non-energizing when service pressure exceeds purge starting pressure, the controller is faulty.</td><td>Check pressure sensor function (refer to 3.2.11)

Check controller (refer to 3.1.3)</td></tr>
<tr><td>D</td><td>Check whether solenoid valve (SV1) for capacity control functions correctly</td><td colspan="2">Remove the tube that connects solenoid valve (SV1) and unloader activation chamber by removing this tube, when service pressure gradually builds up and exceeds purge starting pressure (solenoid valve is in non-energizing status) check if air comes out. If not, the solenoid valve is faulty.</td><td>Repair or replace solenoid valve</td></tr>
<tr><td>E</td><td>Disassemble and check unloader</td><td colspan="2">Disassemble unloader to check if movement of piston is abnormal and any damage on valve, seal.</td><td>If you find some abnormal function or scratch, scar, should replace damage part (refer to 2.4.3)</td></tr>
<tr><td>F</td><td>Check oil seal</td><td colspan="2">If air is taken in through sealing portion, unloader valve is closed, but raise tank pressure and safety valve sometimes functions.</td><td>Replace oil seal</td></tr>
</table>

(2) Regulator control type



4. Troubleshooting

<table>
<tr><th>Mark</th><th>Item</th><th>Cause & Explanation</th><th>Countermeasures & Remarks</th></tr>
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<tr><td>B</td><td>Check safety valve</td><td colspan="2">Check if there is an incorrect pressure setting at safety valve.
<table>
<tr><td>Specifications of service pressure (MPa)</td><td>0.70
[STD. spec]</td><td>0.85
[Factory opt.]</td><td>0.90
(SAS series)
[Factory opt.]</td></tr>
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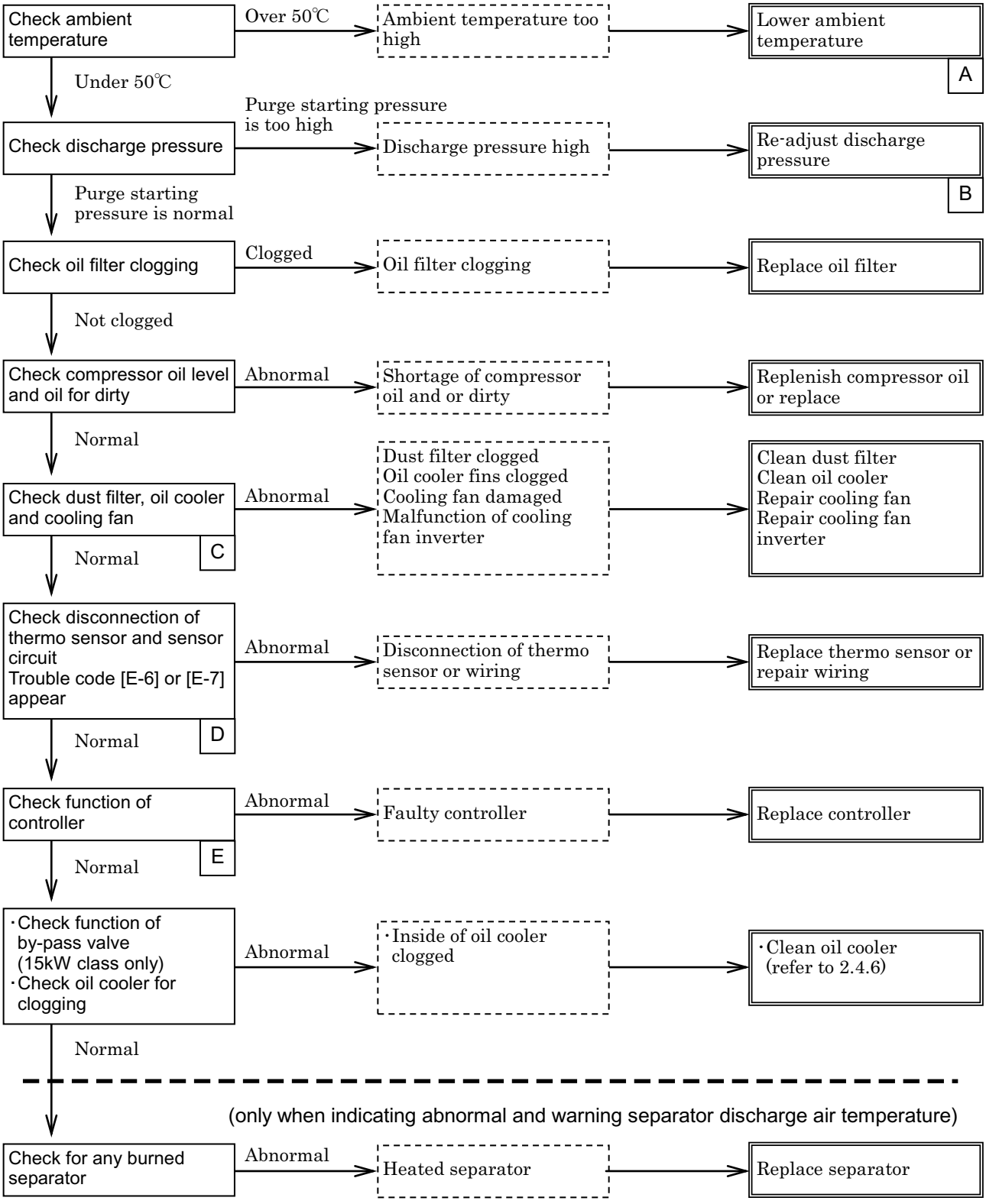
</table></td></tr>
<tr><td>C</td><td>Check function of pressure sensor and controller</td><td>Check if the pressure sensor functions properly.
If it does not indicate proper signal, the pressure sensor is faulty.
If the pressure sensor is correct, check if the solenoid valve (SV1) shows correct volume control signal.
・When it starts…no conductivity is found
・About 15 seconds after it starts…conductivity is found (Cancellation of starting unloader operation)
・When pressure is higher than purge starting pressure…no conductivity is found
If it is not changed to non-energizing when service pressure exceeds purge starting pressure, the controller is faulty.</td><td>Check pressure sensor function (refer to 3.2.11)

Check controller (refer to 3.1.3)</td></tr>
<tr><td>D</td><td>Check whether solenoid valve (SV1) for purge control functions correctly</td><td>Remove the tube that connects solenoid valve (SV1) and unloader activation chamber by removing this tube, when service pressure gradually builds up and exceeds purge starting pressure (solenoid valve is in non-energizing status) check if air comes out. If not, the solenoid valve is faulty.</td><td>Repair or replace solenoid valve</td></tr>
<tr><td>E</td><td>Check orifice at primary side of pressure regulator</td><td>If the orifice clogged, unloader valve will not function appropriately.</td><td>Remove tube and check the orifice</td></tr>
<tr><td>F</td><td>Disassemble and check unloader</td><td>Disassemble unloader to check if movement of piston is abnormal and any damage on valve, seal.</td><td>If you find some abnormal function or scratch, scar, should replace damage part (refer to 2.4.3)</td></tr>
<tr><td>G</td><td>Check oil seal</td><td>If air is taken in through sealing portion, unloader valve is closed, but raise tank pressure and safety valve sometimes functions.</td><td>Replace oil seal</td></tr>
</table>

4. Troubleshooting

4.3 Function of Emergency Switch

4.3.1 Stop when discharge air temperature rising trouble code [E-1] or separator discharge air temperature rising trouble code [E-5] is indicated.

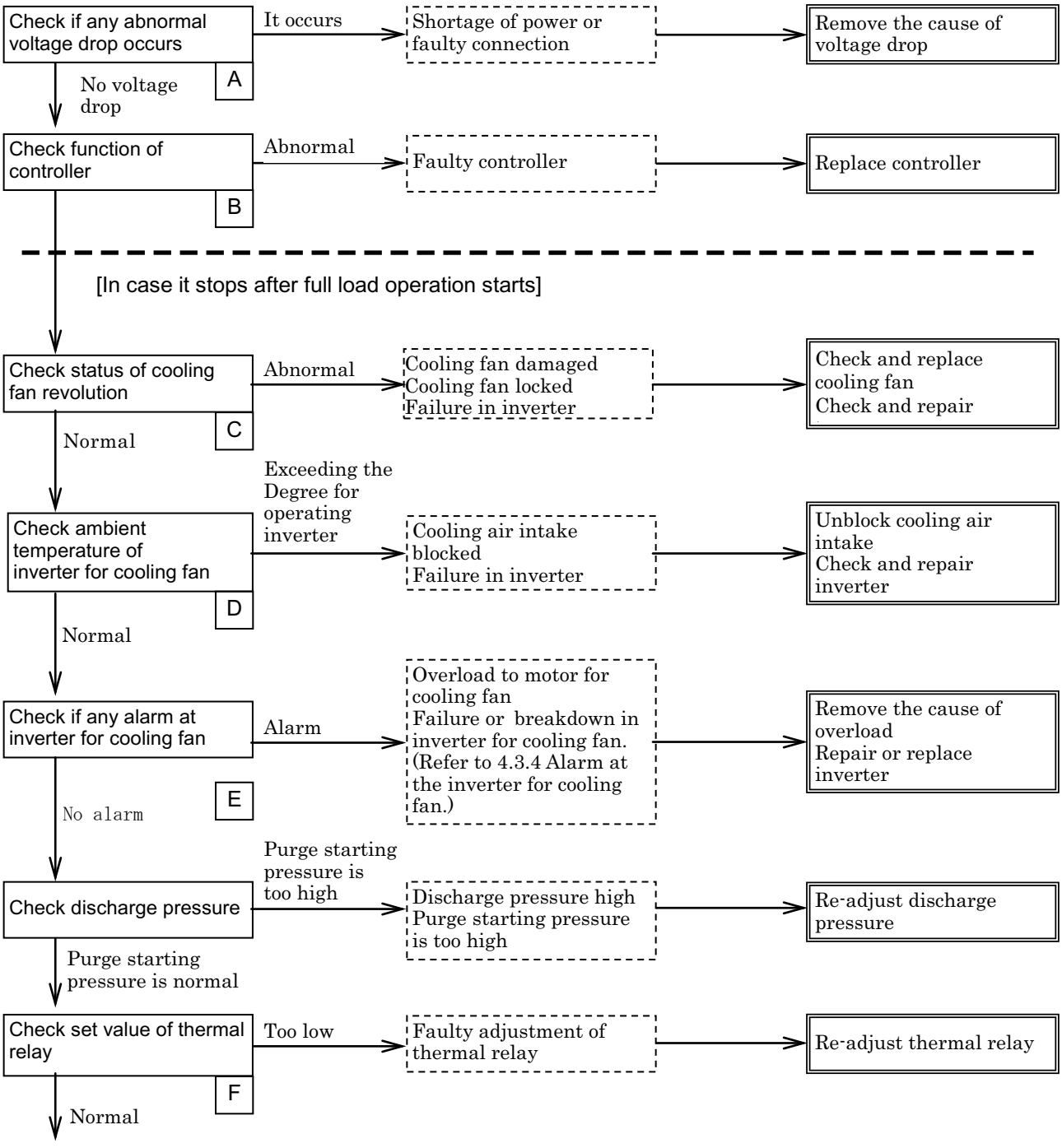


4. Troubleshooting

Mark	Item	Cause & Explanation	Countermeasures & Remarks
A	Lower ambient temperature	It sometime happen that temperature of the room is heated over 50℃ by compressor installed in poorly ventilated. It causes overheating. The unit can be operated until ambient temperature rises to 50℃, but consumable parts such as compressor oil is promptly deteriorated under high temperature so it is recommended to operate the unit at temperature range of 2—40℃.	Ventilate suction and discharge air fully of the room.
B	Re-adjust discharge pressure	For adjustment…refer to 3.4	
C	Check cooling fan	Revolution of cooling fan is controlled by an inverter to keep the stability of compressor oil temperature. When cooling fan is not working appropriately, compressor oil might be emulsified as it is overcooled or overheat might happens that leads to emergency stopping of the unit under the abnormal state of discharge air temperature. ※ Cooling fan revolution range Normal rotation speed is 300min^{-1} (purge unload operation) — 1,400 (rated operation). However, the is a possibility of repetition of running-stopping when ambient temperature is low (oil temperature is low). DANGER ● Please refrain from leaving your hands or other objects near the cooling fan when removing its cover.	・Refer to 3.2.2Inverter for cooling fan. ・Refer to 4.3.4Alarm at the inverter for cooling fan. ※Repair of inverter should be carried out by original maker.
D	Check disconnection of thermo sensor and sensor circuit	It sometime happens that snapping of thermo sensor by vibration or faulty of fittings. So, use tester to check circuit connectivity and resistance of sensor. (For the relation between temperature and resistance, refer to 2.4.8)	Repair or replace sensor and wiring
E	Check function of controller	Operate the compressor and check whether the discharge air temperature exceed 110℃. ・In case the unit stops even under normal temperature, the controller is faulty. ・When temperature exceeds 110℃, the controller is normal. Instead of resistance value when it shows disorder. (How to check, refer to 3.1.4)	

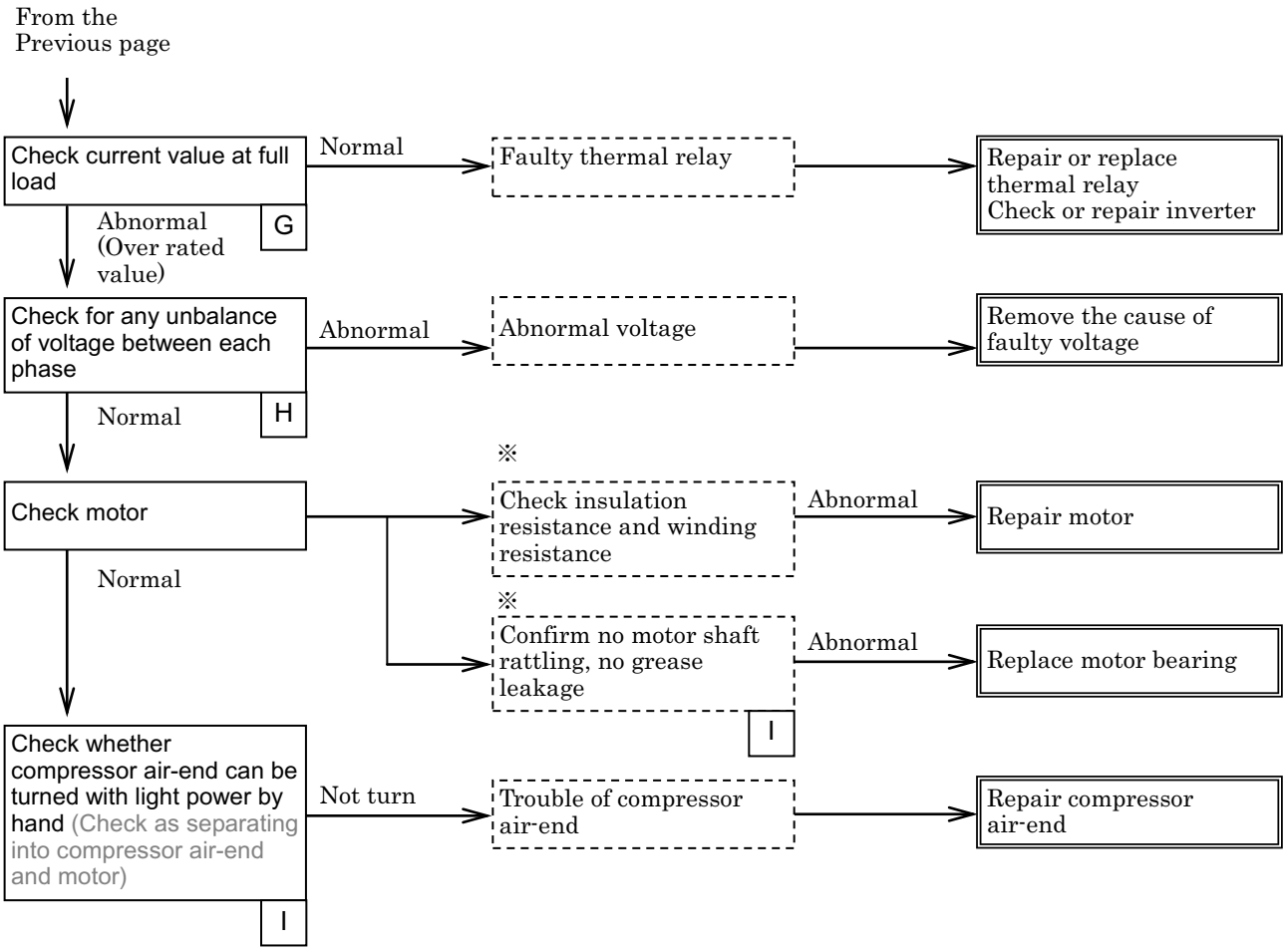
4.3.2 Stop when overload trouble code [E-4] is indicated.

[In case it stops before full load operation starts]



To the next page

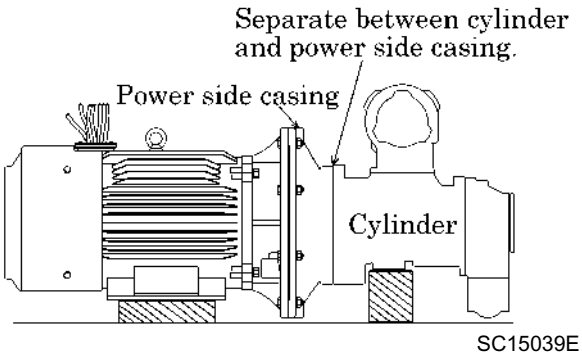
4. Troubleshooting



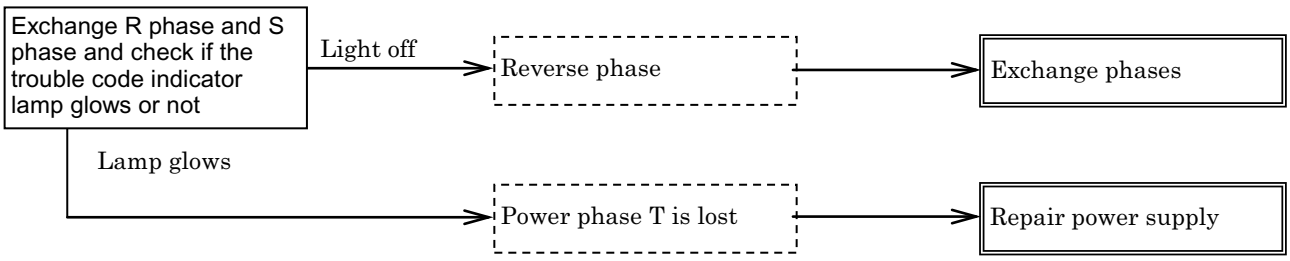
※Refer to 2.4.1 for procedure of checking insulation resistance, winding resistance and replacement of motor bearing.

4. Troubleshooting

Mark	Item	Cause & Explanation	Countermeasures & Remarks
A	Check if any abnormal voltage drop occurs	Check such items as shortage of power supply, length of wiring, and cable size. They cause abnormal drop of voltage. 《Reference》 Allowable voltage drop rate shall be within 15%.	
B	Check function of controller	Check voltage between wire No.22 and 28. ・In case of emergency stop despite DC12V, controller is faulty. ・In case of emergency stop in DC0V, controller is acceptable.	Replace controller
C	Check revolution of cooling fan	Revolution of cooling fan is controlled by an inverter to keep the stability of compressor oil temperature. If cooling fan does not revolve normally or its revolution speed is not controlled by inverter, compressor oil temperature become too cold and cause emulsification of compressor oil. Or in other case it become too hot and cause overheat and compressor stopping by overload.	Replace cooling fan For inverter checking, ・refer to 3.2.3 inverter for cooling fan ・refer to 4.3.4 Alarm at the inverter for cooling fan ※Repair of inverter should be carried out by original maker.
D	Check ambient temperature of inverter for cooling fan	Cooling air intake is blocked and ambient temperature is exceeding the degree for operating inverter. Cooling fan at starting board is in breakdown and inverter is not cooled. Inverter is in failure and does not operate normally by overheat.	Unblock cooling air intake. Check and repair cooling fan at starting board. Check and repair inverter.
E	Check if any alarm at inverter for cooling fan	Overload in motor for cooling fan. Failure or breakdown in inverter for cooling fan. (refer to 4.3.4 Alarm at the inverter for cooling fan)	Check and remove the cause of overload. Repair or replace inverter.
F	Check set value of thermal relay	For the set value, refer to 3.2.1	
G	Check current value at full load	For the current value, refer to 1.2	
H	Check for any unbalance of voltage between each phase	・Unbalance between phases is within±2% ・Keep the fluctuation of input voltage within rated voltage±5%.	

Mark	Item	Cause & Explanation	Countermeasures & Remarks
I	Check whether compressor air-end can be turned with light power by hand. (Check as separating into compressor air-end and motor)	Compressor air-end is coupled with motor directly. Check as separating into compressor air-end and motor ＜Procedure＞ ① Lift off compressor air-end and motor set from the frame and put it onto a stable stand. ② Separate compressor air-end by removing joint bolts (12 pieces of M10 socket bolt) which is in between cylinder and power side casing. Caution: Operates crane carefully not to harm drive/driven gear. ③ Refer clause 2.2.3 for a cautionary note when reconstruction (For example, tightening torque etc.). Replace O-ring which is used in mating surface.  SC15039E	In case compressor air-end or motor shaft rotates slowly, there must be a trouble so please do overhaul or replacing bearing.

4.3.3 Stop when reverse phase trouble code [E-2] is indicated.



4.3.4 Alarm at the inverter for cooling fan.

【Excerpted from inverter manufacturer's instruction manual】

If an abnormal condition arises, the protective function is invoked and issues an alarm, then the inverter automatically enters alarm mode. At the same time, an alarm code appears on the LED monitor.

■Releasing the alarm and switching to running mode

Remove the cause of the alarm and press the PRG/RESET key to release the alarm and return to running mode. The alarm can be removed using the PRG/RESET key only when the current alarm code is displayed.

■Displaying the alarm history

It is possible to display the most recent 3 alarm codes in addition to the one currently displayed. Previous alarm codes can be displayed by pressing the ∧/∨ key while the current alarm code is displayed.

■Displaying the status of inverter at the time of alarm

When the alarm code is displayed, you may check various running status information (output frequency and output current, etc.) by pressing the FUNC/DATA key. The item number and data for each running information will be displayed alternately. Further, you can view various pieces of information on the running status of the inverter using the ∧/∨ key.

Pressing the PRG/RESET key while the running status information is displayed returns to the alarm code display.

Note: When the running status information is displayed after removal of the alarm cause, pressing the PRG/RESET key twice returns to the alarm code display and releases the inverter from the alarm state. This means that the motor starts running if a run command has been received by this time.

4. Troubleshooting

[Possible causes / What to check and suggested measures (Provide only main items)]

[1] OC□ Instantaneous overcurrent

Problem The inverter momentary output current exceeded the overcurrent level.

OC1 Overcurrent occurred during acceleration.
OC2 Overcurrent occurred during deceleration.
OC3 Overcurrent occurred during running at a constant speed.

Possible Causes	What to Check and Suggested Measures
(1) The inverter output lines were short-circuited.	Disconnect the wiring from the inverter output terminals ([U], [V] and [W]) and measure the interphase resistance of the motor wiring. Check if the resistance is too low. ➔ Remove the short-circuited part (including replacement of the wires, relay terminals and motor).
(2) Ground faults have occurred at the inverter output lines.	Disconnect the wiring from the output terminals ([U], [V] and [W]) and perform a Megger test. ➔ Remove the grounded parts (including replacement of the wires, relay terminals and motor).
(3) Overload.	Measure the motor current with a measuring device to trace the current trend. Then, use this data to judge if the trend is over the calculated load value for your system design. ➔If the load is too heavy, reduce it or increase the inverter capacity.
	Trace the current trend and check if there are any sudden changes in the current. ➔ If there are any sudden changes, make the load fluctuation smaller or increase the inverter capacity.
(4) Malfunction caused by noise.	Check if noise control measures are appropriate (e.g., correct grounding and routing of control and main circuit wires).

[2] OU□ Overvoltage

Problem The DC link bus voltage was over the detection level of overvoltage.

OU1 Overvoltage occurred during acceleration.
OU2 Overvoltage occurred during deceleration.
OU3 Overvoltage occurred during running at constant speed.

Possible Causes	What to Check and Suggested Measures
(1) The power supply voltage exceeded the inverter's specification range.	Measure the input voltage. ➔ Decrease the voltage to within the specified range.
(2) A surge current entered the input power supply.	In the same power line, if a phase-advancing capacitor is turned ON/OFF or a thyristor converter is activated, a surge (momentary large increase in the voltage or current) may be caused in the input power. ➔ Install a DC reactor.
(3) Malfunction caused by noise.	Check if the DC link bus voltage was below the protective level when the overvoltage alarm occurred.

SC15043E

[3] LU Undervoltage

Problem DC link bus voltage has dropped below the undervoltage detection level.

Possible Causes	What to Check and Suggested Measures
(1) A momentary power failure occurred.	➔ Release the alarm.
(2) The power supply voltage did not reach the inverter's specification range.	Measure the input voltage. ➔ Increase the voltage to within the specified range.
(3) Peripheral equipment for the power circuit malfunctioned, or the connection was incorrect.	Measure the input voltage to find which peripheral equipment malfunctioned or which connection is incorrect. ➔ Replace any faulty peripheral equipment, or correct any incorrect connections.

[4] L IN Input phase loss

Problem Input phase loss occurred, or interphase voltage unbalance rate was large.

Possible Causes	What to Check and Suggested Measures
(1) Breaks in wiring to the main power input terminals.	Measure the input voltage. ➔ Repair or replace the main circuit power input wires or input devices (MCCB, MC, etc.).
(2) The screws on the main power input terminals are loosely tightened.	Check if the screws on the main power input terminals have become loose. ➔ Tighten the terminal screws to the recommended torque.
(3) Interphase voltage unbalance between three phases was too large.	Measure the input voltage.

[5] OPL Output phase loss

Problem Output phase loss occurred.

Possible Causes	What to Check and Suggested Measures
(1) Inverter output wires are broken.	Measure the output current. ➔ Replace the output wires.
(2) The motor winding is broken.	Measure the output current. ➔ Replace the motor.
(3) The terminal screws for inverter output were not tight enough.	Check if any screws on the inverter output terminals have become loose. ➔ Tighten the terminal screws to the recommended torque.

SC15044

[6] OH / Heat sink overheat

Problem Temperature around heat sink has risen abnormally.

Possible Causes	What to Check and Suggested Measures
(1) Temperature around the inverter exceeded the inverter's specification range.	Measure the temperature around the inverter. ➔ Lower the temperature around the inverter (e.g., ventilate the panel where the inverter is mounted).
(2) Ventilation path is blocked.	Check if there is sufficient clearance around the inverter. ➔ Change the mounting place to ensure the clearance.
	Check if the heat sink is not clogged. ➔ Clean the heat sink.
(3) Cooling fan's airflow volume decreased due to the service life expired or failure.	Check the cumulative run time of the cooling fan. ➔ Replace the cooling fan.
	Visually check whether the cooling fan rotates normally. ➔ Replace the cooling fan.
(4) Overload.	Measure the output current.

[7] OL / Overload of motor 1 / OL2 Overload of motor 2

Problem Electronic thermal protection for motor 1 and 2 activated.

Possible Causes	What to Check and Suggested Measures
(1) The electronic thermal characteristics do not match the motor overload characteristics.	Check the motor characteristics.
(2) Activation level for the electronic thermal protection was inadequate.	Check the continuous allowable current of the motor.
(3) Overload.	Measure the output current. ➔ Reduce the load.

SC15045

[8] OLU Inverter overload

Problem Temperature inside inverter has risen abnormally.

Possible Causes	What to Check and Suggested Measures
(1) Temperature around the inverter exceeded the inverter's specification range.	Measure the temperature around the inverter. ➔ Lower the temperature (e.g., ventilate the panel where the inverter is mounted).
(2) Overload.	Measure the output current. ➔ Reduce the load.
(3) Ventilation paths are blocked.	Check if there is sufficient clearance around the inverter. ➔ Change the mounting place to ensure the clearance.
	Check if the heat sink is not clogged. ➔ Clean the heat sink.
(4) Cooling fan's airflow volume decreased due to the service life expired or failure.	Check the cumulative run time of the cooling fan. ➔ Replace the cooling fan.
	Visually check that the cooling fan rotates normally. ➔ Replace the cooling fan.
(5) The wires to the motor are too long, causing a large leakage current from them.	Measure the leakage current. ➔ Insert an output circuit filter (OFL).

[9] Er-3 CPU error

Problem A CPU error (e.g. erratic CPU operation) occurred.

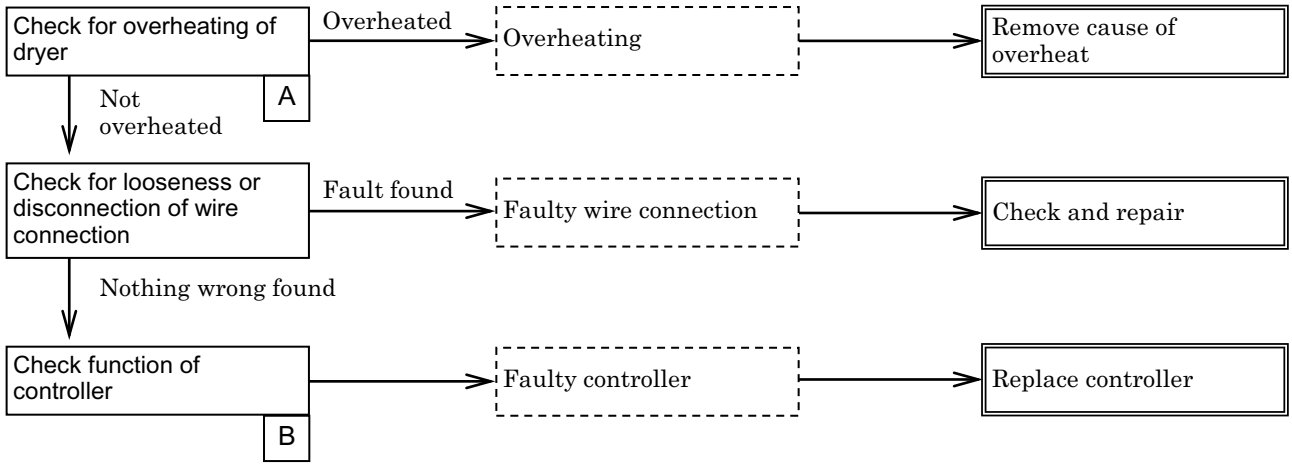
Possible Causes	What to Check and Suggested Measures
(1) Inverter affected by strong electrical noise.	Check if appropriate noise control measures have been implemented (e.g. correct grounding and routing of signal wires, communications cables, and main circuit wires). ➔ Implement noise control measures.

SC15046E

WARNING

- Before proceeding to the maintenance and inspection, turn OFF the power and wait at least five minutes. Make sure that the LED monitor is turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped below the safe level (+25 VDC or below).
  Electric shock may occur.

4.3.5 Dryer abnormality trouble code [E-3] (Stopping if abnormality mode is set)



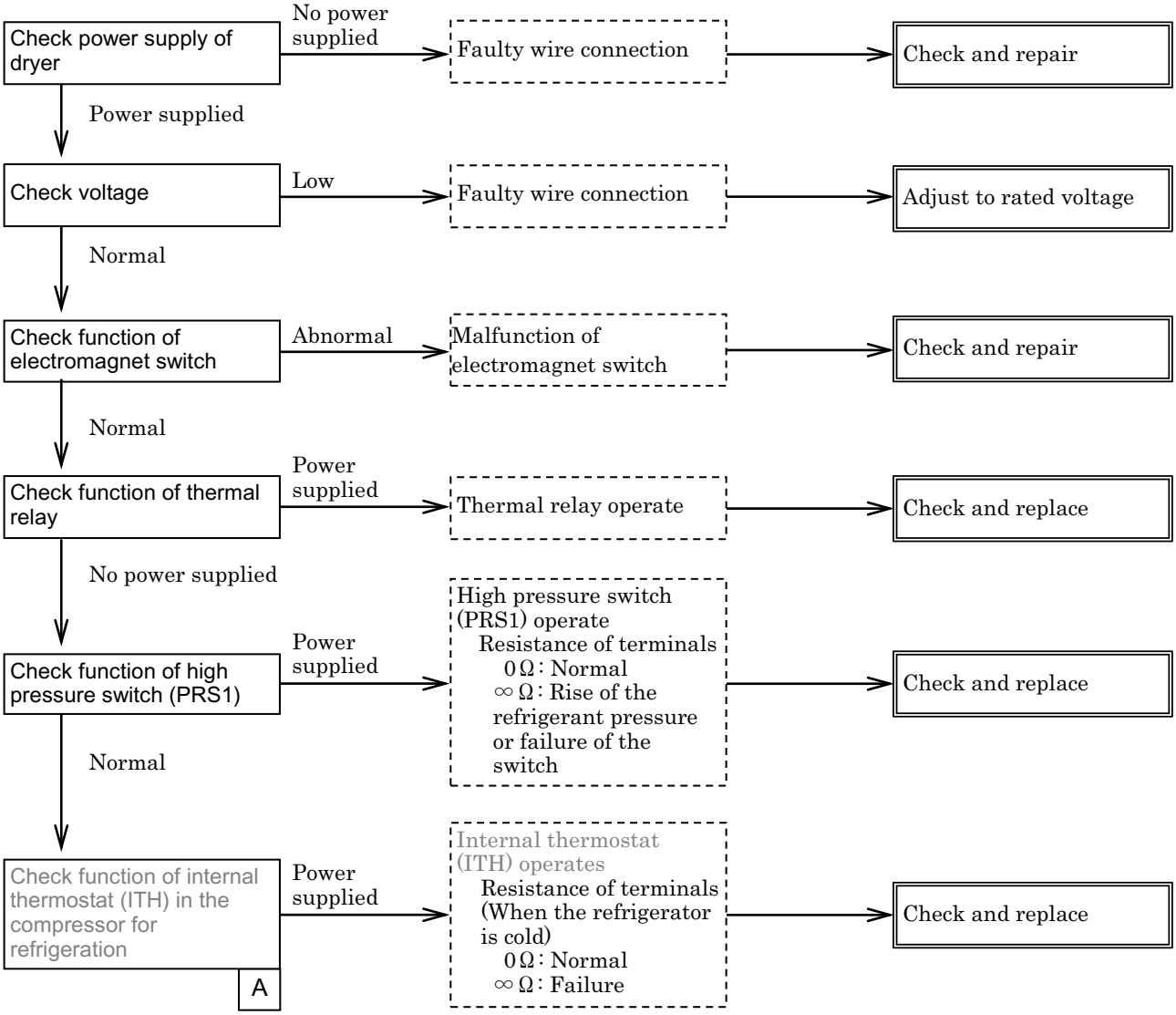
Mark	Item	Cause and Explanation	Countermeasures and Remarks
A	Check for overheating of dryer	Higher ambient temperature than 50℃ and poor ventilation of dryer may cause overheating. Pay carefully attention to them especially in summer season. And make sure the dust-poof filter is not clogged.	Suction of air and ventilation of the room shall be sufficient. To restart hold down the reset button at operation panel.
B	Check function of controller	In case other causes can be found, check controller. Measure voltage between cable No.33 and 28. DC12V : under normal operation DC0V : when thermal relay functions When trouble code cannot be reset under normal operation, the controller is faulty.	Replace controller

※Dryer warning / abnormality : Warning and abnormality can be changed by setting at the operating panel. (for details, refer to 3.4.1 and 3.4.2) (Factory default settings : “Abnormality”)

4. Troubleshooting

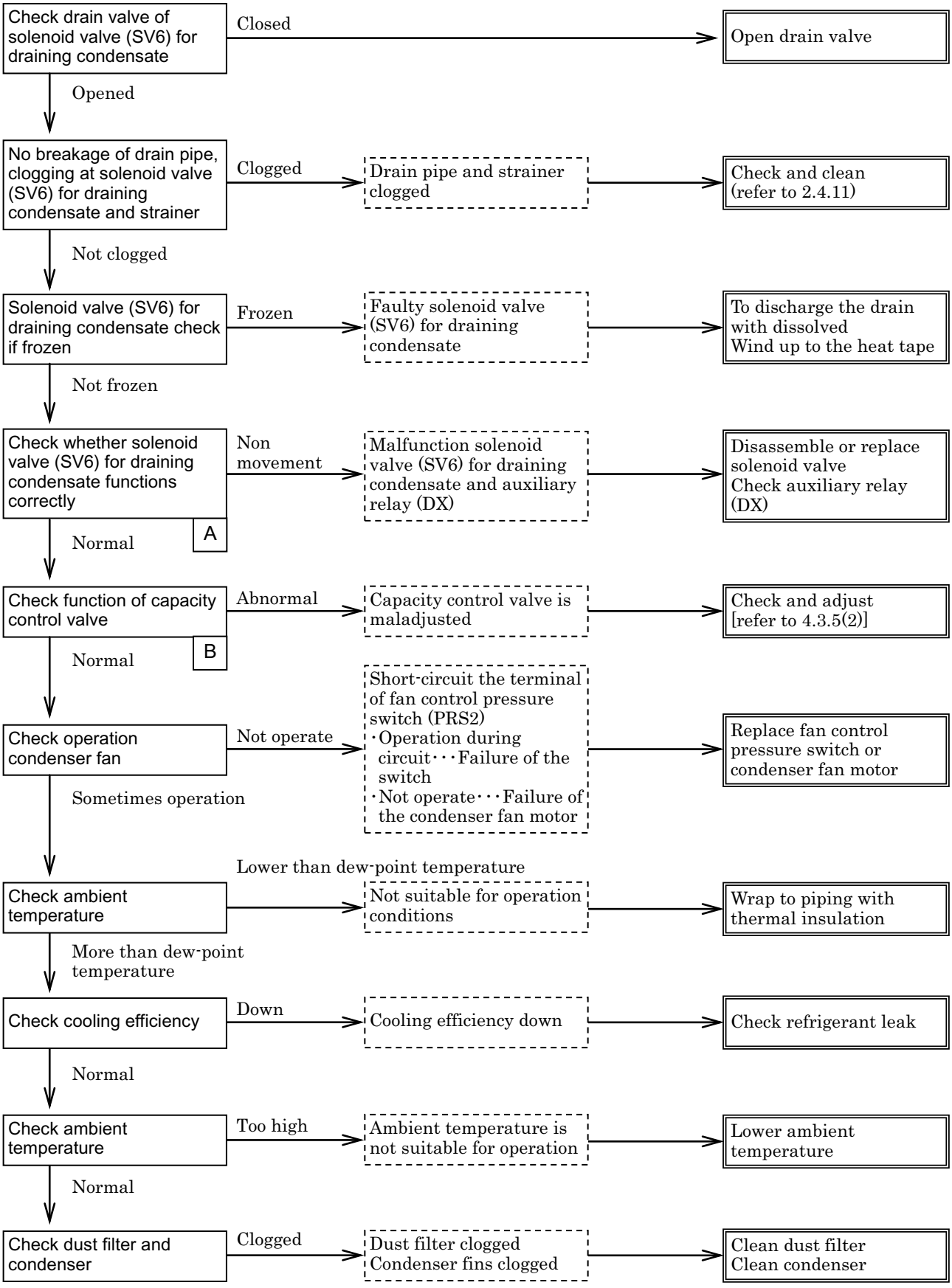
(1) Troubleshooting of dryer

1. Unable to run



Mark	Item	Cause & Explanation	Countermeasures & Remarks
A	Check function of internal thermostat (ITH)	ITH is bimetal thermostat built in compressor motor coil. It works as a breaker when motor temperature rises abnormally. <Cause> ① Refrigerant gas leakage (the indicator needle of refrigerant evaporation pressure gauge points out of the lower limit of operating range.) ② High temperature of intake refrigerant gas due to maladjustment of capacity control valve. ③ Faulty ITH	・ITH operating/return temperature : 135℃/113℃ ・Refrigerant evaporation pressure gauge operating range (During operation). 0.70—1.15MPa ・Ask dryer maker for replacing ITH. ・Check and adjust of capacity control valve [refer to 4.3.5(2)] ・Check and replace

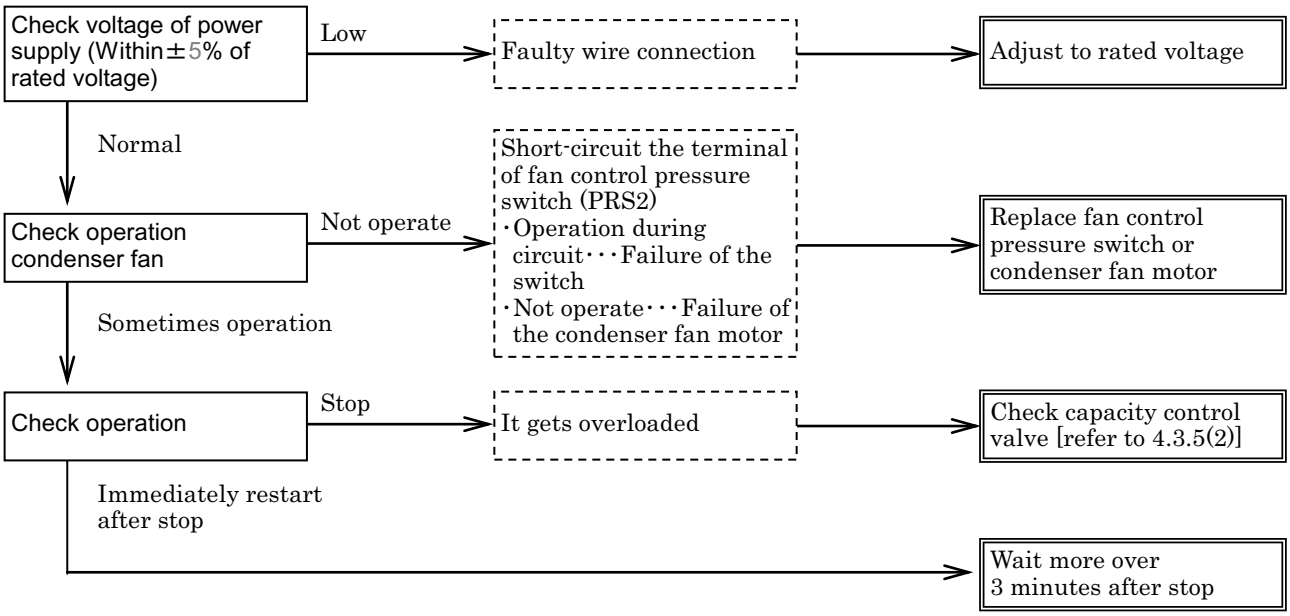
2. Water drained at outlet



4. Troubleshooting

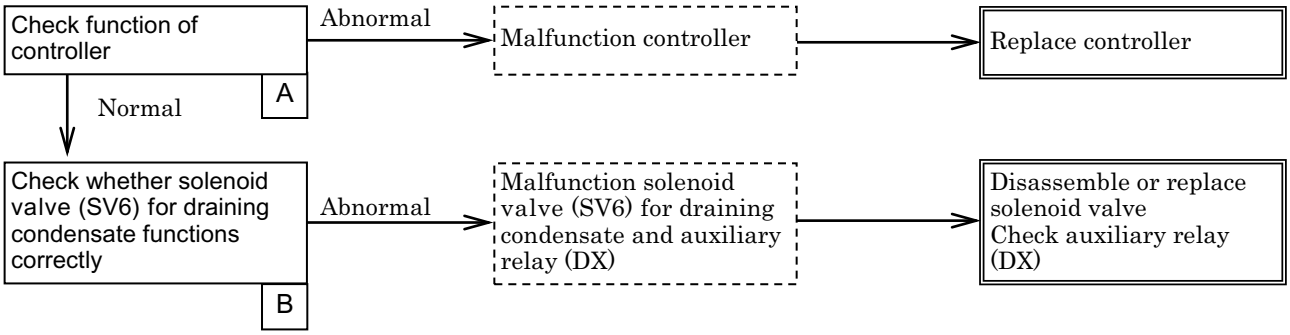
Mark	Item	Cause & Explanation	Countermeasures & Remarks
A	Check whether solenoid valve (SV6) for draining condensate functions correctly	At a ratio of 5 seconds, normal solenoid valve is activated when the AC200V is applied to S1 between the line No. 18 of about 22 to 90 seconds intervals (varies according to ambient temperature/load operation total time). It is normal if solenoid valve activates when AC200V applied for 5 seconds between the line No. 18 and S1 at about 22 - 90 seconds intervals (varies according to ambient temperature/load operation total time) during operation.	・Check wiring ・Check seizing at solenoid valve ・Check auxiliary relay (DX)
B	Check function of capacity control valve	During operation if the indicator needle of refrigerant evaporation pressure gauge exceeds upper limit of operating gauge then there is maladjustment of capacity control valve. evaporation pressure gauge operating range (During operation) 0.70—1.15MPa	・Check and adjust of capacity control valve [refer to 4.3.5(2)]

3. Able to start, but stop soon



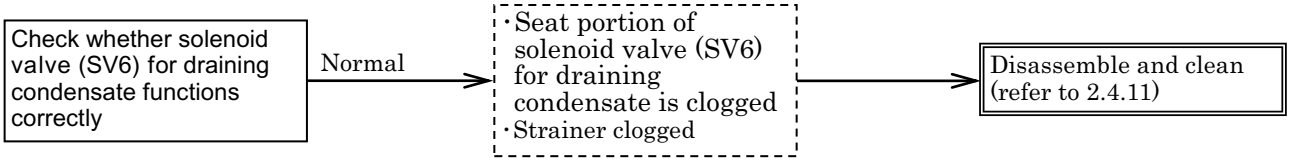
4. Troubleshooting

4. Air or drain blowing at drain outlet



Mark	Item	Cause & Explanation	Countermeasures & Remarks
A	Check function of controller	Check and confirm that correct signal is sent to solenoid valve (SV6). It is OK when power is supplied for 1 second at the internal of about 22 to 90 seconds (varies according to ambient temperature/load operation total time).	Check controller
B	Check whether solenoid valve (SV6) for draining condensate functions correctly	At a ratio of 1 second, normal solenoid valve is activated when the AC200V is applied to S1 between the line No. 18 of about 22 to 90 seconds intervals (varies according to ambient temperature/load operation total time).	・Check wiring ・Check seizing of solenoid valve ・Check auxiliary relay (DX)

5. Drain not discharge from drain outlet

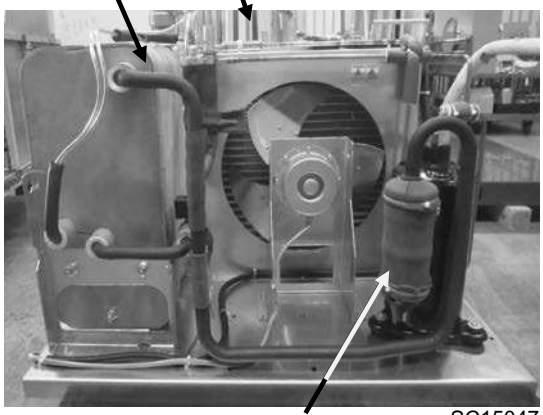


(2) Countermeasures for dryer troubles

[Adjust of the capacity control valve]

"Temperature measurement position" at refrigerant exit pipe of heat exchanger (HX)

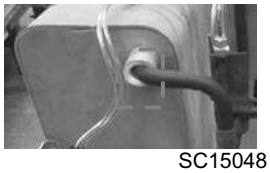
Capacity control valve



Accumulator

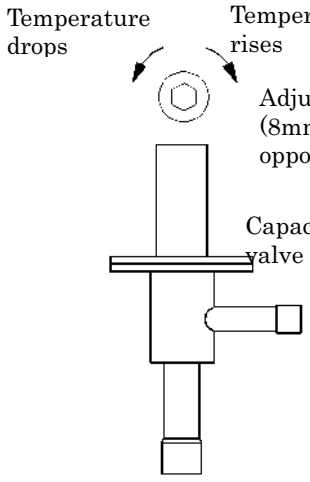
SC15047

[Position to attach temperature sensor]



SC15048

※Flip up the isolator materials and attach a sensor at the portion that is about 30—40mm from the root part of heat exchanger (HX) outlet pipe.



SC15004

● In case the interior of heat exchanger gets frozen when the dryer is operated with the indicator of refrigerant evaporation pressure gauge placed lower than the refrigerant evaporation pressure.

① Stop the compressor, and melt ice.

② Remove the left side cover and top cover of dryer and attach a thermistor temperature sensor to the refrigerant exit pipe of heat exchanger (HX) (※refer to picture on the left side).

③ Make short circuit between the coil (wire number 11) of magnetic switch 52C for the dryer inside the starting board then input power and operate the dryer under unload condition.
At the time, be care and be sure on safety, as the dryer is start in a moment power source ON.

④ Use a hexagonal wrench (size 8 mm) to slowly turn the adjusting screw in a clockwise direction to adjust temperature of refrigerant pipe surface meet the range 1.5—2.5℃(50Hz) , 1.0—2.0℃(60Hz).
After a moment, fan motor for condenser should be repeat "ON"・"OFF".

⑤ In case proper adjustment is impossible, the capacity control valve is defective. Replace it with a new one.

● In case the dew point indicator of refrigerant evaporation pressure gauge shows unusually high temperature while the ambient temperature is not so high. When high pressure switch activated.

① Operate the dryer at unload condition and follow step ②,③ mentioned above.

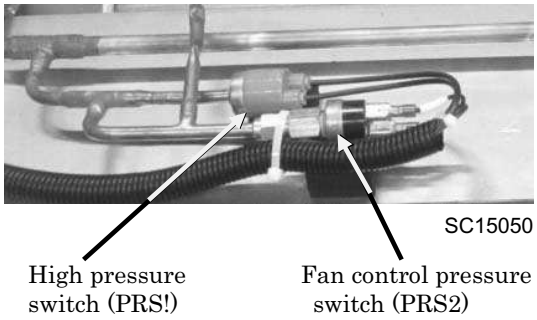
② Use a hexagonal wrench (size 8 mm) to slowly turn the adjusting screw counterclockwise direction to adjust temperature of refrigerant pipe surface meet the range 1.5—2.5℃(50Hz) , 1.0—2.0℃(60Hz).
After a moment, fan motor for condenser should be repeat "ON"・"OFF".

③ In case proper adjustment is impossible, the capacity control valve is defective. Replace it with a new one.

Position of indicator needle of pressure gauge when stop.

SC15049

[Explanation of the fan control pressure switch (PRS2) and the high pressure switch (PRS1)]



- The fan control pressure switch is a device that switches the condenser fan ON/OFF to control the condensing pressure to stay within an appropriate range.
- The high pressure switch is arranged in a parallel manner with the fan control pressure switch and is a protective device that abnormal error or alarm of the dryer or shuts down (when the controller is configured as ON) when the refrigerant pressure has abnormally increased.

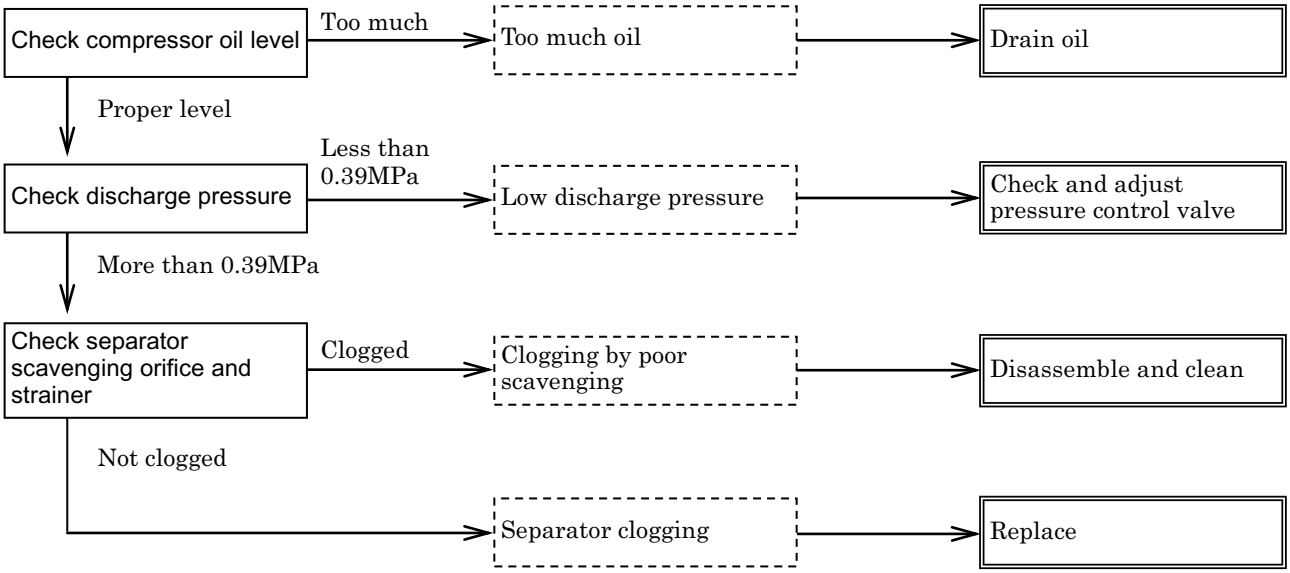
[Failure case on fan control pressure switch]

When fan for condenser does not function, rising of refrigerant pressure leads to appearance of water drops, oil drops appear (indicator needle exceeds upper limit) and cause activation of high pressure switch.

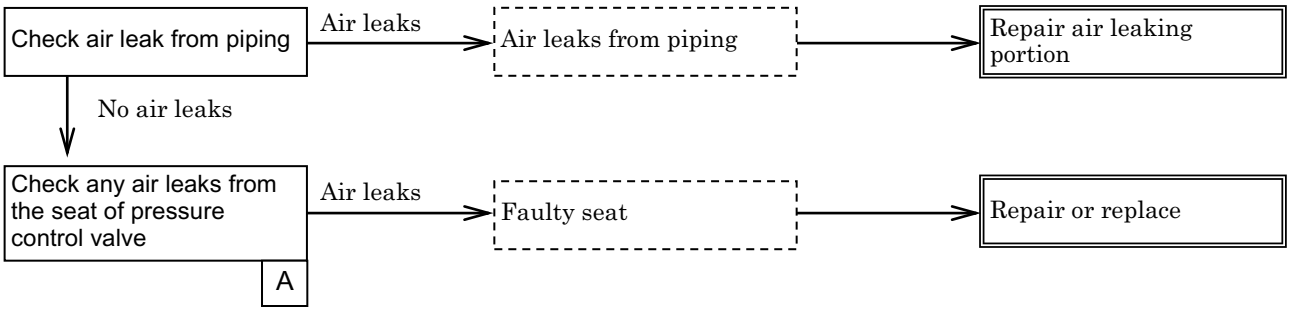
4. Troubleshooting

4.4 Others

4.4.1 Oil is found mixed in discharge air. (Oil consumption increases)

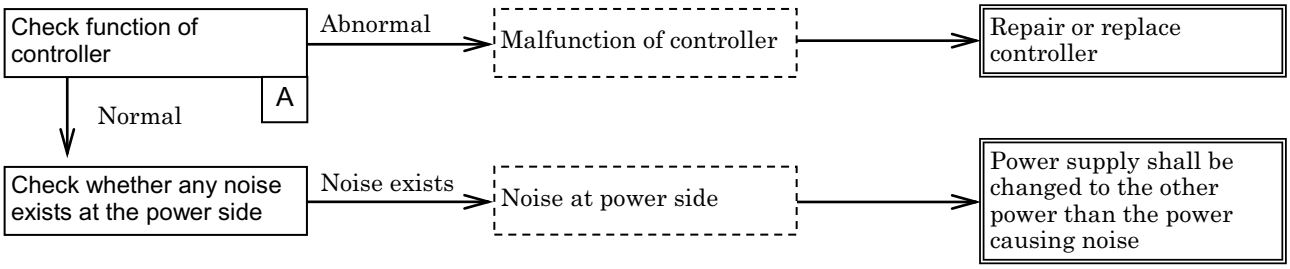


4.4.2 Compressor, start and stops too frequently while no air is consumed. (Auto start/stop operation)



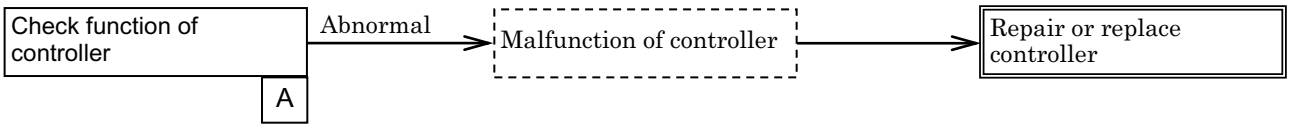
Mark	Item	Cause & Explanation	Countermeasures & Remarks
A	Check any air leaks from the seat of pressure control valve	The control valve functions as a check valve also. When leakage happens at the seat part, air from secondary side of pipe of purging (Circuit of solenoid valve for capacity control) is released to primary side of air filter via pressure control valve so even without using air, the machine starts automatically.	Replace the valve of pressure control valve

4.4.3 Compressor often stops without trouble code indicator lamp glowing and knowing no reason of the phenomena.



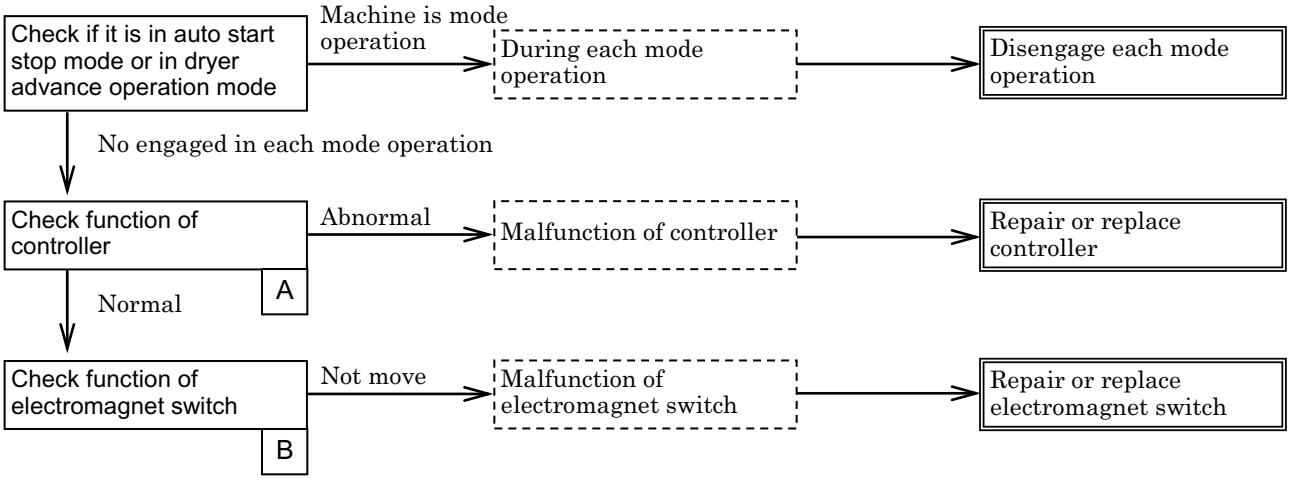
Mark	Item	Cause & Explanation	Countermeasures & Remarks
A	Check function of controller	When performing remote control operation, check wiring of terminal No.34 and 37 for any looseness or check the remote control switch for any faulty contact.	[Refer electric wiring diagram clause 3.3] EX-R: Remote operation signal switch ADT : Low pressure operation signal switch

4.4.4 Even when each control switch is pushed ON, the machine will not start.



Mark	Item	Cause and Explanation	Countermeasures and Remarks
A	Check function of controller	Check if any key is pushed due to incorrect installation of controller. If any, each operation becomes impossible. ・Faulty contact of each switch ・Faulty contact of controller connector ・Damage of controller	Check installation of controller Repair or replace wiring Repair or replace controller

4.4.5 Start indicator lamp glows, but the unit will not start.



Mark	Item	Cause and Explanation	Countermeasures and Remarks
A	Check function of controller	If AC200V is not generated between line number 1—S1, controller is faulty.	Replace controller
B	Check function of electromagnet switch	If AC200V is generated between line number 1—S1, then breakage of switch or disconnection of wiring might be the cause. If the switch functions but the motor does not work then the motor is burnt or its wiring is disconnected.	Repair or replace

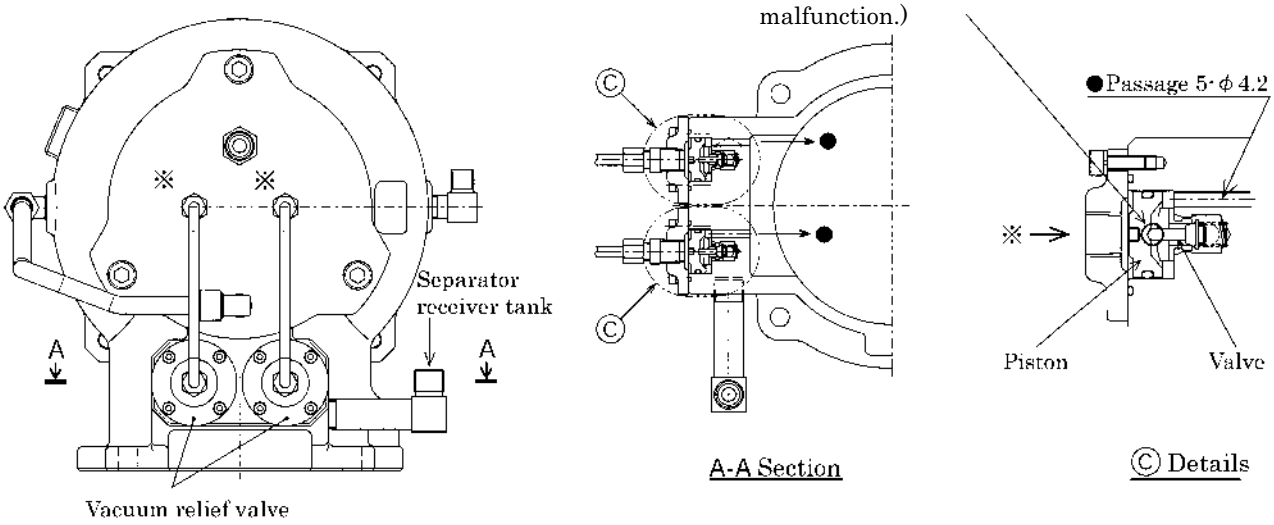
5. Reference

5.1 Structure of Parts

5.1.1 Vacuum relief valve (Built in unloader)

※PILOT pressure
Relas the PILOT pressure to the vacuum relief valve from the unloader activation chamber

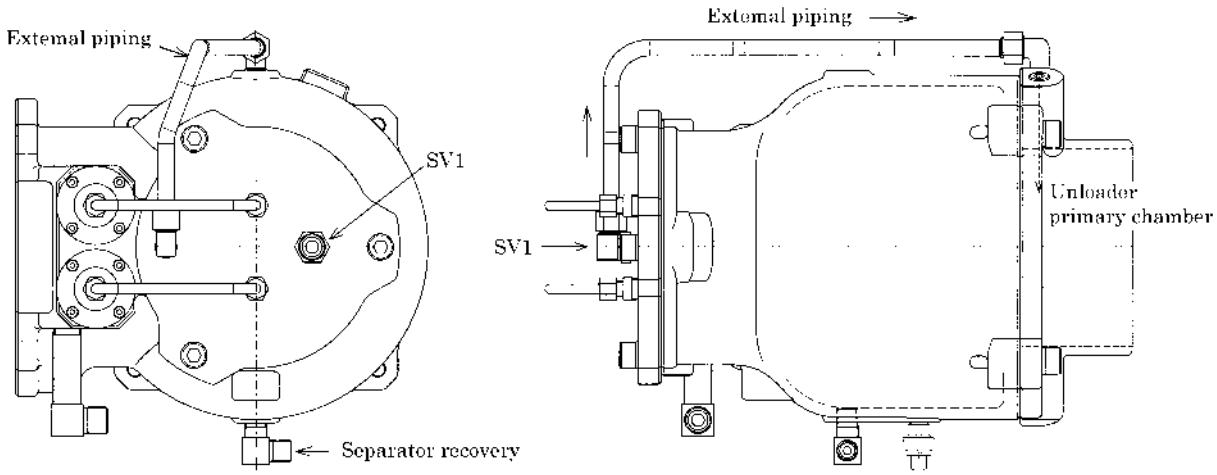
During assembling, carefully install valve so that it should be straight. (If it is installed slant, the valve top could not fit the hollowed portion of the valve. Sometimes it could cause malfunction.)



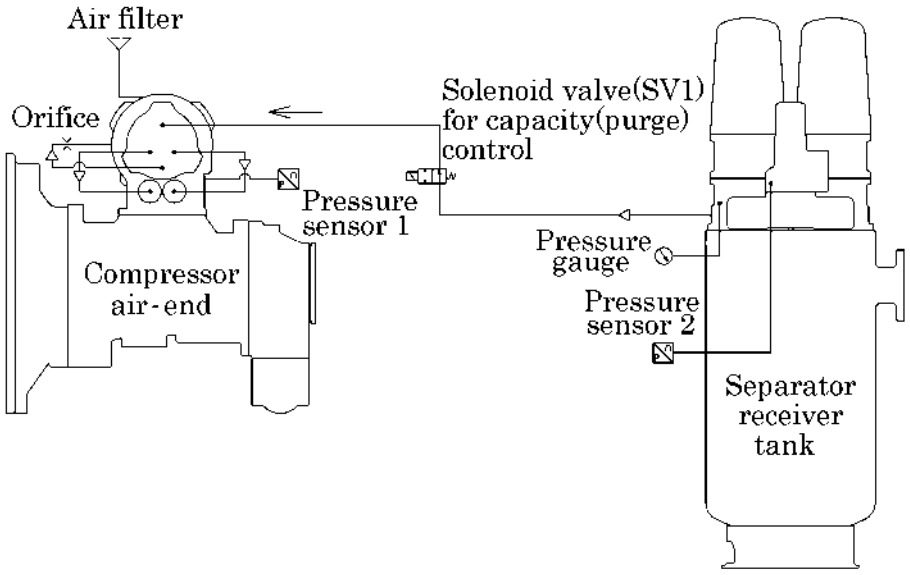
SC16063

Function :
When unloading, the piston will be pressed by the signal (※) from either the unloader activation chamber, and by the valve opening in conjunction with this, the compressed air from the separator receiver tank will flow into the compressor air-end from the passage marked with the black dot(●). Therefore, interior of compressor air-end will not become excessively vacuum and so vacuum noise is alleviated.

5.1.2 Auto-relief circuit



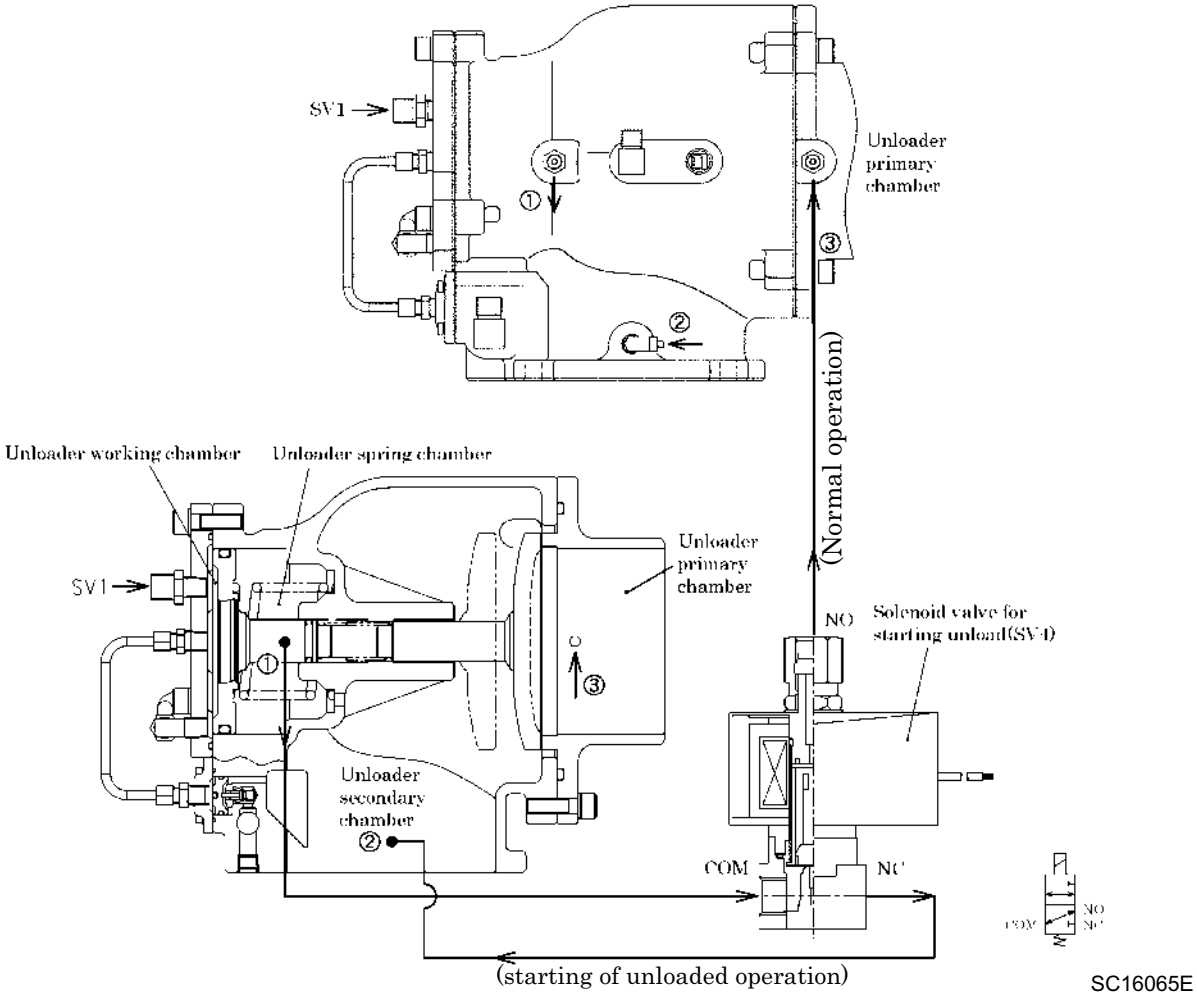
SC16064E



SC16064E-1

Function :
When stopping, capacity (purge) control solenoid valve (SV1) opens thus pressurized air from separator receiver tank flows through SV1 to unloader working chamber. Pressurized air from external piping flows in the primary chamber of unloader and be released to the atmosphere through the air filter.

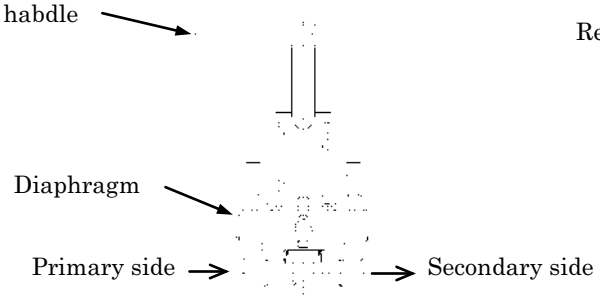
5.1.3 Solenoid valve for starting unload (SV4) (Regulator control type only)



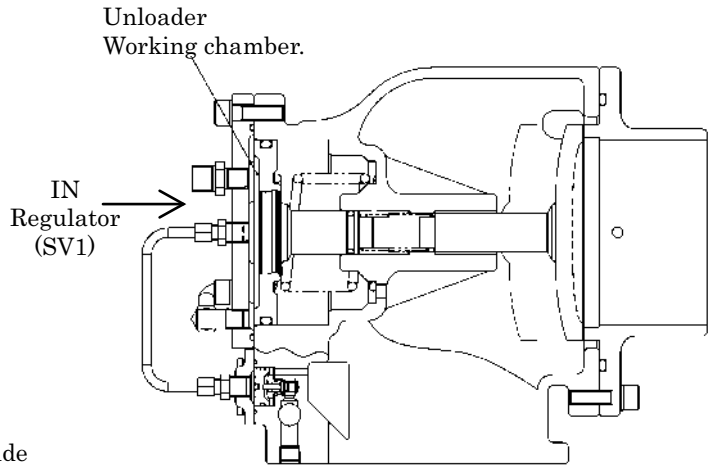
Function :

When starting, when electricity is conducted to the solenoid valve for starting unload (SV4), the unloader secondary chamber (NC) and the unloader spring chamber (COM) communicate, the spring chamber is placed under a negative pressure, and with a low pressure the unloader valve becomes completely closed and the starting of unloaded operation is performed. When the starting of unloaded operation is cancelled, SV4 is de-energized, the unloader spring chamber (COM) communicates with the unloader primary chamber (NO), and normal operation is performed.

5.1.4 Regulator (Regulator control type only)



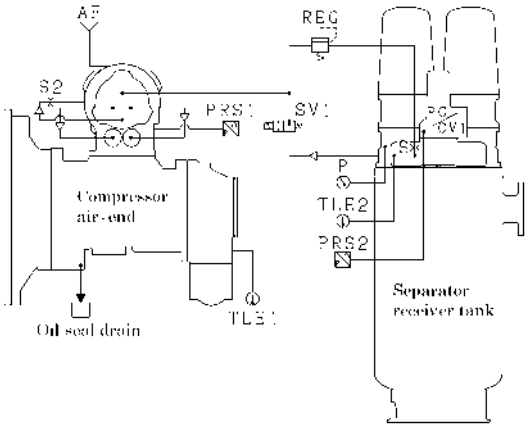
SC15106



SC15054E

Function :

The primary side of the regulator is arranged in line with the separator receiver tank and the secondary side of the same is arranged in line with the solenoid valve for purge control (SV1) and the activation chamber of the unloader.



SC15055E

- When air consumption decreases, pressure in separator receiver tank builds up and exceeds set value of regulator's spring tension. It pushes the spring and diaphragm of regulator. As a result, internal passage of regulator is opened so pressurized air from regulator secondary side flows into unloader activation chamber and close the unloader.
- When air consumption increases, pressure in separator receiver tank drops to a lower value set for regulator's spring tension. The spring expands and closes internal passage of the regulator. Another spring in the unloader will open the unloader and air is sucked in and compressed.
- Depending on the increase-decrease of air consumption, regulator steplessly adjust the air intake amount in a range from 0—100%. Solenoid valve (SV1) for purge control is closed after starting unloader operation but as air consumption decreases so it is opened when [purge operation switching time] is reached. Therefore purge operation begins and pressurized air from separator receiver tank is released through the air filter. When air consumption increase and service air pressure drops to [Full load recovering (purge cancellation) pressure] purge operation is cancelled and the regulator control operation is restarted.

5. Reference

5.2 Table of Reference Data

5.2.1 Table of set values

Item	Unit	Set value		
・Protection devices				
Set value of main motor thermal relay	A	See 3.2.1		
Set value of dryer thermal relay	A	See 3.2.1		
Discharge air temperature	℃	Abnormality 110℃ Alarm 105℃		
Separator discharge air temperature	℃	Abnormality 110℃ Alarm 105℃		
Emergency stop due to excessive rise of discharge air temperature	℃	Abnormality 120℃		
・Dryer set value				
※1Capacity control valve	℃	1.5～2.5(50Hz) 1.0～2.0(60Hz)		
※2 Internal thermostat Operating/Return temp	℃	135/113		
High pressure switch PRS1 Operating/Return press.	MPa	4.30±0.15/3.30±0.20		
Fan control (pressure) switch PRS2 Operation/Stop press.	MPa	2.60/1.90		
※3 Bimetal thermostat Operating/Return temp.	℃	90/80		
・Pressure				
Specifications of air service pressure	MPa (kgf/cm²)	0.7(7.1)	0.85(8.7)	(SAS series only) 2point control type 0.93(9.5) Regulator control type 0.90(9.2)
Air filter indicator	kPa (mmAq)	6.22(635)		
Pressure control valve	MPa (kgf/cm²)	0.39 $^{+0.10}_{-0.05}$		
Safety valve (Blowout press.)	MPa (kgf/cm²)	1.0(10.2)		
Full load recovering pressure (Purge cancellation pressure) Control pressure (PL)	MPa (kgf/cm²)	See 3.4		
Unloading (purge) operation starting pressure (PH)	MPa (kgf/cm²)			
・Timer				
Auto start/stop predicted stop time	sec	60(20～180)		
Y operation time	sec	10(0～ 15)		
Starting unload time	sec	Discharge air temperature higher than 10℃(※40℃) for 15 seconds / less than 10℃(※40℃) for 60 seconds		

※1 Refer clause 4.3.5(2) for adjusting capacity control valve.

※2 Internal thermostat prevents dryer refrigeration compressor from overloading. It is built in motor coil. Ask dryer maker for replacing it when trouble occurs.

※3 The bimetal thermostat controls the ON/OFF of the solenoid valve in the by-pass circuit of the refrigerant.

5. Reference

※4 The temperature of the ※4 mark apply from the following SER.NO.

●SAS55SD(RD)-5E/6E	:0075～/0063～	●SMS55ESD(ERD)-5E/6E	:0058～/0058～
●SAS75SD(RD)-5E/6E	:0070～/0064～	●SMS75ESD(ERD)-5E/6E	:0059～/0069～
		●SMS75RD-5E/6E	:0061～/0066～

5. Reference

5.3 Table of Oil Supply (for reference)

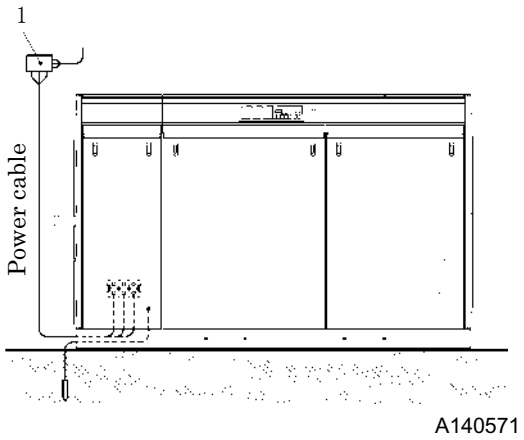
Quantity of oil primarily supplied for each model is listed in the following table. For confirmation, quantity oil primarily supplied is not always same as that of oil replaced, because oil is residual in compressor air-end, oil cooler and pipes. Change oil as completely as possible, leaving no residual oil.

Please make sure to use the AIRMAN genuine dedicated oil "LONG-LIFE HP". However, in case AIRMAN dedicated oil is un-acquirable, using of the below mentioned oil is strongly recommended, and please reduce by half all the periods those are suggested in the table of periodic inspection/ maintenance.

Model	Quantity of oil (L)	Maker	Brand
55kW class	41	・SHELL ・JX NIPPON OIL & ENERGY CORPORATION	・SHELL CORENA S3R (VG32) ・FAIRCOL RA32
75kW class	42		

5.4 Wiring

5.4.1 Breaker capacity and wiring operation

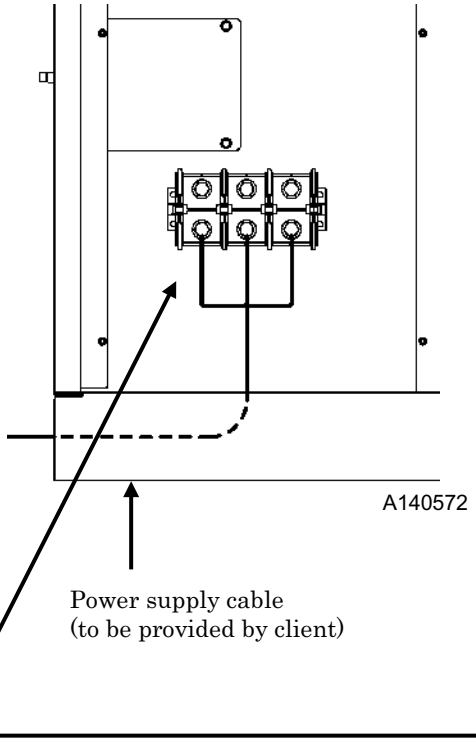


SAS75SD-5E/6E

- All the wirings in the compressor are completed; therefore, power supply and ground connections should be made.
- Fluctuation of the supply power voltage must be kept within rated voltage±5% and rated voltage±2% among phases.
- Be sure to install a ground fault circuit interrupter "1". Also use dedicated circuit for it. Insufficient capacity of the power circuit or improper electric work could cause an accident such as electric shock or fire.
- Only fully qualified and experienced electric technicians should carry out electrical installation.
- Be sure to directly bury a grounding rod in the ground. Never connect it to the in-house steel construction, gas and water pipes.

5. Reference

[The connection method of a power cable]



Unscrew three round screws for power cable connection terminal plate, using a screwdriver or a tool like that.
Be sure to use a round terminal.

- This table is indicated as a standard.
  (Keep in mind that it may change with power supply situations.)
- The figures of cable thickness in the above table are based on the straight line of 10m long for single machine connection.
- However, determine cable specifications, taking into account the actual power supply situations and the cable length.
- Use an EV cable for 600V or a CV cable for 600V for the wire.
  EV : Polyethylene insulated PVC sheathed electric power cable.
  CV : Cross-link polyethylene insulated PVC sheathed electric power cable.
- Use the "Ground fault circuit interrupter" select below for current sensitivity.
  SAS series : 200mA
  SMS series : 100mA

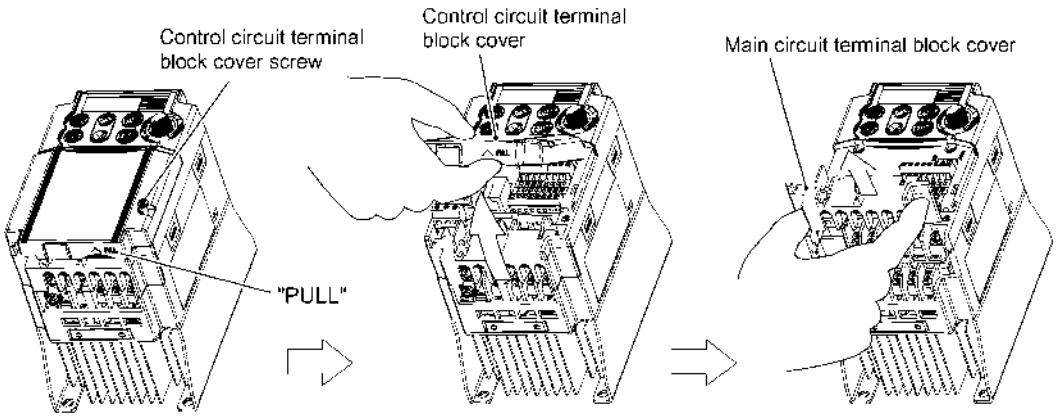
Model	Voltage of power source	Transformer capacity (kVA)	Circuit breaker rated current (A)	Thread size of power supply connection terminal plate	Wire size (mm^2)	Ground cable diameter (mm^2)
55kW class	200V	More than 100	400	M10	100	22
75kW class		More than 150	600	M12	150	38
55kW class	400V	More than 100	200	M10	38	14
75kW class		More than 150	225	M12	60	22

5.4.2 Desorption method for the front cover of the inverter

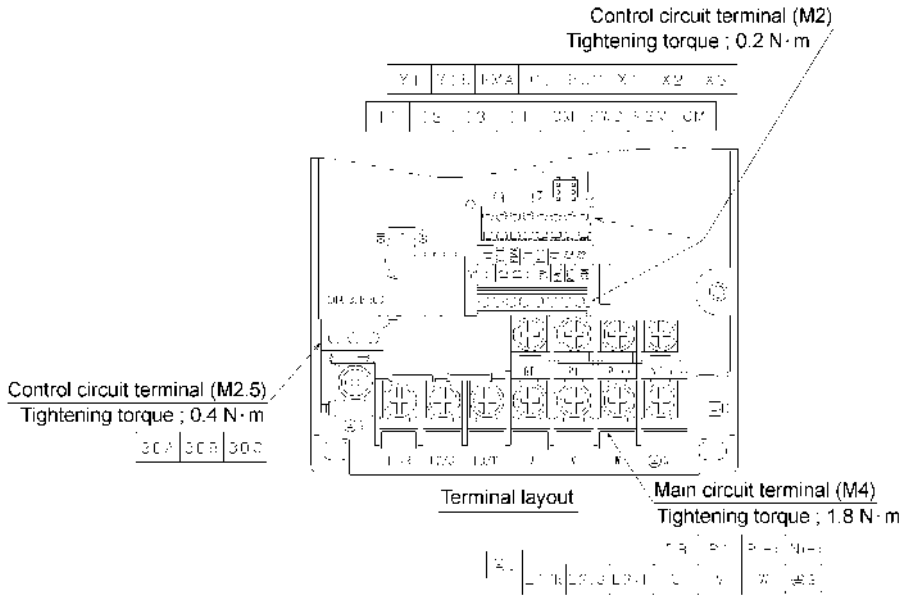
When removing the inverter connection cable for desorption of the inverter, and remove the cable by removing the inverter terminal block cover with the following procedure.

<Procedures>

① Loosen the screw securing the control circuit terminal block cover.
② Insert your finger in the cutout (near "PULL") in the bottom of the control circuit terminal block cover, then pull the cover towards you.
③ Hold both sides of the main circuit terminal block cover between thumb and forefinger and slide it towards you.
④ After performing wiring, mount the main circuit terminal block cover and control circuit terminal block cover in the reverse order of removal.



SC15056E



SC15057E

WARNING	● Before proceeding to the maintenance and inspection, turn OFF the power and wait at least five minutes. Make sure that the LED monitor is turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped below the safe level (+25 VDC or below). **Electric shock may occur.**

5. Reference

5.5 List of Consumable Parts and Electrical Appliances

Item	55kW class	75kW class
●Element / Filter / Belt		
Air filter ASS'Y	32100 43300	←
Air filter element	32143 15400	←
Oil filter	37438 09700	←
Oil separator	34224 03000×2	34224 02601×2
O-ring for oil separator	03402 15145×2	←
Dustproof air filter, dryer side (SAS type only)	With dryer 32163 21300×2 Without dryer 32163 21300×1	←
Dustproof air filter, (Compressor side : SAS type only)	32163 21400×2	←
Dustproof air filter, (Stater panel suction port)	32163 20900	←
O-ring of oil filler	03402 25030	←
●Air control		
Consumable part of unloader		
O-ring	21441 05300	←
O-ring	21441 05400	←
O-ring	03402 15135	←
O-ring	03402 15150	←
O-ring	03402 15170	←
Consumable part of vacuum relief valve		
O-ring	21221 02100×2	←
O-ring	03402 25021×2	←
O-ring	03402 25008×2	←
Consumable part of pressure control valve		
※Piston	35303 08700	←
※Piston	35303 09800	←
Spring	22144 17000	←
O-ring	03402 15090	←
O-ring	03402 25045×2	←
Regulator ASS'Y (Regulator control type only)	36400 22701	←
Diaphragm for regulator	36437 02101	←

※ If there is no abnormality after inspection of the piston for the pressure control valve, can be reused.

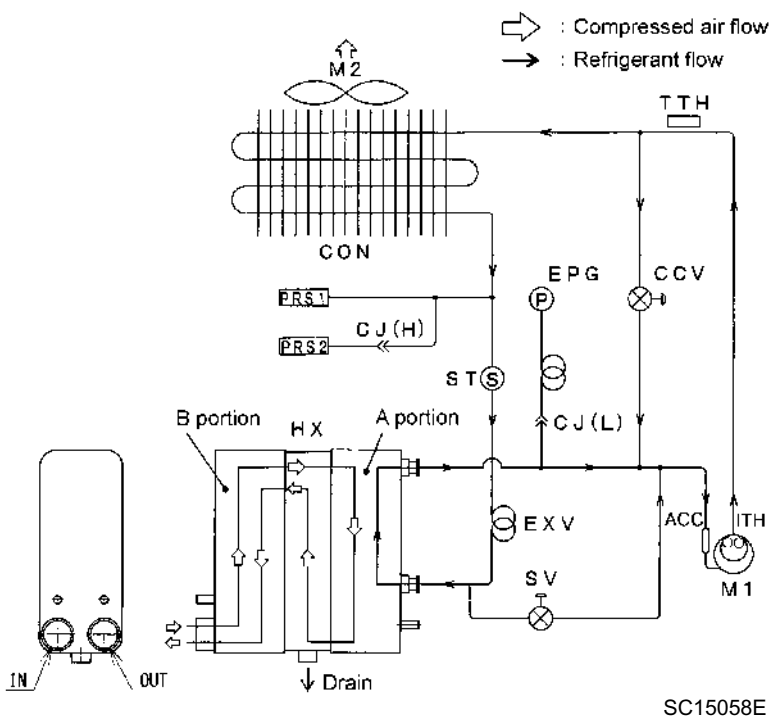
5. Reference

Item	55kW class	75kW class
●Electrical appliances		
Controller (2-Point control type)	46870 60302	←
Controller (Regulator control type)	46870 60402	←
FX, DX relay	46177 08000×2	←
Solenoid valve (SV1) [For capacity･purge control]	46811 29300	←
Solenoid valve (SV4) (For starting unload) (Regulator control type only)	46811 13300	←
Solenoid valve (SV6) (For draining condensate in dryer)	46811 30800	←
O-ring (for strainer in the solenoid valve for draining condensate in dryer)	21221 05400	←
Thermo sensor (Discharge air temp./ Separator discharge air temp.)	44364 08200×2	←
Thermo sensor (For intake air temp.)	44364 06800	←
Pressure sensor (Service pressure / Intake negative pressure)	44328 20600×2	←
Fuse (AC250V 5A)	46934 03000×2	←
Air filter indicator	32148 03000	←
Inverter for cooling fan	46879 69302(200V) 46879 71501(400V)	46879 69202(200V) 46879 71701(400V)
Cooling fan for starter panel SAS,SMS55･75	38490 30800	←
SMS75(one-point lifting type)	-	38490 22600
Pressure gauge (For displaying the pressure in the separator receiver tank)	36141 18500	←
Oil level gauge	33200 04900	←
O-ring for oil level gauge	03402 25016×4	←
Cooling fan ass'y	38490 31701(200V) 38490 31901(400V)	←
Cooling fan	38490 31300	←
Inlet ring(Bell mouth)	38540 25300	←
Cooling fan motor	45101 15011(200V) 45101 16311(400V)	←

There is a case that part number is changed, such as modification. Please refer to the parts catalog number of the latest.

5. Reference

5.6 Dryer Structure and Functions of Component Parts



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HX	Cooler
M1	Motor (refrigerating compressor)
M2	Motor (fan motor)
CON	Condenser
ST	Strainer
EXV	Capillary tube
CCV	Capacity control valve
PRS1	High pressure switch
PRS2	Fan control pressure switch
EPG	Evaporating pressure gauge
CJ(L)	Check joint on low-pressure side
CJ(H)	Check joint on high-pressure side
TTH	Bimetal thermostat
ITH	Internal thermostat
SV	Solenoid valve (By-pass valve)
ACC	Accumulator

[Compressed air flow]

The compressed air that flows through the after cooler will flow into cooler (HX) and B portion (IN line). When cold refrigerant flows through circulating A portion compressed air exchanges heat, moisture is eliminated thus compressed air becomes dry and cool. Condensed moisture is drained via the bottom side of cooler (HX). Cool and dry compressed air flows through B portion (OUT line) and exchanges heat with warm compressed air that flows in IN line. Compressed air is dried and reheated before being discharged from OUT line.

[Refrigerant flow]

High temperature-high pressure refrigerant gas from compressor (M1) flows into condenser (CON) and becomes normal temperature-high pressure under the functioning of a fan (M2).
After contamination and deteriorated oil in refrigerant are removed by strainer (ST), refrigerant then becomes low temperature-low pressure under depressurization of the capillary tube (EXV) and flow into A portion of cooler (HX) for heat exchange with compressed air. Heat exchanged refrigerant evaporates-gasify inside cooler (HX), flows through accumulator (ACC), be drawn by compressor (M1) and recompressed then discharged. This cycle is repeated over time.

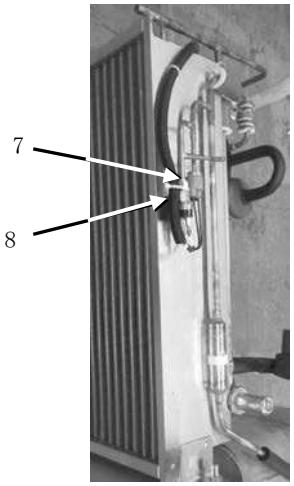
5. Reference

[Component parts and its functions]

No.	Description	Symbol	Function
1	Cooler	HX	To condense moist compressed air and separate water and air.
2	Motor (refrigerating compressor)	M1	To pressurize refrigerant from low temperature-low pressure to high pressure (high temperature) to ease the condensation.
3	Condenser	CON	To liquidize high pressure (high temperature) from compressor.
4	Strainer	ST	To remove contamination, deteriorated oil in the flow line of refrigerant in order to prevent clogging at the capillary tube of the downstream.
5	Capillary tube	EXV	To make high pressure liquid refrigerant expanded to become low pressure (low temperature) refrigerant in order to facilitate heat absorption.
6	Capacity control valve	CCV	When air consumption and compressed air flow is small it leads high temperature refrigerant gas into the intake side of compressor to prevent freezing at the line of the compressor.
7	High pressure switch	PRS1	Activate to shut down electric circuit and stops the machine when pressure in refrigerant line rises abnormally. ·····(Operating/Return temperature : 4.15±0.15/3.2±0.20MPa)
8	Fan control pressure switch	PRS2	To control condense pressure within normal limits by turn ON-OFF the cooling fan of condenser depending on pressure of refrigerant gas. ·····(Operation/Stop pressure : 2.6±0.1/1.9±0.1MPa)
9	Evaporating pressure gauge	EPG	For observation (visual) pressure of refrigerant after flowing through the cooler. Operation when pressure of refrigerant is under its evaporating pressure range will make moisture in pressurized air freeze inside the cooler.
10	Check joint on low-pressure side	CJ(L)	Portion to assemble pressure gauge, pressure switch for inspection or repairing.
11	Check joint on high-pressure side	CJ(H)	
12	Bimetal thermostat	TTH	To control temperature of refrigerant gas by detecting temperature of refrigerant discharged from compressor and turn ON-OFF the solenoid valve in the by-pass line of refrigerant. ·····(Operating/Return temperature : 90/80℃)
13	Internal thermostat	ITP	Bimetal thermostat is built in refrigeration compressor motor coil. It prevents motor from overloading. ·····(Operation/ reset temperature:135/113℃)
14	Solenoid valve (By-pass valve)	SV	Turn ON-OFF the by-pass line depending on signal received from bimetal thermostat.
15	Accumulator	ACC	Assembled at the intake pipe of compressor. In case liquid refrigerant is mixed in intake gas it will separate liquid and gas and supply refrigerant gas to the compressor.

5. Reference

Positions of sensors



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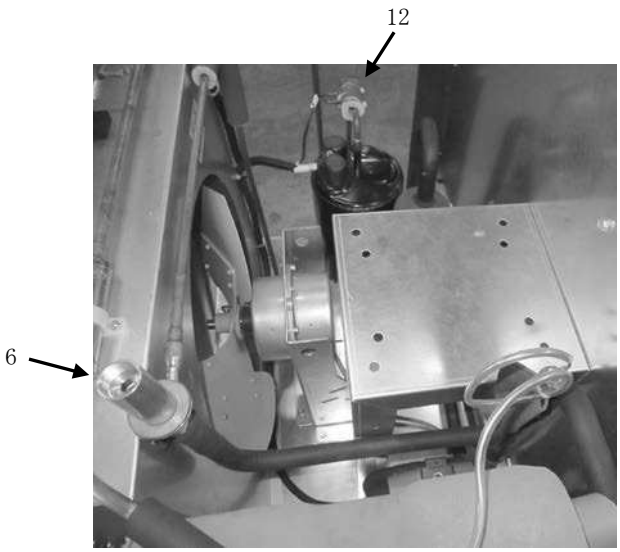

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