

Service Manual

Thermal Shock Chamber

TSE-11

40161050002F0

This Service Manual has been compiled specifically for servicepeople trained or certified by ESPEC CORP. Because of the dangers involved, service described herein should not be performed by other persons.

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Introduction

This service manual provides a clear description of the causes of and handling procedures for problems that may arise during the operation of this chamber.

In particular:

(1) The procedures for identifying the causes are provided as flow charts with judgment criteria provided for each item so that the cause can be identified without ambiguity.

(2) The handling procedures are provided to facilitate correct handling, and the component replacement procedures are also included as a part of this manual.

In the event that a problem persists even after you have followed the handling procedures described in this manual, contact your dealer or ESPEC.

Read this manual in the manner described below.

For restricted use

The test chamber should be operated only by experienced engineers or persons who have received training in proper usage from an experienced engineer.

■ Definition of an experienced engineer

A person who understands the purpose of use of the chamber, has received training in the operation method, daily maintenance and inspections, etc., and can foresee and prevent risks associated with common sources of hazards such as electricity, etc.

Safety Indications

The following safety indications are used throughout this manual.

■ The following signs represent the degrees of danger to users.

 DANGER	Means that extremely dangerous consequences may arise, with the risk of death or serious injury to the user, if the chamber is handled improperly.
 WARNING	Means that dangerous consequences may arise, with the risk of death or serious injury to the user, if the chamber is handled improperly.
 CAUTION	Means that dangerous consequences may arise, with the risk of minor injury or light wounds to the user, if the chamber is handled improperly.

■ Labels that instruct the user to avoid danger

 PROHIBITED	This mark means that specific actions are prohibited in order to prevent a dangerous situation from arising.
 Imperative Action Required	This mark means that it is imperative for the user to take specific actions (instructions) in order to prevent a dangerous situation from arising.

■ Labels that indicate information on physical damage and environmental contamination

NOTICE	This mark means dangerous consequences may arise, with the possibility of damage to equipment and facilities, or environmental pollution, if the equipment is handled incorrectly.
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Keywords

■ The following keywords are used throughout this manual.

Note	Provides information necessary for gaining full performance from the chamber or to prevent damage to the equipment.
Procedure	Explains how to operate the chamber on a step-by-step basis.
Reference	Offers additional information.

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Read this section BEFORE servicing the equipment.

Chapter 1 For Your Safety

This chapter explains safety precautions to be observed when servicing the equipment. Read this section BEFORE servicing the equipment to prevent accidents to you, users, specimens or the user's equipment. These precautions are written for all models of environmental chambers, therefore some of them may not apply to the specific chamber.

1.1 Who May Service the Equipment

 WARNING

-  This Service Manual was written for persons trained and certified by ESPEC CORP. or servicepeople with the same knowledge and skill. Because of the dangers involved, persons untrained in service procedures should never perform servicing described herein.
-  ESPEC CORP. assumes no responsibility whatsoever for accidents or trouble incurred because of usage outside of the information contained in this manual.

1.2 Being Prepared

WARNING

! Anyone servicing the equipment as explained in this manual is exposed to various forms of danger.

For your safety and that of others, read this chapter thoroughly BEFORE servicing the equipment. The first dangers that come to mind are as follows. In all cases, the servicepeople can be killed or seriously injured.

- | | | |
|---------------------|---|---|
| Electric shock | → | Always ground the equipment when servicing the equipment. |
| Toxic gas poisoning | → | Always wear a safety mask when servicing the equipment. |
| Mechanical dangers | → | Always wear protective gear when servicing the equipment. |

In servicing the equipment, always remember the safety first principle, follow procedures to the letter, and use tools as specified.

1.3 Clothing and Safety Gear for Servicepeople

WARNING

-  The person performing the service should wear long-sleeved cloths and long trousers. Make sure to use equipment appropriate for the content of the service to perform.
-  Routine service
Make sure to wear designated work clothes and safety shoes.
-  Wiring, circuit checkup
Make sure that there are no metallic objects adhering to the surface of work clothes.
-  Welding
Wear eye protection, gloves, and long-sleeved work clothes.
-  Solvent use (e.g. cleaning of refrigerator water circuit)
Wear a dust-protective mask, eye-protecting goggles, gloves and long-sleeved work clothes.
-  Glass wool insulation
Wear a dust-protective mask and gloves.
-  Processing operation
Wear a dust-protective mask.
-  Superglue use
Wear dust-protective glasses and gloves (made of vinyl, for instance).
-  High-place work
Wear a helmet and a safety harness.
-  Heavy load/metal sheet work
Wear leather gloves.
-  Clean room work
Wear a clean room garment.

1.4 Reporting Accidents and Trouble

If personnel is lost, property is damaged or work is shut down (more specifically, if a life-endangering accident, damaged specimens, fire, water pollution, or other serious situation occurs) because of trouble attributable to the product itself or service thereto or if the possibility thereof is foreseen; contact the place of purchase or ESPEC CORP.

1.5 Precautions in Service

Before Starting

WARNING



To prevent electric shock, check the equipment is properly and effectively grounded.



Test the leakage breaker and check it is functioning properly.

Troubleshooting, Checks and Adjustments

WARNING



Because power is ON (live parts) when troubleshooting or when making checks and adjustments, precautions are listed separate of those for repair work.



Prerun checks

- ① Check no inflammables or explosives have been loaded inside the equipment as specimens.
- ② If the customer charges specimens in testing, check specimen power supply control terminals are properly wired.
- ③ Have the customer remove specimens and wiring from inside the equipment before starting the equipment.



Precautions in usage

- ① Do not touch exposed live terminals.
- ② Do not touch rotating parts such as fans.
- ③ Do not disable safety circuit when running the equipment.
If however unavoidable, restore the safety circuit and check tripping after servicing the equipment.
- ④ Door opening-closing during high temperature, high humidity operations
 - Do not suddenly open the door.
 - Use extreme caution when opening the door if fire alarm is located directly above the equipment.
- ⑤ Door opening-closing during high temperature, high pressure operation
 - Do not open the door when the chamber is pressurized on the inside.

Repair Work

WARNING



Make sure to turn the power supply off while performing repair work, including for any part replacement. Take appropriate measures to prevent the power from being turned back on accidentally.



Precautions in electric wiring work

Use spring washers with fastening screws in the load circuits. Make sure to tighten them securely and to use locking agents on the screws.



Precautions in refrigeration circuit work

- ① Do not place fire near any inflammable refrigerant or additive refrigerant.
- ② Perform any work involving welding, refrigerant or solvent in an area with as much air flow or ventilation as possible.

Take appropriate measures when incidents such as the following occur while handling solvent or refrigerant:

Contact with the eyes: wash the affected eye with clean water for 15 minutes or more, and consult a doctor immediately.

Contact with the skin: wash the affected area thoroughly with a copious amount of water.

Inhalation: move to an area with fresh air. In all cases, consult the doctor as required.

- ③ Make sure to prepare a power type class A, B, or C fire extinguisher together with a bucket full of water during work involving welding or use of fire.
Do not perform such work in an area marked as fire-prohibited, or in the proximity of dangerous, flammable or ignitable objects.
- ④ Place an appropriate tray when releasing water from the water circuit of the water cooled refrigerator.
- ⑤ Use appropriate sealing materials or fastening tools when joining pipes to the water circuit of the water cooled refrigerator.
- ⑥ Ask a specialist qualified for waste disposal to perform cleaning of the water circuit of the water cooled refrigerator.
Drain the process effluent after diluting it with water enough to meet the effluent standard.



Precautions in water circuit work

- ① Place an appropriate tray when releasing water from the water circuit.
- ② Use appropriate sealing materials or fastening tools when joining pipes to the water circuit.



Precautions in air circuit work

Make sure to release the air by disconnecting piping before removing parts from the pneumatic circuit.

 WARNING



Precautions in using solvents

Perform work in an area with as much air flow or ventilation as possible.



Precautions in working in high places

- ① Take appropriate anti-drop measures for the tools and equipment being carried to high places.
- ② Use a ladder or other appropriate tools to climb up to high places.
- ③ Wear a safety harness and a helmet when working in high places.



Precautions in moving heavy objects

Work in a group as required. Wear leather gloves to avoid slipping.



Precautions in using superglue

- ① Wear a dust-protective glasses and gloves (made of vinyl, for instance).
- ② Make sure not to touch squeezed-out excess glue.



Other

- ① Take appropriate measures to prevent the door from closing accidentally when working inside the test area.
- ② Perform any work involving auxiliary coolant gas in an area with as much air flow or ventilation as possible to prevent the gas from filling up in the area.
- ③ Avoid contact with low temperature parts for an extended period. (Be aware of this in particular when dismounting the evaporator and the cool storage.)
- ④ Wear leather gloves when handling sheet metal.

After Servicing the Equipment

CAUTION

-  **Keep the area tidy, uncluttered and clean. (Make sure in particular that there are no objects, including tools or cloth pieces, left inside.)**
-  **Restore the operation pattern (including set temperature/humidity) and the overheat (overcool) protector to their original state prior to performing the service, and check that the settings are appropriate.**
-  **Make sure that there is no loosening in the screw terminals of the load circuit.**

NOTICE

-  **Check for leaks.**
 - ① Visually inspect the area surrounding the chamber to see if there is any water leakage.
 - ② Make sure there is no deterioration in the tubes or the pressure resistant hoses used in the cooling water circuit.
 - ③ Make sure that the draining hose is adequately connected to the drain-collecting piping.

Chapter 2

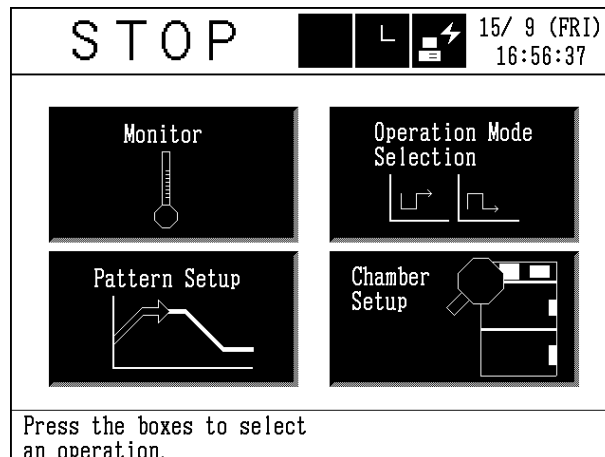
Precautions in Operation

This chapter discusses common problems that occur in chamber use and how to remedy them.

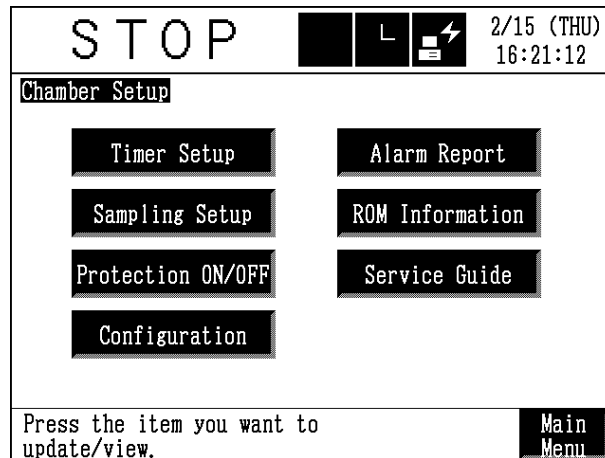
2.1 How to Unlock Keys (Protection)

If you cannot make settings or operate the chamber because protection is ON, turn the protection OFF as follows.

1. With the main menu on the display, get the chamber setup mode.
Press **Chamber Setup**.



2. Press **Protection ON/OFF** on the Chamber Setup screen.



3. If the dot in any of the settings is yellow, that protection is ON. Press the item so that the dot turns black (protection turns OFF).
- * Whenever protection settings are changed, a message asking you to confirm your choice will be displayed.



Table 2.1 Protection modes when ON

Prevent data update.	Prevents any changes to settings.
Prevent operation control changes.	Disables operating buttons on the Operation Mode Selection screen as well as the POWER key.
Prevent remote control.	Prevents any changes to settings or operating status via RS-485 or general communications.

* General communication is optional.

2.2 How to Switch Integrating Hour Meter Frequency

Note Set the power supply frequency according to the primary power supply connected to the chamber.
A wrong power supply frequency setting can destabilize temperature pull-down and control.

When relocating this chamber to a different frequency area, change the power supply frequency setting as appropriate. Switch the frequency of the integrating hour meter and set the power supply frequency of the chamber. For details on how to set the frequency of the chamber, see "Other Settings" of "5.8 Chamber Configuration" in the User's Manual -Reference-.

1. Check the main power switch is in the OFF position
2. Remove the screws that lock down the electric parts compartment panel and detach the panel.
3. Switch the frequency switch of the integrating hour meter.

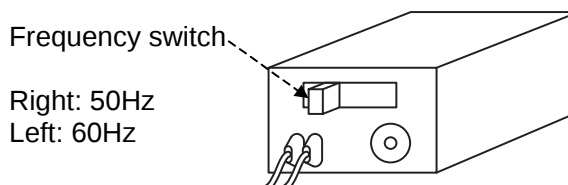


Fig. 2.1 Integrating hour meter

4. Reattach the electric parts compartment panel as before.

2.3 Resuming Tests Interrupted by a Power Outage

Whether testing can be resumed or not after a power outage depends on whether **Power OFF** or **Continue** has been selected for Restoration after a Power Failure on the Other Settings display.

- **Power OFF**: Control power remains OFF after primary power is recovered from an outage.
- **Continue**: Operation is resumed after primary power is recovered from an outage. Testing will resume from the exposure state prior to the outage and that entire cycle will be repeated.

<Example>

In the below example, **Continue** has been selected for Restoration after a Power Failure and power was lost at point B during the described cycle test. Once power has been recovered, testing will resume from point A.

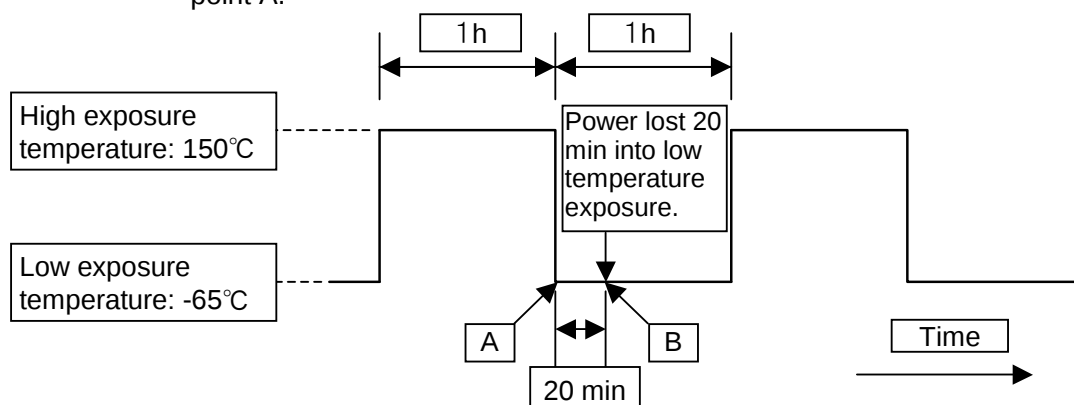
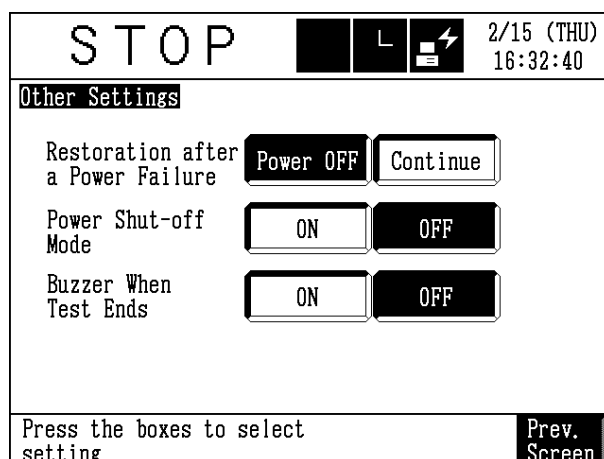


Fig. 2.2 Cycle pattern before and after power recovery

Reference To get the Other Settings display, select **Chamber Setup** ⇒ **Configuration** ⇒ **Other Settings**.



Chapter 3

Troubleshooting

This chapter explains what to check and how when trouble occurs during chamber use, as well as what remedial action should be taken to correct the trouble. Explanations are presented as check lists.

3.1 Troubles Not Displayed as Alarms

The display does not light up when the **POWER** key is pressed.

NO.	Check item	Check method	What to do
1	Power check	Check primary power source and that rated primary power is supplied to main power switch (LB1). • Rated power supply voltage $\pm 10\%$	Supply rated voltage.
2	Main power switch trip	Check main power switch (LB1) can be set in ON position. • If switch's leakage indicator button has popped out, circuit insulation may have broken down (current leak). • If switch's leakage indicator button has not popped out, an overload or overcurrent (short-circuit) in the circuit may have occurred. • If main power switch trips even when secondary wires are disconnected, trouble is in switch itself.	Locate insulation breakdown. Locate overcurrent. Replace switch (LB1). See "5.1 Electrical Compartment".
3	Electrical compartment panel switch functioning.	Check continuity across C-NC of electrical compartment panel switch (DS1). • When door is open: Continuous (Shorted) • When door is closed: Not continuous (Open)	Replace switch (DS1).
4	Fuse check	Check if fuse (F1) in electrical compartment has blown or not. • If fuse blows in short amount of time (instantly), trouble may be overcurrent caused by short-circuiting in either load or load circuit wiring. • If not blown to the eye, check with tester. If not continuous, more often than not fuse is at end of service-life. • If fuse blows soon after replacing, trouble is in fuse holder or caused by faulty contact such as a loose cap.	Replace fuse (F1). See "5.1 Electrical Compartment".
5	High temperature chamber temperature check	Check whether high temperature chamber is abnormally hot or not. • If over 280°C, high temperature switch (TS1) tripped main power switch.	See "3.2 HOT BOX ABS. HI LIMIT (ALM)".
6	Low temperature chamber temperature check	Check whether low temperature chamber is abnormally hot or not. • If over 80°C, low temperature switch (TS2) tripped main power switch. • If not 80°C, low temperature switch (TS2) malfunctioned because of insulation breakdown or trouble in switch itself. Check insulation with tester.	See "3.2 COLD BOX ABS. HI LIMIT (ALM)". Replace switch (TS2). See "5.4 Internal Mechanism".
7	Program setter/Temperature controller wiring check	Check for faulty contact in connectors, etc. See "4.3 Electric Parts and Instrumentation".	Reconnect connector.

The display goes out suddenly or the displayed message is strange.

NO.	Check item	Check method	What to do
1	Display unit - Temperature controller connection check	Check cable is properly connected. See "4.3 Electric Parts and Instrumentation".	Reconnect cable.
		Check cable for open circuit. See "4.3 Electric Parts and Instrumentation".	Replace cable.
		Check 5V line from temperature controller is properly connected. See "4.3 Electric Parts and Instrumentation".	Reconnect cable.
		Check 5V line from temperature controller for open circuit. See "4.3 Electric Parts and Instrumentation".	Replace cable.
2	Display unit LCD – BOARD connection check	Check cable is properly connected to LCD. See "4.3 Electric Parts and Instrumentation".	Reconnect cable.
		Check LCD cable for open circuit. See "4.3 Electric Parts and Instrumentation".	Replace cable.
3	Display unit BOARD – LCD inverter connection check	Check cable is properly connected to LCD inverter. See "4.3 Electric Parts and Instrumentation".	Reconnect cable.
		Check LCD inverter cable for open circuit. See "4.3 Electric Parts and Instrumentation".	Replace cable.
4	Display unit backlight check	Perform checks in No. 3.	Same as No. 3
		Check the backlight is lit.	Replace backlight. See "5.1 Electrical Compartment".
5	Display unit LCD damage check	Check if LCD is damaged anywhere.	Replace LCD. See "5.1 Electrical Compartment".

Strange sounds can be heard coming from the chamber.

NO.	Check item	Check method	What to do
1	High temperature chamber air circulator obstruction	Detach front panel of high temperature chamber air circulator and visually check if anything is obstructing fan runner. See Chapter 5 "Parts Replacement".	Remove obstruction.
2	Low temperature chamber air circulator obstruction	Detach front panel of low temperature chamber air circulator and visually check if anything is obstructing fan runner. Could also be overload due to freezing. See Chapter 5 "Parts Replacement".	Remove obstruction.
3	Air circulator motor rotation (High/Low temperature chambers)	Turn motor shaft by hand from chamber rear and check rotation. If turns smoothly without catching, motor is OK.	Detach air circulator motor and remove obstruction. See "5.4 Internal Mechanism".
4	Test area or elevator shaft obstruction	Open low and high temperature chambers and check for protruding obstructions from test area or in elevator shaft.	Remove obstruction.
5	High temperature chamber link mechanism obstruction	Open high temperature chamber, hold door switch (lock catch) in detected position, shift test area and check link mechanism for obstruction.	Remove obstruction.

Poor temperature uniformity

NO.	Check item	Check method	What to do
1	Test area check	Check if anything is obstructing air flow in test area.	Improve air flow.
2	Specimen heat generation check	Check whether specimens are generating high heat load.	Reduce specimen quantity.
3	Frost check	Check if frost buildup on cold accumulator fin (low temperature chamber air intake) is impeding air flow or not.	Defrost under manual control.
4	Cold/Hot air leak check	Check if below packing in cracked, aged or otherwise no longer functional. • High temperature chamber door packing • Low temperature chamber door packing • Elevator shaft packing on high temperature chamber side • Elevator shaft packing on low temperature chamber side • Elevator shaft L-packing	Replace and adjust packing contact. See "4.1 Structure".
5	Elevator motor check	Press above-mentioned packing and check contact. If bad, gear may be worn in linear motor rack.	Replace linear motor. See "5.1 Electrical Compartment".

Power shuts OFF during operation and test system shuts down.

NO.	Check item	Check method	What to do
1	Main power switch trip	Check main power switch (LB1) can be set in ON position. • If switch's leakage indicator button has popped out, circuit insulation may have broken down (current leak). • If switch's leakage indicator button has not popped out, an overload or overcurrent (short-circuit) in the circuit may have occurred. • If main power switch trips even when secondary wires are disconnected, trouble is in switch itself.	Locate insulation breakdown. Locate overcurrent. Replace switch (LB1). See "5.1 Electrical Compartment".
2	Electrical compartment panel switch functioning	Check continuity over C-NC of electrical compartment panel switch (DS1). • When door is open: Continuous (Shorted) • When door is closed: Not continuous (Open)	Replace switch (DS1).
3	Fuse check	Check if fuse (F1) in electrical compartment has blown or not. • If fuse blows in short amount of time (instantly), trouble may be overcurrent caused by short-circuiting in either load or load circuit wiring. • If not blown to the eye, check with tester. If not continuous, more often than not fuse is at end of service-life. • If fuse blows soon after replacing, trouble is in fuse holder or caused by faulty contact such as a loose cap.	Replace fuse (F1). See "5.1 Electrical Compartment".
4	High temperature chamber temperature check	Check whether high temperature chamber is abnormally hot or not. • If over 280°C, high temperature switch (TS1) tripped main power switch.	See "3.2 HOT BOX ABS. HI LIMIT (ALM)".
5	Low temperature chamber temperature check	Check whether low temperature chamber is abnormally hot or not. • If over 80°C, low temperature switch (TS2) tripped main power switch. • If not 80°C, low temperature switch (TS2) malfunctioned because of insulation breakdown or trouble in switch itself. Check insulation with a tester.	See "3.2 COLD BOX ABS. HI LIMIT (ALM)". Replace switch (TS2). See "5.4 Internal Mechanism".

Temperature recovers slowly.

NO.	Check item	Check method	What to do
1	Room temperature check	Check if room temperature is high or not.	Lower room temperature.
2	Power check	Check primary power source and that rated primary power is supplied to main power switch (LB1). • Rated power supply voltage $\pm 10\%$	Supply rated voltage.
3	Frost check	Check if frost buildup on cold accumulator fin (low temperature chamber air intake) is impeding air flow or not.	Defrost under manual control.
4	Sensor position check	Check sensors are in below standard positions. • High temperature chamber sensor: Extended 135 mm from rear wall • Low temperature chamber sensor: Extended 155 mm from rear wall • Upstream/Downstream sensors: Sensor tip at horizontal center	Reposition sensors.
5	Cold/Hot air leak check	Check if below packing in cracked, aged or otherwise no longer functional. • High temperature chamber door packing • Low temperature chamber door packing • Elevator shaft packing on high temperature chamber side • Elevator shaft packing on low temperature chamber side • Elevator shaft L-packing	Replace packing and adjust contact. See "4.1 Structure".
6	Elevator motor check	Press above-mentioned packing and check contact. If bad, gear may be worn in linear motor rack.	Replace linear motor. See "5.1 Electrical Compartment".

The integrating hour meter is running fast, slow or stopped.

NO.	Check item	Check method	What to do
1	Frequency check	Check setting (50/60 Hz) of frequency switch on backside of integrating hour meter (electrical compartment).	Set frequency properly.
2	Power check	Check primary power source and that rated primary power is supplied to main power switch (LB1). • Rated power supply voltage $\pm 10\%$	Supply rated voltage. If supply voltage OK, replace integrating hour meter.

The temperature recorder (option) does not turn ON.

NO.	Check item	Check method	What to do
1	Temperature recorder power switch check	Open temperature recorder front cover and check power switch is in ON position.	Set switch in ON position.
2	Special status check	Check the following. • If trouble occurs 120 min or more after test end and is left unattended for 120 min or more, power is not output.	Set POWER key (operating panel) in ON position then OFF.
3	Temperature recorder power terminal voltage check	Check voltage at temperature recorder power terminal with tester. If voltage is 200V AC $\pm 10\%$, power is OK.	Replace recorder.
4	Drive output check	Check contact of connector CN1 (wire No. 59) on I/O board 2. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between temperature recorder and I/O board 2.	Repair connection. If no trouble in wiring, replace I/O board 2. See "5.1 Electrical Compartment".

3.2 Displayed Alarms

PROGRAM SETTING TIME INVALID (WAR)

NO.	Check item	Check method	What to do
1	Time setting check	Check if high/low temperature exposure time is set to 0.	Set time correctly.

HI STAGE REFG. SURFACE TEMP. FAILURE (ALM)

NO.	Check item	Check method	What to do
1	Temperature switch (TS11)	Check continuity across temperature switch terminals at max. 78°C. If continuous, switch is OK. If not, switch is broken.	Replace switch (TS11).
2	Condenser fin clogging	Detach rear panel and check lower part of condenser for dust buildup.	Clean fins.
3	Refrigerant leaking	Check sight glass during chamber operation. If no bubbling detected, refrigerant is OK. If bubbles detected, perform leak test to identify location of leak.	Repair leak. Replace refrigerant.
4	Condenser fan	Vary fan rotation and speed, and check operation. If air is not blown, check input voltage. If 200V, fan is broken.	Replace condenser fan. See "5.5 Mechanical Parts Compartment".
5	Compressor power supply	Measure voltage at each RST phase and check for misalignment.	Rewire as necessary.
6	Refrigeration circuit	Check injection solenoid (SV12) functioning. Check solenoid's temperature sensor is securely attached with twice-wrapped aluminum tape. If discharge line is 100°C or less (max. 70°C for 20°C ambient temperature), refrigeration circuit is OK.	Rewire or replace solenoid. Reattach or replace temperature sensor.
7	I/O board 1 connector contact check	Check contact of connector CN6 (wire Nos. 14D, 2D) on I/O board 1. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between temperature switch (TS11) and I/O board 1.	Repair connection.
8	I/O board 1 and temperature controller functioning	Check ON/OFF switching of Di3 using Di monitor of temperature controller. • When pin Nos. 1 and 2 of connector CN6 are shorted, Di3 should turn ON. When open, Di3 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 1 and temperature controller. See "5.1 Electrical Compartment".

HI STAGE HI-PRESURE FAILURE (ALM)

NO.	Check item	Check method	What to do
1	High pressure switch (PS11)	Check continuity across pressure switch terminals with refrigerator OFF. If continuous, switch is OK. If not, switch is broken.	Replace switch (PS11).
2	Condenser fin clogging	Detach rear panel and check lower part of condenser for dust buildup.	Clean fins.
3	Condenser fan	Vary fan rotation and speed, and check operation. If air is not blown, check input voltage. If 200V, fan is broken.	Replace condenser fan. See "5.5 Mechanical Parts Compartment".
4	Installation environment	• Check if room temperature is high or not. • Check if low ceiling is routing hot air behind chamber. • Check for anything obstructing exhaust port on chamber top.	Improve environment.
5	I/O board 1 connector contact check	Check contact of connector CN6 (wire Nos. 16D, 2D) on I/O board 1. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between pressure switch (PS11) and I/O board 1.	Repair connection.
6	I/O board 1 and temperature controller functioning	Check ON/OFF switching of Di5 using Di monitor of temperature controller. • When pin Nos. 5 and 6 of connector CN6 are shorted, Di5 should turn ON. When open, Di5 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 1 and temperature controller. See "5.1 Electrical Compartment".

HI STAGE REFG. OVERCURRENT (ALM)

NO.	Check item	Check method	What to do
1	Thermal relay (Th1)	Check continuity across relay terminals with refrigerator OFF. If continuous, relay is OK. If not, relay is broken.	Replace relay (Th1). See "5.1 Electrical Compartment".
2	Compressor locking	Measure operating current at startup. If 8 A or more, compressor is broken.	Replace compressor.
3	Condenser fin clogging	Detach rear panel and check lower part of condenser for dust buildup.	Clean fins.
4	Condenser fan	Vary fan rotation and speed, and check operation. If air is not blown, check input voltage. If 200V, fan is broken.	Replace condenser fan. See "5.5 Mechanical Parts Compartment".
5	Compressor power supply	Measure voltage at each RST phase and check for misalignment. Also, check for loose terminals.	Rewire as necessary.
6	Refrigeration circuit	• Check room temperature is 35°C or less. • Check injection solenoid (SV12) functioning. Check solenoid's temperature sensor is securely attached.	Lower room temperature and clear around exhaust port. Rewire or replace solenoid. Reattach or replace temperature sensor, expansion valve, etc.
7	I/O board 2 connector contact check	Check contact of connector CN9 (wire Nos. 20D, 2D) on I/O board 2. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between thermal relay (Th1) and I/O board 2.	Repair connection.
8	I/O board 2 and temperature controller functioning	Check ON/OFF switching of Di9 using Di monitor of temperature controller. • When pin Nos. 3 and 4 of connector CN9 are shorted, Di9 should turn ON. When open, Di9 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 2 and temperature controller. See "5.1 Electrical Compartment".

LOW STAGE REFG. SURFACE TEMP. FAILURE (ALM)

NO.	Check item	Check method	What to do
1	Temperature switch (TS21)	Check continuity across temperature switch terminals at max. 78°C. If continuous, switch is OK. If not, switch is broken.	Replace switch (TS21). See "5.4 Internal Mechanism".
2	Condenser fin clogging	Detach rear panel and check lower part of condenser for dust buildup.	Clean fins.
3	Refrigerant leaking	Check steam temperature (CH10) on Channel Monitor of service mode. If about -65°C during temperature pull-down (-40°C and higher), no leaking has occurred. If -75°C or lower, leaking has occurred.	Repair leak. Replace refrigerant.
4	Condenser fan	Vary fan rotation and speed, and check operation. If air is not blown, check input voltage. If 200V, fan is broken.	Replace condenser fan. See "5.5 Mechanical Parts Compartment".
5	Compressor power supply	Measure voltage at each RST phase and check for misalignment. Also, check for loose terminals.	Rewire as necessary.
6	Refrigeration circuit	• Check injection solenoid (SV22) functioning. • Check solenoid's temperature sensor is securely attached with twice-wrapped aluminum tape. • If discharge line is 100°C or less, refrigeration circuit is OK.	Rewire or replace solenoid. Reattach or replace temperature sensor.
7	I/O board 1 connector contact check	Check contact of connector CN6 (wire Nos. 15D, 2D) on I/O board 1. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between temperature switch (TS21) and I/O board 1.	Repair connection.
8	I/O board 1 and temperature controller functioning	Check ON/OFF switching of Di4 using Di monitor of temperature controller. • When pin Nos. 3 and 4 of connector CN6 are shorted, Di4 should turn ON. When open, Di4 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 1 and temperature controller. See "5.1 Electrical Compartment".

LOW STAGE HI-PRESSURE FAILURE (ALM)

NO.	Check item	Check method	What to do
1	High pressure switch (PS11)	Check continuity across pressure switch terminals with refrigerator OFF. If continuous, switch is OK. If not, switch is broken.	Replace switch (PS11).
2	Refrigeration circuit	High temperature side refrigeration capacity low • Gas leaking: Check sight glass for bubbling. • Dryer clogging: Check temperature differential between condenser outlet and expansion valve inlet is max. 2°C. • Solenoid valve (SV11): Check if cascade inlet is below 0°C or not. Low temperature side circuit • Electronic expansion valve: Run chamber at –20°C and check steam temperature (CH10) on Channel Monitor of service mode. After attaining target, check steam gradually drops from –65°C. If steam temperature does not change, turn coil of electronic expansion valve clockwise 2 turns by hand. If temperature then drops, trouble is in wiring or coil. If temperature does not change, electronic expansion valve is broken.	If bubbling detected, repair leak. Recharge refrigerant. Replace dryer. Rewire or replace solenoid valve. Rewire or replace coil. Replace electronic expansion valve.
3	I/O board 1 connector contact check	Check contact of connector CN6 (wire Nos. 17D, 2D) on I/O board 1. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between pressure switch (PS11) and I/O board 1.	Repair connection.
4	I/O board 1 and temperature controller functioning	Check ON/OFF switching of Di5 using Di monitor of temperature controller. • When pin Nos. 5 and 6 of connector CN6 are shorted, Di5 should turn ON. When open, Di5 should turn OFF. See “4.3 Electric Parts and Instrumentation”.	Initialize temperature controller and check again. See “6.1 Temperature Controller Initialization and Parameter Setup”. Replace I/O board 1 and temperature controller. See “5.1 Electrical Compartment”.

LOW STAGE REFG. OVERCURRENT (ALM)

NO.	Check item	Check method	What to do
1	Thermal relay (Th2)	Check continuity across relay terminals with refrigerator OFF. If continuous, relay is OK. If not, relay is broken.	Replace relay (Th2). See "5.1 Electrical Compartment".
2	Compressor locking	Measure operating current at startup. If 8 A or more, compressor is broken.	Replace compressor.
3	Condenser fin clogging	Detach rear panel and check lower part of condenser for dust buildup.	Clean fins.
4	Condenser fan	Vary fan rotation and speed, and check operation. If air is not blown, check input voltage. If 200V, fan is broken.	Replace condenser fan. See "5.5 Mechanical Parts Compartment".
5	Compressor power supply	Measure voltage at each RST phase and check for misalignment. Check for loose terminals.	Rewire as necessary.
6	Refrigeration circuit	High temperature side refrigeration capacity low See "LOW STAGE HI-PRESSURE (ALM)".	Rewire or replace solenoid. Reattach or replace temperature sensor.
7	I/O board 2 connector contact check	Check contact of connector CN9 (wire Nos. 21D, 2D) on I/O board 2. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between thermal relay (Th2) and I/O board 2.	Repair connection.
8	I/O board 2 and temperature controller functioning	Check ON/OFF switching of Di10 using Di monitor of temperature controller. • When pin Nos. 5 and 6 of connector CN9 are shorted, Di10 should turn ON. When open, Di10 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 2 and temperature controller. See "5.1 Electrical Compartment".

REFRIG. CONDENSER FAN FAILURE (ALM)

NO.	Check item	Check method	What to do
1	Fan temperature switch	Check continuity across fan wires (18D and 18-D-1, 18D-1 and 2D) with refrigerator OFF. If continuous, switch is OK. If not, switch is broken.	Replace condenser fan. See "5.5 Mechanical Parts Compartment".
2	I/O board 1 connector contact check	Check contact of connector CN6 (wire Nos. 18D, 2D) on I/O board 1. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between temperature switches (TS31, TS32) and I/O board 1.	Repair connection.
3	I/O board 1 and temperature controller functioning	Check ON/OFF switching of Di7 using Di monitor of temperature controller. • When pin Nos. 9 and 10 of connector CN6 are shorted, Di7 should turn ON. When open, Di7 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 1 and temperature controller. See "5.1 Electrical Compartment".

POWER PHASE FAILURE (ALM)

NO.	Check item	Check method	What to do
1	R/T reversing	With exception to ground phase (S), reverse phases R (L1) and T (L3), reactivate power and check if alarm appears. If no alarm appears, phases were reversed.	Reconnect power cable.
2	Reverse phase prevention relay (PR1) wiring check	Check for loose terminals.	Rewire as necessary. Replace relay (PR1).
3	I/O board 2 connector contact check	Check contact of connector CN9 (wire Nos. 19D, 2D) on I/O board 2. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between reverse phase prevention relay (PR1) and I/O board 2.	Repair connection.
4	I/O board 2 and temperature controller functioning	Check ON/OFF switching of Di8 using Di monitor of temperature controller. • When pin Nos. 1 and 2 of connector CN9 are shorted, Di8 should turn ON. When open, Di8 should turn OFF. See “4.3 Electric Parts and Instrumentation”.	Initialize temperature controller and check again. See “6.1 Temperature Controller Initialization and Parameter Setup”. Replace I/O board 2 and temperature controller. See “5.1 Electrical Compartment”.

TEST AREA POSITION FAILURE (ALM)

NO.	Check item	Check method	What to do
1	Test area specimen quantity	Check test area has no more than 8 kg of specimens.	Reduce specimen quantity.
2	Test area sinking in high temperature exposure	Check if test area gradually sinks from high exposure position.	Replace linear motor (M1). See "5.1 Electrical Compartment". Replace and adjust packing contact. See "4.1 Structure".
3	High temperature chamber position detecting mechanism functioning	Shift test area to high temperature chamber and check continuity of position detecting limit switch (LS3). If continuous, switch is OK. If not, switch is broken. * LS3 located at front right inside electrical compartment	Replace switch (LS3). See "5.1 Electrical Compartment".
4	I/O board 2 connector contact check	Check contact of connector CN11 (wire Nos. 29D, 2D) on I/O board 2. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between limit switch (LS3) and I/O board 2.	Repair connection.
5	I/O board 2 and temperature controller functioning	Check ON/OFF switching of Di18 using Di monitor of temperature controller. • When pin Nos. 7 and 8 of connector CN11 are shorted, Di18 should turn ON. When open, Di18 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 2 and temperature controller. See "5.1 Electrical Compartment".
6	Link mechanism connection check	Shift test area to low temperature chamber and check for loose parts in connection and rails of link mechanism.	Replace and adjust packing contact. See "4.1 Structure". Tighten loose parts. If this fails to clear trouble, replace link mechanism. See "5.3 Link Mechanism".

HOT BOX CIRCULATOR FAILURE (ALM)

NO.	Check item	Check method	What to do
1	High temperature chamber air circulator obstruction	Detach front panel of high temperature chamber air circulator and visually check if anything is obstructing fan runner.	Remove obstruction.
2	Air circulator motor rotation (High temperature chamber)	Turn motor shaft by hand from chamber rear and check rotation. If turns smoothly without catching, motor is OK.	Detach air circulator motor and remove obstruction. See "5.4 Internal Mechanism" and "5.5 Mechanical Parts Compartment".
3	Air circulator motor electrical characteristics: Motor internal temperature switch continuity	Check temperature switch is closed when motor at room temperature. Check continuity of motor leads (white, white). If continuous (0 resistance), motor is OK.	Replace air circulator motor. See "5.4 Internal Mechanism" and "5.5 Mechanical Parts Compartment".
4	Air circulator motor electrical characteristics: Motor current measurement	Measure motor current. If 1.5 A or less, motor is OK.	Replace air circulator motor. See "5.4 Internal Mechanism" and "5.5 Mechanical Parts Compartment".
5	Reoccurrence check: Motor internal temperature switch continuity	Defrost under manual control. Listen for rotating sound, strange noises and check for vibrations. Check if alarm reoccurs. If triggered, immediately check continuity of internal temperature switch.	Replace fan unit. See "5.4 Internal Mechanism" and "5.5 Mechanical Parts Compartment".
6	Air circulator motor temperature	Check for foreign matter that might drive up motor surface temperature. Check for anything obstructing exhaust port on chamber top.	Remove obstruction.
7	Contact check (Board and relay connectors)	Check contact of connector CN11 (wire Nos. 26D, 2D) on I/O board 2 and motor relay connectors. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between motor and I/O board 2.	Repair connection.
8	I/O board 2 and temperature controller functioning	Check ON/OFF switching of Di3 using Di monitor of temperature controller. • When pin Nos. 1 and 2 of connector CN11 are shorted, Di3 should turn ON. When open, Di3 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 2 and temperature controller. See "5.1 Electrical Compartment".

HOT BOX ABS. HI LIMIT (ALM)

NO.	Check item	Check method	What to do
1	Overshoot	Check if alarm triggered by overshoot.	Lower preheat temperature.
2	Solid state contactor (SSC1)	Check solid state contactor functioning. Detach input terminal pin No. 2C of solid state contactor. If current flows to heater circuit, contactor is broken.	Replace contactor (SSC1). See "5.1 Electrical Compartment".
3	I/O board 1 and temperature controller functioning	Lower preheat temperature (high exposure target) below temperature of high temperature chamber and check if 24V DC is applied to solid state contactor (SSC1). If so, I/O board 1 and temperature controller is broken.	See "5.1 Electrical Compartment".

COLD BOX CIRCULATOR FAILURE (ALM)

NO.	Check item	Check method	What to do
1	Low temperature chamber air circulator obstruction	Detach front panel of low temperature chamber air circulator and visually check if anything is obstructing fan runner.	Remove obstruction.
2	Low temperature chamber air circulator motor rotation	Turn motor shaft by hand from chamber rear and check rotation. If turns smoothly without catching, motor is OK. Could also be overload due to freezing.	Detach air circulator motor and remove obstruction. See "5.4 Internal Mechanism" and "5.5 Mechanical Parts Compartment". Defrost system.
3	Thermal relay (Th3)	Check continuity across relay terminals with air circulator OFF. If continuous, relay is OK. If not, relay is broken.	Replace relay (Th3). See "5.4 Internal Mechanism".
4	Air circulator motor electrical characteristics: Motor current measurement	Measure motor current. If 1.3 A or less, motor is OK.	Replace air circulator motor. See "5.4 Internal Mechanism" and "5.5 Mechanical Parts Compartment".
5	I/O board 2 connector contact check	Check contact of connector CN11 (wire Nos. 27D, 2D) on I/O board 2. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between thermal relay (Th3) and I/O board 2.	Repair connection.
6	I/O board 2 and temperature controller functioning	Check ON/OFF switching of Di9 using Di monitor of temperature controller. • When pin Nos. 3 and 4 of connector CN11 are shorted, Di9 should turn ON. When open, Di9 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 2 and temperature controller. See "5.1 Electrical Compartment".

COLD BOX ABS. HI LIMIT (ALM)

NO.	Check item	Check method	What to do
1	Solid state relay (SSR1)	Check solid state relay functioning. Detach input terminal pin No. 2C of solid state relay. If current flows to heater circuit, relay is broken.	Replace relay (SSR1). See "5.1 Electrical Compartment".
2	I/O board 1 and temperature controller functioning	Lower precool temperature (low exposure target) below temperature of low temperature chamber and check if 24V DC is applied to solid state relay (SSR1). If so, I/O board 1 and temperature controller is broken.	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 1 and temperature controller. See "5.1 Electrical Compartment".
3	Refrigerant leaking	Check steam temperature (CH10) on Channel Monitor of service mode. If about -65°C during temperature pull-down (-40°C and higher), no leaking has occurred. If -75°C or lower or 0°C or higher, leaking has occurred.	Repair leak. Replace refrigerant.

COLD BOX ABS. LOW LIMIT (ALM)

NO.	Check item	Check method	What to do
1	Low temperature chamber door switch	Press handle inward all the way and check door switch trips.	Reposition pawl and pin as explained in Door Packing Contact Adjustment. See "4.1 Structure".
2	Solid state relay (SSR1)	Check solid state relay functioning. Lower precool temperature (low exposure target) below temperature of low temperature chamber and check if 24V DC is applied to relay. If so, relay is broken.	Replace relay (SSR1). See "5.1 Electrical Compartment".
3	I/O board 1 and temperature controller functioning	Lower precool temperature (low exposure target) below temperature of low temperature chamber and check if 24V DC is applied to solid state relay (SSR1). If not, I/O board 1 or temperature controller is broken.	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 1 and temperature controller. See "5.1 Electrical Compartment".
4	Heater	Set main power switch in OFF position and measure resistance of heater (H4). If 40Ω or less, heater is OK. Pin Nos. ·22, 27: 200V AC, 220V AC ·2, 27: 380V AC, 400/415V AC	Replace heater (H4). See "5.4 Internal Mechanism".

OVERHEATING (TEST AREA) (ALM), OVERHEAT PROTECTOR TRIP(ALM)

NO.	Check item	Check method	What to do
1	Test area specimen quantity	Check if specimens are interrupting air flow.	Reduce specimen quantity.
2	Overshoot	Check if alarm triggered by overshoot.	Lower preheat temperature.
3	Solid state contactor (SSC1)	Check solid state contactor functioning. Detach input terminal pin No. 2C of solid state contactor. If current flows to heater circuit, contactor is broken.	Replace contactor (SSC1). See "5.1 Electrical Compartment".
4	I/O board 1 and temperature controller functioning	Lower preheat temperature (high exposure target) below temperature of high temperature chamber and check if 24V DC is applied to solid state contactor (SSC1). If so, I/O board 1 and temperature controller is broken.	See "5.1 Electrical Compartment".

OVERCOOLING (TEST AREA) (ALM), OVERCOOL PROTECTOR TRIP (ALM)

NO.	Check item	Check method	What to do
1	Test area specimen quantity	Check if specimens are interrupting air flow.	Reduce specimen quantity.
2	Undershoot	Check if alarm triggered by undershoot.	Raise precool temperature.
3	Low temperature chamber door switch	Press handle inward all the way and check door switch trips.	Reposition pawl and pin as explained in Door Packing Contact Adjustment. See "4.1 Structure".
4	Solid state relay (SSR1)	Check solid state relay functioning. Lower precool temperature (low exposure target) below temperature of low temperature chamber and check if 24V DC is applied to relay. If so, relay is broken.	Replace relay (SSR1). See "5.1 Electrical Compartment".
5	I/O board 1 and temperature controller functioning	Lower precool temperature (low exposure target) below temperature of low temperature chamber and check if 24V DC is applied to solid state relay (SSR1). If not, I/O board 1 and temperature controller is broken.	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 1 and temperature controller. See "5.1 Electrical Compartment".
6	Heater	Set main power switch in OFF position and measure resistance of heater (H4). If 40Ω or less, heater is OK. Pin Nos. · 22, 27 : 200V AC, 220V AC · 2, 27 : 380V AC, 400/415V AC	Replace heater (H4). See "5.4 Internal Mechanism".

TEST AREA SHIFT FAILURE (ALM)

NO.	Check item	Check method	What to do
1	Test area specimen quantity	Check test area has no more than 8 kg of specimens.	Reduce specimen quantity.
2	Test area or elevator shaft obstruction	Open low and high temperature chambers and check for protruding obstructions from test area or in elevator shaft.	Remove obstruction.
3	High temperature chamber link mechanism obstruction	Open high temperature chamber, hold door switch (lock catch) in detected position, shift test area and check link mechanism for obstruction.	Remove obstruction.
4	Inverter	Check frequency (60 Hz) on inverter display. Shift test area under manual control and check 60 Hz is indicated during operation. • If frequency is not indicated, measure voltage at inverter power terminals (RST and RS). If 200 to 240V AC, inverter is broken. If 0 V, trouble is in wiring.	Replace inverter (INV1). See "5.1 Electrical Compartment". Rewire as necessary.
		• If indication does not change from 0 Hz, check contact of connector CN10 (wire Nos. 1B, 2B, 3B) on I/O board 1. Check for missing pins and disconnected or loose wires. Check continuity in cable between inverter and I/O board 1.	Repair connection. If no trouble in wiring, replace I/O board 1. See "5.1 Electrical Compartment".
5	Linear motor wiring	Check contact of power connector of linear motor. • Check for missing pins and disconnected or loose wires. Check continuity in cable between inverter and linear motor (M1). • If no trouble detected in wiring, linear motor is broken.	Repair connection. Replace linear motor (M1). See "5.1 Electrical Compartment". Replace and adjust packing contact. See "4.1 Structure".

TRANSFER FAILURE (ALM)

NO.	Check item	Check method	What to do
1	Contact check between link arm and test area support mechanism shaft	Check if link arm is contacting test area support mechanism shaft. If so, below troubles are thinkable.	Retighten as necessary. See "4.1 Structure".
		• Coupling between link arm and linear motor is loose or disconnected. • If coupling is not loose or disconnected, linear motor clutch is broken.	Replace linear motor (M1). See "5.1 Electrical Compartment". Replace and adjust packing contact. See "4.1 Structure".
2	Test area support mechanism functioning	If link arm is not contacting test area support mechanism shaft, set POWER key in ON position and check operation for few seconds.	Replace solenoid (SD1). See "5.1 Electrical Compartment".
		• If not working, measure voltage at test area support mechanism solenoid (SD1) with tester. (Measure at solenoid leads.) If 24V DC, solenoid is OK. If voltage not applied, solenoid (SD1) is broken.	
		• If voltage not applied, check contact of connector CN2 (wire Nos. 45D) on I/O board 2. Check for missing pins and disconnected or loose wires. Check continuity in cable between solenoid and I/O board 2.	Repair connection. If no trouble in wiring, replace I/O board 2. See "5.1 Electrical Compartment".
		• If working, check continuity of limit switch (LS4) of test area support mechanism. (Measure at support mechanism leads.) If continuous when support mechanism shaft is pressed, support mechanism is OK.	Replace test area support mechanism (LS4). See "5.1 Electrical Compartment".
3	I/O board 2 connector contact check	Check contact of connector CN11 (wire Nos. 30D, 2D) on I/O board 2. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between test area support mechanism (LS4) and I/O board 2.	Repair connection.
4	I/O board 2 and temperature controller functioning	Check ON/OFF switching of Di19 using Di monitor of temperature controller. • When pin Nos. 9 and 10 of connector CN11 are shorted, Di19 should turn ON. When open, Di19 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 2 and temperature controller. See "5.1 Electrical Compartment".

SPECIMEN TRANSFER MOTOR FAILURE (ALM)

NO.	Check item	Check method	What to do
1	Inverter (INV1)	Check error message on inverter display. • If "THM" displayed, linear motor (M1) is broken. • If other than "THM", inverter (INV1) is broken.	Replace linear motor (M1). See "5.1 Electrical Compartment". Replace inverter (INV1). See "5.1 Electrical Compartment".
2	I/O board 2 connector contact check	Check contact of connector CN11 (wire Nos. 28D, 2D) on I/O board 2. • Check for missing pins and disconnected or loose wires. • Check continuity in cable between inverter (INV1) and I/O board 2.	Repair connection.
3	I/O board 2 and temperature controller functioning	Check ON/OFF switching of Di17 using Di monitor of temperature controller. • When pin Nos. 5 and 6 of connector CN11 are shorted, Di17 should turn ON. When open, Di17 should turn OFF. See "4.3 Electric Parts and Instrumentation".	Initialize temperature controller and check again. See "6.1 Temperature Controller Initialization and Parameter Setup". Replace I/O board 2 and temperature controller. See "5.1 Electrical Compartment".

BURN-OUT (AI-0CH to AI-9CH) (ALM)

NO.	Check item	Check method	What to do
1	Temperature controller analog board looseness and contact check	Check temperature control for loose or poor contacting terminals.	Retighten as necessary.
2	Sensor disconnection check	Disconnect sensor from temperature controller and measure resistance at both ends of lead. If 10 to few 10Ω, sensor is OK. If high resistance detected, sensor is broken.	Replace sensor. See below sensor table.
3	Temperature controller functioning	Short input terminals of sensor and check if alarm clears. If it does not, temperature controller is broken. With Ai-0CH burnout, temperature controller must be replaced.	Replace temperature controller. See "5.1 Electrical Compartment".
4	Temperature controller analog board – CPU board wiring check	Check for faulty contact in connector. Faulty contact can trigger multiple sensor disconnection alarms.	Repair connection.

Sensors

Ai No.	Displayed channel No.	Sensor code	Detection point	Refer to for repairs
Ai0	CH0	—	Temperature controller room temperature offset	5.1 Electrical Compartment
Ai1	CH1	THC1	Test area upstream	5.4 Internal Mechanism
Ai2	CH2	THC2	Test area downstream	5.4 Internal Mechanism
Ai3	CH3	—	Not connected	—
Ai5	CH8	THC4	High temperature chamber	5.4 Internal Mechanism
Ai6	CH9	THC5	Low temperature chamber	5.4 Internal Mechanism
Ai7	CH10	THC111	Evaporator inlet	—
Ai8	CH11	THC112	Evaporator outlet	—
Ai9	CH12	THC113	Condenser	—

COMMUNICATION ERROR-1/2 (ALM)

NO.	Check item	Check method	What to do
1	Temperature controller connection check	Check flat cable is properly connected. See "4.3 Electric Parts and Instrumentation".	Reconnect cable.
		Check flat cable for open circuit. See "4.3 Electric Parts and Instrumentation".	Replace cable.
		Check 5V line from temperature controller is properly connected. See "4.3 Electric Parts and Instrumentation".	Reconnect cable.
		Check 5V line from temperature controller for open circuit. See "4.3 Electric Parts and Instrumentation".	Replace cable.
2	Temperature controller functioning	Check if FAIL LED (red) lamp on CPU board of temperature controller is lit or not.	If lit, initialize temperature controller.
			If lamp still lit after initializing temperature controller, replace controller. See "5.1 Electrical Compartment".

SYSTEM ERROR-1/2/4/5/6 (ALM)

NO.	Check item	Check method	What to do
1	Temperature controller functioning	Initialize temperature controller and watch system for a while.	Initialize temperature controller.
			If alarm does not clear after initializing temperature controller, replace controller. See "5.1 Electrical Compartment".

Chapter 4

Checks and Adjustments

This chapter explains how to check and adjust parts. For the temperature controller, see Chapter 6 “Temperature Controller Adjustments”.

4.1 Structure

Elevator Shaft Packing Contact Adjustment

■ Preparations

Required tools *: Hexagon socket screw keys (width across flat 1.5 mm)
(for operating dog)

* “Required tools” make work proceed smoothly though they are not specifically required. This applies to all adjustments and checks.

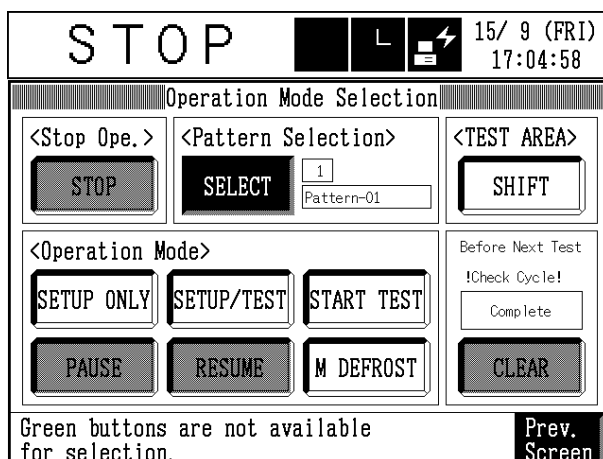
■ Adjustment Procedure

First check packing contact and then adjust packing from the linear motor dog.

■ Packing Contact Check

Elevator Shaft Packing on High Temperature Chamber Side

1. Set the main power switch in the ON position. The switch is on the right side of the chamber towards the top.
2. Set the **POWER** key on the operating panel in the ON position.
3. Open the high temperature chamber and, if the test area is in the low temperature chamber, perform step 4 to shift it to the high temperature chamber. Remember to close the low temperature chamber if you open it.
4. Press the **OPER./STOP** key on the operating panel to get the Operation Mode Selection screen and press **SHIFT** under TEST AREA.



5. A message asking you to “Shift test area” will appear on the display. Press **Yes**.

6. Hold down the lever of the door switch (lock catch) of the high temperature chamber in the detected position. In a few seconds, the operating status box in the upper left-hand corner of the display will change from “STOP” to “SHIFT”, and the test area will move to the high temperature chamber.

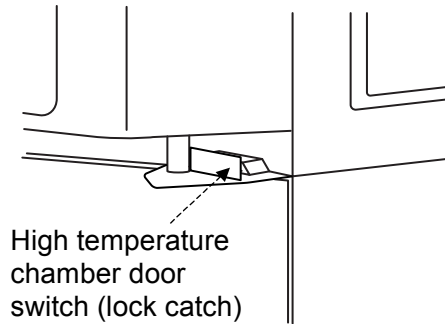


Fig. 4.1 High temperature chamber door switch

7. Set a sheet of thin paper (copy paper) on the elevator shaft packing on the high temperature chamber side and perform steps 4 to 6 to shift the test area to the low temperature chamber.
8. With the test area pressing against the elevator shaft packing on the high temperature chamber side, check packing is 12 to 13 mm in height. Also, try pulling the sheet of paper out. It should not come out easily.

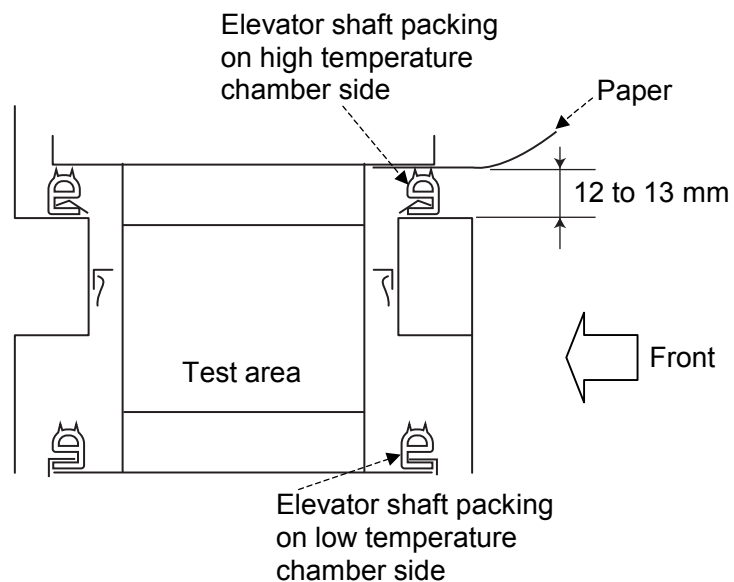


Fig. 4.2 Elevator shaft packing contact

- This 12 to 13 mm height is for factory-adjusted new packing, therefore if packing is old, adjust contact with the test area.
 - Also, open the low temperature chamber and check that the test area cannot be pushed upward from underneath.
9. Remove the sheet of paper and close the high and low temperature chambers.

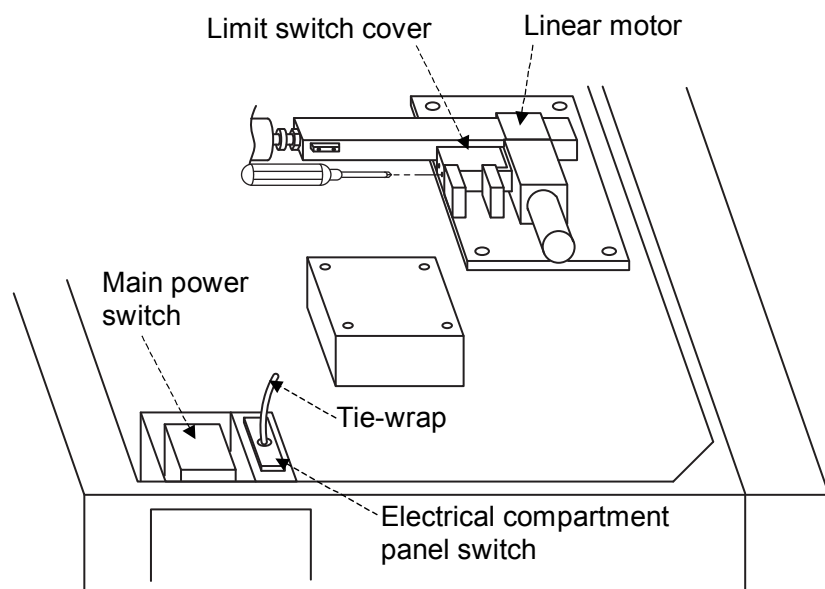
Elevator Shaft Packing on Low Temperature Chamber Side

1. Open the low temperature chamber and set a sheet of thin paper (copy paper) on the elevator shaft packing on the low temperature chamber side and perform steps 4 to 6 of the previous procedure to shift the test area to the high temperature chamber. (Hold down the low temperature door switch to imitate the door being closed.)
2. With the test area pressing against the elevator shaft packing on the low temperature chamber side, check packing is 12 to 13 mm in height. Also, try pulling the sheet of paper out. It should not come out easily.

- This 12 to 13 mm height is for factory-adjusted new packing, therefore if packing is old, adjust contact with the test area.

■ **Packing Contact Adjustment from Linear Motor Dog**

1. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
2. Depress the trip reed of the electrical compartment panel switch and hold it down with a tie-wrap or other means to keep the switch from tripping.



4.3 Electrical compartment with panel open

Elevator Shaft Packing on High Temperature Chamber Side

1. Shift the test area to the high temperature chamber.
2. Check the rack is in the position shown in the below figure.
3. To increase the test area's contact with the packing, loosen dog 1 in the below figure and slide it to the left. To decrease contact, slide dog 1 to the right.
4. Shift the test area to the low temperature chamber.
5. Check packing contact as explained in the preceding "Packing Contact Check".

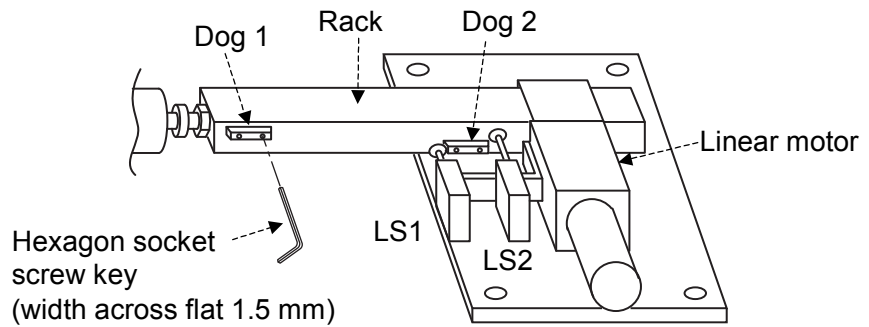


Fig. 4.4 Packing contact adjustment on high temperature chamber side

Elevator Shaft Packing on Low Temperature Chamber Side

1. Shift the test area to the low temperature chamber.
2. Check the rack is in the position shown in the below figure.
3. To increase the test area's contact with the packing, loosen dog 2 in the below figure and slide it to the right. To decrease contact, slide dog 2 to the left.
4. Shift the test area to the high temperature chamber.
5. Check packing contact as explained in the preceding "Packing Contact Check".

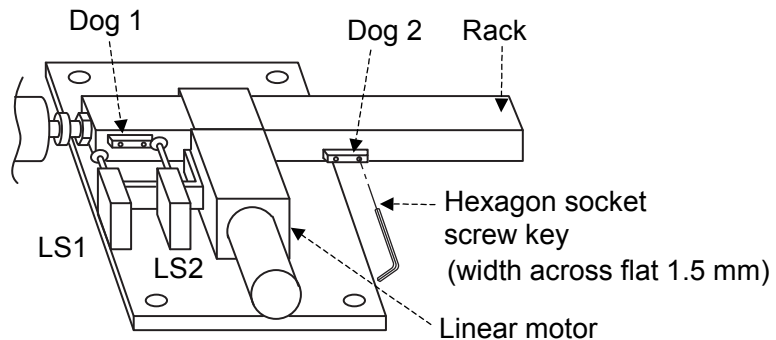


Fig. 4.5 Packing contact adjustment on low temperature chamber side

Door Packing Contact Adjustment

■ Adjustment Procedure

See the below clearance reference when adjusting door packing contact. Note, however, that this value is for new packing. Actual clearance can vary slightly as packing loses its sturdiness. Therefore, a sure test is to set a sheet of thin paper (copy paper) between the packing and door and try pulling it out. It should not come out easily.

Door Hinge Adjustment

1. Set the main power switch in the OFF position and detach the hinge cover.
2. Loosen the bolts that lock down the hinge.
3. Slide the door forward and backward to the proper position. See the below reference.

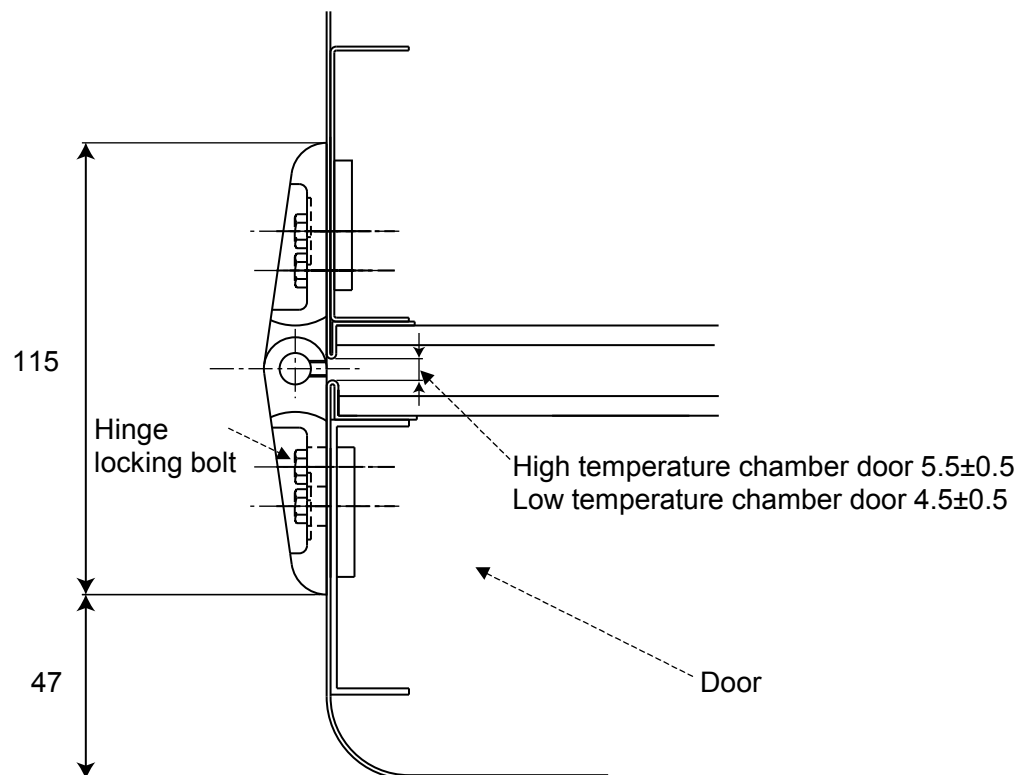


Fig. 4.6 Door hinge adjustment

High Temperature Chamber Door (Top) Lock Adjustment

1. Install and adjust the lock so that the A is 35 mm to the left and 26 mm to the rear of the door outer surface.
2. Install and adjust the top lock catch of the high temperature chamber door to the below position.
 B: The right edge of the lock catch is 11 mm from the door right outer surface.
 C: The front edge of the lock catch is 31 mm from the door right outer surface.
3. Adjust the top lock catch so that the pawl and pin are 1.5 ± 0.3 mm apart.
4. Check that the roller securely engages the top lock catch. (Try turning the roller and check that it does not turn.)
5. Measure the clearance (5.5 ± 0.5 mm) from the door and chamber frame at both the top and bottom ends of the door. This clearance is adjusted by repositioning the top lock catch of the high temperature chamber door.

For reference values, see the below figure. Note, however, that these values are for new packing.

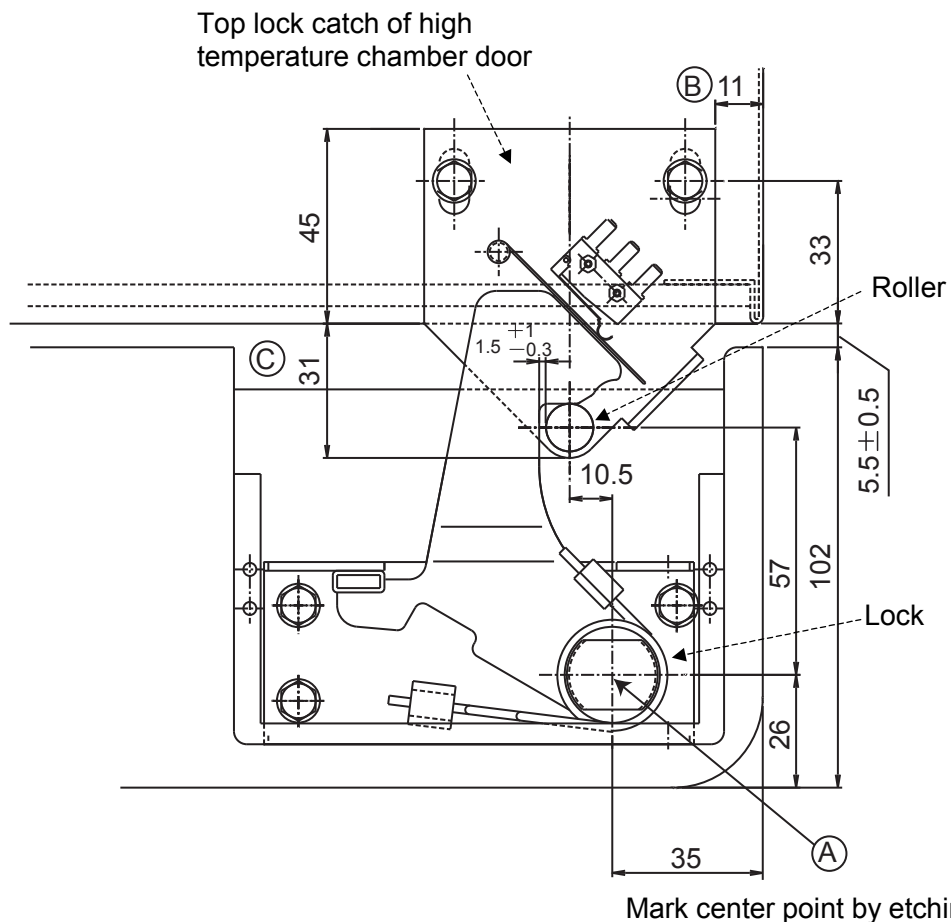
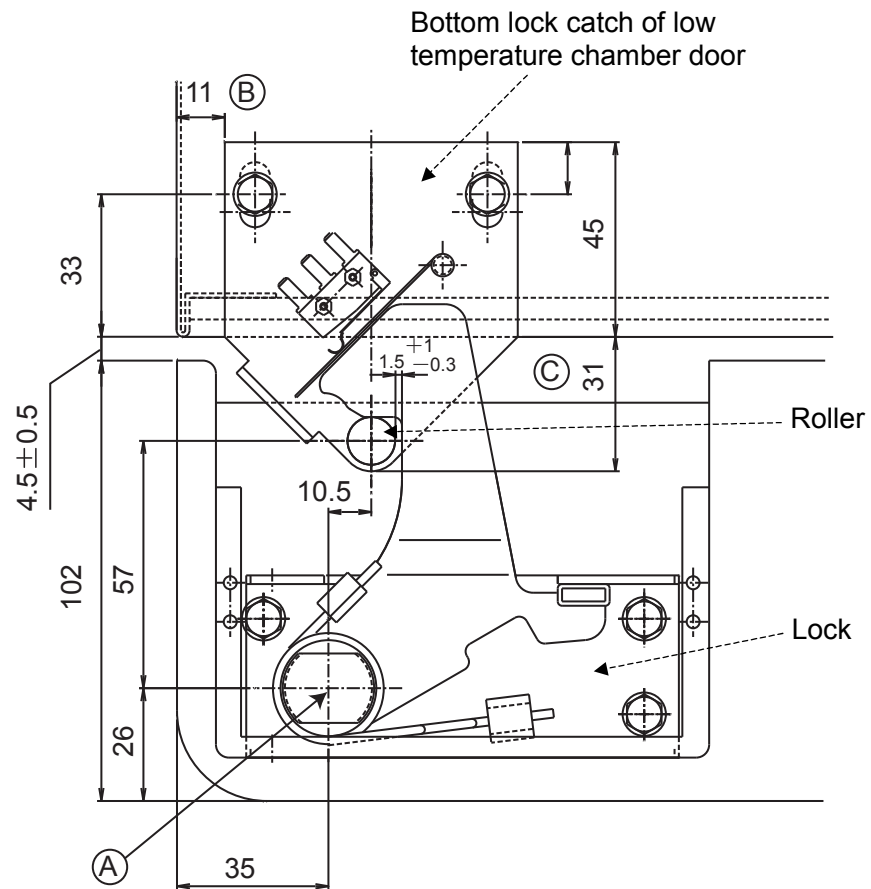


Fig. 4.7 Reference values for high temperature chamber door (top) lock
(Seen from above)

Low Temperature Chamber Door (Bottom) Lock Adjustment

1. Install and adjust the lock so that the A is 35 mm to the right and 26 mm to the rear of the door outer surface.
2. Install and adjust the bottom lock catch of the low temperature chamber door to the below position.
 B: The left edge of the lock catch is 11 mm from the door right outer surface.
 C: The front edge of the lock catch is 31 mm from the door right outer surface.
3. Adjust the bottom lock catch so that the pawl and pin are $1.5 \pm 1/-0.3$ mm apart.
4. Check that the roller securely engages the bottom lock catch. (Try turning the roller and check that it does not turn.)
5. Measure the clearance (4.5 ± 0.5 mm) from the door and chamber frame at both the top and bottom ends of the door. This clearance is adjusted by repositioning the bottom lock catch of the low temperature chamber door.

For reference values, see the below figure. Note, however, that these values are for new packing.



Mark center point by etching.

Fig. 4.8 Reference values for low temperature chamber door (bottom) lock
(Seen from below)

Middle Locks (Bottom of High Temperature Chamber/Top of Low Temperature Chamber) Adjustment

1. Install and adjust the lock so that the A is 35 mm to the left and 26 mm to the rear of the door outer surface.
2. Install and adjust the middle lock catches to the below position.
 B: The right edge of the middle lock catch is 21 mm from the door right outer surface.
 C: The front edge of the middle lock catch is 35 mm from the chamber frame center line.
3. Adjust the middle lock catches so that the pawl and pin are 1.5 ± 0.3 mm apart.
4. Check that the roller securely engages the middle lock catches. (Try turning the roller and check that it does not turn.)
5. Measure the clearance (high temperature chamber door 5.5 ± 0.5 mm, low temperature chamber door 4.5 ± 0.5 mm) from the door and chamber frame at both the top and bottom ends of the doors. This clearance is adjusted by repositioning the middle lock catches.

For reference values, see the below figure. Note, however, that these values are for new packing.

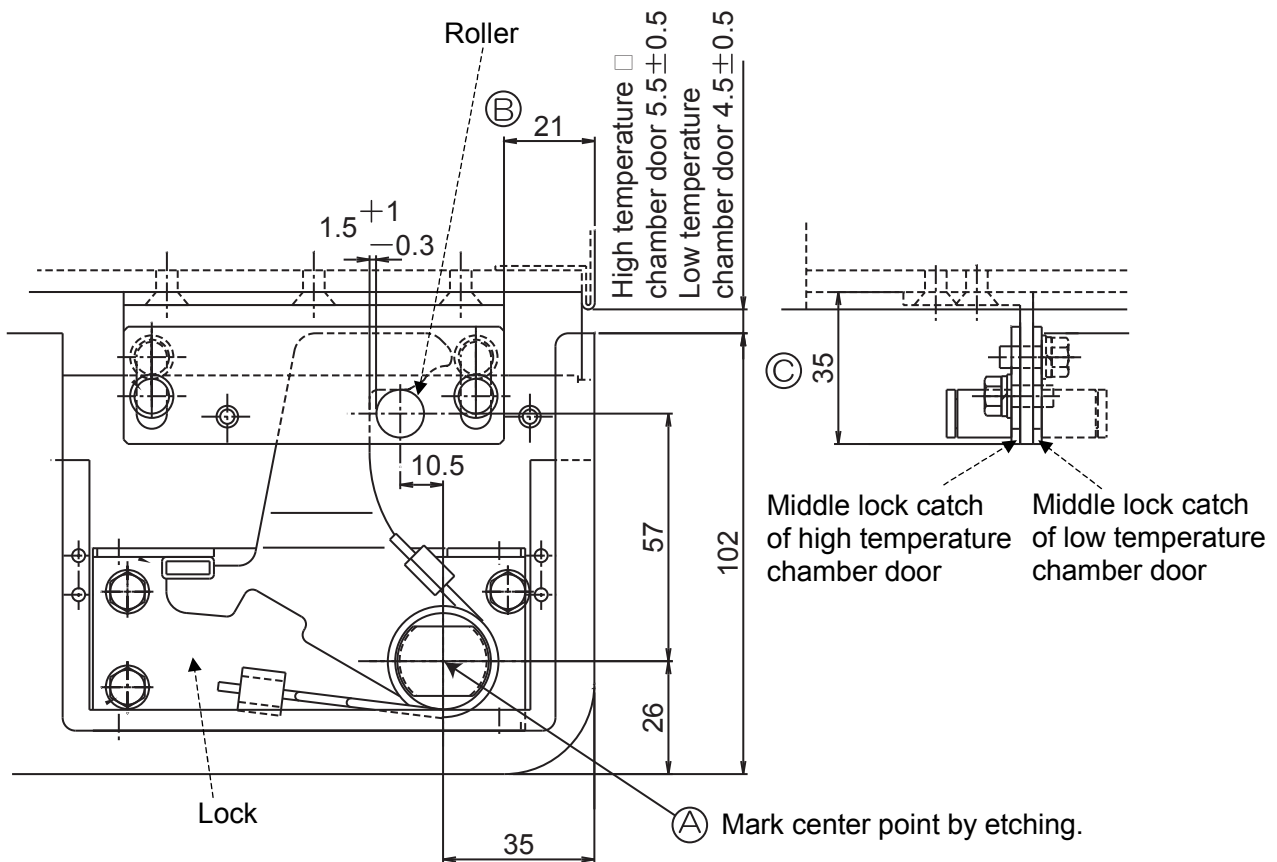


Fig. 4.9 Reference values for middle locks
(bottom of high temperature chamber/top of low temperature chamber)

4.2 Refrigerator

Refrigerator Adjustment Reference Data

■ Notes

- Refrigerant: This chamber uses an HFC refrigerant of a zero ozone depletion factor. Both the refrigerant and refrigerator machine oil hate moisture found in air. Moisture can hydrolyze the media. Therefore, to prevent the refrigerant and refrigerator machine oil from absorbing moisture, keep the refrigeration circuit open for no more than 15 minutes.
- Refrigerant adjustment reference: Refrigerant quantity can vary. See the below reference data when handling refrigerant.

■ Refrigerant Adjustment Reference

The below data is given for running the refrigerator at 100% capacity.

Table 4.1 Refrigerant adjustment references

Room temp.	Low temp. chamber temp. setting	Pulse	Heater output	High pressure	Low pressure	Remarks
35°C	-80°C	100	7%	2.1MPa (Gauge) (21kg/cm ² G)	0.16MPa (Gauge) (1.6kg/cm ² G)	High temperature chamber
				1.47MPa (Gauge) (14.7kg/cm ² G)	-0.01MPa (Gauge) (-0.1kg/cm ² G)	Low temperature chamber
20°C	-80°C	100 to 120	10 to 24%	1.3 to 1.5MPa (Gauge) (13 to 15kg/cm ² G)	00.6 to 0.13MPa (Gauge) (0.6 to 1.3kg/cm ² G)	High temperature chamber
				1.0 to 1.35MPa (Gauge) (10 to 13.5kg/cm ² G)	-0.03 to 0MPa (Gauge) (-0.3 to 0kg/cm ² G)	Low temperature chamber

4.3 Electric Parts and Instrumentation

Display Unit

Check the connection of connectors and wires listed in Table 4.2.

Table 4.2 Display unit trouble and concerned connector (wire)

Symbol *	Connector (Wire)	Trouble
P1	Touch panel connector	Touch panel is inoperative.
P2	LCD inverter connector	LCD (backlight) is out.
P3	Power connector	LCD is out and inoperative.
P4	Flexible cable (Connected to LCD)	Lines appear across display.
P5	RS422 communication connector	COMMUNICATION ERROR-2 (ALM) occurred.
P6	Key input/display output connector	On-screen buttons are inoperative.
	LCD backlight connector	LCD is dark.

* Symbols P1 to P6 are indicated on labels attached to the program setter cover.

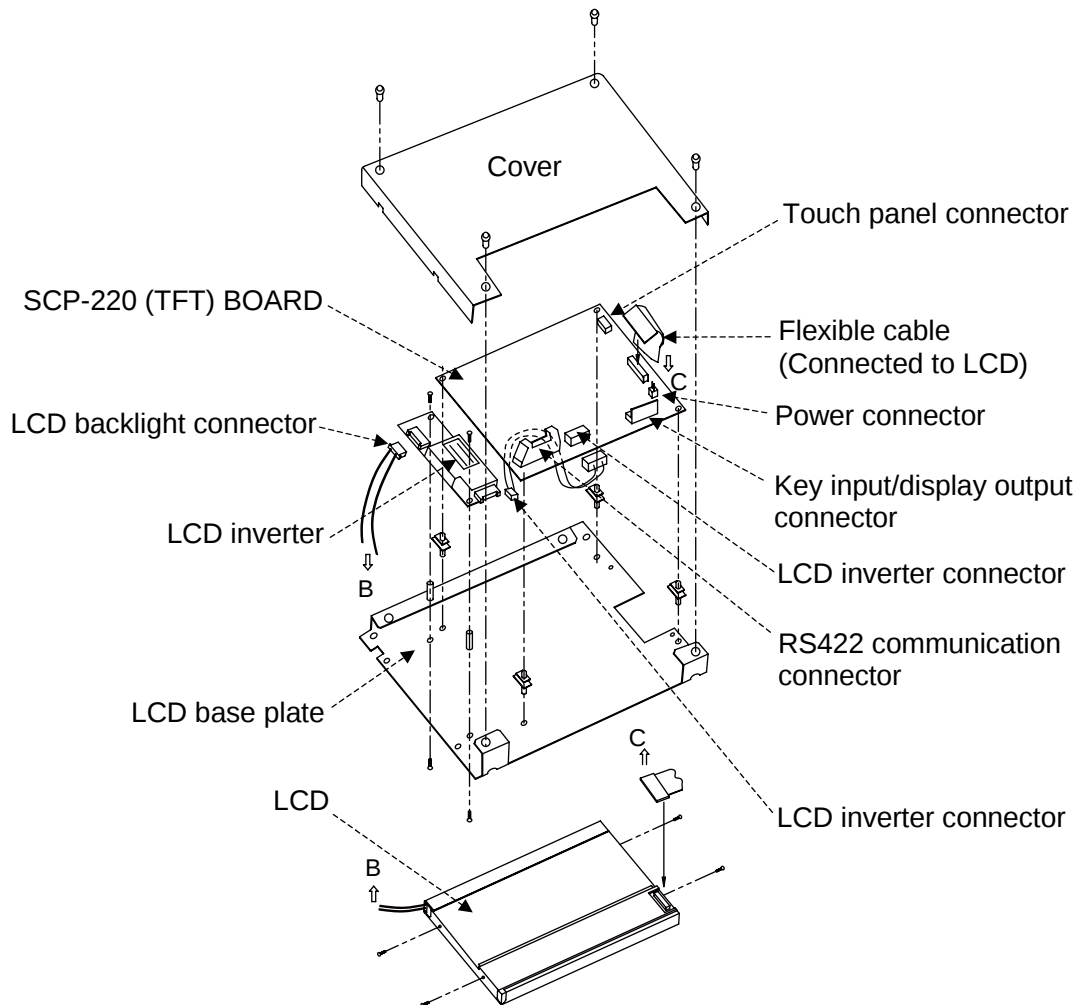


Fig. 4.10 Display unit connectors

Input/Output (DI/DO)

DI/DO are monitored and manual output set from the service mode.

■ How to Get the Service Mode

1. With the main menu on the screen, press **Chamber Setup**.
2. Press **Configuration** to get the Chamber Configuration display.
3. Press **9 Service**.
4. Input the service mode password (3132) and press **Enter** on the keypad.

Table 4.3 DI monitor

DI No.	Input signal	Part symbol	Contact status
0	Test area position detection (High temperature chamber)	LS1	When test area in high temperature chamber: Open
1	Test area position detection (Low temperature chamber)	LS2	When test area in low temperature chamber: Open
2	Door closed detection (High/Low temperature chamber)	DS3, 4	When door closed: Closed
3	Refrigerator high temperature side temperature switch	TS11	When operating normally: Closed
4	Refrigerator low temperature side temperature switch	TS21	When operating normally: Closed
5	Refrigerator high temperature side pressure switch	PS11	When operating normally: Closed
6	Refrigerator low temperature side pressure switch	PS21	When operating normally: Closed
7	Condenser fan motor temperature switch	TS31, 32	When operating normally: Closed
8	Reverse phase detection (Reverse phase prevention relay)	PR1	When operating normally: Closed
9	Refrigerator high temperature side thermal relay	Th1	When operating normally: Closed
10	Refrigerator low temperature side thermal relay	Th2	When operating normally: Closed
11	Test area overheating	OHCP1-H	When operating normally: Closed
12	Test area overcooling	OHCP1-L	When operating normally: Closed
13	High temperature chamber door closed detection	DS3	When door closed: Closed
14	Low temperature chamber door closed detection	DS4	When door closed: Closed
15	High temperature chamber air circulator temperature switch	TS3	When operating normally: Closed
16	Low temperature chamber air circulator thermal relay	Th3	When operating normally: Closed

Cont.

Cont. from the previous page

DI No.	Input signal	Part symbol	Contact status
17	Drive inverter safety device	INV1	When operating normally: Closed
18	Test area detected in high temperature chamber	LS3	When test area in high temperature chamber: Closed
19	Safety lock unlocked detection	LS4	When unlocked: Closed
20	Cooling water suspension detection (Water suspension relay)	Not in use	When operating normally: Closed
21	Not in use		
22	Not in use		
23	Not in use		

Table 4.4 DO monitor

DO No.	Output signal	Part symbol	Contact status
0	Test area shifting to high temperature chamber	INV-STF	Test area shifting to high temperature chamber: Closed
1	Test area shifting to low temperature chamber	INV-STR	Test area shifting to low temperature chamber: Closed
2	Test area shift speed control	INV-RM	Low speed: Closed
3	Auxiliary cooling solenoid valve control (Option)	SV31	Auxiliary cooling control ON: Closed
4	Auto power shutoff	LB1-TBL	When power OFF signal output: Closed
5	Heater safety relay	MC1	When operating normally: Closed
6	Refrigerator high temperature side voltage-charging magnetic switch ON	MS1	Switch ON: Closed
7	Refrigerator low temperature side voltage-charging magnetic switch ON	MS2	Switch ON: Closed
8	Integrating hour meter	IT1	When integrating hour meter running: Closed
9	Temperature recorder power	TR1	When chamber running: Closed
10	High temperature chamber air supply damper closed	M6	When damper is closing: Closed
11	High temperature chamber air supply damper open	M6	When damper is opening: Closed
12	High temperature chamber air circulator output	M2	When air circulator is running: Closed
13	Low temperature chamber air circulator output	MS3	When air circulator is running: Closed
14	Buzzer (Defrost or test-end)	BZ1	Output control ON: Closed
15	Safety lock	SD1	When unlocked: Closed
16	Monitor point selection	SS1	When downstream sensor selected: Closed
17	External alarm (Option)		When trouble occurs: Closed
18	External output 1		Output control ON: Closed
19	External output 2		Output control ON: Closed
20	Door lock (for test area shifting)	SD2, 3	When locked: Closed
21	Test end signal		Output control ON: Closed
22	Total cycle counter (Option)	CC1	Counter ON: Closed
23	Temperature attainment		When temperature attained: Closed

Chapter 5 Parts Replacement

This chapter explains how to replace parts. It contains replacement procedures and part codes.

WARNING

-  **Be sure to turn OFF the breaker before replacing parts.**
-  **SHARP EDGES! Wear gloves when handling metal panels to prevent cutting hands on corners and edges.**

5.1 Electrical compartment (Chamber and Operating Panel)

(1) Main Power Switch (Leakage Breaker)

■ Preparations

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)
0217010100330000	Leakage breaker	NV-30CS(200V.30A.30mA.3P.TBL)

■ Replacement

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)

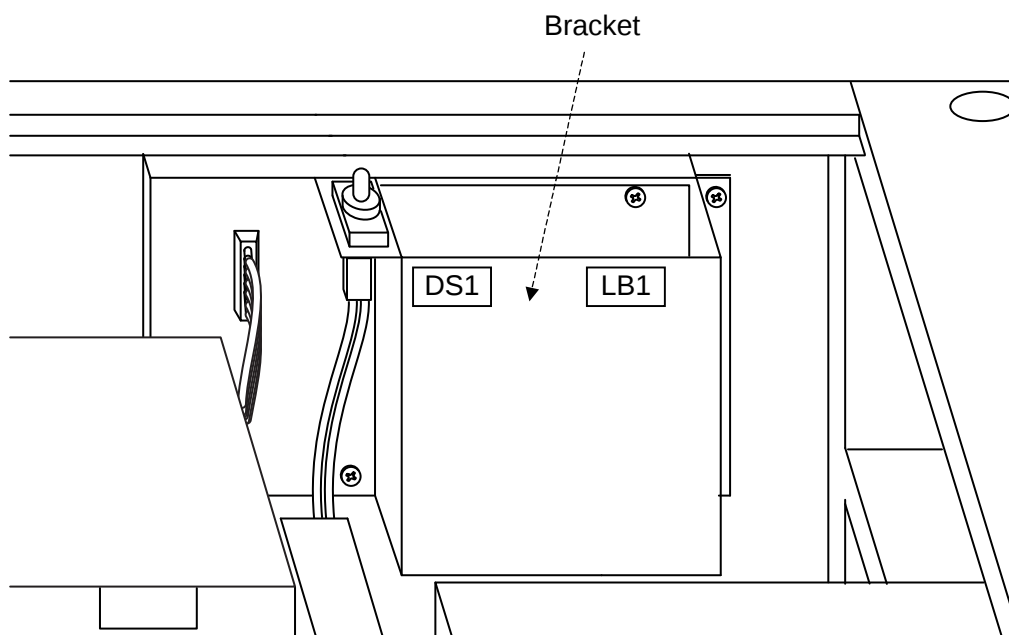


Fig. 5.1 Main power switch (Leakage breaker)

3. Detach the main power switch (LB1), bracket and all.
4. Detach the main power switch from the bracket.
5. Disconnect the wires from the main power switch. (Main circuit x 6, door switch [DS1] x 2)
6. Install a new main power switch in the opposite order in which the old one was detached.

(2) Display Unit (ROM) and Switch Board

■ Preparations

Required tools: 200 mm or longer Philips screwdriver

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)
0218058000324000	Display panel	PL-LCD-UNIT-TSE
0218050102610000	Touch panel	Customized touch panel screen for 6.5"
0217080116701000	Backing frame (Touch panel)	2170801167010
0218050100040000	Operating panel	PLK-LED
0219100200091000	SCP instrumentation key caps	2191002000910
0217080100070000	Switch film	NO.17600H726P3

■ Replacement

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. To gain better access to parts, detach the panel indicated in the below figure. (Loosen the screws inside the holes indicated with the arrows. It is not necessary to remove the screws.)
Also, detach the three screws that lock the panel to the electrical compartment frame.

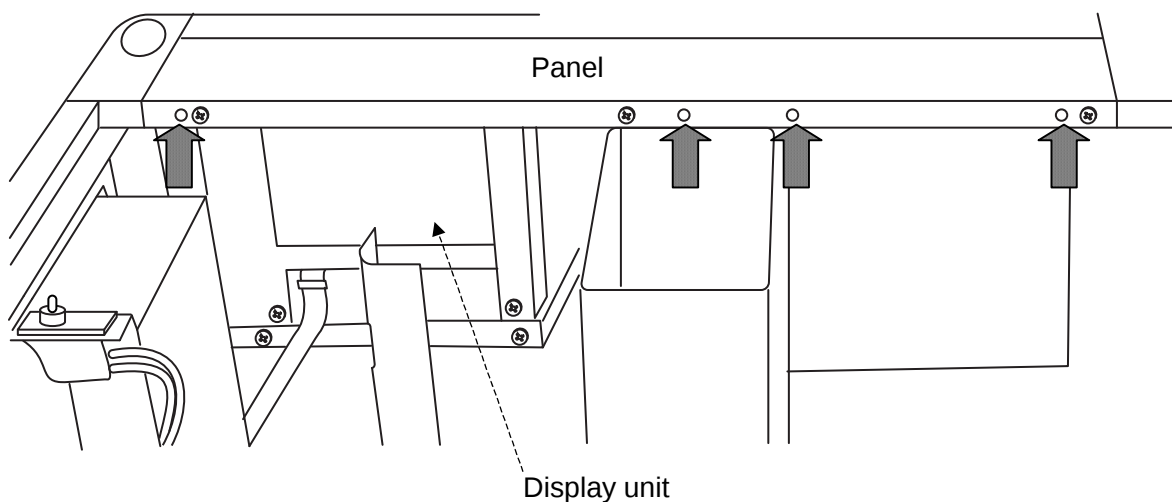


Fig. 5.2 Electrical compartment front end with panel open

4. Undo the latches to the display unit's backing frame and detach the frame.
5. If wanting to replace the display unit (ROM), replace both the font ROM (top) and control (ROM) (bottom). Once replaced, check the panel starts up correctly. It is not necessary to initialize the ROMs. (If something is wrong, a buzzer will sound.)

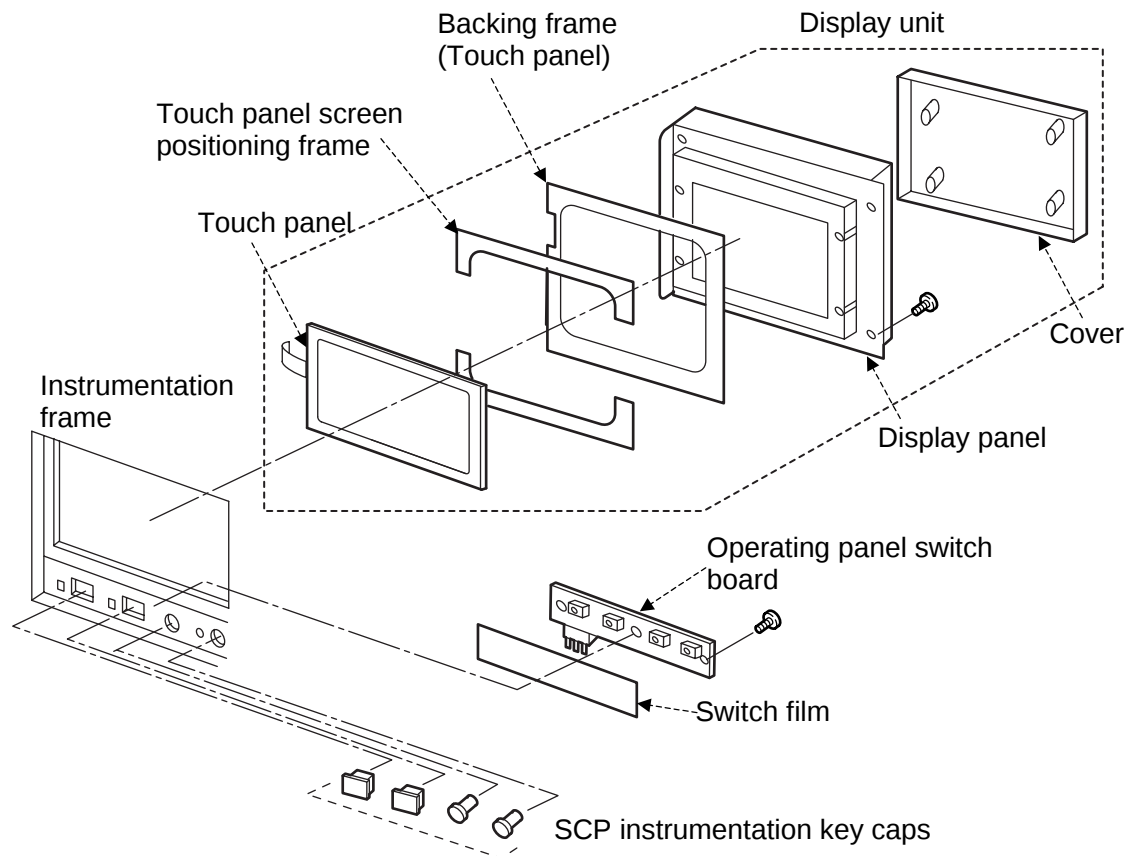


Fig. 5.3 Display unit

Replace the switch board as follows.

6. Disconnect the bottom three connectors from the display unit.
7. Remove the four M4 x 8 truss screws that lock down the display unit cover.
8. Remove the two screws at the bottom of the display unit that lock the display unit to the machine frame.
9. Remove the display unit from the rear.
10. Detach the switch board and install a new board.
11. Reassemble parts in the opposite order in which they were detached.

(3) Overheat Protector and Overcool Protector

■ Preparations

Required tools: 200 mm or longer Philips screwdriver

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)	Remarks
0218010107450000	Overheat and overcool protector board	ESP-F04 -99 to 299°C	Same assembly
0218010107440000	Overheat and overcool protector setter	ESP-C02	Same assembly
0218010106361000	Sensor select board	ESP-S02	Same assembly

■ Replacement

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. To gain better access to parts, detach the panel indicated in the below figure. (Loosen the screws inside the holes indicated with the arrows. It is not necessary to remove the screws.) Also, detach the three screws that lock the panel to the electrical compartment frame.

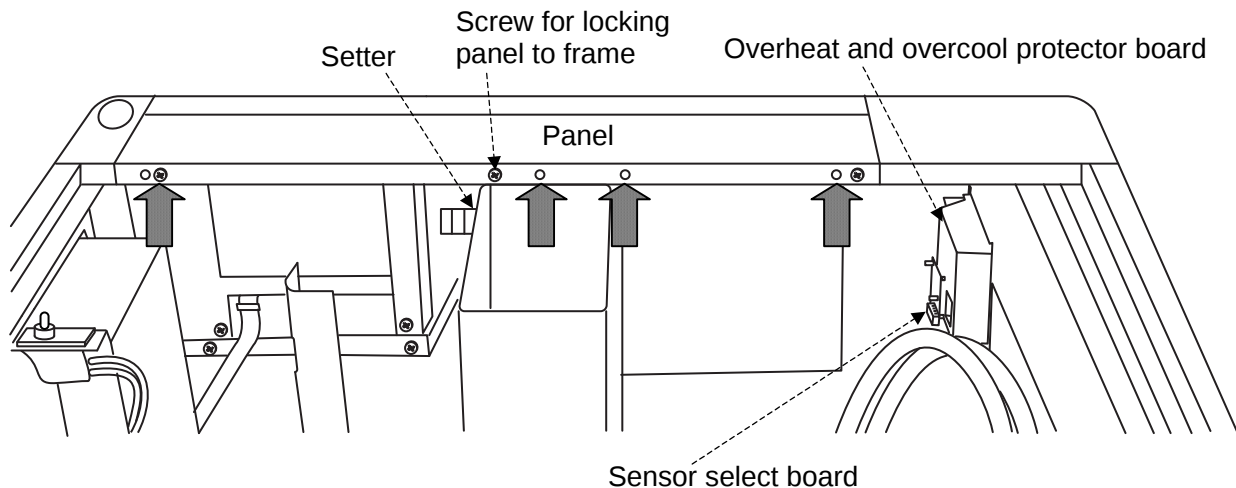


Fig. 5.4 Overheat and overcool protector parts

4. To replace the setter, disconnect wires to the overheat and overcool protector board and wire to a new setter.
5. To replace the overheat and overcool protector board. Disconnect connectors and wires from the setter.
6. Detach the overheat/overcool protector board.
7. Install the new board in the opposite order that the old one was detached.

(4) I/O Board

■ Preparations

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)
0218028000010000	I/O board 1	SCP-220-I/O(1)
0218028000021000	I/O board 2	SCP-220-I/O(2) 10 revised
0221010200880000	Connecting cable between I/O boards 1 and 2	2210102008800

■ Replacement

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. To gain better access to parts, detach the nearby wiring ducts.

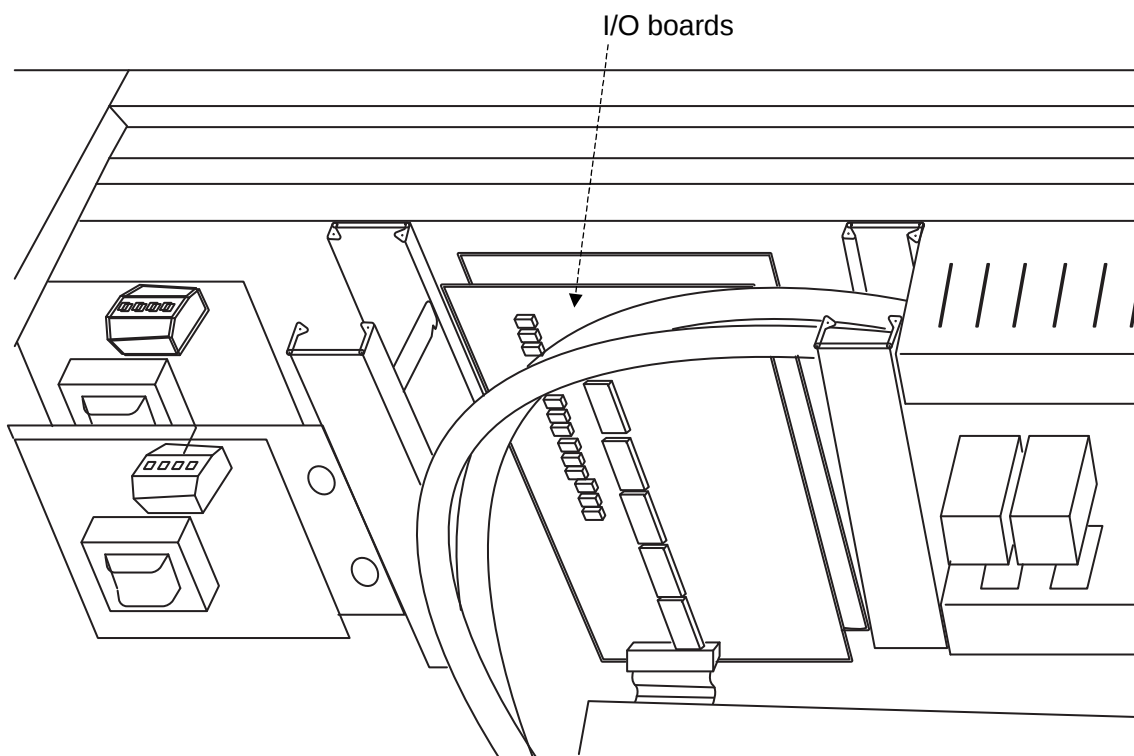


Fig. 5.5 I/O boards

4. The two boards are stacked on top of one another. The top board (that which you see) is the SCP-220-I/O(2), whereas the underlying board (that which is hidden) is the SCP-220-I/O(1).
5. Disconnect connectors and wires from the boards, and detach the boards.
6. Install new boards in the opposite order in which the old boards were detached.

(5) Temperature Controller (ROM and Battery)

■ Preparations

Adjustments required after replacement: See “6.1 Temperature Controller Initialization and Parameter Setup”.

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)
0218010100510000	Temperature controller unit (Platinous K)	PL-K (F-810185/U-810001)
	Battery	

■ Replacement

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. Disconnect wires from the E-BUS board.

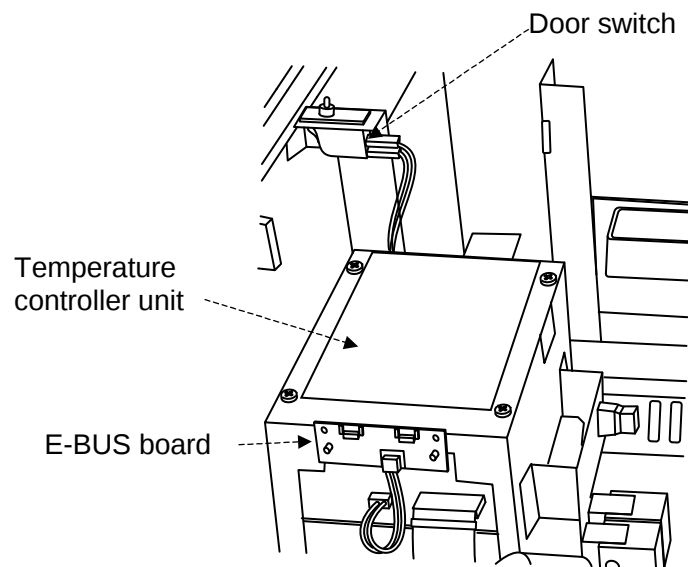


Fig. 5.6 Temperature controller unit as installed

4. Undo the latches that lock down the temperature controller unit cover and detach the cover.
5. Disconnect connectors and wires from the analog board.
6. Disconnect the connectors from the left and right side of the temperature controller unit, and detach the unit.
7. Install a new unit in the opposite order in which the old unit was detached.
8. To detach individual boards or components, slide the analog and CPU boards outward and disassemble as necessary.
9. To replace the ROM, slide the analog board outward enough to gain access to the ROM on the CPU board and replace it.

10. To replace the battery, detach the CPU board from the unit, break soldered bonds that anchor the battery to the board and solder a new battery to the board.

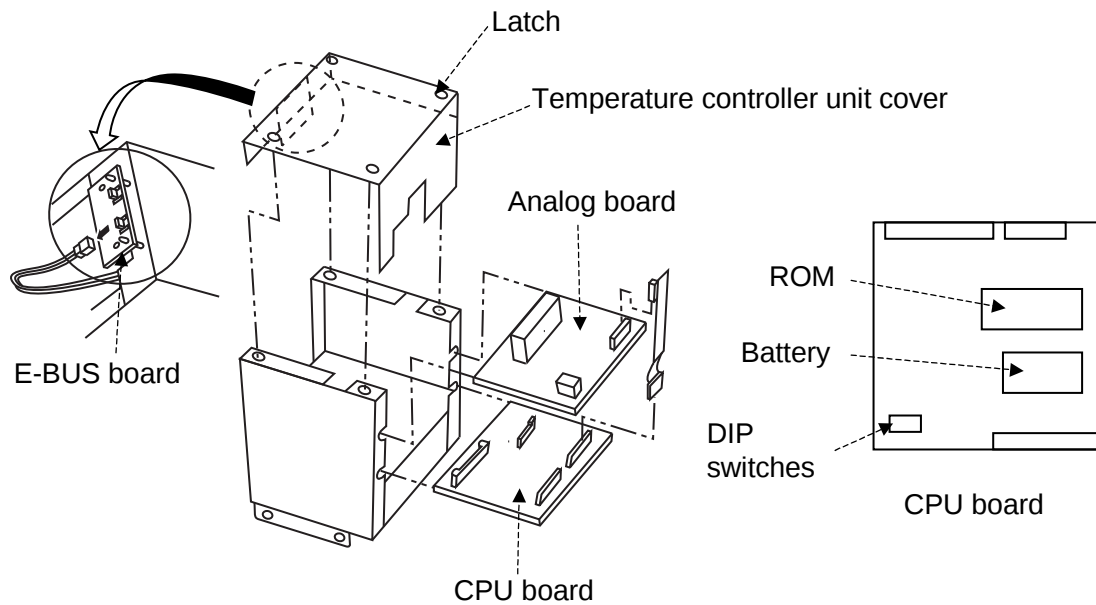


Fig. 5.7 Temperature controller unit parts

11. Reconnect wires as before and enable powering.
12. After replacing the temperature control unit, ROM or battery, initialize the unit and set parameters. See “6.1 Temperature Controller Initialization and Parameter Setup”.

(6) Electric Chassis Parts (Magnetic Switches, Relays, Solid State Relays, Cartridge Fuses, etc.)

■ Preparations

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)	Symbol
0217030100120000	Magnetic switch	MSO-N10(1.3A 200V AC)	MS3
0217030100170000	Magnetic switch	MSO-N10(9.0A 200V AC)	MS1, 2
0217030100260000	Contactor	S-N10(200V AC)	MC1
0217030100080000	Auxiliary contact unit	UN-AX2-1A1B	(MC1, MS1)
0217040100020000	Reverse phase prevention relay	RDR-S-1 (200V AC)	PR1
0217060100090000	Solid state relay	G3NE-220T-T 24V DC	SSR1
0217060101020000	Solid state contactor	G3PB-215B-2-VD	SSC1
0220020100010000	Switching power supply	LDA30F-24	SPS2
0216040100230000	Buzzer	EB2114	BZ1
0217040102280000	Relay	G2R-1-SD-24V DC	X5
0217040100290000	Relay (Built-in diode)	MY-2D(24V DC)	X1, 2, 3, 4
0217070100210000	Cartridge fuse	5.0A (FGAO Class A, 250 V)	F1
0217070100990000	Fuse holder	F-7111 1P	

■ Replacement

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. To gain better access to parts, detach nearby wiring ducts.
4. Locate parts on the below diagram and replace them. Switching power supply SPS2 is on the back side of the chassis. Also, magnetic switch MS3 is attached to the rear wall of the electrical compartment.

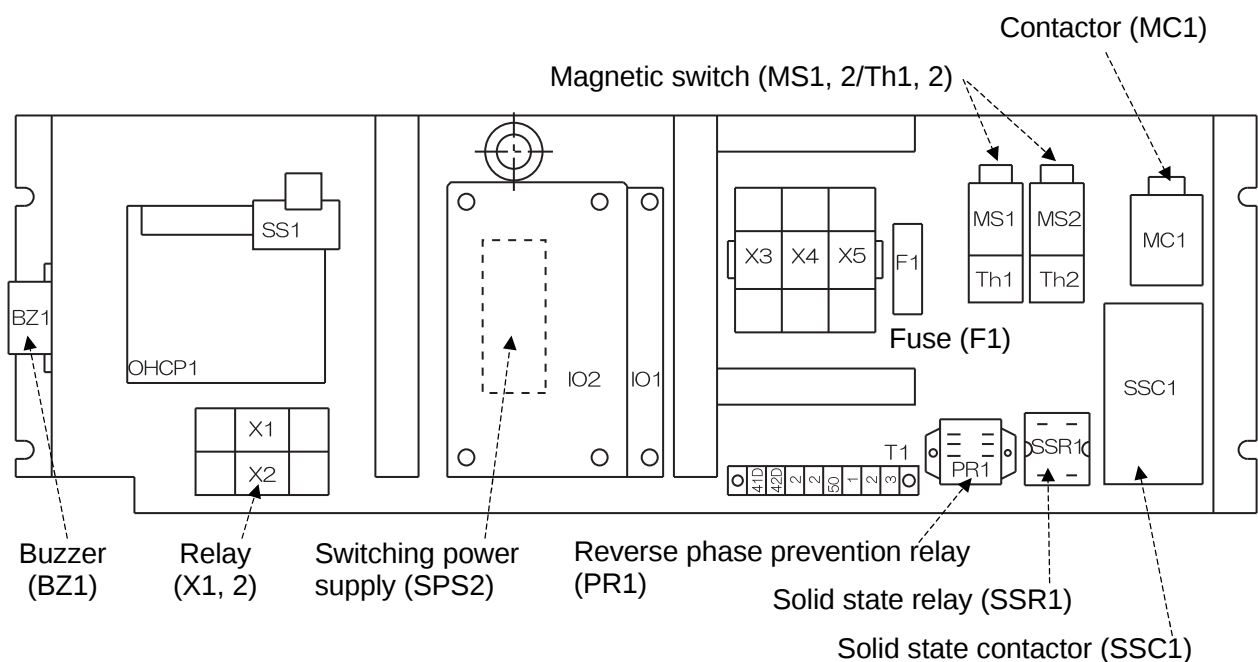


Fig. 5.8 Electric parts chassis

5. Check the thermal setting of the magnetic switch and set reset control to "AUTO".
6. Lock the auxiliary contact units MC1 and MS1 to magnetic switch MS1 and contactor MC1, respectively.
7. Coat solid state relay SSR1 with heat sink on the backside.

(7) Lift Motor

■ Preparations

Required tools: Hexagon socket screw keys (width across flat 1.5 mm)
(for operating dog)

Adjustments required after replacement: See “4.1 Structure”.

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)
0216010101900000	Linear motor	LD1030-244 (With limit switch)

■ Replacement

1. Shift the test area to the low temperature chamber.
2. Set the main power switch in the OFF position.
3. Detach the electrical compartment panel. (Loosen the two screws at the rear.)

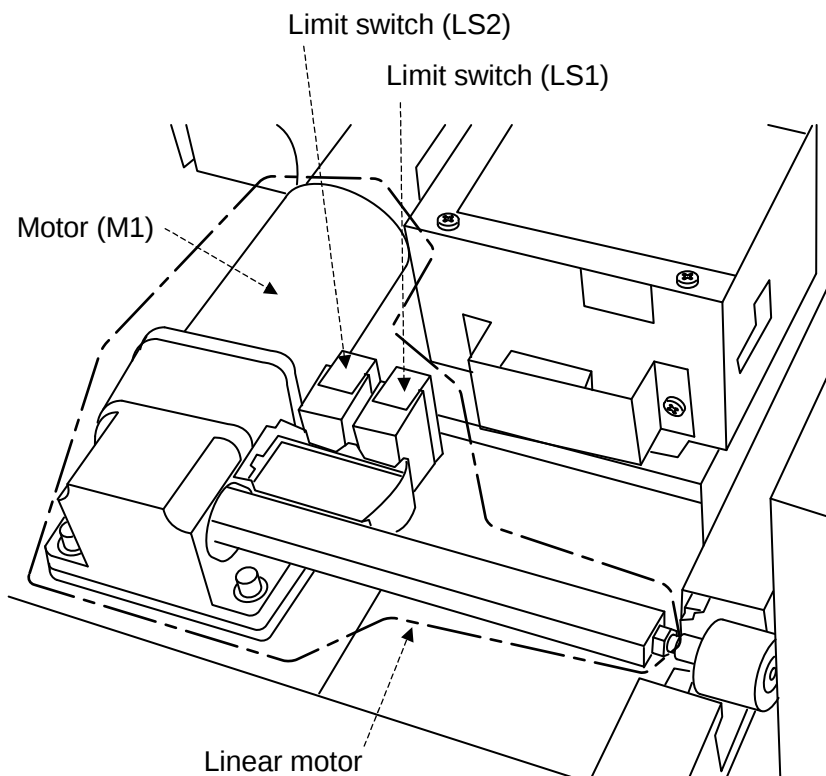


Fig. 5.9 Lift motor and nearby parts

4. Detach the coupling between the linear motor and mechanism.
(Loosen parts in the direction of the arrows with wrenches.)

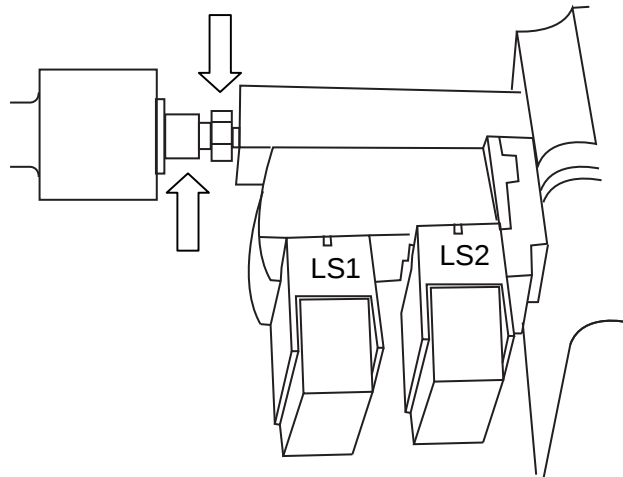


Fig. 5.10 Coupling between linear motor and mechanism

5. Disconnect wires and detach the linear motor.
6. Install and assemble a new linear motor.
7. Insert limit switches LS1 and LS2 completely to the rear and lock in place.
8. Lock down and wire the new linear motor in the opposite order in which the old was detached.
9. Reconnect the coupling between the linear motor and mechanism.
10. Shift the test area to the low temperature chamber and position the rack detecting dog as necessary. Do the same for the high temperature chamber and position detecting dog.

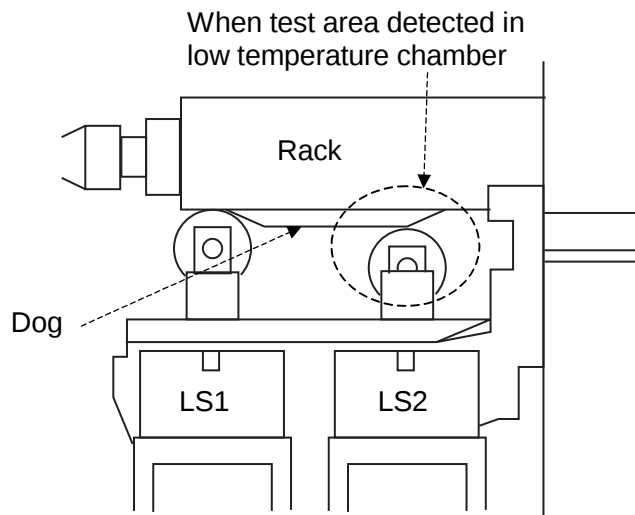


Fig. 5.11 Position detecting dog when test area in low temperature chamber

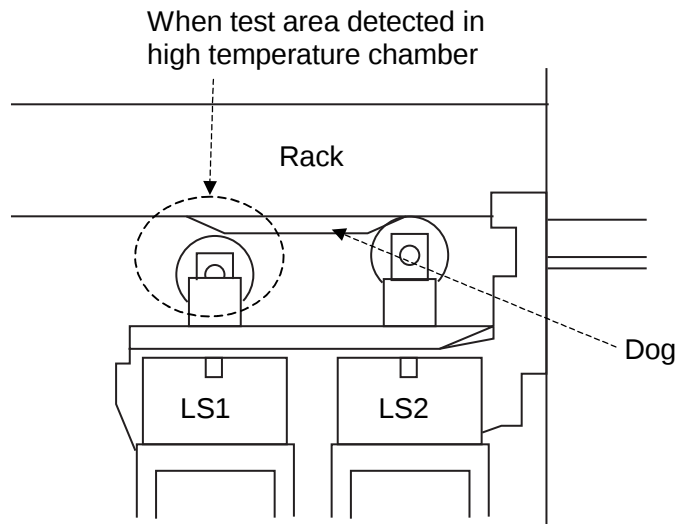
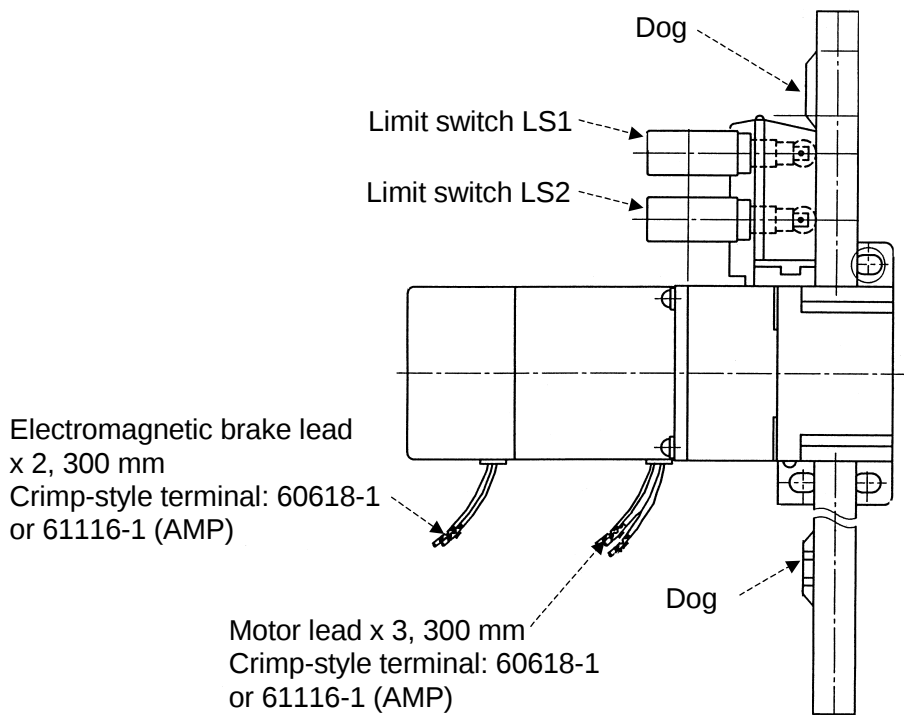
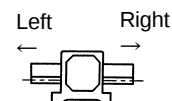
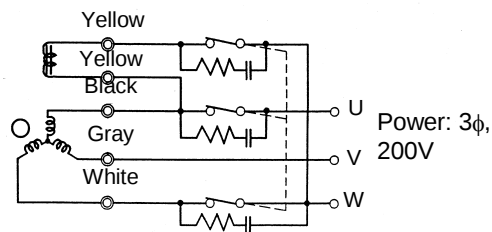


Fig. 5.12 Position detecting dog when test area in high temperature chamber



Connections



Rack direction of movement
Moves to right, but rewire any 2
of white, black and gray wires to
move to left.

Fig. 5.13 Wiring for linear motor

(8) Inverter

■ Preparations

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)	Remarks
0220040100790000	Inverter	ER-S520E-0.1K (200V AC 3 ϕ 0.1kW)	200/220V AC specification
0220040100301000	Inverter	ER-S520SE-0.1K (200V AC 1 ϕ 0.1kW)	Other than 200/220V AC specification

■ Replacement

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)

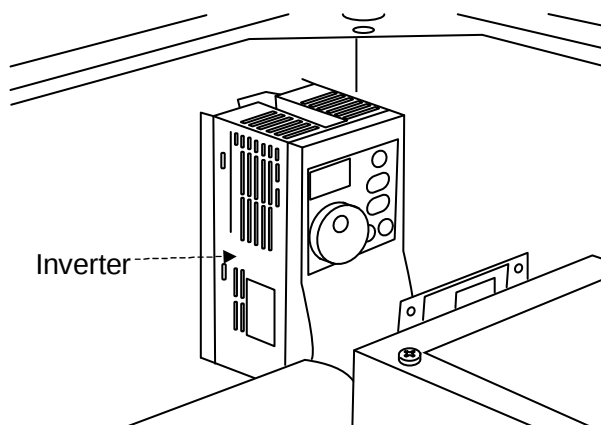


Fig. 5.14 Inverter

3. Pull the inverter's front and wiring covers forward and detach.
4. Remove the screws that lock down the inverter and detach the inverter.
5. Disconnect wires, wire to a new inverter and lock the new inverter in place.
6. Reattach the front and wiring covers.
7. Set inverter parameters. (P5: 40, P8: 0.1, P19: 200V [ER-S520SE only])

■ Inverter Setup

1. Set the main power switch in the ON position.
2. Set the below parameters from the inverter itself.
3. Check the inverter is in the PU mode. (The PU LED lamp is lit. If the PU LED lamp is not lit, press the PU/EXT key.)
4. Press the MODE key to display "P ##".
5. Turn the dial to display a parameter No.
6. Press the SET key to display the current setting, then turn the dial to the new setting and press the SET key.
7. Repeat steps 5 and 6 until setting necessary parameters.
8. Press the MODE key twice to return to the monitor display.

Table 5.1 Inverter parameters to change after inverter replacement

Parameter No.	Parameter	Setting
P 5	Speed (Medium)	40
P 8	Deceleration time	0.1
P 19 *	Base frequency voltage	200V

* P19 needs to be changed for the ER-S520S only.

(9) Solenoid and Limit Switch

■ Preparations

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)	Symbol
0205050102210000	Solenoid	LE-30-10-S (Built-in limit switch LS4)	SD1 (LS4)
0214050100040000	Limit switch (Micro switch)	ABS111450	LS3

■ Replacement

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. Locate parts on the below diagram and replace them.

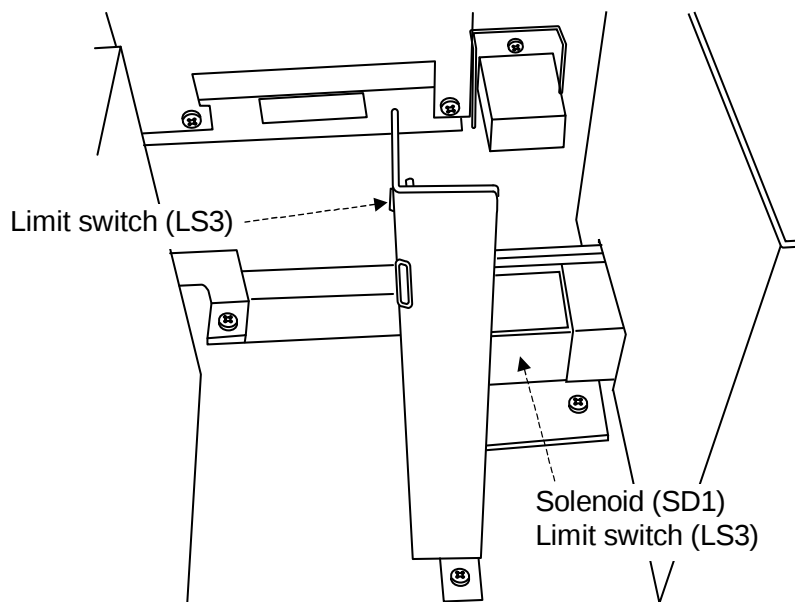


Fig. 5.15 Solenoid and limit switch

5.2 Door

(1) Door Lock Assemblies and Catches

■ Preparations

Adjustments required after replacement: See “4.1 Structure”.

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)	Remarks
0205050102160000	Top lock catch (High temperature chamber)	2050501021600	(29) in Fig. 5.17
0205050102170000	Bottom lock catch (Low temperature chamber)	2050501021700	(36) in Fig. 5.17
0205050102180000	Middle lock catch (High temperature chamber)	2050501021800	(31) in Fig. 5.17
0205050102190000	Middle lock catch (Low temperature chamber)	2050501021900	(33) in Fig. 5.17
0205050101111000	Lock assembly (Single set for top/bottom)	2050501011110	Set for top lock on high temperature chamber and bottom lock on low temperature chamber
0205050102150000	Middle lock assembly (Top/Bottom)	2050501021500	Set for bottom lock on high temperature chamber and top lock on low temperature chamber
0205020104140000	Shaft for high temperature chamber door	2050201041400	(16) in Fig. 5.17
0205020104130000	Shaft for low temperature chamber door	2050201041300	(37) in Fig. 5.17

■ Replacement

To identify parts in (), see Fig. 5.17 “Door lock and hinge assemblies”.

Top Lock Catch of High Temperature Chamber, Bottom Lock Catch of Low Temperature Chamber

1. Set the main power switch in the OFF position and open the high temperature chamber.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. Remove the two M5 hexagon head bolts (26) and detach the top lock catch of the high temperature chamber (29).
4. Remove the two M5 hexagon head bolts (26) and detach the bottom lock catch of the low temperature chamber (36). (This will require a 8 mm bite wrench.)
5. Install a new lock catch in the opposite order in which the old one was detached.

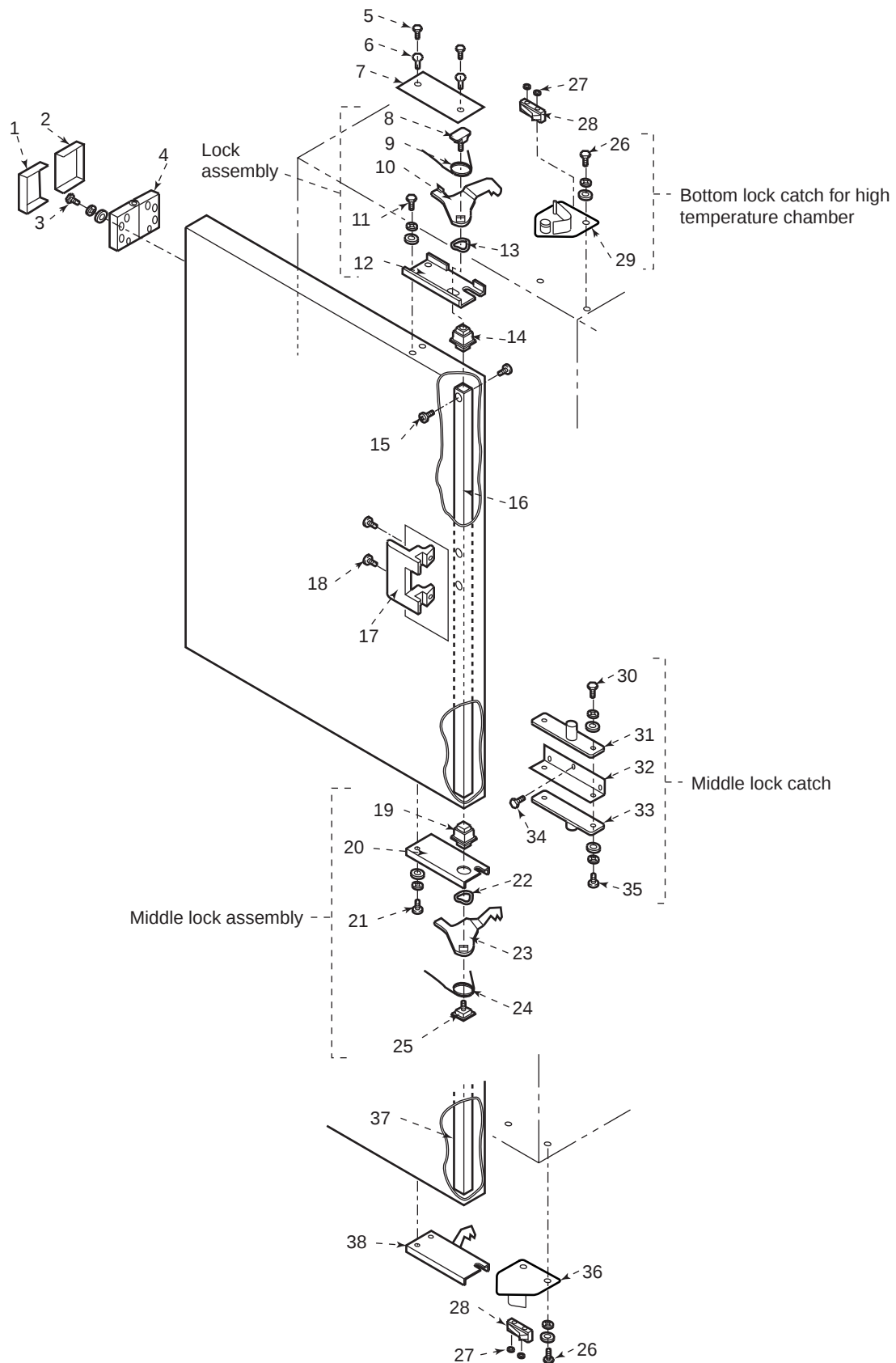
Middle Lock Catch of High Temperature Chamber/Low Temperature Chamber

1. Remove the bolt (30) that holds the middle lock catch assembly of the high temperature chamber together and detach the lock catch (31).
2. Similarly with the low temperature chamber, remove the fixing bolt (35) and detach the middle lock catch (33).
3. Install a new lock catch in the opposite order in which the old one was detached.

Lock Assembly (High/Low Temperature Chambers)

Replace the pawls and springs if the pawls are severely worn or the springs have lost their recoil.

1. Pull out the rivet (5) that locks the cover (7) to the top and bottom lock assemblies and detach the cover. (Hook the rivet with your fingernail and pull.)
2. Open the door and remove the two M5 hexagon socket head cap screws (18) that lock the shaft to the door handle. Hexagon socket screw keys (width across flat 4 mm)
3. Remove the three M4 bolts (11) that lock down the top lock assembly. 7 mm bite wrench
4. Remove the three M4 bolts (21) that lock down the middle lock assembly and pull the middle lock assembly straight downward and off the shaft. (If the middle lock assembly does not come readily off the shaft, pry the shaft [16] and shaft connecting rod bushing [19] apart with a slotted-head screwdriver.)
5. Raise the top lock assembly upward, remove the two M3 countersunk head screws (15) that lock down the shaft and detach the top lock assembly and shaft. (This will require a Philips screwdriver.)
6. Install new lock assemblies in the opposite order in which the old ones were detached.



5.16 Door lock and hinge assemblies

(2) Door Lock Solenoid

■ Preparations

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)
0205050101770000	Electromagnetic lock	LE-33-11

■ Replacement

1. Set the main power switch in the OFF position and open the high temperature chamber.
2. Pull out the rivet (1) that locks the cover (3) to the door's top lock solenoid and detach the cover. (Hook the rivet with your fingernail and pull.)
3. Remove the screw (7) that locks down the solenoid (4) and detach both the bracket (8) and solenoid.
4. Remove the screws (6 and 9) that lock solenoid to the bracket and detach the solenoid. Then, cut leads.
5. Install a new lock solenoid in the opposite order in which the old one was detached. Connect leads to the insulated closed-end connector.

Note Locate the insulated closed-end connector between the chamber insulation and the outer door panel to prevent it from getting hot. The connector is not enclosed in insulation.

6. Replace the solenoid of the door's bottom lock in the same way.

Note The same electromagnetic lock is used on the top and bottom of the high temperature chamber door, but their installation brackets differ. Be careful not to confuse which bracket is which if replacing both locks at the same time. When installed, the top end of the lock plunger should be flush with the top lock bracket, while the bottom end should protrude about 4 mm below the bottom lock bracket.

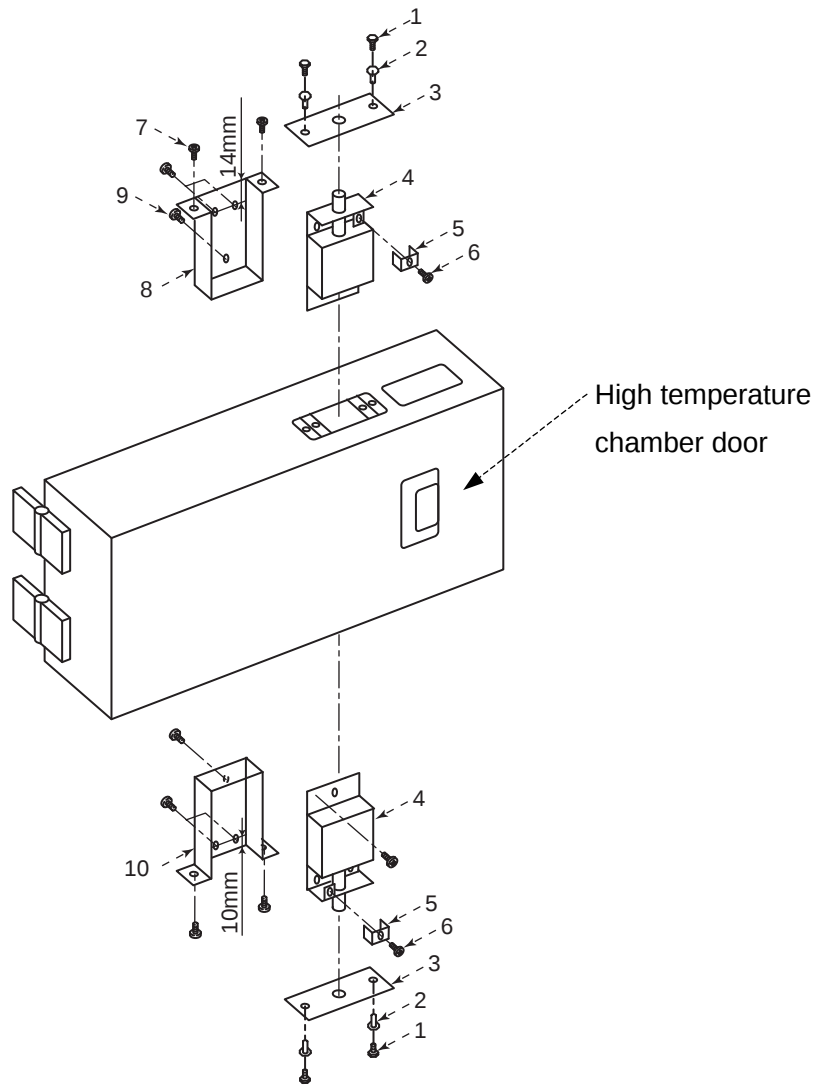


Fig. 5.17 Door lock solenoid

(3) High/Low Temperature Chamber Packing, Low Temperature Chamber Door Outer Packing and Insulation Box Bottom Sheet

■ Preparations

Required tools: Silicon sealant KE-45 (SHIN-ETSU) or similar

Adjustments required after replacement: See "4.1 Structure".

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)
0204130109060000	High temperature chamber packing	2041301090600 5AV A—15WHO Silicon
0204130109050000	Low temperature chamber packing	2041301090500 5DG A—15WHO Silicon
0204130111640000	Low temperature chamber door outer packing	2041301116400 FC-779-2-3 EPDM
0207110106870000	Insulation box bottom sheet	2071101068700 Unwoven sheet
0208110101800000	Silicone tube	2081101018000 1017-09 ($\phi 2 \times \phi 4$)

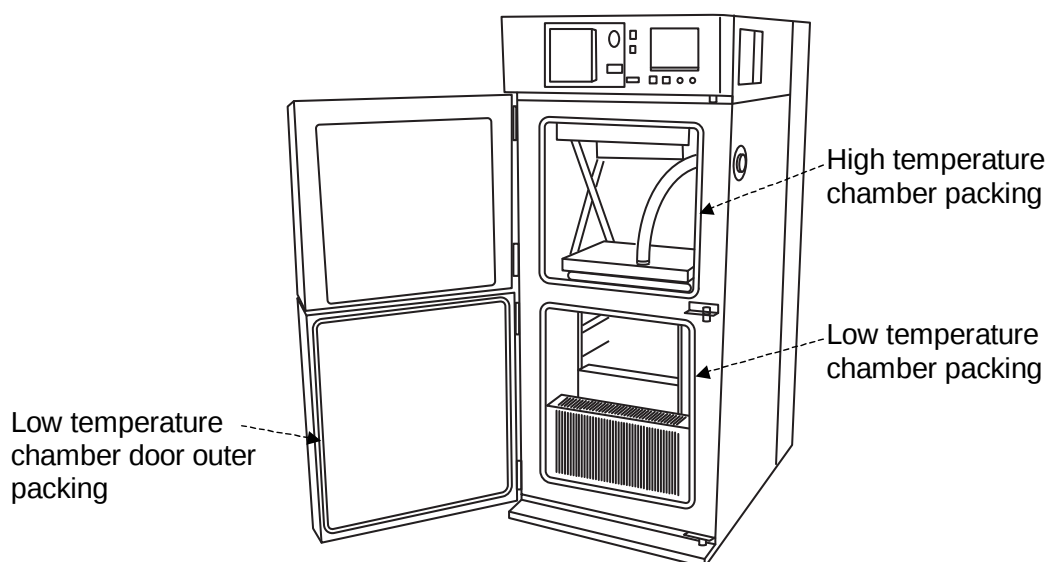


Fig. 5.18 Chamber packing

■ Replacement

High Temperature Chamber Packing

1. Set the main power switch in the OFF position and open the high temperature chamber door.
2. Remove the three screws that lock down the front partition and detach the partition.
3. Remove the screws that lock the packing retainer to the chamber frame and pull the packing out of the retainer.
4. Fit a new packing in the retainer, coat screws with sealant and reattach the retainer to the chamber frame.

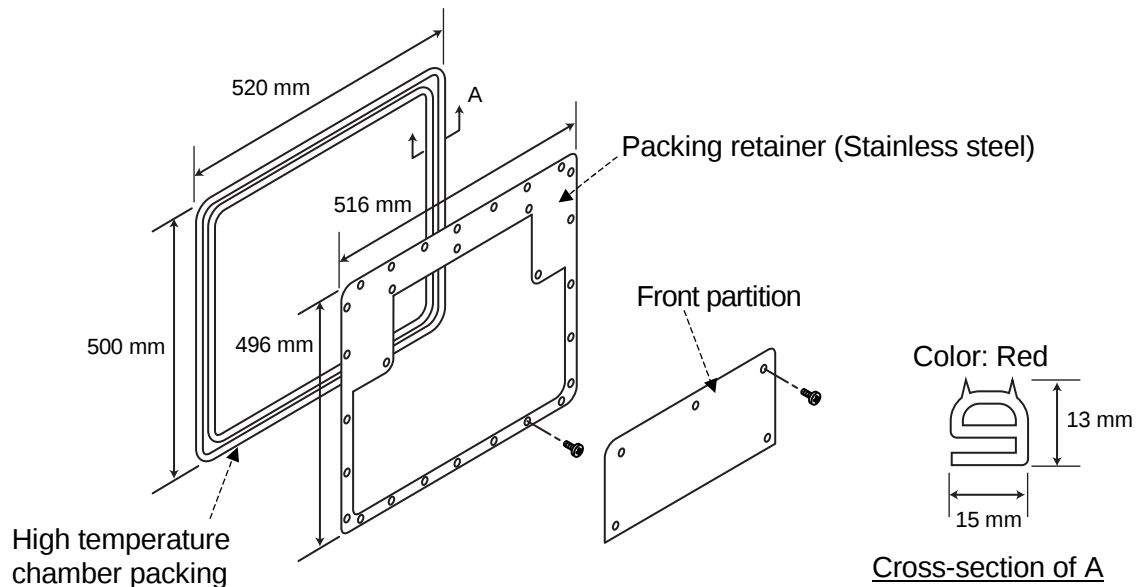


Fig. 5.19 High temperature chamber packing and related parts

Low Temperature Chamber Packing

1. Set the main power switch in the OFF position and open the low temperature chamber door.
2. Remove the screws that lock the packing retainer to the chamber frame and pull the packing out of the retainer.
3. Fit a new packing in the retainer, coat screws with sealant and reattach the retainer to the chamber frame.

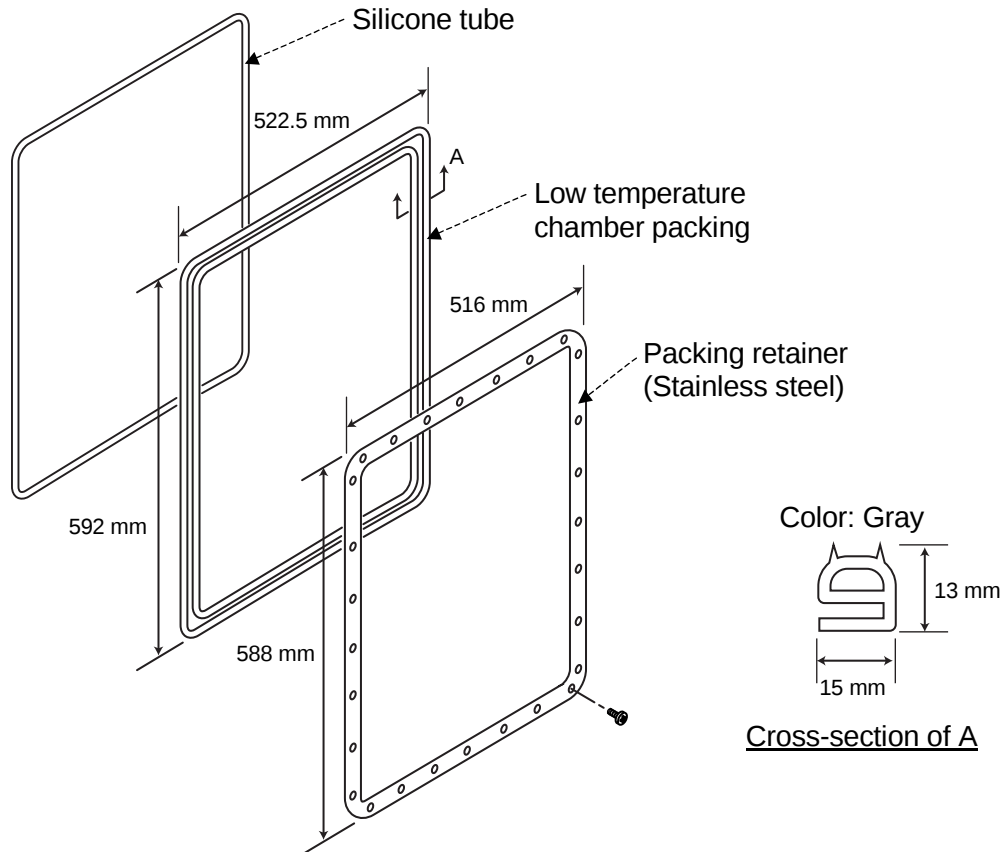


Fig. 5.20 Low temperature chamber packing and related parts

Low Temperature Chamber Door Outer Packing

1. Set the main power switch in the OFF position and open the low temperature chamber door.
2. Remove the packing.
3. Fit a new packing, cut off the extra at the hinge and have the two ends meet so as to close the gap.

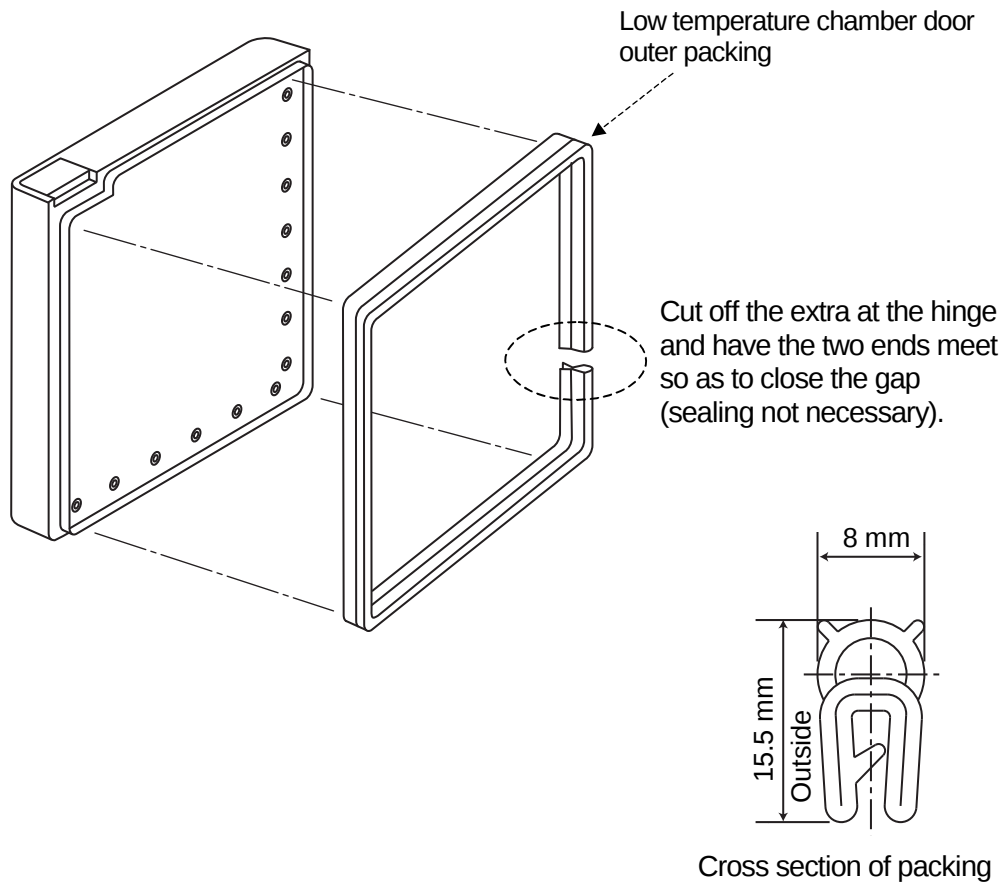


Fig. 5.21 Low temperature chamber door outer packing and related parts

5.3 Link Mechanism

(1) Link Mechanism

■ Preparations

Required tools: Wrench (width across flat 7*, 8, 13 mm), hexagon socket screw keys (for tightening/removing screws), M4 box-head driver, ratchet wrench for M4 and M5 bolts, snap-ring pliers (for C-ring attaching/detaching), heat-resistant tie-wraps x 5 (if cutting sensor and duct hoses to create work space)

Adjustments required after replacement: See “4.1 Structure”.

Part code: The link mechanism is replaced as a unit. Because parts can be updated, check part codes in advance.

(*Use less than 3.2mm thickness)

Part code	Part	Model (Specification)	Remarks
	Link mechanism		
0222990103650000	Tie-wrap	TYZ-25M (Blue)	Long: For wrapping wires to ducts
0222990101840000	Tie-wrap	TYZ-23M (Blue)	Short: For wrapping wires only

■ Replacement

To identify parts in (), see Fig. 5.27 “Link mechanism parts”.

[How to Detach]

Test Area Shift

1. Set the main power switch in the ON position.
2. Press the **POWER** key on the operating panel to activate power to the instrumentation.
3. Open both the high and low temperature chambers. Remove the screws to the front partition in the high temperature chamber and detach the partition.

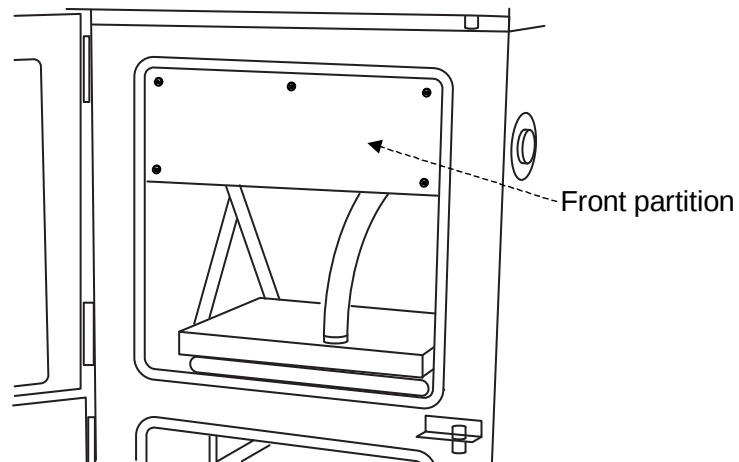
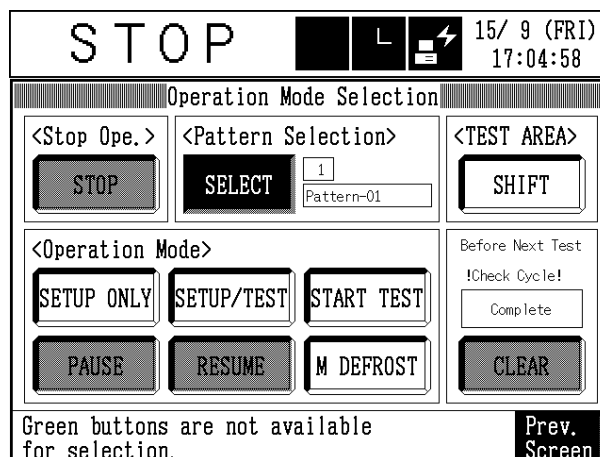


Fig. 5.22 High temperature chamber front partition

4. Check the test area is in the high temperature chamber. If it isn't, perform step 5 to shift it to the high temperature chamber.
5. Press the **OPER./STOP** key on the operating panel to get the Operation Mode Selection screen and press **SHIFT** under TEST AREA.



6. A message asking you to “Shift test area” will appear on the display. Press **Yes**.
7. Hold down the lever of both the high and low temperature chamber door switches in the detected position. In a few seconds, the operating status box in the upper left-hand corner of the display will change from “STOP” to “SHIFT”, and the test area will move to the high temperature chamber.
8. To detach the bottom end of the vertical rail, lower the test area from the high temperature chamber enough to work with a screwdriver. (Lower the test area about 5 cm.)

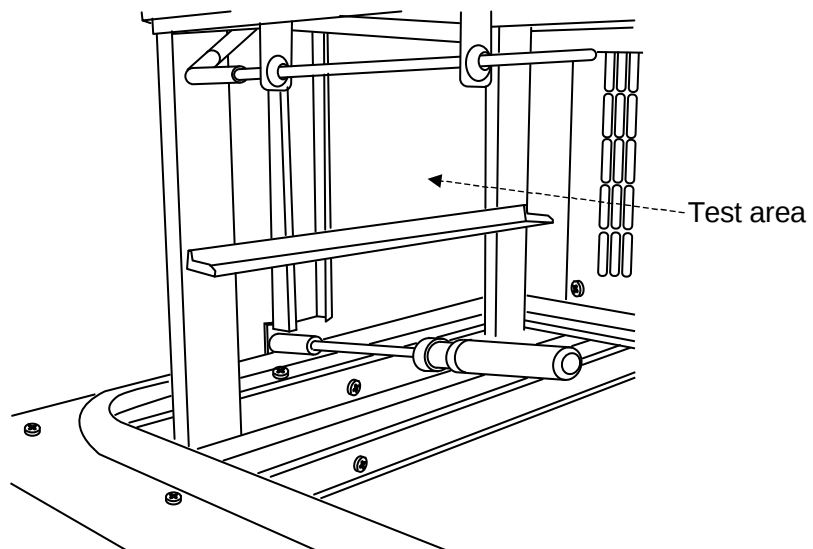


Fig. 5.23 Detaching bottom end of vertical rail

9. Remove the two M4 bolts (16) that lock down the bottom end of the vertical rail (15). Do the same with the vertical rail on the opposite side of the chamber.
10. Shift the test area to the low temperature chamber. The operating status box in the upper left-hand corner of the display will read “SHIFT”, therefore holding down the lever of both the high and low temperature chamber door switches in the detected position will allow the test area descend to the low temperature chamber.

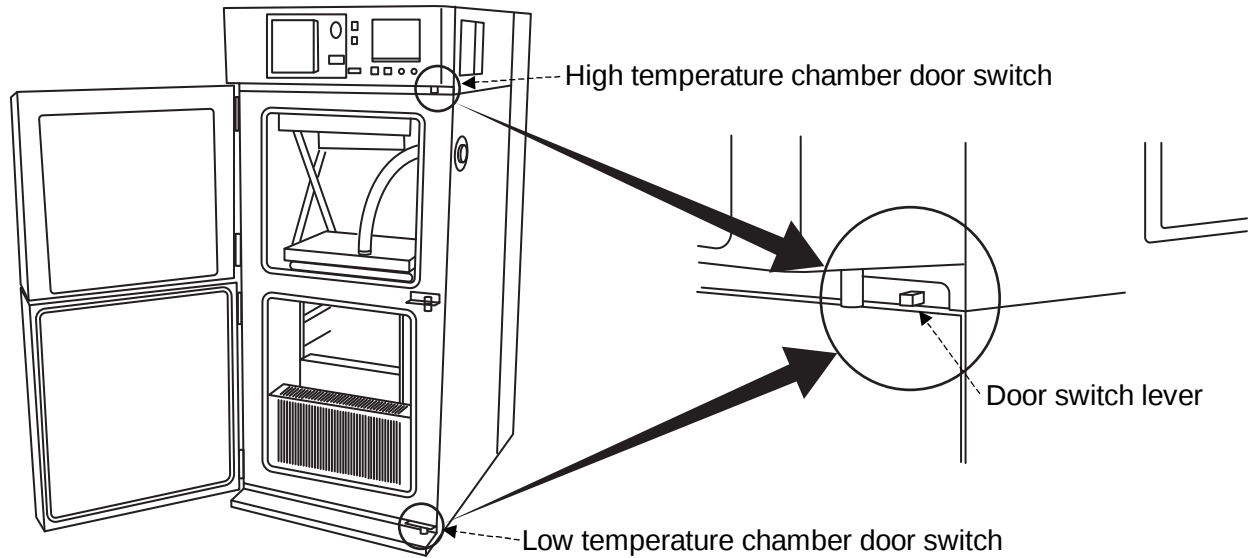


Fig. 5.24 Chamber door switches

11. Shift the test area slightly towards the high temperature chamber. (To make it easier to detach the linear motor coupling in the electrical compartment, it is smart to create some space on the high temperature chamber side.)

Linear Motor Coupling (Inside Electrical compartment)

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. Remove the four screws that lock down the drive arm housing (1).
4. Remove the three screws that lock down the bracket (4) of the safety lock solenoid (3).
5. Remove the locking screw (12) and C-ring (9) from the top of the link arm (13), in order to remove the pin (7) that locks the connecting shaft (6) from the linear motor to the link arm.
6. Press on the pin (7) from the C-ring (9) side and detach. If the pin is tightly held, it sometimes helps to have someone slightly raise the test area. If working by yourself, stuff a magazine or other stopping means between the test area packing (38) on the high temperature side and the test area support frame (37).

Link Mechanism

1. Loosen the stainless steel band (25) that locks the top end of the duct hose (24) in place and pull the duct hose out of the high temperature chamber through the flange on the right side. It is not necessary to undo the bottom end of the hose duct. If the tie-wrap (26) that bundles the sensor leads (42) to the duct hose (24) obstructs your working, cut it.

2. Remove the M8 loose-preventing nut (19) and washer (18) from the bottom right end of the outer strut (41) of the link mechanism. (The M8 loose-preventing nut need not be removed if it is not in your way of removing the M4 bolt [21] in the next step.)
3. Remove the four M4 bolts (21) and flat washers (20) located around the M8 loose-preventing nut (19) at the bottom front end of the right outer strut (41). Do the same with the other three struts on the front side.
4. Remove the four M5 bolts (35) that lock the horizontal rails (36) to the test area support frame (37).
5. Detach the center pivots (28) where the inner and outer struts intersect. (Remove the outer M8 loose-preventing nut [31] with a wrench (width across flat 13 mm), followed by the M5 countersunk head screw [27].)
6. Holding the bottom rear end, pull the right inner strut (40) to the front until freeing the roller (39) from the horizontal rail (36). Do the same with the other struts and pull the inner and outer struts (40, 41) out of the chamber.
7. With the test area in the low temperature chamber, remove the two M4 bolts (14) that lock down the top end of the vertical rail (15).
8. Pull the vertical rail (15) out of the chamber.
9. Detach the guide chip (33) that are locked to the right and left sides of the test area support frame (37). (Loosen M4nut(32) by wrench 7(less than 3.2mm thickness), take out guide chip (33) fixed to M4 truss head screw.)

[How to Install]

1. Lock new guide chip (33) to the test area support frame (37).
2. Detach the center pivots (28) from the intersection of the inner and outer struts of the replacement link mechanism (see below figure). (Remove the outer M8 loose-preventing nut [31] with a wrench (width across flat 13 mm), followed by the M5 countersunk head screw [27].)

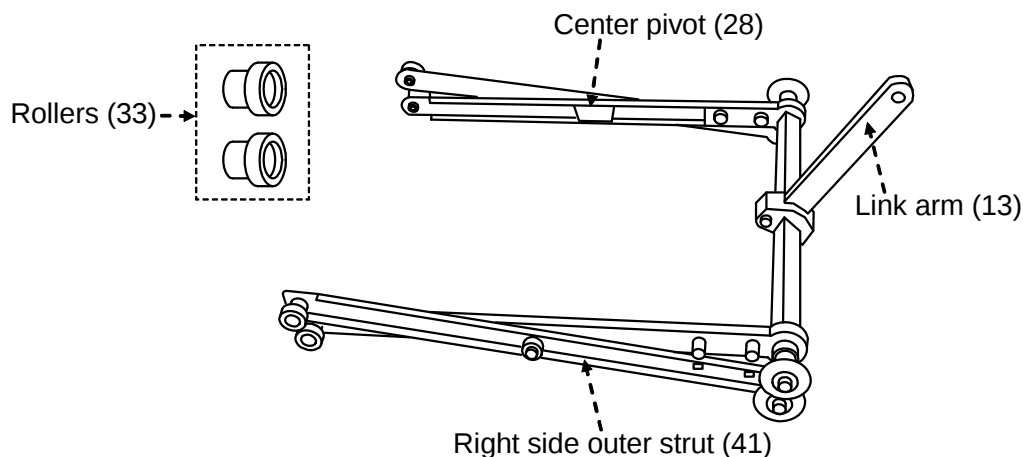


Fig. 5.25 Link mechanism

3. Insert the inner struts (40) of the link mechanism inside the high temperature chamber. Fit the rollers (39) inside the horizontal rails (36).
4. Insert the outer struts (41) of the link mechanism inside the high temperature chamber. Be careful that the sensor leads (42) are to the front of the drive rod (22) of the inner struts.
5. Fit the two center pivots that were detached in step 2 with each a center pivot (28), thrust washer (29, red), washer (30) and M8 loose-preventing nut (31).

Note The thrust washer (29, red) must fit between the inner and outer struts (40, 41).

6. Attach the four M4 bolts (21) and flat washers (20) around the M8 loose-preventing nut (19) at the bottom front end of the right outer strut (41). (This step is made easier if the M8 loose-preventing nut and washer are first removed.) Do the same with the other three struts on the front side.
The bushing (17) that is locked down by the M4 bolts (21) must fit the hole in a specific direction. The side with the wider hole pitch should be to the top. It should be to the bottom when attached to the top end of the left and right struts.
7. Fit the bottom end of the vertical rail (15) over the guide chip (33) of the test area support mechanism (37), and lock down the top end with the M4 bolt (14) from the outside. Move the test area by hand enough to reach the bottom end of the vertical rail with an M4 box-head driver, stop the test area and lock down the bottom end of the vertical rail. (It is OK to hold the test area up while installing the vertical rail.) Do the same with the vertical rail on the opposite side of the chamber.
Fit the top end of the duct hose (24) into the high temperature chamber through the right side flange and lock down with the stainless steel band (25). If you cut the tie-wrap (26) that bundled the sensor leads (42) to the duct hose when detaching the link mechanism, bundle the sensor leads to the duct hose again with a new tie-wrap.

Note Use a temperature resistant tie-wrap (26). Ordinary tie-wraps will melt.

8. Couple the connecting shaft (6) from the linear motor to the link arm (13). Fit the coupling with the pin (7), but, if tight and hard to insert, have someone hold the test area up enough that the pin smoothly fits the hole.
9. Attach the bracket (5) that locks the safety lock solenoid (3) to the drive arm housing (1).

[How to Check Functioning]

1. Shift the test area up and down, and check that it moves smoothly.
2. Check that elevator shaft packing on the high and low temperature chamber sides is 12 to 13 mm in height. This 12 to 13 mm height is for factory-adjusted new packing, therefore if packing is old, check contact with the test area as explained in step 4.
3. With the test area in the low temperature chamber, check that the test area does not move when pushed from underneath.
4. Set a sheet of thin paper of about 20 cm in length on the elevator shaft packing on the high temperature chamber side and try pulling it out with the test area in the low temperature chamber. It should not come out easily as the packing should be gripping it.
5. Make the same check with the elevator shaft packing on the low temperature chamber side.

For instructions on adjusting elevator shaft packing contact, see “Elevator Shaft Packing Contact Adjustment” in “4.1 Structure”.

Note Do not use spring lock washers. They will break at 200°C.
Use temperature resistant tie-wraps (23, 26). Ordinary tie-wraps will melt.

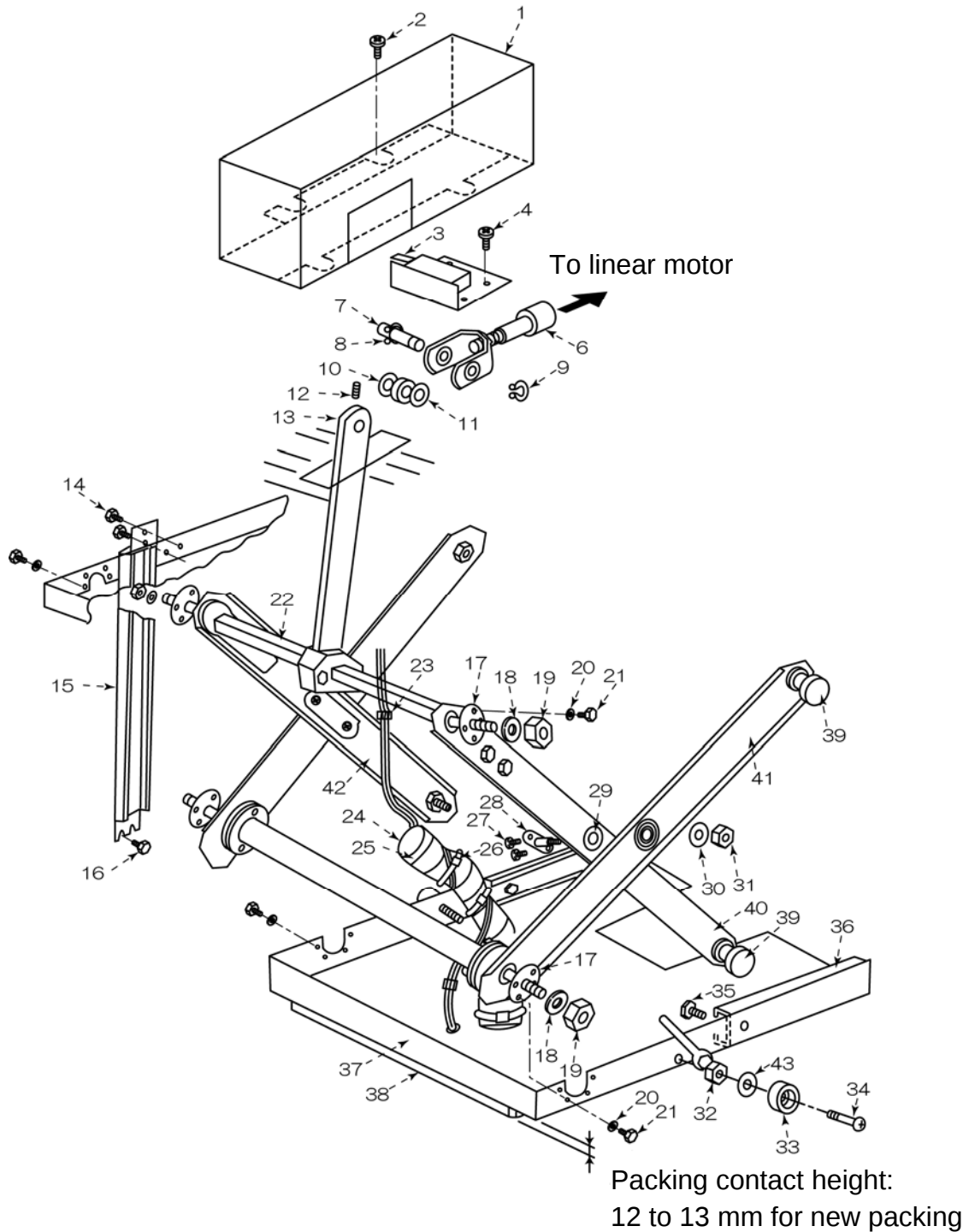


Fig. 5.26 Link mechanism parts

5.4 Internal Mechanism

(1) Heater (High/Low Temperature Chambers), Sirocco Fan and Temperature Switch (Low Temperature Chamber Only)

■ Preparations

Required tools: 200 mm or longer Philips screwdriver, box wrench (M12), special tool (width across flat 27 mm)

■ Replacement

1. To ensure enough space for replacing parts, shift the test area to the opposite side where planning to work.
2. Set the main power switch in the OFF position.
3. Open the high (low) temperature chamber.

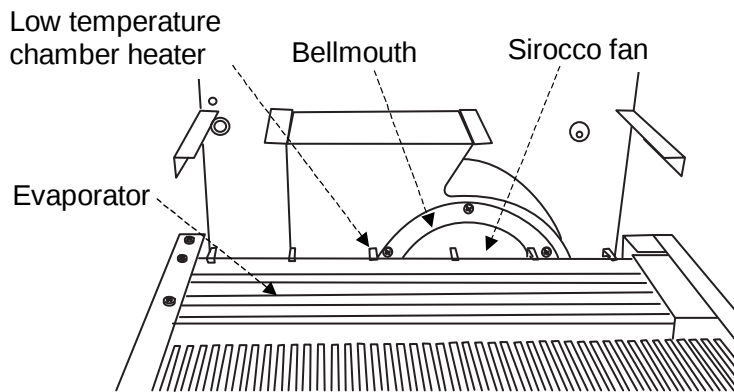


Fig. 5.27 Low temperature chamber heater

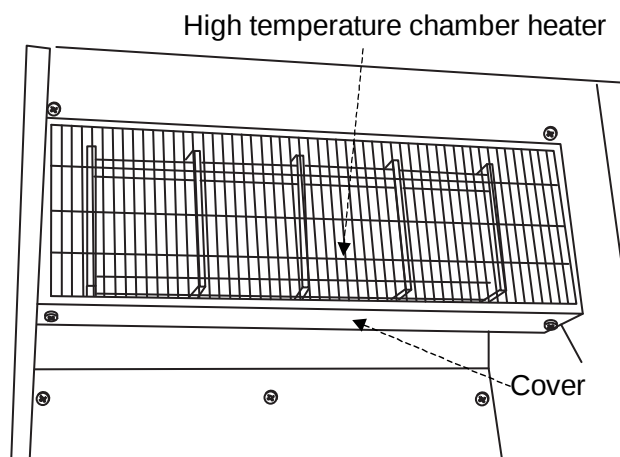


Fig. 5.28 High temperature chamber heater

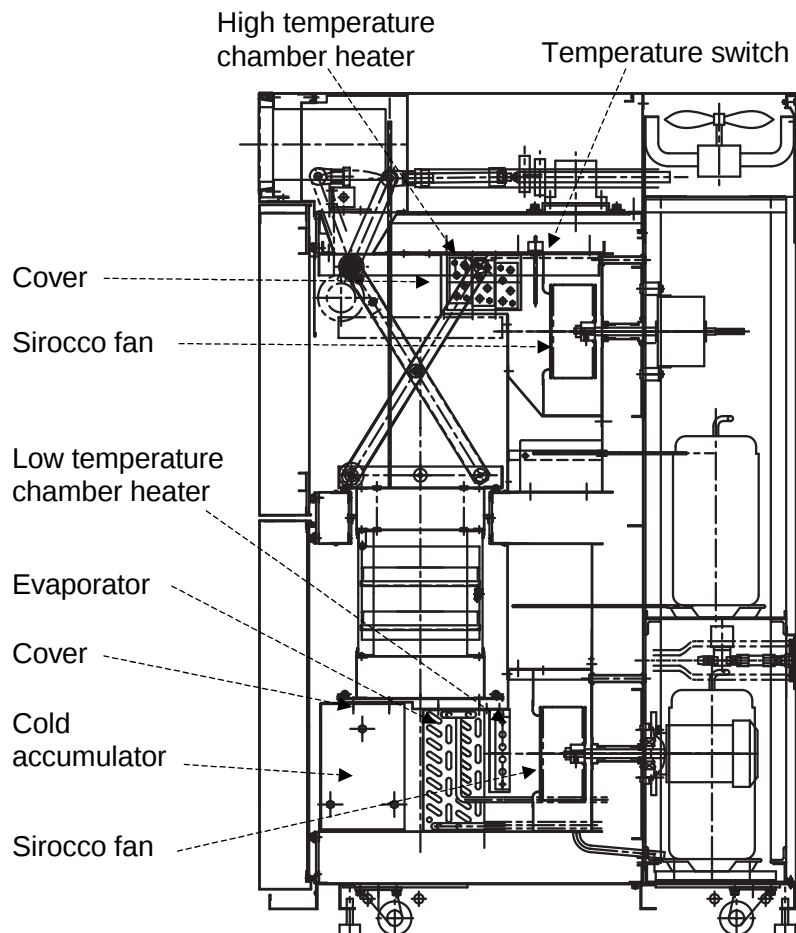


Fig. 5.29 Heaters, sirocco fans and temperature switch

4. Detach the heater cover.
5. Detach the heater and install a new one in the opposite order in which the old one was detached.
6. Feed leads through the rear wall and connect inside the mechanical parts compartment.
7. To detach the sirocco fan, first detach the heater and bellmouth.
8. The low temperature chamber temperature switch is locked to the low temperature chamber heater frame, therefore detach the heater to replace the switch.

(2) High Temperature Chamber Temperature Switch

■ Preparations

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)	Use
0214020100380000	Temperature switch	EX-3 ON+280°C OFF+260°C 100MM	For high temp. chamber

■ Replacement

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. To gain better access to parts, detach the nearby wiring ducts.
4. Detach the cover to the temperature switch from the electrical compartment.
5. Detach the temperature switch and install a new one in the opposite order in which the old was detached.

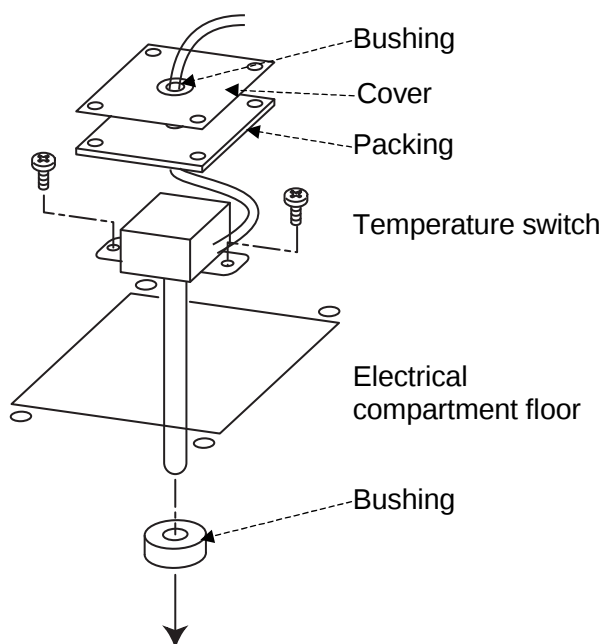


Fig. 5.30 High temperature chamber temperature switch

(3) Temperature Sensors

■ Preparations

Required tools: Heat-resistant tie-wraps x 5. See “5.1(3) Overheat Protector and Overcool Protector” and “5.1(5) Temperature Controller (ROM and Battery)” in “5.1 Electrical compartment”.

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)	Use
0214020105740000	Temperature sensor	2140201057400	For test area upstream/downstream
0214020101480000	Temperature sensor	TT-3-L-4-300-3X2	For high/low temperature chamber
0222990103650000	Tie-wrap	TYZ-25M (Blue)	Long: For wrapping wires to ducts
0222990101840000	Tie-wrap	TYZ-23M (Blue)	Short: For wrapping wires only

■ Replacement

1. To ensure enough space for replacing parts, shift the test area to the opposite side where planning to work. (To replace temperature sensors in the test area or high temperature chamber, shift test area to the low temperature chamber.)
2. Set the main power switch in the OFF position.
3. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
4. Disconnect the temperature sensor lead from the temperature controller (see “5.1[5] Temperature Controller [ROM and Battery]”) or overheat/overcool protector board (see “5.1[3] Overheat Protector and Overcool Protector”), whichever planning to replace.
5. Undo the tie-wraps up between the temperature sensor protective covering and temperature controller.

Note

Do not straighten the twisted duct.
The duct is installed inclining toward (twisted counterclockwise 90-degrees when the underside of the duct is inserted in the flange).

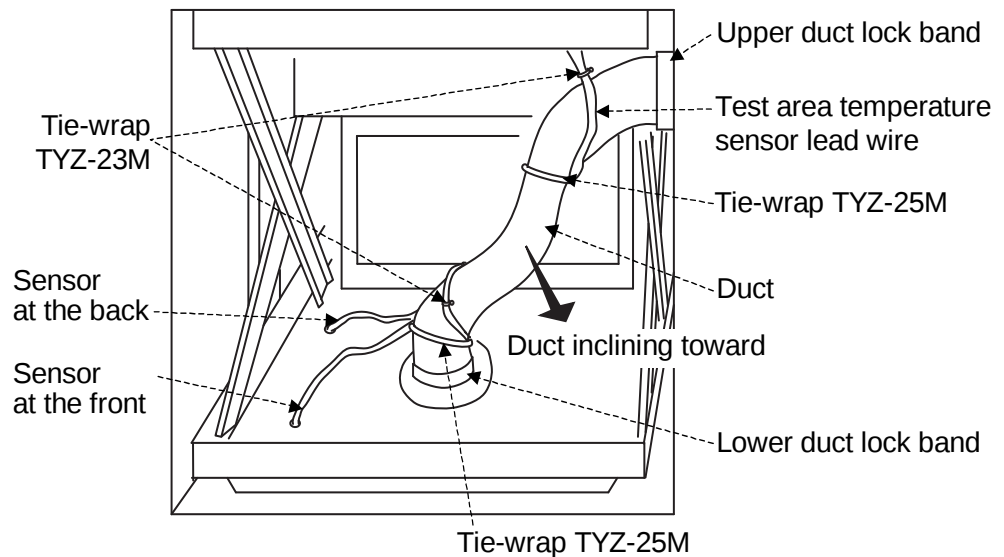


Fig. 5.31 Temperature sensor lead anchoring

6. Detach the temperature sensor.

The test area temperature sensors are locked to the test area rack by brackets, therefore detach the bracket to replace the sensors.

7. Connect a new sensor to the temperature controller, wind the lead around the duct twice as before and lock down with tie-wraps as shown in Fig. 5.32.

Note

Lock down the test area temperature sensor leads with the tie-wraps as shown in the above figure to prevent them from creeping up or down.

The leads can be severed or wrongly anchored. Follow the notes below.

■ Notes

Wiring of the temperature sensors

- ① Make sure that the temperature sensors do not pull the duct at the front and at the back.
- ② Keep the longer dimensional allowance of the temperature sensors at the back than at the front.
- ③ Check that the sensors does not pull the duct nor the duct is not inclined backward.

8. The high and low temperature chamber temperature sensors are inserted into their respective chambers from the mechanical parts compartment through the rear wall, therefore check that the bushing on the chamber side has not been dislodged.

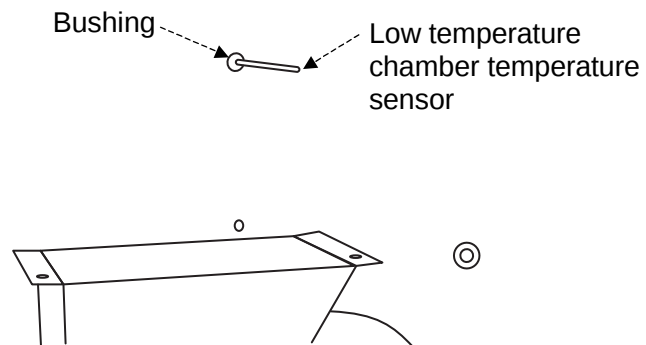


Fig. 5.32 Low temperature chamber temperature sensor

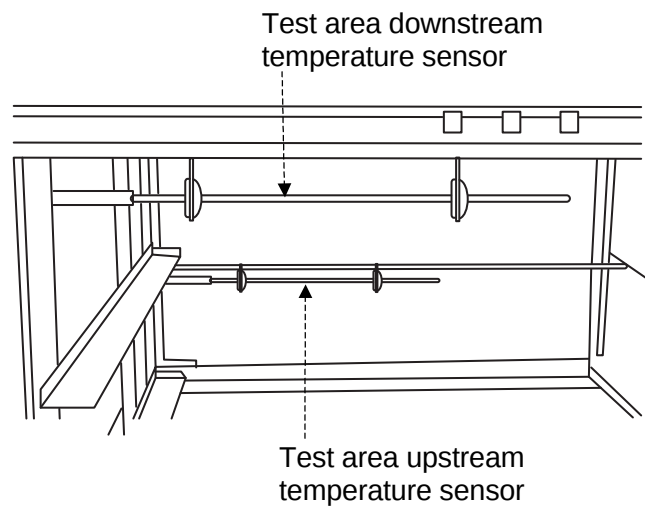


Fig. 5.33 Test area temperature sensors

(4) Elevator Shaft Packing

■ Preparations

Required tools: Silicon sealant KE-45 (SHIN-ETSU) or similar

Adjustments required after replacement: See “4.1 Structure”.

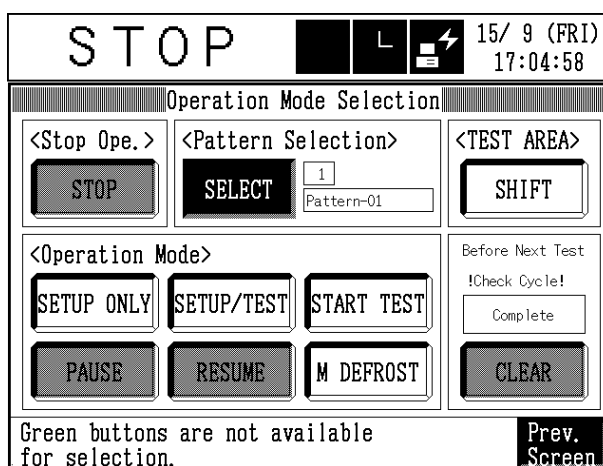
Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)	Remark
0204130109020000	Elevator shaft packing on high temperature chamber side	2041301090200	—
0204130109030000	Elevator shaft packing on low temperature chamber side	2041301090300	—
0204130109042000	L-packing	2041301090420	1.3 m

■ Replacement

To identify parts in (), see Fig. 5.37 “Elevator shaft and test area parts”.

1. Set the main power switch in the ON position.
2. Set the **POWER** key on the operating panel in the ON position.
3. Open the high and low temperature chambers and check the test area is in the low temperature chamber. If not, perform step 4 to shift it to the low temperature chamber.
4. Press the **OPER./STOP** key on the operating panel to get the Operation Mode Selection screen and press **SHIFT** under TEST AREA.



5. A message asking you to “Shift test area” will appear on the display. Press **Yes**.

6. Hold down the lever of both the high and low temperature chamber door switches in the detected position. In a few seconds, the operating status box in the upper left-hand corner of the display will change from "STOP" to "SHIFT", and the test area will move to the low temperature chamber.

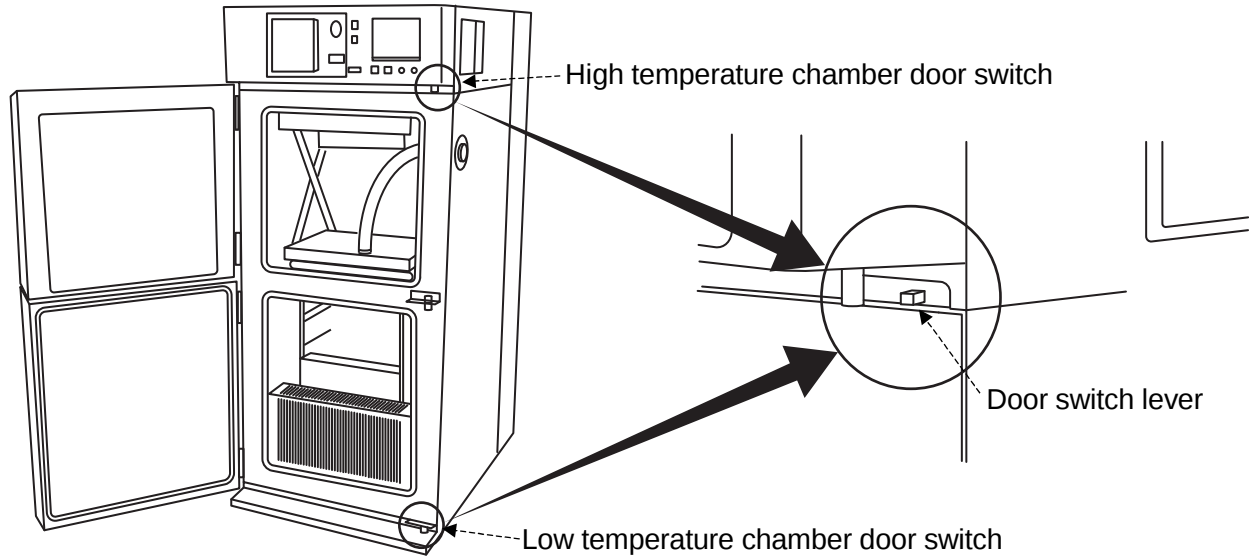


Fig. 5.34 Door switches

7. Remove the screw that locks down the temperature sensor bracket (15, 12[upstream]), detach the bracket and pull the temperature sensors (13, 16) out of the test area.
8. With the test area in the low temperature chamber, remove all the screws (10) from the test area ceiling.

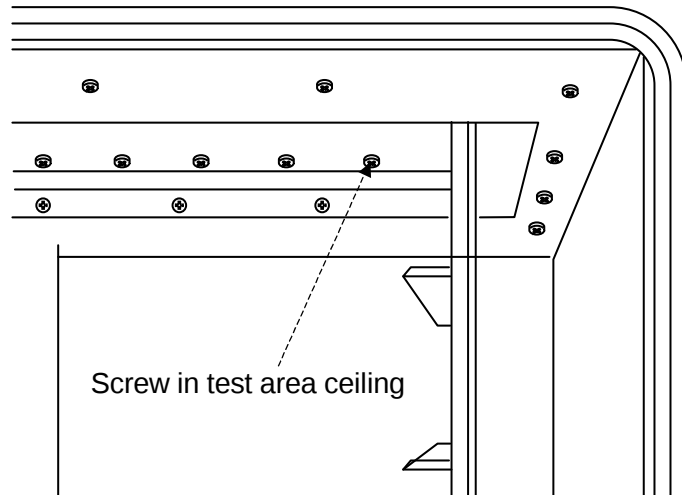


Fig. 5.35 Test area ceiling screws

9. Shift the test area to the high temperature chamber.
Actually, only the link mechanism moves, while the test area sits on the floor of the low temperature chamber. Shift the mechanism as explained in steps 4 to 6.
10. Lean the test area forward and pull it out of the chamber.

11. To detach the packing (1) on the high temperature chamber side, remove the screws (3) that lock down the packing and detach the packing retainer (2) and packing.
12. To detach the packing (7) on the low temperature chamber side and the insulation box bottom sheet (18), remove the screws (9) that lock down the packing. Detach the packing retainer (8), the packing (7) and sheet (18).
13. To detach the L-packing (4), remove the screws (6) that lock down the packing and detach the L-packing retainer (5) and L-packing.
14. Fit new packing in the opposite order that the old packing was detached.

Note

- Order a 1.3 m piece of L-packing and cut into two 270 mm and two 370 mm strips to install.
- Before reattaching the packing retainers (2, 8 and 5), coat screws (3, 9 and 6) with sealant.

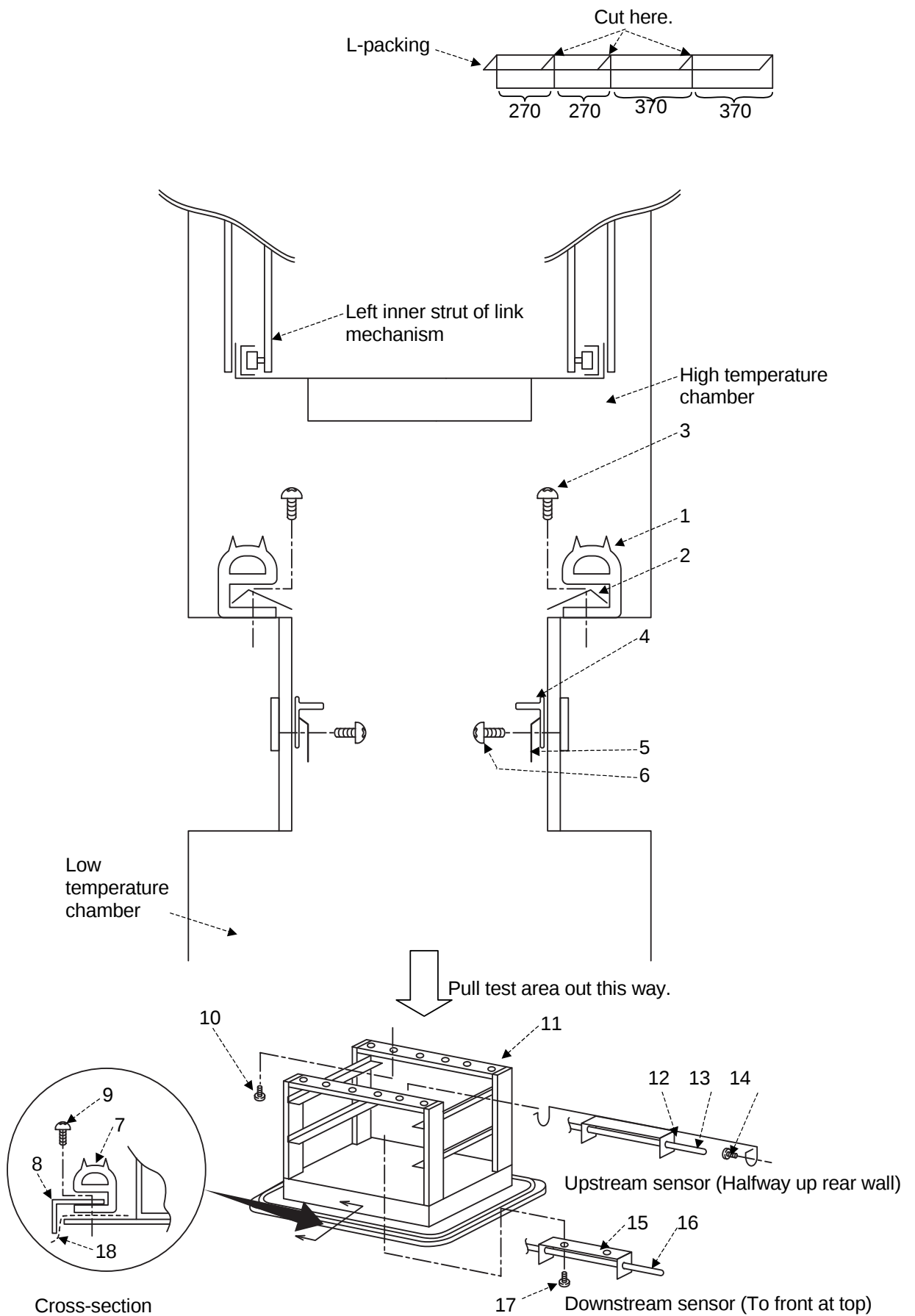


Fig. 5.36 Elevator shaft and test area parts

5.5 Mechanical Parts Compartment

(1) Refrigerator Unit, Condenser Fan and Evaporator

■ Preparations

Required tools: 200 mm or longer Philips screwdriver (For condenser fan replacement)

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Drawing No./Model (Specification)
0207050100231000	Rotary compressor	NDJ- 33T(1.5 kW)
0207090104000000	Air-cooled condenser	2070901040000
0206010103911000	Condenser fan	EF-25UTB05
0207090104015000	Evaporator	2070901040150
0207180100550000	Expansion valve	FWE-E534NW(0.5T)
0207180100120000	Injection expansion valve	JHC-5NTB-1
0207180101960000	Electronic expansion valve (Valve + Coil)	SKV-14D103 SKV-MOZT035B0
0207110102650000	Oil separator	#5582
0207110101370000	Brazed dryer	NO.KC-8458(3/8) For HFC 134A
0207190100310000	Check valve	NRV-12S (1/2, brazed)
0207190100980000	Check valve	NRV6S
0207110100011000	Pressure regulator	DPR-4003D(17KG/CM2)
0207100100411000	Relief tank	NO.TSAB-870P3A (For 3B TSA-40)
0204990100300000	Relief tank bracket	C-75
0207090102270000	Cascade condenser	CH2
0207140100011000	Solenoid valve (Solenoid +Coil) for HFC	NEV-603DXF(2.9MPa)+ NEV-MOAG560B1(200V AC)
0214040101680000	High pressure switch	HTB-23107
0214020101780000	Refrigerator temperature sensor	NO.17600H885P3B
0203010100010000	HFC alternative gas	R-404A
0203010100020000	HFC gas	R508A
0203010100030000	Propane gas	C3H8 PURE
0203030100050000	Refrigerator machine oil	NEO-15

■ Replacement**Refrigerator Unit**

1. Detach the rear panel. (Loosen the two screws at the rear.)
2. To gain better access to parts, detach the panels indicated in the below figure. This is not necessary. (Remove the screws and slide the panel up and off.)

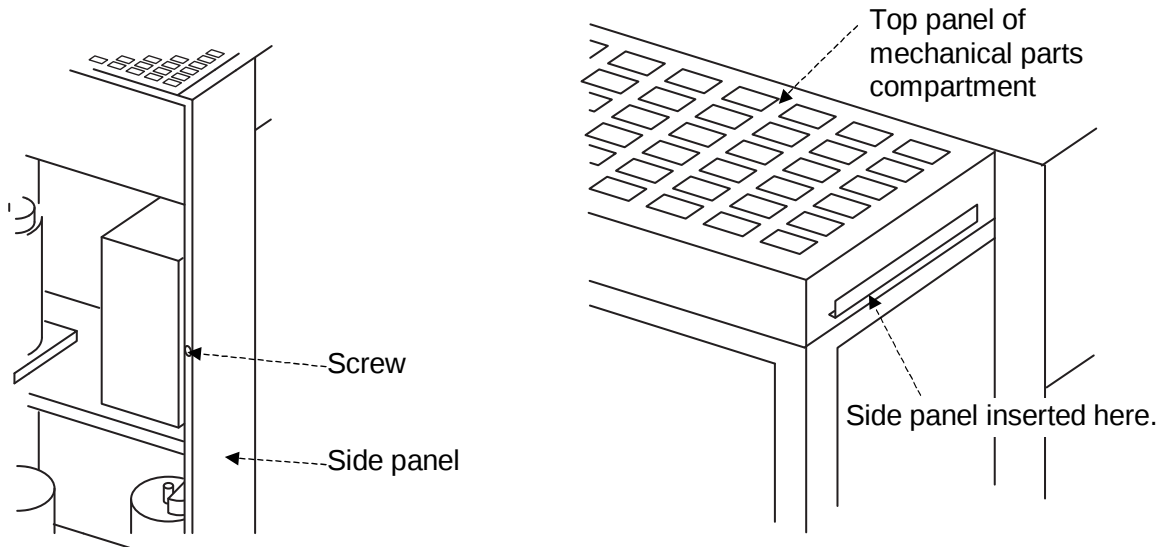


Fig. 5.37 Detaching side panel of mechanical parts compartment

3. Replace parts as necessary.

Condenser Fan (Visible at Top Rear)

1. Detach the top panel of the mechanical parts compartment. (Loosen the screws on the electrical compartment side, raise the top panel slightly and detach.)

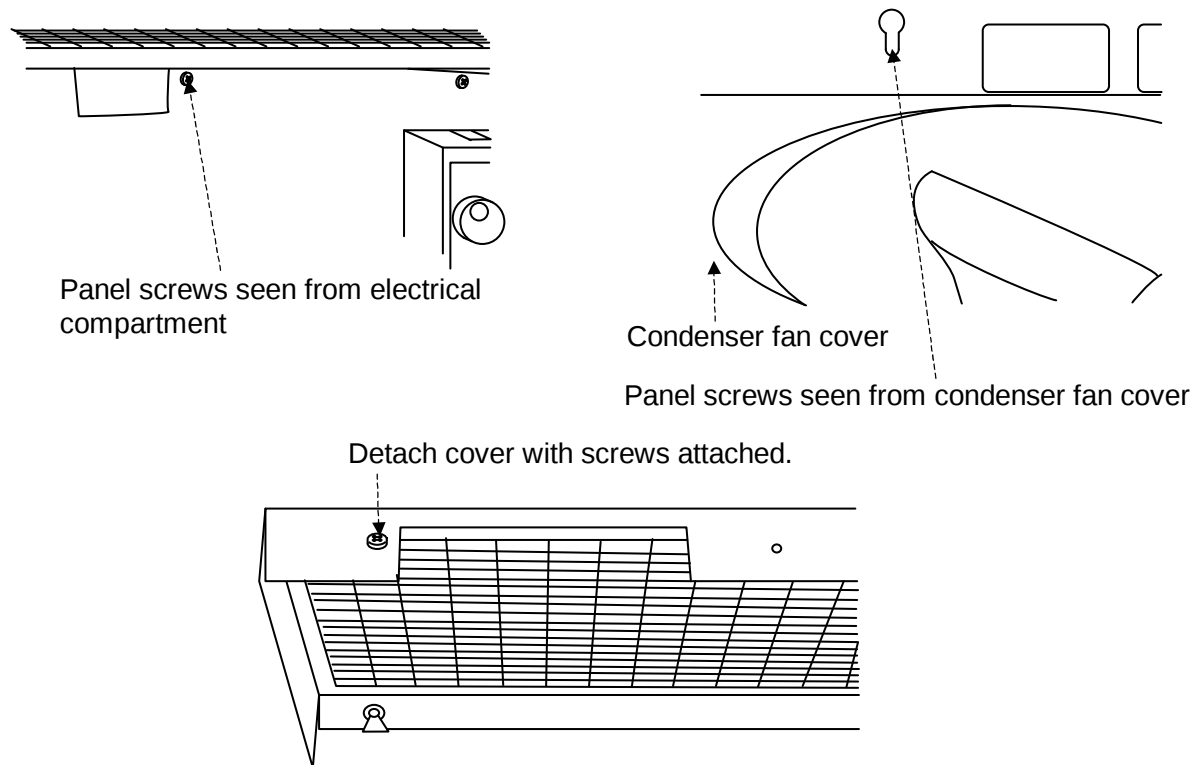


Fig. 5.38 Detaching top panel of mechanical parts compartment

2. Detach the condenser fan cover followed by the condenser fan.
3. Install a new fan in the opposite order in which the old one was detached.

Evaporator

1. Detach the low temperature chamber floor.
2. Detach the cold accumulator.
3. Detach the evaporator.

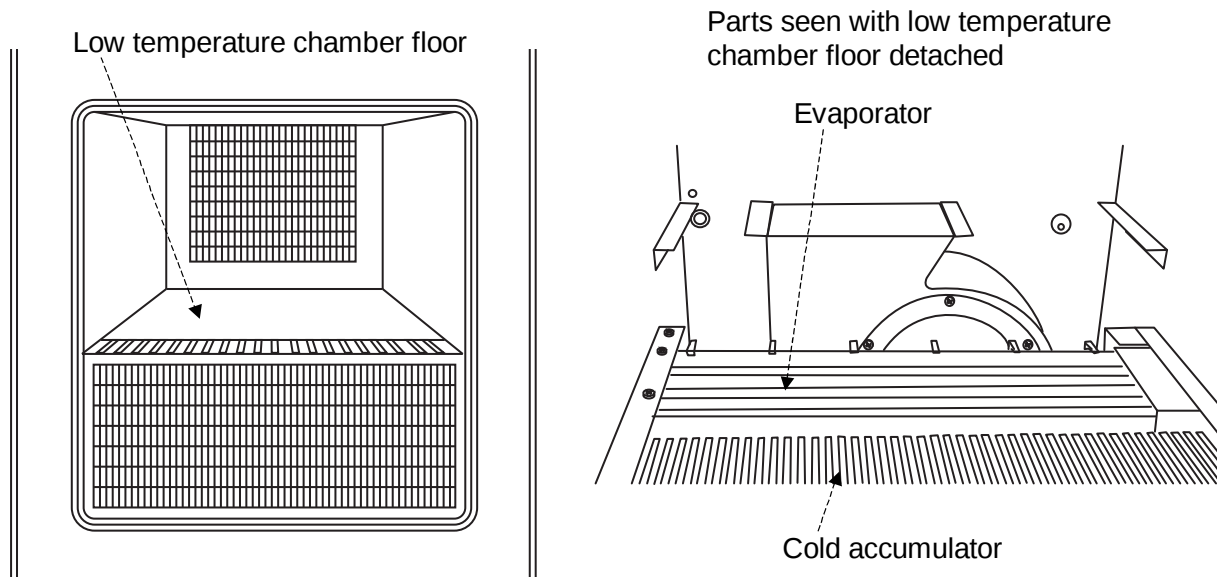


Fig. 5.39 Low temperature chamber without and with floor detached

(2) High/Low Temperature Chamber Air Circulator Motor

■ Preparations

The sirocco fans of the high and low temperature chambers must be detached first. See 5.4(1).

■ Replacement

High/Low Temperature Chamber Air Circulator Motors

The sirocco fans of the high and low temperature chambers must be detached first. See 5.4 (1).

1. Detach the rear panel. (Loosen the two screws at the rear.)
2. Remove the bolts that lock down the air circulator motor.

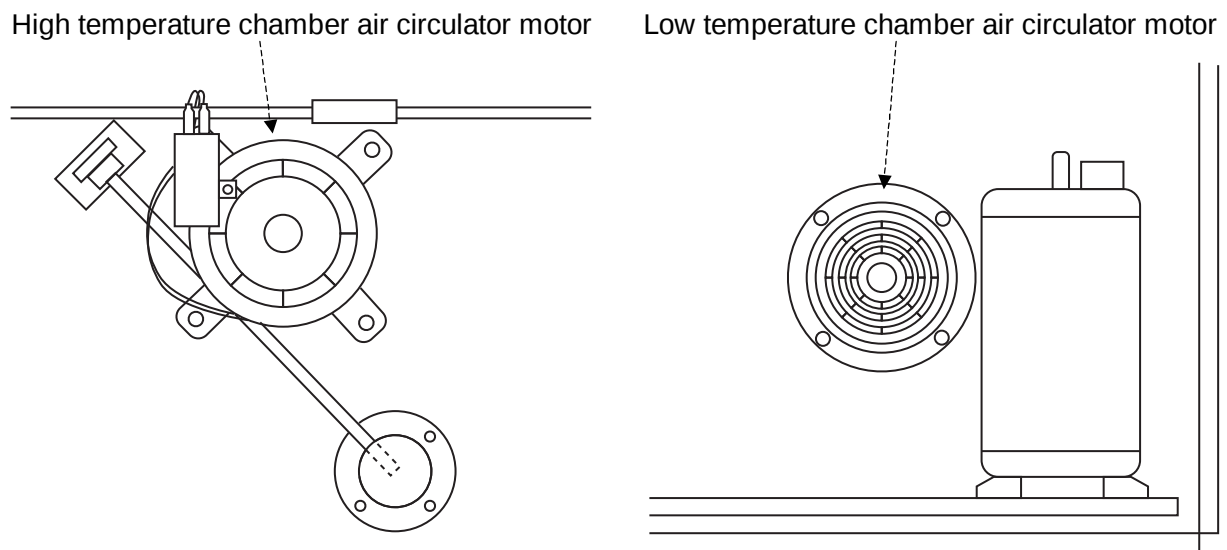


Fig. 5.40 High/Low temperature chamber air circulator motors

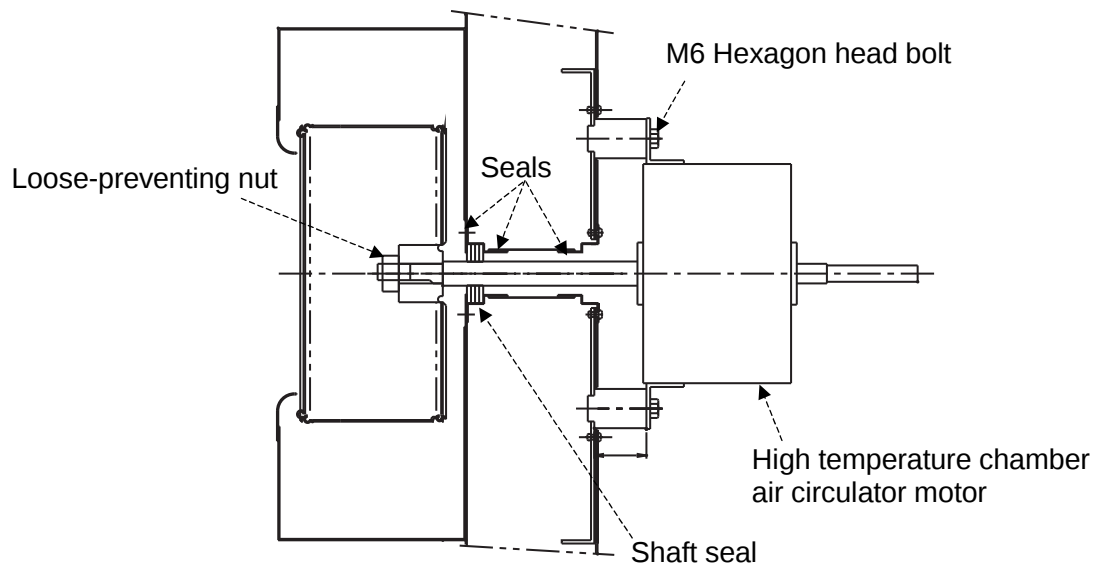


Fig. 5.41 High temperature chamber air circulator motor assembly

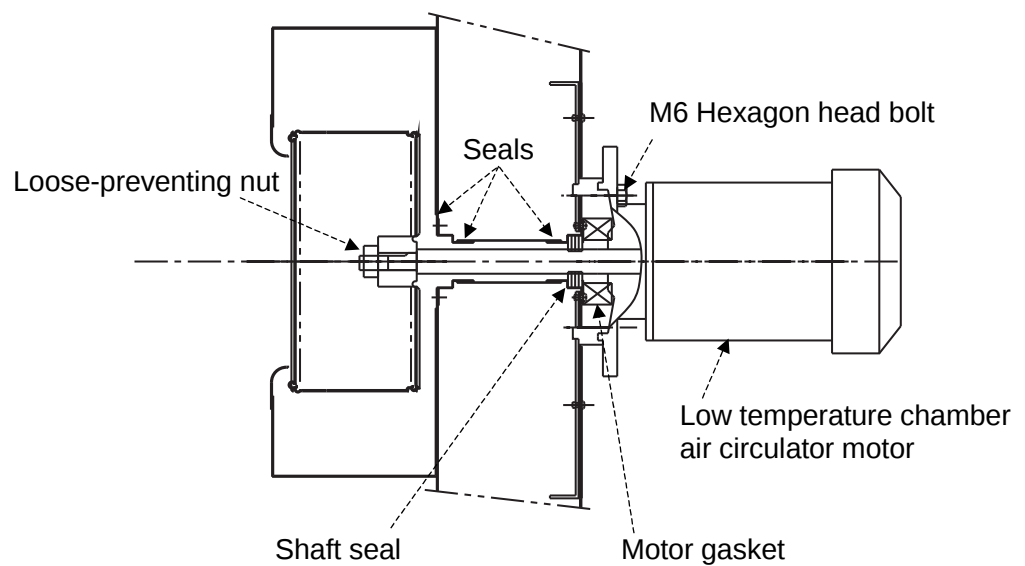


Fig. 5.42 Low temperature chamber air circulator motor assembly

(3) Air Supply Damper Drive Motor

■ Preparations

The sirocco fans of the high and low temperature chambers must be detached first. See 5.4 (1).

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Drawing No./Model (Specification)	Remark
0216010101910000	Synchronous motor	J200-046(200V AC)	High temp. chamber
0206020100190000	Air supply/exhaust damper cam	14607H489P3B (Approved: 93-603)	
0204130108870000	Damper packing	204130108870000	
0205020104000000	Damper shaft	205020104000000	

■ Replacement

Air Supply Damper Drive Motor

1. Detach the rear panel. (Loosen the two screws at the rear.)
2. Remove the screws that lock down the air supply damper drive motor.

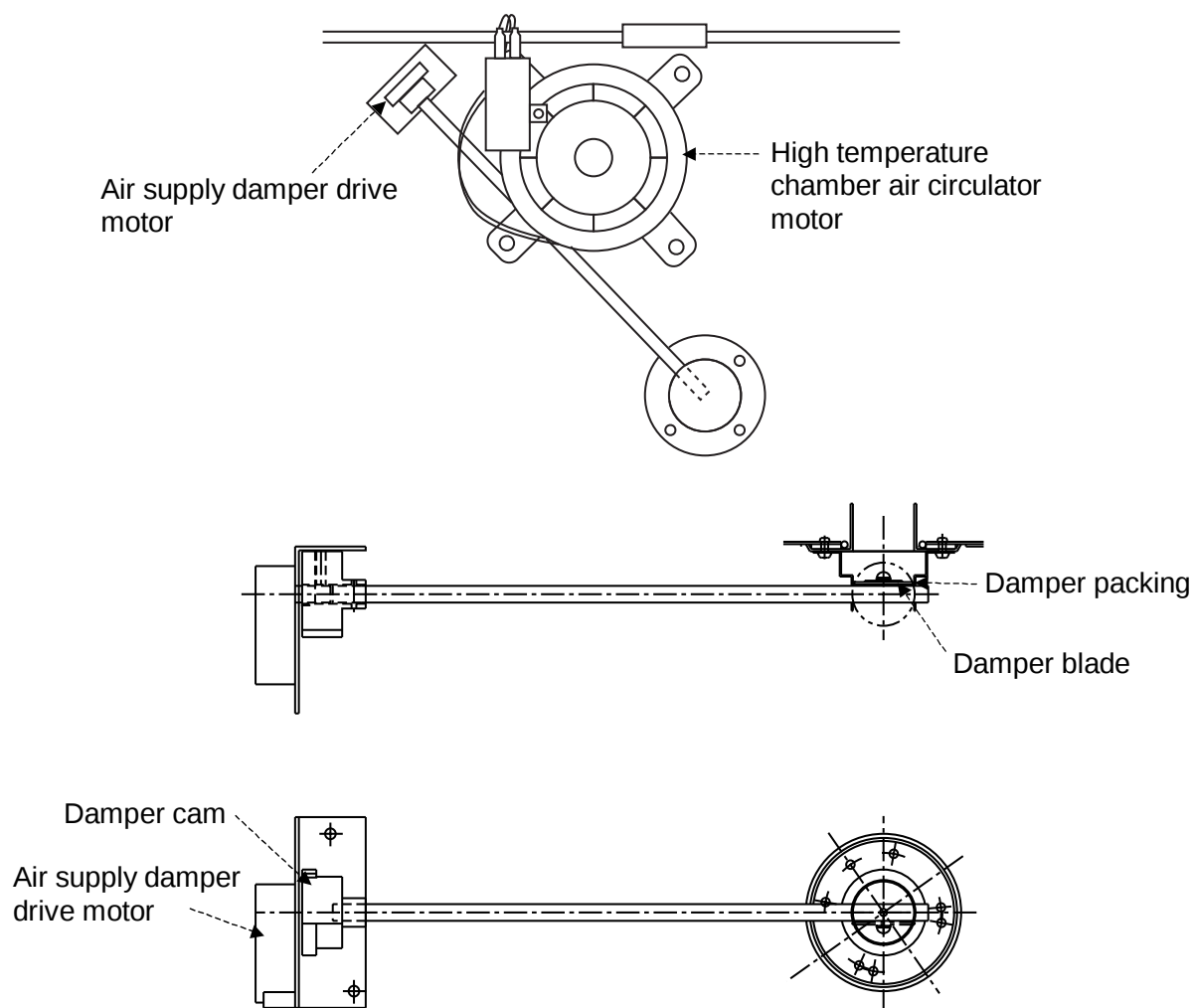


Fig. 5.43 Air supply damper drive motor

Chapter 6

Temperature Controller Adjustments

This chapter explains how to initialize the temperature controller and offset sensors.

WARNING

-  **Be sure to turn OFF the breaker before replacing parts.**
-  **SHARP EDGES! Wear gloves when handling metal panels to prevent cutting hands on corners and edges.**

6.1 Temperature Controller Initialization and Parameter Setup

■ Notes

- After replacing the temperature controller's (CPU board) ROM or battery, initialize the temperature controller and set up parameters again. For instructions on replacing parts, see "(5) Temperature Controller (ROM and Battery)" in "5.1 Electrical Compartment".
- It is also necessary to remake test setup and other chamber settings.
- It is not necessary to initialize the display ROM of the program setter.

Initialization

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. Disconnect wires from the E-BUS board.

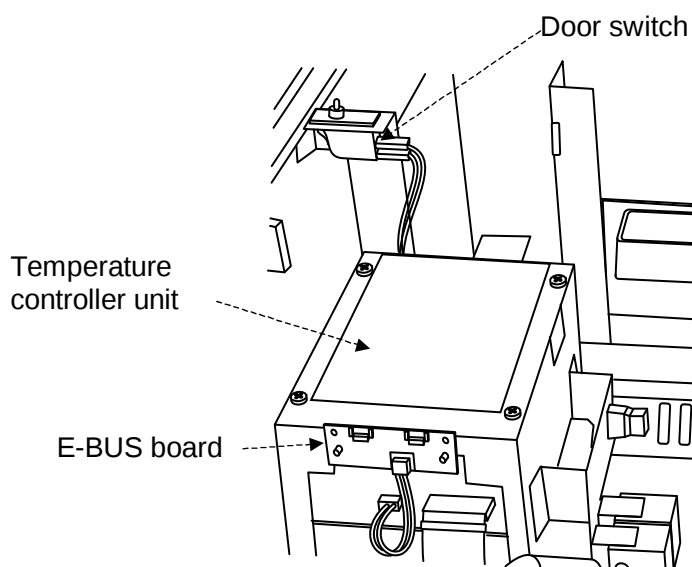


Fig. 6.1 Temperature controller unit as installed-1

4. Undo the latches that lock down the temperature controller unit cover and detach the cover.
5. Slide the analog board about 2 cm to the side to gain access to CPU board DIP switches.
6. Set DIP switches Nos. 1 and 4 in the ON position.
7. Holding down the lever of the door switch in the detected position, set the main power switch in the ON position to activate power. Keep the door switch lever depressed while performing subsequent steps.

8. After holding the door switch lever down for at least 15 seconds, turn the touch panel ON from the operating panel. If the display appears normal, initialization was successful. Set the main power switch in the OFF position and set DIP switches Nos. 1 and 4 in the OFF position.

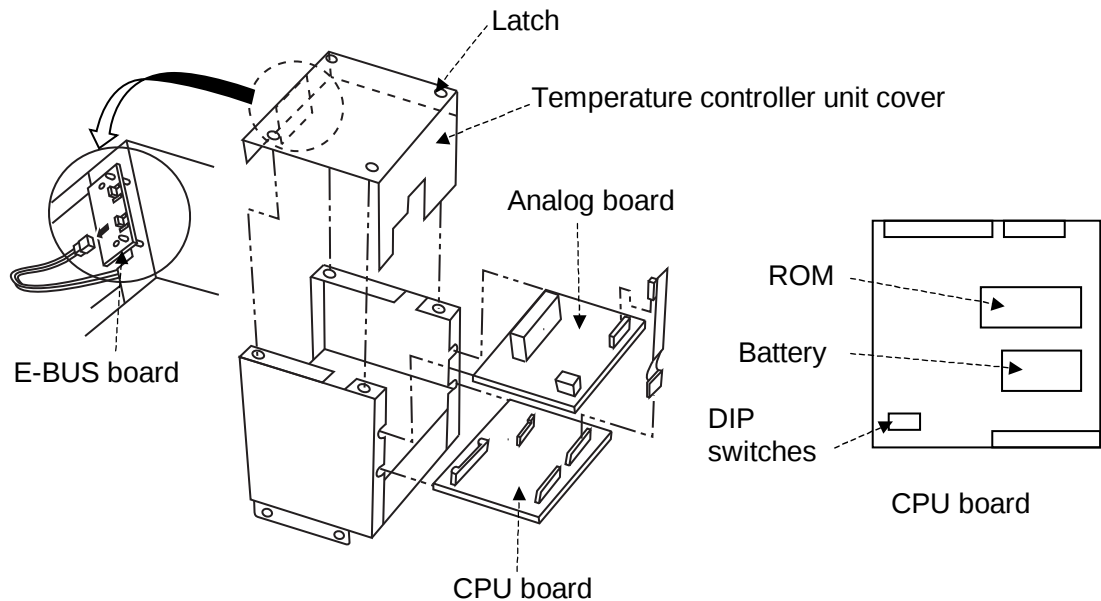


Fig. 6.2 Temperature controller unit boards-2

9. Reassemble the analog board, temperature controller unit cover and E-BUS board as before.
10. Reset parameters as explained here following.

Parameter Setup

When the temperature controller unit is initialized, all parameters necessary for operating the chamber including the model code are returned to the TSE-11 defaults. If there is need to change these defaults because of chamber model, options or modifications, check and reset parameters as necessary. Settings can be made from the display by accessing the service mode.

■ How to Get the Service Mode

1. With the main menu on the screen, press **Chamber Setup**.
2. Press **Configuration** to get the Chamber Configuration display.
3. Press **9 Service**.
4. Input the service mode password (3132) and press **Enter** on the keypad.

Here following, check settings under ① System Configuration, ② Sequence, ③ Refrigerator and ④ PID Parameter.

Service

- | | |
|------------------------|------------------------|
| ① System Configuration | ⑥ DI Monitor |
| ② Sequence | ⑦ DO Monitor |
| ③ Refrigerator | ⑧ Z·W Register |
| ④ PID Parameter | ⑨ Channel Set/Monitor |
| ⑤ Manual Output | ⑩ Alarm Report Monitor |

System Configuration

1. Select "System Configuration" from the above display.

System Configuration

- | | |
|-------------------------|--------------------------|
| ① Chamber Type | ⑥ Pre Heat/Cool Settings |
| ② SCP-220 Configuration | ⑦ PV Offset Settings |
| ③ Range Settings | ⑧ Other Settings |
| ④ Alarm Detection | ⑨ Options |
| ⑤ AI Operation Settings | |

Chamber Type

Default settings are shown below. Change settings to match the chamber.

(1)	Model	TSE
(2)	Type	11
(3)	Voltage Type	Standard

After changing parameters, the message instructing you to "Reset breaker ON." will appear on the display. Therefore, press **OK** and set the main power switch once in the OFF position, then set the switch back in the ON position. You can also reboot the system without pressing **OK**.

SCP-220 Configuration

1. Usually, the below defaults can be used as is. Servicemen normally do not change them in the field.
2. For example, to send or check the ladder, or view or update the database from PC, turn "E-BUS" OFF and change "Comm. Rate for Aux."

Cont. on next page

①	Language	Japanese
②	Comm. Rate for Aux.	19200 (For RS232C communications. Setting not necessary when "E-BUS" is ON.)
③	E-BUS	ON (Turns E-BUS communications ON/OFF.)
④	Photo	OFF
⑤	VRAM	☐ ON

Range Settings

1. The high temperature limit is automatically set to match the chamber model set in "Chamber Type".
2. To set limit manually, change settings to match the chamber. Default settings are shown below.

	Upper Limit	Lower Limit
Test Area (Hot)	205°C	60°C
Test Area (Cold)	0°C	−77°C
Hi-Temp. Box	205°C	60°C
Low-Temp. Box	0°C	−82°C

3. Other items are also set according to chamber model. If there is no need to change any of them, just check them.
4. After changing parameters, set the main power switch once in the OFF position, then set the switch back in the ON position.

Alarm Detection

Alarms are automatically set to match the chamber model set in "Chamber Type". There is no need to change any of them. Default settings for the TSE-11 are shown below.

	Alarm 1		Alarm 2	
	Upper	Lower	Upper	Lower
Test-Area (Hot)	● ON	● ON	○ ON	● ON
Test-Area (Cold)	● ON	● ON	● ON	○ ON
Hi-Temp. Box	○ ON	● ON	● ON	● ON
Low-Temp. Box	○ ON	○ ON	● ON	● ON

- When the dot is white: Detection is ON.
 ● When the dot is black: Detection is OFF.

Cont. on next page

Hi/Low Limit Alarm Setup

Only alarms that have been turned ON in the Alarm 1 cells can be set.

	Upper Limit	Lower Limit
Test-Area	_____	_____
Hi-Temp. Box	220°C	_____
Low-Temp. Box	80°C	−85°C

AI Operation Setting

Parameters are automatically set to match the chamber model set in “Chamber Type”. There is no need to change any of them. Default settings automatically set after initialization are shown below. Once the chamber starts running, the displayed values will change. However, the Overshoot/Undershoot Specified Values remain fixed.

Temp. Heat-Up Rate	3.0	Temp. Cool-Down Rate	
Overshoot Specified value	6.0	−40°C < PV	2.7
		−60°C < PV ≤ −40°C	1.7
		−70°C < PV ≤ −60°C	1.3
		PV ≤ −70°C	0.9
		Undershoot Specified Value	3.0

Pre-Heat/Cool Settings

Parameters are automatically set to match the chamber model set in “Chamber Type”. There is no need to change any of them. Default settings for the TSE-11 are shown below.

	Pre-Heat	Pre-Cool
Stable Range	1.0°C	1.0°C
Stable Time	300 sec	300 sec

Cont. on next page

PV Offset Settings

Parameters are automatically set to match the chamber model set in “Chamber Type”. There is no need to change any of them. Default settings for the TSE-11 are shown below.

PV Offset	☐ ON
Band	0.1
P	0.3

Other Settings

Parameters are automatically set to match the chamber model set in “Chamber Type”. There is no need to change any of them. Default settings for the TSE-11 are shown below.

EST END TIME of Set Up Operation (Monitoring only)	※	
Quick Exp. Set	Down	
Products Temp.	☒ MON	☒ CTRL
Condition at Time of Power ON	PWR OFF	

※ Value will vary depending on preheat/precool setting. (Indicates time required to prep end.)

Options

1. Check whether the chamber is equipped with options or not. If so, turn them ON (white dot).
2. The below “External Alarm Output” is the optional external alarm output feature.

Default settings for the TSE-11 are shown below.

External Alarm Output	☒ ON	Specimen Power Supply	☐ ON
Aux Cooling	☒ ON	Analog Output	☒ ON
Product Temp Sensor	☒ ON		

Cont. on next page

Sequence

Usually, the below defaults can be used as is.

PGM Area	ROM
----------	-----

Temperature Attainment

Usually, the below defaults can be used with all chamber models.

①	LOOP -1 Range	1.0°C
②	LOOP -1 Holding Time	60 sec
③	LOOP -2 Range	1.0°C
④	LOOP -2 Holding Time	60 sec
⑤	LOOP -3 Range	1.0°C
⑥	LOOP -3 Holding Time	60 sec

Attain. Setting

Usually, the below defaults can be used as is.

Control Sensor	Quick Sensor	Stable Range	Stable Time
Upstream Sensor	UP	±1.0°C	30 sec
	DOWN	±1.5°C	30 sec
	Product	±2.0°C	30 sec
Downstream Sensor	UP	±1.0°C	30 sec
	DOWN	±1.0°C	30 sec
	Product	±2.0°C	30 sec

Defrost Setting

Usually, the below defaults can be used as is.

For cycle defrosting

Defrost Setting Temp.	+40.0°C
Stable Range	+0.0°C
Stable Time	900 sec
Pre-Cool Attain. Temp.	+0.0°C
Pre-Cool Attain. Stable Time	300 sec

For auto defrosting

Temp. Deviation	+1.0°C
Continuing Time	600 sec
Dewatering Time	360 sec

Cont. on next page

Defrost Rate

Usually, the below defaults can be used as is.

Temp. Heat-up Rate		+3.0
Temp. cool-down Rate	$-40^{\circ}\text{C} < \text{PV}$	+2.7
	$-60^{\circ}\text{C} < \text{PV} \leq -40^{\circ}\text{C}$	+1.7
	$-70^{\circ}\text{C} < \text{PV} \leq -60^{\circ}\text{C}$	+1.3
	$\text{PV} \leq -70^{\circ}\text{C}$	+0.9

Refrigeration

Usually, the below defaults can be used as is.

Ref. Calc. Type	Japanese
Air Unit	○ ON
Cooling Type	Mech
Cooling MV	ELV
Cooling Table	LOW
Threshold Rate	1.0
Cool T.P.	1.0
Cool T.P. Cycle	60 sec

○ When dot is white: Equipped

● When dot is black: Not equipped

Aux. Cool

Usually, the below defaults can be used as is.

Stable Range	+1.0°C
Stable Time	3 sec
Cool OFF Time	300 sec

Cont. on next page

PID Parameter

Usually, the below defaults can be used as is.

For loops 1 and 3, see below.

		P-Const	I-Const	D-Const	Low Limit for P
SSR1	Input-1	1.5	36	9	0.0
	Input-2	1.5	36	9	0.0
	Input-3	1.5	36	9	0.0
SSR2	Input-1	1.5	36	9	0.0
	Input-2	1.5	36	9	0.0
	Input-3	1.5	36	9	0.0

For loop 2, see below. SSR1 input-1 is the only difference between loop 2 and loops 1 and 3.

		P-Const	I-Const	D-Const	Low Limit for P
SSR1	Input-1	4.5	40	10	0.0
	Input-2	1.5	36	9	0.0
	Input-3	1.5	36	9	0.0
SSR2	Input-1	1.5	36	9	0.0
	Input-2	1.5	36	9	0.0
	Input-3	1.5	36	9	0.0

Manual Output

- DO Manual Output

After initializing the temperature controller, DO manual output is OFF (black dot). In ordinary operation, this setting can be used as is. But, if wanting to use the feature, be sure to turn it ON (white dot).

Reference:

● Manual Output: Turns the manual output feature ON/OFF.

When dot is black: Manual output is OFF. When dot is white: Manual output is ON.

0 to 23: Turns DO0 to DO23 ON/OFF.

24 to 47: Turns DO24 to DO47 ON/OFF.

● ON: When dot is black: Output is OFF.

When dot is white: Output is ON.

- SSR Manual Output

After initializing the temperature controller, SSR manual output is OFF (black dot). In ordinary operation, this setting can be used as is. But, if wanting to use the feature, be sure to turn it ON (white dot).

Reference:

●ON: When dot is black: Output is OFF.

When dot is white: Output is ON.

1 to 4: Sets operating capacity to 4 set levels between 0.0% to 100.0%.

- ELV Manual Output

After initializing the temperature controller, ELV manual output is OFF (black dot). In ordinary operation, this setting can be used as is. But, if wanting to use the feature, be sure to turn it ON (white dot).

Reference:

●ON: When dot is black: Output is OFF.

When dot is white: Output is ON.

1 and 2: Sets operating capacity to 2 levels between 0.0% and 100.0%.

6.2 Sensor Offset

■ Notes

- Sensor offset is applied to measured values, therefore it effects all temperature indications on monitor displays and trend graphs.
- Because sensor offset is applied to all measured values, it cannot be set for individual sensors.
- Use a calibrated equipment.
- Warm up the temperature controller and calibrated equipment for at least 30 minutes before setting offset.

■ Offsetting

1. Connect a calibrated equipment (voltage generator + cold contact) to the temperature sensor input terminal of the temperature controller. Of course, you must disconnect the chamber sensor first.

Temperature sensor signal	Terminal No.	Sensor	Thermocouple
THC1	1	Test area upstream	Copper/Copper-Nickel
THC2	2	Test area downstream	Copper/Copper-Nickel

2. Output the reference voltage from the voltage generator.
3. Get the sensor offset display as follows.
4. With the main menu on the display, press **Chamber Setup**.
5. Press **Configuration** on the Chamber Setup display.
6. Input the service mode password (3132) and press **Enter** on the keypad.
7. Press **3 Sensor Offset**.
8. Select a sensor to offset.
9. Compare the [Process Value] against the reference temperature and input the offset in [Corrected By]. Once entered, the offset will be added to the measured temperature and the [Process Value] will read the corrected temperature.
10. Press **Prev. Screen** to end.

STOP

L



2/15 (THU)
16:29:37

Sensor Offset

	Corrected By	Process Value
Test-Area Upstream	+0.0° C	+27.5° C
Test-Area Downstream	+0.0° C	+34.7° C

Press the field boxes to set offset.

Prev. Screen

Chapter 7

Specifications and Performance Data

This chapter contains specifications necessary towards servicing as well as performance data that users frequently asked for.

7.1 Specifications

Chamber Type	TSE-11-A		
Temperature exposure	2-zone switching by vertical transfer of specimens		
Allowable ambient temperature range	0 to 40°C		
Performance	(Figures given for an ambient temperature of +23°C)		
Test area			
High temperature exposure range	+60 to +200°C		
Low temperature exposure range	-65 to 0°C		
Temperature constancy *1	±0.5°C		
High temperature chamber			
Pre-heat upper limit	+200°C		
Temperature heat-up rate *2	Within 30 min from ambient temperature to +200°C		
Low temperature chamber			
Pre-cool lower limit	-80°C		
Temperature pull-down rate *2	Within 90 min from ambient temperature to -80°C		
Temperature recovery			
Recovery conditions	2-zone		
	High temperature exposure	+150°C	30 min
	Low temperature exposure	-65°C	30 min
	Power supply voltage	200V AC	
	Monitor point	Upstream of specimens	
	Specimen load	2 kg (Plastic molded IC)	
Recovery time	Within 5 min		
Temperature controller			
Temperature setting range	High temperature chamber:	60 to 205°C	
	Low temperature chamber:	-82 to 0°C	
Setting resolution	1°C		
Indication accuracy	±1°C		
Test area loading capacity (kg)	8kg (Evenly distributed load)		
Specimen basket loading capacity (kg)	2kg (Evenly distributed load)		
Test area dimensions (W×H×D mm)	W320×H130×D230mm		
Outer dimensions (W×H×D mm)	W680×H1625×D1050mm		
Weight (kg)	Approx. 390kg		

Cont.

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Power supply	200V AC $\pm 10\%$, 3 ϕ , 3 W, 50/60 Hz 220V AC $\pm 10\%$, 3 ϕ , 3 W, 60 Hz 380V AC $\pm 10\%$, 3 ϕ , 4 W, 50 Hz 400V/415V AC $\pm 10\%$, 3 ϕ , 4 W, 50 Hz
Max. load current (A)	26A*3
Smallest diameter cable for primary supply (mm ²)	5.5 (Vinyl cabtyre cable)

*1 Temperature constancy based on JTM K 01-1998.

*2 Temperature heat-up/pull-down rates given respectively for single chamber use only.

*3 For 200V AC power supply

7.2 Performance Data

The below performance data is provided only as an example. Data can vary according to chamber, therefore use it only for reference.

(1) Exhaust rate

50 Hz: 1,465 m³/h

60 Hz: 1,544 m³/h

(2) Heat exhaust rate

17, 585 kJ/h

This is the heat load generated at the highest temperature allowed (peaked during prepping) and an ambient temperature of +23°C.

(3) Noise emission

Max. 60 dB

Noise emission was measured at a height of 1.2 m above the floor, 1 m from the chamber front in a non-soundproof room of minimal echo. Noise emission will greatly vary, however, depending on the place of use and surrounding noise.

Chapter 8

Periodic Replacement Parts

This chapter lists parts that need to be replaced periodically in order to maintain chamber functioning and performance.

8.1 Replacement Parts List

■ Notes

- The below “Recommended replacement interval as chamber running time” are not guaranteed figures. They will vary according to place and conditions of use.
- If detecting trouble in daily checks and maintenance, replace the part.

Table 8.1 Replacement parts

Part code	Part name	Model (Specifications)	Recommended replacement interval as chamber running time	Refer to for instructions	Remarks
0204130109020000	Elevator shaft packing on high temperature chamber side	2041301090200	10,000 h	5.4(4)	—
0204130109030000	Elevator shaft packing on low temperature chamber side	2041301090300			—
0204130109042000	L-packing	2041301090420			Inside elevator shaft (1.3 m)
0204130109060000	High temperature chamber packing	2041301090600	10,000 h	5.2(3)	—
0204130109051000	Low temperature chamber packing	2041301090510	10,000 h		—
0204130111640000	Low temperature chamber door outer packing	2041301116400	10,000 h		Length: 3 m
0208110101800000	Silicone tube	2081101018000	10,000 h	5.2(3)	Length: 2.6 m
0217040100290000	Relay (Built-in diode)	MY-2D(24V DC)	20,000 h	5.1(6)	X1, 2, 3, 4
0217040102280000	Relay	G2R-1-SD-24V DC	20,000 h		X5
0220070100091000	Lithium battery	BR-2/3AE2PK	3 years (Without power)	5.1(5)	On temperature controller board
	Link mechanism unit		5 years	5.3(1)	Link mechanism unit including rollers and dry bearings
0214020105740000	Temperature sensor	2140201057400	3 years	5.4(3)	For test area up/downstream
0214020101480000	Temperature sensor	TT-3-L-4-300-3×2	3 years		For high/low temperature chambers
0207110106871000	Insulation box bottom sheet	2071101068710	3 years	5.2(3)	

Chapter 9

On-site Modification Options

This chapter explains parts and modifications when options are added to the chamber after delivery.

9.1 Emergency Stop Switch

■Preparations

Required tools: 200 mm or longer Philips screwdriver

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Model (Specification)
0204060165590000	Option panel for emergency stop switch	2040601655900
0217080100020000	Push-button type switch	AVW411-R

■Installation

1. Set the main power switch in the OFF position.
2. Detach the electrical compartment panel. (Loosen the two screws at the rear.)
3. To gain better access to parts, detach the panel indicated in the below figure. (Loosen the screws inside the holes indicated with the arrows. It is not necessary to remove the screws.) Also, detach the three screws that lock the panel to the electrical compartment frame.

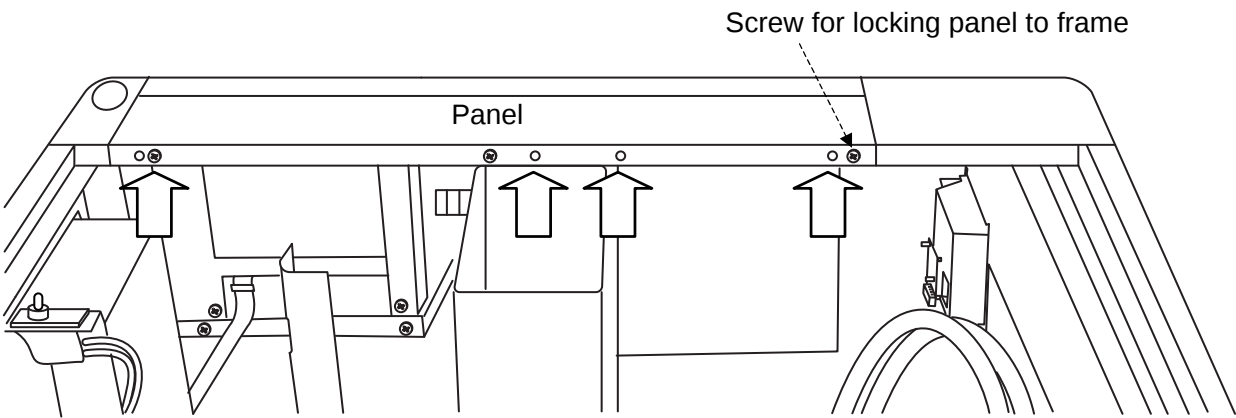


Fig. 9.1 Detaching panel to gain easier access

4. Open the high temperature chamber.
5. Remove the bottom screw from the blank panel.

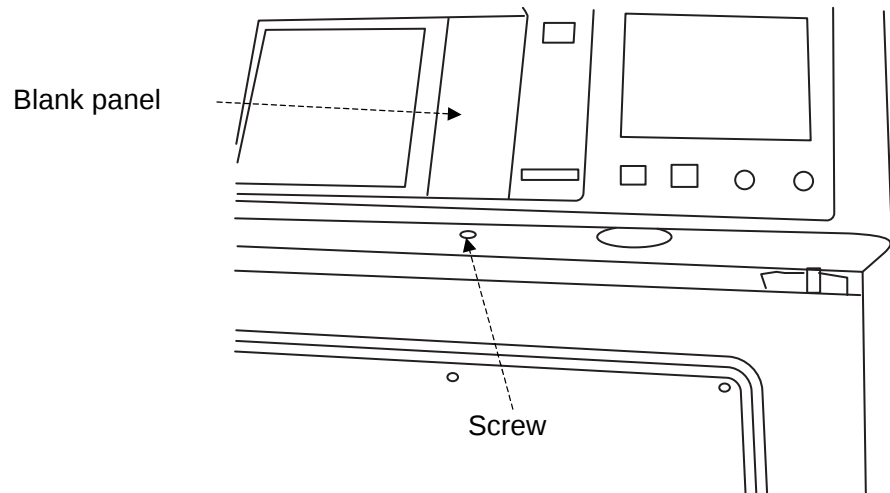


Fig. 9.2 Blank panel and screw

6. Remove the screw from the backside of the blank panel.
7. Install the push-button switch (S4) on the optional panel for emergency stop switch and install the panel on the chamber operating panel.
8. Wire as shown in the below diagrams.

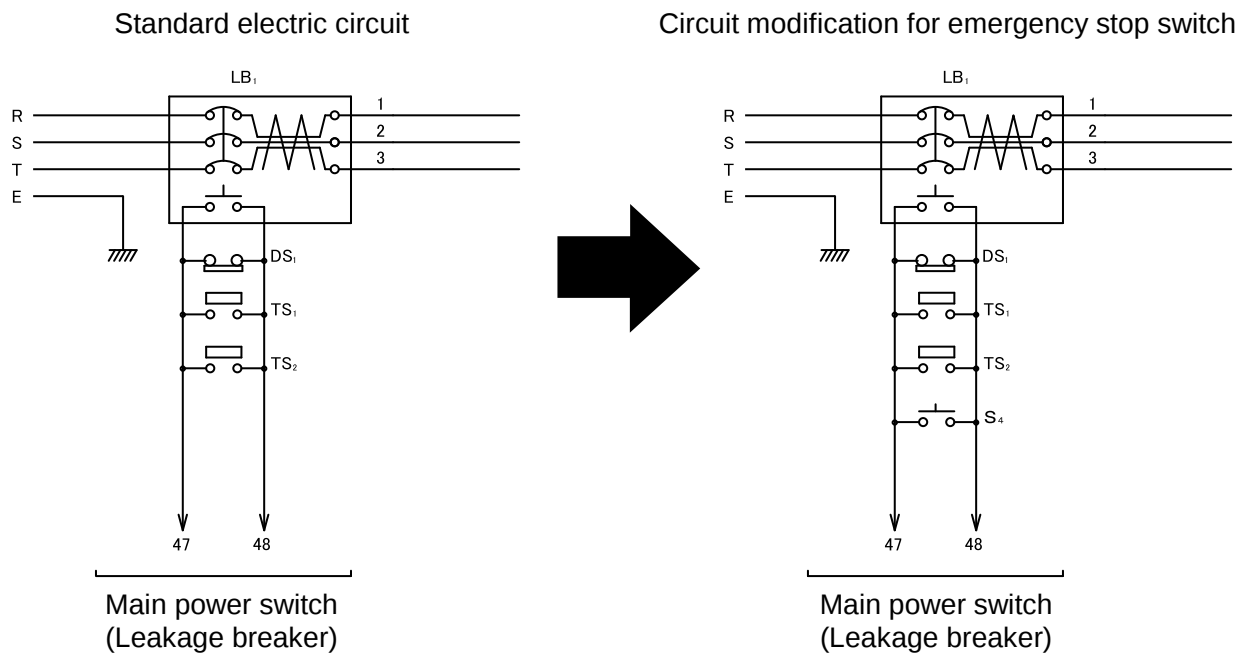


Fig. 9.3 Emergency stop switch electric circuit

9.2 External Alarm Terminal

■ Preparations

Note: Make it possible to check terminal connection.

Part code: Because parts can be updated, check part codes in advance.

Part code	Part	Drawing No./Model (Specification)
0221070100110000	Connector (Through-panel connector terminal)	DFK-MSTB2.5/ 6-G-5.08 (6P)
0221070100120000	Connector plug	MSTBT2.5/ 6-ST-5.08 (6P)
0204060155670000	Breaker decorative panel (Option)	204060155670000
0223020122971000	Optional terminal board rating plate	223020122971000

■ Installation

External Alarm Terminal

1. Replace the breaker decorative panel and install necessary parts.
2. Wire as indicated on the below electric circuit diagram.
3. From the service mode, get the Options display from the System Configuration display, and turn ON (white dot) "External Alarm Output".
 - How to Get the Service Mode
 - (1) With the main menu on the screen, press **Chamber Setup**.
 - (2) Press **Configuration** to get the Chamber Configuration display.
 - (3) Press **9 Service**.
 - (4) Input the service mode password (3132) and press **Enter** on the keypad.

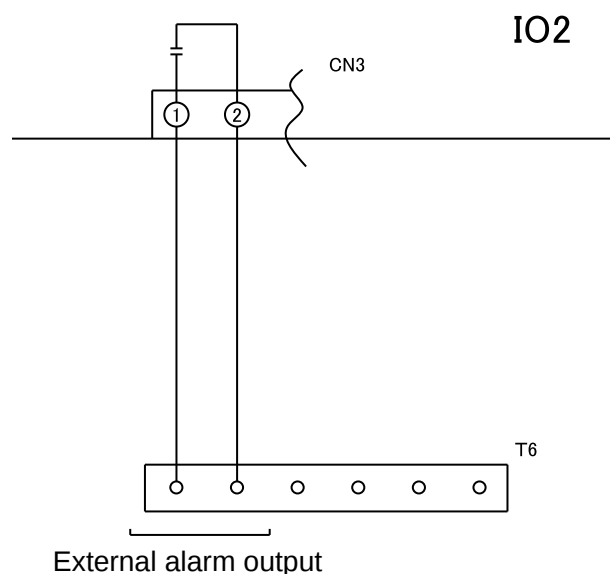


Fig. 9.4 Electric circuit diagram for optional external alarm terminal

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Thermal Shock Chamber

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