16DJ
Double-Effect Direct-Fired Absorption Chillers/Heaters

Nominal cooling capacity 352-5274 kW
50 Hz

Operation and maintenance manual
NOTES TO USERS

Thank you for purchasing a Carrier/Sanyo absorption chiller/heater.

Read this manual carefully before operating the unit. It contains instructions for the operation and maintenance of the chiller/heater.

Please utilize the chiller/heater to its optimum performance by carrying out the recommended daily maintenance and handling instructions as well as the periodic service.

If you need any information about maintenance contracts or have any other enquiries, please contact your Carrier service agent.
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The cover photograph is for illustrative purposes only, and are not contractually binding.
1 - PRECAUTIONS

1.1 - Safety precautions

• Before operating this chiller, first carefully read the following instructions.
• All precautions are classified as either WARNING or CAUTION.

WARNING: Failure to observe this instruction may result in serious injury or death.

CAUTION: Failure to observe this instruction may cause an injury or failure of chiller/heater. Depending on circumstances, this may result in serious injury or death.

This symbol denotes danger, a warning or a caution. The illustration in this symbol shows the specific description of the item.

This symbol prohibits an action. The illustration next to this symbol shows the specific description of the item.

This symbol instructs an action to be done. The illustration in this symbol shows the specific description of the item.

• After reading this manual, it should be kept in a safe place to be available for any user at any time.

1.1.1 Safety considerations

WARNING

TURN OFF THE BREAKER BEFORE CLEANING AND CHECKING

Always turn off the circuit breaker before cleaning and checking the cooling tower fan, chilled water pump, or other components linked to the chiller/heater, to provide protection from electric shock or possible injury from the rotating fan.

INSPECTION

STOP OPERATION IN CASE OF FIRE, EARTHQUAKE OR ELECTRICAL STORMS

Stop operation in case of fire, earthquake or an electrical storm, to prevent fire or electric shock.

MUST BE OBSERVED

DO NOT TOUCH THE CONTROL PANEL SWITCH WITH WET HANDS

Do not touch the switch inside the control panel with wet hands to avoid electric shock.

DO NOT TOUCH

DO NOT TOUCH THE WIRING INSIDE THE CONTROL PANEL

Do not touch the wiring inside the control panel to avoid electric shock.

DO NOT TOUCH

DO NOT TOUCH HIGH-VOLTAGE CABLES

Do not touch high-voltage cables to avoid electric shock.

DO NOT TOUCH
WARNINGS

KEEP FLAMMABLE SUBSTANCES AWAY FROM THE CHILLER/HEATER
Do not place any flammable substances (e.g., gasoline, thinner) close to chiller/heater, flue, chimney and oil tank to prevent fire.

DO NOT OPERATE THE CHILLER/HEATER IF THERE IS A SMELL OF GAS
Do not operate the chiller/heater if there is a smell of gas. Do not turn on/off any switch, as this could cause a fire.

DO NOT TOUCH ROTATING PARTS OF FANS
Keep away from rotating part of fans or pumps to avoid possible injury.

CAUTIONS

SOLVE ALL PROBLEMS BEFORE RESTARTING THE CHILLER/HEATER
Solve all problems before restarting the chiller/heater after a safety or security device is activated, to prevent fire.

DO NOT PLACE HEAVY OBJECTS ON THE CHILLER/HEATER OR CONTROL PANEL
Do not place heavy objects on the chiller/heater or control panel as these may fall off and cause injuries.

DO NOT CLimb ON THE CHILLER/HEATER
Do not climb on the chiller/heater as you may fall off.

CALL SPECIALISTS FOR SERVICE OR MAINTENANCE
Call specialists for service or maintenance. Incorrect service/maintenance may cause electric shocks, fire or burns.

AUTHORIZED PERSONNEL ONLY
A notice, “For Authorized Personnel Only” must be affixed to the chiller/heater to stop unauthorized personnel from touching it. If necessary surround the chiller/heater by a protective fence. Misuse of the chiller/heater may cause injury.
**1 - PRECAUTIONS - CONT.**

**CAUTIONS**

**DO NOT POUR WATER ON THE CHILLER/HEATER OR CONTROL PANEL.**

Do not pour water on the chiller/heater or control panel to avoid electric shock.

PROHIBITED

**USE THE CORRECT POWER SUPPLY**

This is indicated on the chiller/heater name plate. Use of an incorrect power supply may cause fire or electric shock.

PROHIBITED

**NEVER CHANGE THE SET VALUES**

Never change the set values of the safety and/or protective devices. Wrong settings may damage the chiller/heater or cause fire.

PROHIBITED

**STOP THE OPERATION WHEN COMBUSTION SMOKE IS BLACK**

Stop the operation when combustion smoke is black and call a service engineer.

MUST BE OBSERVED

**DO NOT TOUCH THE ABSORBENT**

Do not touch the spare or leaked absorbent, as this can cause metal corrosion or skin disease.

PROHIBITED

**OBSERVE THE SPECIFIED WATER AND PRESSURE**

The specified chilled/hot water, and cooling water pressure must be strictly observed. Incorrect pressure may cause the water to leak/spray which can lead to short circuits or burns.

MUST BE OBSERVED

**DO NOT TOUCH HIGH-TEMPERATURE AREAS**

Do not touch high-temperature areas, as they may cause burns. These areas are indicated by caution label.

PROHIBITED

**STOP THE PURGE PUMP TO REPLACE OIL**

Stop the purge pump when replacing oil to avoid possible injury by fuel spillage.

MUST BE OBSERVED

**STOP**
1.1.2 - Safety precautions for repair, moving or disposal

**WARNINGS**

ONLY AUTHORIZED PERSONNEL SHOULD SERVICE THE CHILLER/HEATER

Only authorized personnel should service the chiller/heater. Incorrect service could result in electric shock or fire.

**PROHIBITED**

**CAUTION**

ONLY AUTHORIZED PERSONNEL SHOULD REMOVE OR REPAIR THE CHILLER/HEATER

Any relocation or moving of the chiller/heater should only be done by authorized personnel. Incorrect work could result in water leaks, electric shock or fire.

MUST BE OBSERVED

**CAUTION**

ONLY AUTHORIZED PERSONNEL SHOULD DISPOSE OF THE CHILLER/HEATER

To dispose of the chiller/heater, contact local specialists. Incorrect disposal may result in absorbent leaks and cause metal corrosion or skin disease, electric shock or fire.

MUST BE OBSERVED

1.1.3 - Operating precautions

1. Keep the purge valve tightly shut to prevent air from leaking into the chiller/heater, which may cause the failure of the chiller/heater.

2. Keep the power supply to the control panel turned on, unless carrying out maintenance or service.

3. During the chiller/heater dilution cycle the chilled-water pump (both the primary side and the secondary side) and air handling unit must be operated for the required time. The chiller/heater has some cooling capacity, even in the dilution cycle. Do not stop the air handling unit before the required time to prevent possible subcooling.

4. Before operating the chiller/heater at the beginning of the cooling or heating season, make sure that necessary cooling/heating changeover is done. Failure in the changeover may cause damage to the chiller/heater. We recommend that you take out a maintenance contract with a Carrier service agent and leave the changeover to them.

5. Do not perform an insulation test on the control circuits of the electric controller.

6. Use a Carrier recommended interlock system to stop/start the auxiliary equipment. The interlock system automatically stops/starts the chilled-water pump and cooling water pump. Please follow the start procedure in Figure 1 below.

**Fig. 1 - Auxiliary equipment start/stop sequence**

**Start sequence**


**Stop sequence**

1 - PRECAUTIONS - CONT.

1.2 - High-temperature - high-voltage caution

- Do not touch the chiller/heater during operation since its surface becomes hot.
- Do not touch the absorbent pump, the refrigerant pump, and the purge pump during operation, since their surface becomes hot.
- Do not touch the junction box during operation, since it contains high-voltage wiring.
- Do not touch the terminal box during operation, since it contains high-voltage wiring.

1.3 - Environmental requirements

1.3.1 - Installation considerations
The 16DJ absorption chiller/heater is designed for indoor installation in a machine room. The protection rating of the chiller/heater is IP40. Room temperature should be maintained between 5°C and 40°C to protect against solution crystallization during chiller/heater shutdown. The humidity in the machine room must be kept below 90%.

Ensure that the machine room is sufficiently ventilated. The required fresh air rate for combustion is a minimum of 0.28 l/s per kW fuel consumed.

1.3.2 - Field wiring
The machines should be connected to a power source that complies with overvoltage category III (IEC 60664). All other wiring should comply with overvoltage category II.

1.3.3 - Altitude
Please install the absorption chiller/heater at a maximum height of 1000 m above sea level. If the location is higher than 1000 m above sea level, please contact your local Carrier office.

1.4 - Water treatment

Refer to chapter 4 "Maintenance".

2 - MACHINE ILLUSTRATIONS

2.1 - Typical chiller/heater detail

2.1.1 - DJ-11 to DJ-42

Fig. 2 - Water header side

Fig. 3 - High-temperature generator side
2.1.2 - DJ-51 to DJ-63

**Fig. 4 - Water header side**

Legend
1. Cooling water outlet
2. Purge tank
3. Low-temperature generator
4. Chilled water outlet
5. Evaporator
6. Absorber
7. Chilled water inlet
8. Low-temperature heat exchanger
9. High temperature heat exchanger
10. Condenser
11. C valve

**Fig. 5 - High-temperature generator side**

Legend
1. Generator pressure gauge
2. Control panel
3. A valve
4. Absorbent pump 1
5. Refrigerent pump
6. Exhaust gas outlet
7. Rupture disk
8. High-temperature generator
9. Burner
10. Cooling water inlet
2.1.3 - DJ-71 to DJ-82

Fig. 6 - Water header side

Legend
1 Low-temperature generator
2 D valve
3 Chilled water outlet
4 Evaporator
5 Absorber
6 Chilled water inlet
7 Cooling water inlet
8 Purge pump
9 Condenser
10 Rupture disk
11 Absorber
12 C valve

Fig. 7 - High-temperature generator side

Legend
1 A valve
2 Exhaust gas outlet
3 Cooling water outlet
4 Generator pressure gauge
5 High-temperature generator
6 Burner
7 Absorbent pump 2
2.2 - Typical burner and gas train

Fig. 8 - Typical burner

Legend
1 Ball valve
2 Filter
3 Pressure regulator
4 Shut-off valve
5 Blower
6 Gas control valve
2.3 - Typical control panel

Fig. 9 - Control panel (CE type)  
Fig. 10 - Control panel inside (CE type)

Legend

1. Fan  
2. Terminal block  
3. Terminal block  
4. Terminal block for power supply  
5. Earth terminal  
6. Control board  
7. Purge pump on/off switch  
8. Purge/indication light  
9. Cooling/heating changeover switch  
10. Operating handle

Legend

1. Control relay  
2. Circuit protector  
3. Isolator  
4. I/O board  
5. Terminal block  
6. AC reactor  
7. Circuit breaker  
8. Inverter  
9. DC reactor  
10. Main circuit breaker  
11. Transformer  
12. Electromagnetic contactor  
13. Filter  
14. Transformer  
15. Terminal block
Fig. 11 - Interface board

Legend
1. Stop indication light
2. Operation indication light
3. Data display
4. Select key
5. Function set key
6. Back select key
7. Cooling/heating light
8. Remote/local select key with light
9. Alarm buzzer stop key
10. Combustion indication light
11. Operation select key with light
12. Alarm indication light
13. Stand by indication light
14. Dilution indication light
15. Safety circuit indication light
16. Power indication light
2.4 - Chiller/heater flowchart and component function description

Evaporator
The refrigerant is dispersed on the heat transfer tubes of the evaporator. Chilled water running through the heat transfer tubes of evaporator is cooled by the latent heat of the vaporized refrigerant. In the heating mode, the evaporator functions as a hot water heater. Hot water in the heat transfer tubes of the evaporator is heated by the refrigerant and used for heating.

Absorber
The concentrated solution is dispersed on the heat transfer tubes of absorber. The refrigerant vapour from the evaporator is absorbed on the heat transfer tubes of the absorber by the concentrated solution. Cooling water running through the heat transfer tubes of the absorber is heated by the absorption heat.

Heat exchangers
After leaving the absorber section the diluted solution passes through the low-temperature heat exchanger, where it is heated by the concentrated solution. The diluted solution then passes through the high-temperature heat exchanger, where it is further heated by the intermediate solution. The intermediate and concentrated solutions are cooled by the diluted solution. This cooling process of the concentrated solution allows for greater absorbing power due to its lower temperature.

High-temperature generator
The diluted solution from the heat exchangers is heated in the high-temperature generator. It releases the refrigerant vapour and is concentrated. It becomes intermediate solution.

Low-temperature generator
The refrigerant vapour from the high-temperature generator passes through the heat transfer tubes of low-temperature generator. The intermediate solution in the low-temperature generator is heated by the refrigerant vapour. It releases the refrigerant vapour and is concentrated. It becomes concentrated solution. The condensed refrigerant in the heat transfer tubes of low-temperature generator flows to the condenser.

Condenser
The refrigerant vapour from the generator is condensed on the heat transfer tubes of the condenser. Cooling water from the absorber is heated by condensation heat.

Purge unit
The purge unit collects the non-condensable gas in the chiller/heater and stores it in the purge tank.

Refrigerant heat recovery exchanger
Heat the low-temperature absorbent using the heat of the refrigerant drain condensed in the low-temperature generator.

Sensors

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
</tr>
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<tbody>
<tr>
<td>DT1</td>
<td>Chilled/hot water outlet temperature</td>
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<tr>
<td>DT2</td>
<td>Cooling water outlet temperature</td>
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<td>DT3</td>
<td>High-temperature generator temperature</td>
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<td>DT4</td>
<td>Low-temperature generator temperature</td>
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<td>DT5</td>
<td>Condenser temperature</td>
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<td>DT6</td>
<td>Chilled/hot water inlet temperature</td>
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<td>DT7</td>
<td>Cooling water inlet temperature</td>
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<td>DT8</td>
<td>Not used</td>
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<td>DT9</td>
<td>Not used</td>
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<tr>
<td>DT10</td>
<td>Diluted solution temperature at absorber outlet</td>
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<td>DT11</td>
<td>Refrigerant temperature at evaporator</td>
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<td>DT12</td>
<td>Cooling water mid temperature</td>
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<td>DT13</td>
<td>Exhaust gas temperature</td>
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<tr>
<td>E1-3</td>
<td>High-temperature generator solution level electrode</td>
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<tr>
<td>63GHH</td>
<td>High-temperature generator pressure switch for cooling.</td>
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<tr>
<td>63GHL</td>
<td>High-temperature generator pressure switch for heating (CE only)</td>
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<tr>
<td>69CH</td>
<td>Chilled/hot water flow switch</td>
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<tr>
<td>69PR</td>
<td>Purge tank pressure</td>
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</table>
3 - OPERATING INSTRUCTIONS

3.1 - Self-diagnostic function

The self-diagnostic function starts when the breaker inside the control panel of the chiller/heater is turned on. After self-diagnosis is completed, the data display on the control board shows the following information.

- Data display (7-segment LED) and all LEDs light up.
- If there is no abnormality the data display shows the version number. If there is a power failure, H-10 is displayed after the power is restored.

![Control panel]

*Fig. 14 - Control panel*

**NOTE:** The version number differs with each chiller/heater type.

- The data display shows the high-temperature generator temperature.

![Temperature Display]

(120.4)

If the self-diagnosis function detects an error, this will be shown on the data display. For the alarm indication, please refer to chapter 3.8.
Fig. 15 - Typical control board

Legend

1. Operation indication light: The operation indication light is on when the chiller/heater is running.
2. Stop indication light: The stop indication light is on when the chiller/heater is shut down.
3. Alarm indication light: The alarm indication light is on when an alarm occurs.
5. Cooling/heating light: The indication light indicates cooling or heating mode.
6. Remote/local select key with LED: To select remote operation or local operation.
7. Operation select key with LED: To run/stop the chiller/heater.
8. Data display (7-segment LED): Shows the temperature, setpoint, etc.
9. Standby indication light: On when the chiller/heater is waiting for the interlock signals form the chilled water and the cooling water pump.
10. Dilution indication light: On during the dilution cycle.
11. Safety circuit indication light: On when power is supplied to the control circuit.
12. Power indication light: On when power is supplied to the control circuit.
13. Data select key: To change the menu and set a new value.
14. Alarm buzzer stop key: To stop the alarm buzzer.


3.3 - Control board settings

3.3.1 - Time setting
Refer to Figure 16.

Fig. 16 - Display example

Generator temperature
Press the "SET" key for about 2 seconds.
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Press the BACK key.
Press the "SET" key for about 2 second...
Fig. 17 - SW3 backup switch and backup battery

SW3: Backup switch
UP: ON
DOWN: OFF
Backup battery

[Diagram of electronic circuit with labels and connections]
3.3.3 - How to change the temperature unit
The temperature unit can be changed as follows, even while the chiller/heater is operating.

Fig. 18 - Display example

Press the "SET" key for about 2 seconds.

Press the ▼ or ▲ key.

Press the SET key for about 2 seconds.

Press the ▼ or ▲ key if you need.

Press the SET key for about 2 seconds.

And press the ▼ or ▲ key.

Press the "SET" key to select °C mode and again to select the °F mode

To select °C

To select °F

3.3.4 - Changing remote signal setting (continuous, pulse etc.)
After wiring of the remote signal, the control board shown below should be set. Refer to field wiring diagram.

Fig. 19 - Display example

Remote signal type
(1) free
(2) pulse
(3) pulse
(4) free
(5) pulse

Control board setting

Press the SET key for about 2 seconds.

Press the ▼ or ▲ key.

Press the SET key for about 2 seconds.

Press the ▼ or ▲ key.

Press the SET key for about 2 seconds.

Press the ▼ or ▲ key.

Press SET key to select positive mode. Press SET key to select negative mode.

3.4 - How to change cooling/heating mode
Purging is necessary at each changeover process. Please contact your Carrier service agent.

3.4.1 - Cooling/heating changeover
Before you change the operation mode from cooling to heating, please perform refrigerant blow down and dilution cycle.

1. Cooling → heating procedure

Cooling operation

Refrigerant blow down

Press the «Stop» key on the operation board.

Chiller/heater stops.

Dilution cycle operation

Changeover position of the chiller/heater valves

Dry system

Changeover of valve in the cooling water line

If necessary, change the auxiliary equipment system.

Heating operation

Wet system

Keep the cooling water full in the chiller/heater. Close cooling water inlet/outlet isolation valves and open D valve.

If the cooling water is likely to freeze, drain the cooling water from the chiller/heater.
2. Heating → cooling procedure
Changeover must be done with chiller/heater switched off.

Changeover chiller/heater valves

Change to heating mode using control board key - refer to section 3.4.2.

If necessary, change auxiliary equipment system.

Refrigerant blow down (2 or 3 times at start-up)

Purging

Cooling operation

3.4.2 - Change the cooling/heating mode using the key while checking the data display.

Fig. 20 - Display example

High-temperature generator temperature

Press the \( \mathbf{\downarrow} \) or \( \mathbf{\uparrow} \) key.

Press the \( \mathbf{\downarrow} \) or \( \mathbf{\uparrow} \) key for about 2 seconds.

Press the \( \mathbf{\downarrow} \) or \( \mathbf{\uparrow} \) key, if necessary. Press the *SET* key for about 2 seconds.

Push the "SET" key for about 2 seconds.

And press the \( \mathbf{\downarrow} \) or \( \mathbf{\uparrow} \) key.

To select heating mode

By pushing the *SET* key, the heating mode is selected and the heating light comes on. The cooling light turns off. Refer to Fig. 12.

To select cooling mode

By pushing the *SET* key, the cooling mode is selected and the cooling light comes on. The heating light turns off. Refer to section 3.5.

3.4.3 - Cooling/heating changeover switch (for CE)

There are two high-temperature generator pressure switches for cooling and heating. It is possible to select the pressure switch using the cooling/heating changeover switch. The operation mode on the control board and the operation mode of the switch must be the same.

Otherwise the high-temperature generator high-temperature alarm (J-14) is activated, preventing the operation. Ensure that the mode on the control board is the same as that of the pressure switch. Refer to Fig. 9.

3.5 - Cooling operation

3.5.1 - Pre-operation check

Refer to Fig. 21.

Check the following items before starting operation.

- Verify the operation mode. Confirm that the cooling light on the control board is on.
- Check the chilled water leaving temperature setpoint. Make sure that the chilled water leaving temperature is set as specified. For the display of the set value, please refer to section 3.8.
- Check the combustion equipment
  - Make a daily inspection. (refer to section 4.)
  - Check that the valve(s) is (are) open.
- Check the valves on the chiller/heater.

Refer to Fig. 12

NOTE: If the chilled/hot water pump, cooling water pump, and chiller/heater are interlocked, each pump runs automatically when starting the chiller/heater.

If not, the start sequence must be: chilled/hot water pump, cooling water pump, chiller/heater.
3.5.2 - Start cooling operation
Refer to Fig. 22.

Local operation mode
• Press the "LOCAL" key on the chiller control board. The "LOCAL" indication light of the key is on.
• Keep pressing the "RUN" key for more than a second and make sure that the "RUN" indicator light of the key is on.
• Automatic operation starts.

Remote operation mode
• Press the "REMOTE" key on the chiller control board. The "REMOTE" indicator light of the key is on.
• Turn on the start switch on the remote control panel for the field supply. The indicator light of the "RUN" key on the chiller control board is on.
• Automatic operation starts.

NOTE: In local operation mode the signal from the remote control panel does not work. In remote operation mode the "RUN" key of the chiller control board does not work.

3.5.3 - Stop operation
Refer to Fig. 22.

Local operation mode
• Keep pressing the "STOP" key on the chiller control board for more than a second.
• Make sure that the "RUN" indication light goes off and the "STOP" indication light comes on.

Remote operation mode
• Turn on the stop switch on the field supply remote control panel.
• Another way to stop the chiller is to press the "STOP" key on the chiller control board during remote operation.

NOTE: If the chilled-water pump, cooling water pump, and chiller are interlocked, each pump stops automatically when the chiller stops.

If not, the stop sequence must be: chiller, cooling water pump, chilled-water pump.

The air handling unit must be stopped after the chilled-water pump is stopped.

3.6 - Heating operation

3.6.1 - Pre-operation check
Refer to Fig. 22.
Check the following items before starting operation.
• Verify the operation mode. Confirm that the heating light on the control board is on.
• Check the hot water temperature setpoint. Make sure that the hot water leaving temperature is set as specified. For the display of the set value, please refer to section 3.8.
• Check the combustion equipment
  - Make a daily inspection (refer to section 4.)
  - Check that the fuel valve(s) is (are) open.

4. Check the chiller/heater valves.

<table>
<thead>
<tr>
<th>Valve</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Open</td>
</tr>
<tr>
<td>B</td>
<td>Closed</td>
</tr>
<tr>
<td>C</td>
<td>Open</td>
</tr>
<tr>
<td>D</td>
<td>Open</td>
</tr>
</tbody>
</table>

Refer to Fig. 12

NOTE: If the chilled/hot water pump and chiller/heater are interlocked, the pump runs automatically when starting the chiller/heater.

If not, the start sequence must be: chilled/hot water pump, chiller/heater.

3.6.2 - Start heating operation
Refer to Fig. 22.

Local operation mode
• Press the "LOCAL" key on the chiller control board. The "LOCAL" indication light of the key is on.
• Keep pressing the "RUN" key for more than a second and make sure that the "RUN" indicator light of the key is on.
• Automatic operation starts.

Remote operation mode
• Press the "REMOTE" key on the chiller control board. The "REMOTE" indicator light of the key is on.
• Turn on the start switch on the remote control panel for the field supply. The indicator light of the "RUN" key on the chiller control board is on.
• Automatic operation starts.

NOTE: In local operation mode the signal from the remote control panel does not work. In remote operation mode the "RUN" key of the chiller control board does not work.
3.6.3 - Stop heating operation
Refer to Fig. 22.

Local operation mode
- Keep pressing the "STOP" key on the chiller control board for more than a second.
- Make sure that the "RUN" indication light goes off and the "STOP" indication light comes on.

Remote operation mode
- Turn on the stop switch on the field supply remote control panel.
- Another way to stop the chiller is to press the "STOP" key on the chiller control board during remote operation.

NOTE: If the chilled-water pump, cooling water pump, and chiller are interlocked, each pump stops automatically when the chiller stops. If not, the stop sequence must be:
Chiller, cooling water pump, chilled-water pump

The air handling unit must be stopped after the chilled-water pump is stopped.

Fig. 22 - Typical control board

3.7 - Changing the information on the data display

3.7.1 - Normal display information
The data display on the control board usually shows the generator temperature as follows (refer to Fig. 22).

It returns to the generator temperature display when no key is pressed for 1 minute.

3.7.2 - Changing the display
Refer to Fig. 22.

If you press the ▲ key, the information on the data display changes in the correct order, and pressing the ▼ key, it changes in reverse order. If you press the ▲ key again when the last information is shown, the display returns to the normal display information.

3.7.3 - Typical display order
Real-time data is shown in the data display (7-segment LED and 6 figures). The display shows a data code (content distinction by code number) and various operating times, on/off time, component temperatures, chilled-water temperature setpoints and alarm codes. A data code is sent in turn from the ▲ ▼ keys and displayed. An alarm code is only shown when one or several abnormalities occur. The alarm code is shown in order of importance, and a dotted "." is shown under the number to the right of the alarm code. When several faults occur, use the ▲ ▼ keys to display the additional alarm codes. If no key including the "BACK" key is pressed for 1 minute, the display returns to the generator temperature display.

Fig. 23 - Typical indication flow

<table>
<thead>
<tr>
<th>Data code</th>
<th>Data name</th>
<th>Display</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 generator temperature</td>
<td>135.0°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Chiller/heater operating hours</td>
<td>1234 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Absorbent pump 1 operating hours</td>
<td>1111 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Absorbent pump 2 operating hours</td>
<td>1230 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Chiller/heater on/off times</td>
<td>123 times</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Chiller/heater on/off times</td>
<td>169 times</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Combustion on/off times</td>
<td>123 times</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Combustion on/off times</td>
<td>189 times</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Refrigerant pump on/off times</td>
<td>138 times</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Purge pump on/off times</td>
<td>91 times</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Chilled water temperature setpoint</td>
<td>7.0°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Chilled water temperature setpoint</td>
<td>55.0°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Chilled water temperature setpoint</td>
<td>11.9°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Chilled water leaving temperature</td>
<td>6.8°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Chilled water entering temperature</td>
<td>31.9°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Chilled water entering temperature</td>
<td>34.7°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Steam drain/exhaust gas temperature</td>
<td>211.7°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 Purge tank pressure</td>
<td>8.5 kPa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 Generator temperature</td>
<td>135.0°C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.8 - Changing display and setpoint

Setpoint display change

Select the current setpoint temperature and change it as follows.
To change the chilled-water temperature:

7.0°C
Press the “SET” key for about 2 seconds.

A number showing the setpoint temperature blinks. Press the ▲ or ▼ key.

7.5°C
Press the “SET” key

The setpoint change has been made.

To change the hot water temperature

55.0°C
Press the “SET” key for about 2 seconds.

A number showing the setpoint temperature blinks. Press the ▲ or ▼ key.

57.0°C
Press the “SET” key

The setpoint change has been made.

If no key including the “BACK” key is pressed for 1 minute, the display returns to the generator temperature.

**NOTES:**
1. Incorrect setting may cause chiller failure. If you need to change the setpoint, always consult your Carrier service agent.
2. Setpoints become effective as soon as they have been changed. Be careful when changing setpoints during operation.

### 3.9 - Maintenance message

If a problem that could affect the efficient operation of the chiller is predicted, a warning message is given. This includes a comment on the data display as shown in Fig. 24

**Fig. 24 - Maintenance message**

<table>
<thead>
<tr>
<th>Data code</th>
<th>Data name</th>
<th>Display</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-01*</td>
<td>Operate purge pump</td>
<td>Display</td>
<td>Operate purge pump.</td>
</tr>
<tr>
<td>H-03*</td>
<td>Clean cooling water tubes</td>
<td>Display</td>
<td>Fouling of cooling water tubes.</td>
</tr>
<tr>
<td>H-04*</td>
<td>Check cooling water system</td>
<td>Display</td>
<td>Check the cooling water pump, cooling tower, etc.</td>
</tr>
<tr>
<td>H-05*</td>
<td>Clean chamber</td>
<td>Display</td>
<td>Fouling of combustion chamber.</td>
</tr>
<tr>
<td>H-06**</td>
<td>Purge tank high pressure</td>
<td>Display</td>
<td>Fouling of cooling water tubes.</td>
</tr>
<tr>
<td>H-07**</td>
<td>Cooling water tube fouling</td>
<td>Display</td>
<td>Fouling of cooling water tubes.</td>
</tr>
<tr>
<td>H-08**</td>
<td>Cooling water high temperature</td>
<td>Display</td>
<td>Fouling of cooling water tubes.</td>
</tr>
<tr>
<td>H-10</td>
<td>Power failure</td>
<td>Display</td>
<td>There was power failure when the chiller/heater was operating</td>
</tr>
</tbody>
</table>

**Legend**

* When this appears, immediate action is required.
** When this appears, no immediate action is required, but as this might lead to a higher code, attention should be paid. Consult Carrier service personnel at the next periodic maintenance.

**NOTE:** These displays disappear when the problem has been corrected.

**Fig. 25 - Maintenance message descriptions and actions required**

<table>
<thead>
<tr>
<th>Maintenance message</th>
<th>Display</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cooling water tube fouling</td>
<td>Display</td>
</tr>
<tr>
<td>2</td>
<td>Vacuum rate</td>
<td>Display</td>
</tr>
<tr>
<td>3</td>
<td>High cooling water temperature</td>
<td>Display</td>
</tr>
<tr>
<td>4</td>
<td>Combustion chamber fouling (for oil-fired type)</td>
<td>Display</td>
</tr>
<tr>
<td>5</td>
<td>Power failure</td>
<td>Display</td>
</tr>
</tbody>
</table>

Legend: See section 3.10.5.
3.10 - Alarm indications and actions

3.10.1 - How they are shown
When an alarm is detected, the alarm buzzer sounds, and the alarm message is shown on the data display. At the same time, the indication light of the "STOP" key blinks. The chiller stops for safety reasons after the dilution cycle. Depending on the alarm message it may also stop without carrying out the dilution cycle.

**Fig. 26 - Display example**

[Display example]

Chilled-water low temperature
An alarm code is only shown when one or several abnormalities occur. If several errors have occurred, the most important one is shown with a dot ".".

[Display example]

Chilled-water low temperature
The other alarm codes are shown by pressing the ▲ key.

The high-temperature generator solution level is too low.

3.10.2 - Troubleshooting flowchart

![Troubleshooting flowchart](image)

3.10.3 - Alarm message and setpoint

**Fig. 27 - List of alarms and setpoints in cooling operation**

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Display</th>
<th>Alarm message</th>
<th>Setpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection of chilled water</td>
<td></td>
<td>Chilled water temperature is too low.</td>
<td>2.5°C or below</td>
</tr>
<tr>
<td>system</td>
<td></td>
<td>Chilled water pump interlock alarm.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chilled water flow alarm</td>
<td>50% or below</td>
</tr>
<tr>
<td>Prevention of</td>
<td></td>
<td>Cooling water temperature is too low.</td>
<td>24°C or below</td>
</tr>
<tr>
<td>crystallisation</td>
<td></td>
<td>Cooling water flow alarm</td>
<td>for 30 minutes</td>
</tr>
<tr>
<td>High-temperature generator</td>
<td></td>
<td>High-temperature generator pressure is too high.</td>
<td>101.3 kPa or above</td>
</tr>
<tr>
<td>protection</td>
<td></td>
<td>High-temperature generator solution level is too low.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High concentration of absorbent</td>
<td>65.0 % or above twice</td>
</tr>
<tr>
<td>Combustion alarm</td>
<td></td>
<td>Exhaust gas temperature is too high (gas)</td>
<td>300°C or above</td>
</tr>
<tr>
<td>Motor protection</td>
<td></td>
<td>Exhaust gas temperature is too high (oil)</td>
<td>350°C or above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flame failure and burner failure</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>Capacity is too low.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Changeover during operation:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heating → cooling</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooling tower overload alarm.</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 28 - List of alarms and setpoints in heating operation**

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Display</th>
<th>Alarm message</th>
<th>Setpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection of hot water system</td>
<td></td>
<td>Hot water temperature is too high.</td>
<td>70°C or above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hot water pump interlock alarm.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hot water flow alarm</td>
<td>50% or below</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-temperature generator pressure is too high.</td>
<td>130°C or above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High-temperature generator solution level is too low.</td>
<td></td>
</tr>
<tr>
<td>Combusion alarm</td>
<td></td>
<td>Exhaust gas temperature is too high (gas)</td>
<td>300°C or above</td>
</tr>
<tr>
<td>Motor protection</td>
<td></td>
<td>Exhaust gas temperature is too high (oil)</td>
<td>350°C or above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flame failure or burner failure</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>Capacity is too low.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Changeover during operation:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heating → cooling</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**

1. If the data display still shows an alarm after the "STOP" key has been pressed, ensure that the alarm cause has definitely been removed.
2. In case of a combustion alarm, operation does not restart without pressing the reset button on the burner controller.

Start operation referring section 3.5 or 3.6
### 3.10.4 - Locating and clearing an alarm

#### Display and content of alarm

<table>
<thead>
<tr>
<th>Alarm of the chilled/hot water and/or cooling water system</th>
<th>Check that the discharge pressure of both chilled/hot water and cooling water pumps is normal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled/hot water temperature is too low.</td>
<td>If not, the strainer may be the clogged or there may be an air leak in the piping, etc.</td>
</tr>
<tr>
<td>Chilled water flow alarm</td>
<td>Correct them to the specified setpoint.</td>
</tr>
<tr>
<td>Hot water temperature is too high.</td>
<td>Is the chilled water setpoint too low?</td>
</tr>
<tr>
<td>Hot water flow alarm</td>
<td>→ Correct them to the specified setpoint.</td>
</tr>
<tr>
<td>Cooling water temperature is too low.</td>
<td>→ Correct it to specified setpoint. (e.g. 28°C)</td>
</tr>
<tr>
<td>Cooling water flow alarm (option)</td>
<td>→ Correct the above causes and restart the chiller/heater.</td>
</tr>
<tr>
<td></td>
<td>To change heating operation refer to section 3.4.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alarm of the motor(s)</th>
<th>Check that the reset button(s) of the overload relay connected to electromagnetic contactor is (are) not pushed in, then contact your Carrier service agent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorbent pump 1 overload alarm.</td>
<td>→ Entering and leaving chilled/hot water temperature</td>
</tr>
<tr>
<td>Absorbent pump 2 overload alarm.</td>
<td>→ High-temperature generator temperature and pressure</td>
</tr>
<tr>
<td>Refrigerant pump overload alarm.</td>
<td>→ Entering and leaving cooling water temperature</td>
</tr>
<tr>
<td>Absorbent pump 3 overload alarm.</td>
<td>→ High-temperature generator temperature and pressure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alarm of the auxiliary equipment</th>
<th>Check that the chilled/hot water pump and cooling water pump are rotating.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled water pump interlock alarm.</td>
<td>→ Start the pump.</td>
</tr>
<tr>
<td></td>
<td>→ Check the ventilation fan and/or other equipment connected to the system interlock.</td>
</tr>
<tr>
<td>Cooling water pump interlock alarm.</td>
<td>→ Correct the above causes and restart the chiller/heater.</td>
</tr>
<tr>
<td>Ventilation fan interlock etc. alarm.</td>
<td>→ If the &quot;ALARMS STOP&quot; continues, contact your Carrier service agent.</td>
</tr>
<tr>
<td>Cooling tower fan interlock alarm.</td>
<td>→ Entering and leaving chilled/hot water temperature</td>
</tr>
<tr>
<td></td>
<td>→ High-temperature generator temperature and pressure</td>
</tr>
<tr>
<td>Alarm of the high-temperature generator</td>
<td>→ Entering and leaving cooling water temperature</td>
</tr>
<tr>
<td>High-temperature generator temperature is too high.</td>
<td>→ High-temperature generator temperature and pressure</td>
</tr>
<tr>
<td>High-temperature generator pressure is too high.</td>
<td>→ Correct it to specified setpoint.</td>
</tr>
<tr>
<td>High-temperature generator solution level is too low.</td>
<td>→ To change cooling operation refer to section 3.4.</td>
</tr>
<tr>
<td>High concentration of absorbent</td>
<td>→ Correct the following and contact your Carrier service agent.</td>
</tr>
<tr>
<td>Exhaust gas temperature is too high.</td>
<td>→ Engaging and leaving chilled water temperature</td>
</tr>
<tr>
<td></td>
<td>→ Entering and leaving cooling water temperature</td>
</tr>
<tr>
<td></td>
<td>→ High-temperature generator temperature and pressure</td>
</tr>
<tr>
<td></td>
<td>→ There may be the fouling of heat transfer tube in the water (especially cooling water) piping.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alarm of sensor</th>
<th>Check the following and contact your Carrier service agent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled/hot water inlet temperature sensor alarm.</td>
<td>→ Correcting and leaving chilled water temperature</td>
</tr>
<tr>
<td>Cooling water inlet temperature sensor alarm.</td>
<td>→ Entering and leaving cooling water temperature</td>
</tr>
<tr>
<td>Cooling water outlet temperature sensor alarm.</td>
<td>→ High-temperature generator temperature and pressure</td>
</tr>
<tr>
<td>Cooling water intermediate temperature sensor alarm.</td>
<td>→ To change cooling operation refer to section 3.4.</td>
</tr>
<tr>
<td>Condenser temperature sensor alarm.</td>
<td>→ Correcting and leaving chilled water temperature</td>
</tr>
<tr>
<td>Low-temperature generator’s temperature sensor alarm.</td>
<td>→ Engaging and leaving cooling water temperature</td>
</tr>
<tr>
<td>Refrigerant temperature sensor (absorber) alarm.</td>
<td>→ High-temperature generator temperature and pressure</td>
</tr>
<tr>
<td>Diluted solution temperature sensor (absorber outlet) has failure.</td>
<td>→ Correcting and leaving chilled water temperature</td>
</tr>
<tr>
<td>Concentrated solution temperature sensor (low-temperature heat exchanger) alarm.</td>
<td>→ Entering and leaving cooling water temperature</td>
</tr>
<tr>
<td>Chilled/hot water outlet temperature sensor alarm.</td>
<td>→ High-temperature generator temperature and pressure</td>
</tr>
<tr>
<td>High-temperature generator’s temperature sensor alarm.</td>
<td>→ Correcting and leaving chilled water temperature</td>
</tr>
<tr>
<td>Exhaust gas temperature sensor alarm.</td>
<td>→ There may be the fouling of heat transfer tube in the water (especially cooling water) piping.</td>
</tr>
</tbody>
</table>

#### Display and content of alarm

<table>
<thead>
<tr>
<th>Alarm of the high-temperature generator</th>
<th>HEATING OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-temperature generator temperature is too high.</td>
<td>If the chiller/heater shows &quot;ALARMS STOP&quot; right after it starts, try to re-start it. If it occurs again, contact your Carrier service agent.</td>
</tr>
<tr>
<td>High-temperature generator pressure is too high.</td>
<td>→ Check the following and contact your Carrier service agent.</td>
</tr>
<tr>
<td>High-temperature generator solution level is too low.</td>
<td>→ Correct it to specified setpoint.</td>
</tr>
<tr>
<td>High absorbent concentration</td>
<td>→ Linkage between gas control valve and damper (disconnected and/or loose).</td>
</tr>
<tr>
<td>Exhaust gas temperature is too high.</td>
<td>→ There may be the fouling of heat transfer tube in the hot water line.</td>
</tr>
</tbody>
</table>

**Note:** The chiller/heater automatically stops for safety reasons when either the high-temperature generator temperature sensor or the chilled/hot water temperature sensor has an alarm. It does not stop when other sensors have an alarm, but this could cause a control failure. Please contact your Carrier service agent as soon as possible.
4 - MAINTENANCE

4.1 - Daily maintenance

4.1.1 - Inspection of each chiller/heater component
If you find an abnormal condition, contact your Carrier service agent:
• Smell of gas or oil leak around the chiller/heater
• Abnormal noise at the start of the burner
• Abnormal noise of absorbent pump and refrigerant pump

For the following items please consult the system manufacturer:
• Cleaning of cooling tower and cooling water line strainer
• Check the condition of the cooling tower
• Check for air leaks in the piping

4.1.2 - Operation data record
Please record the operation data regularly, as this is useful for troubleshooting and alarm prevention. Show the record to the Carrier service personnel when they visit you for the service or the periodic inspection.

On the next page you will find a sample of the operation data sheet.

---

2. Actions to be taken if a power failure occurs

If a power failure occurs, the chiller/heater stops completely without carrying out a dilution cycle. Special attention should be paid to the following.

<table>
<thead>
<tr>
<th>Operating condition at failure</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occurred during cooling operation, and power did not return for more than an hour</td>
<td>Immediately contact Carrier service agent. Do not restart operation.</td>
</tr>
<tr>
<td>Occurred during cooling operation, and power returned in less than an hour</td>
<td>Contact Carrier service agent after restarting operation.</td>
</tr>
<tr>
<td>Occurred during heating operation</td>
<td>Contact Carrier service agent after restarting operation.</td>
</tr>
<tr>
<td>Occurred during purging operation</td>
<td>Immediately close the purge valve completely and turn the purge pump switch on the control panel off. After the power is restored, restart purging, and consult your Carrier service agent.</td>
</tr>
</tbody>
</table>

---

3.10.5 - Action in case of power failure

1. Flowchart of action in case of power failure

A power failure occurs.

The chiller/heater stops completely.

Power returns.

Press the "RUN" key.

Operation restarts

Power failure indication "H-10" is shown on the data display.

Power failure indication on the data display disappears.
<table>
<thead>
<tr>
<th>No.</th>
<th>Data items</th>
<th>Unit</th>
<th>Spec.</th>
<th>DATA-1 Time:</th>
<th>DATA-2 Time:</th>
<th>DATA-3 Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ambient temperature</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Room temperature</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Chilled/hot-water entering temperature</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Chilled/hot-water leaving temperature</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Chilled/hot-water entering pressure</td>
<td>kPa/psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Chilled/hot-water leaving pressure</td>
<td>kPa/psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Evaporator pressure drop</td>
<td>kPa/psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Chilled/hot-water flow rate</td>
<td>l/s/gpm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Cooling water entering temperature</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Cooling water leaving temperature</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Cooling water entering pressure</td>
<td>kPa/psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Cooling water leaving pressure</td>
<td>kPa/psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Pressure drop in absorber &amp; condenser</td>
<td>kPa/psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Cooling water flow rate</td>
<td>l/s/gpm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>High-temperature generator temperature</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>High-temperature generator pressure</td>
<td>kPa/psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Evaporator solution level</td>
<td>n/60 mm n/2-3/8&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>High-temperature generator solution level</td>
<td>n/60 mm n/2-3/8&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Solution level in bottom of absorber</td>
<td>n/60 mm n/2-3/8&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Purge tank pressure</td>
<td>kPa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Concentration of concentrated solution</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relative density of concentrated solution</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature of concentrated solution</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Concentration of diluted solution</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relative density of diluted solution</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature of diluted solution</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Concentration of refrigerant</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relative density of refrigerant</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature of refrigerant</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Condensed refrigerant temperature</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>LTD *</td>
<td>°C/°F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Absorbent pump 1 current</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Absorbent pump 2 current</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Refrigerant pump current</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Purge pump current</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* LTD = Condensed refrigerant temperature minus cooling water leaving temperature

Notes
4.2 - Periodic maintenance

To optimize performance, the chiller/heater requires purging, refrigerant blow down, absorbent control and management of the combustion equipment etc. We recommend that you arrange a maintenance contract with your Carrier service agent.

4.2.1 - Purging

Non-condensable gas inside the machine not only decreases cooling/heating capacity, but also potentially shortens the life of the machine. Therefore purging must be done at cooling/heating changeover. This should be done by the Carrier service personnel under a maintenance contract. If customers carry out the purging themselves, they should take instruction from our service personnel.

Purge procedure (DJ-11-42)

Refer to Figs. 30 and 31. When the purge indication light on the control panel comes on, start purging, following the instructions below. Do not purge during the heating mode.

- Turn on the purge pump on/off switch on the control panel, and operate the purge pump for 10 minutes.
- Open V1 and V2.
- Press the ▲ key on the control panel once to show data code 17 "Purge tank pressure" (refer to chapter 3.7.3) and check if the indicated value drops. If it does not drop, follow the procedure described in steps 1, 2 and 3 below and contact your Carrier service agent.
- Purge for 10 minutes. Even if the purge indication light goes off before 10 minutes have elapsed, continue purging for the full 10 minutes. If the light does not go off, continue purging until it does.

1. Close V1 and V2.
2. Turn the purge pump on/off switch off.
3. Check if the valves are open/closed.

V1 | Closed
---|---
V2 | Closed
V3 | Closed
V4 | Open
B valve | Open

Purge indication light
Purge pump on/off switch

Fig. 30

Fig. 31

V1
V2
V3
SV1
SV2
B valve
Maintenance pressure gauge
Purge tank
Liquid trap
Purge pump

Fig. 32

2. Purge procedure (DJ-51-82)

Refer to Figs. 30 and 32. When the purge indication light on the control panel comes on, start purging, following the instructions below.

- Turn on the purge pump on/off switch on the control panel and operate the purge pump for 10 minutes.
- Close B valve and V4, and open V1 and V2.
- Press the ▲ key on the control panel once to show data code 17 "Purge tank pressure" (refer to chapter 3.7.3) and check if the indicated value drops. If it does not drop, follow the procedure described in steps 1, 2 and 3 below and contact your Carrier service agent.
- Open B valve and V4, and purge for 10 minutes. Even if the purge indication light goes off before 10 minutes have elapsed, continue purging for the full 10 minutes. If the light does not go off, continue purging until it does.

1. Close V1 and V2.
2. Turn the purge pump on/off switch off.
3. Check if the valves are open/closed.
4.2.2 - Refrigerant blow down
During cooling operation a small quantity of absorbent can mix with the refrigerant. This amount can increase over time and result in a reduced cooling capacity. Therefore refrigerant blow-down must be performed once during the cooling season. By doing this the dirty refrigerant is transferred to the absorber side and new, clean refrigerant is regenerated.

Fig. 33

- Make sure the refrigerant pump is rotating and that the solution level is visible through the evaporator sight glass.
- Open the transfer valve completely.
- When the solution level is no longer visible, close the transfer valve tightly.

The above blow-down procedure should be repeated a few times, as necessary. We recommend that you arrange a maintenance contract with your Carrier service agent which will include refrigerant blow-down.
### 4.3 - Recommended schedule of maintenance and replacement of main components

<table>
<thead>
<tr>
<th>Component</th>
<th>Name</th>
<th>Inspection area</th>
<th>Inspection area</th>
<th>Inspection</th>
<th>Method</th>
<th>Interval</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Vacuum area</td>
<td>Non-vacuum area</td>
<td>Item</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Corrosion of the surface of the heat transfer tube</td>
<td>Eddy-current test/Endoscope/Visual inspection</td>
<td>Every 3 years</td>
<td>Random inspection from the bundle (no vacuum destruction)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Corrosion of the internal surface of the heat transfer tube</td>
<td>Scale and/or slime adhesion</td>
<td>Once a year</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Corrosion of the surface of the heat transfer tube</td>
<td>Eddy-current test/Endoscope/Visual inspection</td>
<td>Every 3 years</td>
<td>Random inspection from the bundle (no vacuum destruction)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Corrosion of the internal surface of the heat transfer tube</td>
<td>Scale and/or slime adhesion</td>
<td>Once a year</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Corrosion of the surface of the heat transfer tube</td>
<td>Overhaul</td>
<td>Every 3 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Corrosion of the internal surface of the heat transfer tube</td>
<td>Scale and/or slime adhesion</td>
<td>Once a year</td>
<td></td>
</tr>
<tr>
<td>Solution</td>
<td>Absorbent (X)</td>
<td></td>
<td></td>
<td></td>
<td>Solution analysis</td>
<td>6 times per year</td>
<td>To be adjusted to the control standards</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Concentration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Alkalinity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inhibitor ratio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dissolved copper ratio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dissolved iron ratio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Solution random inspection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump</td>
<td>Absorbent pump (X)</td>
<td></td>
<td></td>
<td></td>
<td>Overhaul</td>
<td>As necessary</td>
<td>Inspection interval 20000 hours or more</td>
</tr>
<tr>
<td></td>
<td>Refrigerant pump</td>
<td></td>
<td></td>
<td></td>
<td>Overhaul</td>
<td>As necessary</td>
<td>Inspection interval 20000 hours or more</td>
</tr>
<tr>
<td></td>
<td>Purge pump (X)</td>
<td></td>
<td></td>
<td></td>
<td>Overhaul</td>
<td>As necessary</td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td>Flame detector (X)</td>
<td></td>
<td></td>
<td></td>
<td>Customer will keep spare parts for one unit</td>
<td>Once a year</td>
<td></td>
</tr>
<tr>
<td>Safety device</td>
<td>Pressure gauge (X)</td>
<td></td>
<td></td>
<td></td>
<td>Periodic replacement (because of safety device)</td>
<td>Every 3 years</td>
<td>Generator pressure gauge</td>
</tr>
<tr>
<td>Control device</td>
<td>Flow switch (X)</td>
<td></td>
<td></td>
<td></td>
<td>Periodic replacement with a maintenance contract</td>
<td>As necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature sensor</td>
<td></td>
<td></td>
<td></td>
<td>Periodic inspection with a maintenance contract (service agent will keep spare parts)</td>
<td>As necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electro-magnetic contactor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inverter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Once a year</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Solution level relay electrode</td>
<td></td>
<td></td>
<td></td>
<td>Periodic replacement (maintaining the vacuum)</td>
<td>Every 3 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sight glass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Every 3 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diaphragm valve packing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Every 3 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other packing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Every 3 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Palladium cell</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Every 3 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smoke chamber cover</td>
<td></td>
<td></td>
<td></td>
<td>Periodic inspection with a maintenance contract (service agent will keep spare parts)</td>
<td>As necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water line packing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>All inspection</td>
<td></td>
</tr>
</tbody>
</table>
4.4 - Water treatment

Water treatment is very important for the chiller/heater. As this requires specialised technical knowledge, please consult your Carrier service agent.

4.4.1 - Water treatment for chilled water and cooling water
The cooling water temperature in an open-type recycling cooling tower is decreased using vaporized latent heat, and the cooling water is reused. At this time, the water is evaporated, and the concentration of the remaining dissolved salts increases. This means that the water quality will gradually deteriorate.

As the water and air are always in contact with each other in the cooling tower, the sulfurous acid gas, dust, sand, etc. in the atmosphere will mix with the water, further degrading the water quality.

These factors cause problems in the cooling water system, such as corrosion, scale and slime.

Water quality standard
The water quality standard is shown in the example in Figure 35. This is an extract from JRA-GL 02-1994.

NOTES:
1. If any item deviates from the standard values it may cause failure due to corrosion or scale. Therefore the water quality should be checked periodically.
2. The water quality range that can be used after chemical treatment is not given here, as the range depends on the chemicals used. The appropriate water quality values should be set together with a water processing specialist and be checked periodically.

Typical water treatment
Even if the make-up water for the cooling water complies with water standards, the water quality will deteriorate due to its concentration. Therefore the following water treatment is necessary. Depending on the degree of deterioration, chilled-water also requires this treatment.

If a concrete heat storage tank is used, special attention should be paid to water treatment.
- Regular manual blow-down of the tower sump water
- Automatic blow-down by measuring electric conductance
- Addition of the anti-corrosion inhibitor
- Slime control
- Periodic water analysis
  Service the water header periodically, check the heat transfer tube and clean it as necessary.

For example, if 0.6 mm of scale clings to the tubes, the cooling capacity drops to 76%, the chilled-water temperature rises by 2°C and fuel consumption rises by 23%.
A Increase in fuel consumption (for constant cooling capacity, ratio at rated fuel consumption)
B Decrease in cooling capacity (for constant chilled water temperature)
C Increase in chilled water temperature (for constant cooling capacity)
# Water Quality Standard Values for Cooling Water, Chilled Water, Mid-Range Temperature Water, and Make-up Water

## Cooling Water Systems

### Recirculating Water
- Make-up Water
- Once Through Water

### Chilled Water Systems
- Make-up Water

### Mid-Range Temperature (20-90°C) Water Systems

#### Lower Mid-Range Temperature Water System
- Make-up Water
- Recirculating Water

#### Higher Mid-Range Temperature Water System
- Make-up Water

### Tendency

<table>
<thead>
<tr>
<th>pH (25°C)</th>
<th>Electrical Conductivity (25°C)</th>
<th>Chloride Ion</th>
<th>Sulfate Ion</th>
<th>Acid Consumption (pH 4.8)</th>
<th>Total Hardness</th>
<th>Calcium Hardness</th>
<th>Ionic Silica</th>
<th>Iron</th>
<th>Copper</th>
<th>Sulfide Ion</th>
<th>Ammonium Ion</th>
<th>Residual Chlorine</th>
<th>Free Carbon Dioxide</th>
<th>Ryzner Stability Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.5 - 8.2</td>
<td>&lt;= 80 mS/m</td>
<td>&lt;= 200 mg Cl⁻/l</td>
<td>&lt;= 200 mg SO₄²⁻/l</td>
<td>&lt;= 100 mg CaCO₃³⁻/l</td>
<td>&lt;= 200 mg CaCO₃³⁻/l</td>
<td>&lt;= 150 mg SiO₂²⁻/l</td>
<td>&lt;= 1.0 mg Fe/l</td>
<td>&lt;= 0.3 mg Cu/l</td>
<td>&lt;= 0.3 mg S²⁻/l</td>
<td>&lt;= 1.0 mg NH₄⁺/l</td>
<td>&lt;= 0.3 mg Cl⁻/l</td>
<td>&lt;= 4.0 mg CO₂⁻/l</td>
<td>- 6.0 - 7.0 mg Cl⁻/l</td>
<td></td>
</tr>
<tr>
<td>6.0 - 8.0</td>
<td>&lt;= 30 mS/m</td>
<td>&lt;= 50 mg Cl⁻/l</td>
<td>&lt;= 50 mg SO₄²⁻/l</td>
<td>&lt;= 50 mg CaCO₃³⁻/l</td>
<td>&lt;= 50 mg CaCO₃³⁻/l</td>
<td>&lt;= 50 mg SiO₂²⁻/l</td>
<td>&lt;= 1.0 mg Fe/l</td>
<td>&lt;= 0.1 mg Cu/l</td>
<td>&lt;= 0.1 mg S²⁻/l</td>
<td>&lt;= 0.1 mg NH₄⁺/l</td>
<td>&lt;= 0.1 mg Cl⁻/l</td>
<td>&lt;= 4.0 mg CO₂⁻/l</td>
<td>- 6.0 - 7.0 mg Cl⁻/l</td>
<td></td>
</tr>
<tr>
<td>6.8 - 8.0</td>
<td>&lt;= 40 mS/m</td>
<td>&lt;= 50 mg Cl⁻/l</td>
<td>&lt;= 50 mg SO₄²⁻/l</td>
<td>&lt;= 50 mg CaCO₃³⁻/l</td>
<td>&lt;= 50 mg CaCO₃³⁻/l</td>
<td>&lt;= 50 mg SiO₂²⁻/l</td>
<td>&lt;= 1.0 mg Fe/l</td>
<td>&lt;= 0.1 mg Cu/l</td>
<td>&lt;= 0.1 mg S²⁻/l</td>
<td>&lt;= 0.1 mg NH₄⁺/l</td>
<td>&lt;= 0.1 mg Cl⁻/l</td>
<td>&lt;= 4.0 mg CO₂⁻/l</td>
<td>- 6.0 - 7.0 mg Cl⁻/l</td>
<td></td>
</tr>
<tr>
<td>7.0 - 8.0</td>
<td>&lt;= 30 mS/m</td>
<td>&lt;= 50 mg Cl⁻/l</td>
<td>&lt;= 50 mg SO₄²⁻/l</td>
<td>&lt;= 50 mg CaCO₃³⁻/l</td>
<td>&lt;= 50 mg CaCO₃³⁻/l</td>
<td>&lt;= 50 mg SiO₂²⁻/l</td>
<td>&lt;= 1.0 mg Fe/l</td>
<td>&lt;= 0.1 mg Cu/l</td>
<td>&lt;= 0.1 mg S²⁻/l</td>
<td>&lt;= 0.1 mg NH₄⁺/l</td>
<td>&lt;= 0.1 mg Cl⁻/l</td>
<td>&lt;= 4.0 mg CO₂⁻/l</td>
<td>- 6.0 - 7.0 mg Cl⁻/l</td>
<td></td>
</tr>
</tbody>
</table>

### Reference Items

- X

## Notes

* The nomenclature of items, definition of terms, and units comply with the JIS K 0101. The units and values in () are conventional ones put here for reference.

** The mark X indicates factors affecting the corrosive or scale-forming tendency.

*** When temperature is high (above 40°C), corrosiveness generally increases. Especially, when iron/steel surface has no protective film and is in direct contact with water, it is desirable to take adequate countermeasures against corrosion, such as addition of corrosion inhibitor and deoxygenation treatment.

**** For the cooling water system using a closed-type cooling tower, the water quality standard for the mid-range temperature water system shall be applied to the closed-circuit recirculating spray water and its make-up water, while the water quality standard for the recirculating cooling water system shall be applied to the spray water and its make-up water, respectively.

++ City water, industrial water and ground water shall be used as source water, and demineralized water, reclaimed water, softened water, etc. shall be excluded.

+++ The 15 items listed above show typical factors of corrosion and scale problems.
4.4.2. Water treatment for long-term shut-down
Perform the following procedure during long-term shut-down when no chilled-water or cooling water circulates in the chiller/heater. Please consult your Carrier service agent for the details.

Cooling water
The usual system is a wet system with the cooling water kept in the chiller/heater. If the cooling water is likely to freeze, drain it from the chiller/heater (dry system). The valve operation is different between wet and dry systems.

Long-term shut-down (wet system)
• Drain the cooling water from its discharge port on the cooling water outlet.
• Add anti-corrosion inhibitor to the water. Check the holding water quantity and decide the inhibitor quantity so that the ratio is appropriate.
• Charge the chiller/heater with cooling water.
• Operate the cooling water pump until the inhibitor is evenly mixed.
• Close the cooling water line inlet and outlet isolation valves.

Dry system
Before draining the cooling water from the chiller/heater, clean the inside of the tubes and provide a corrosion protection covering.
• Drain the cooling water from its discharge port on the cooling water inlet.
• Remove the scale and/or slime from the tubes with a brush. If scale and/or slime cannot be removed with a brush use chemical cleaning.
• After sufficient cleaning, add anti-corrosion inhibitor to the water, and circulate the water with the inhibitor for 30 minutes or more. The inhibitor concentration should be even.
• Drain the water from the discharge port on the cooling water inlet.
• Keep the discharge port open during shut-down.

Chilled water
The usual system is a wet system with the chilled water kept in the chiller/heater.

4.4.3 - Winter season
If the ambient temperature of the chiller/heater is likely to be below 0°C in winter, freeze protection is necessary. Consult your Carrier service agent for the details.

5 - TROUBLESHOOTING
For identifying and eliminating the causes of machine failure, please refer to the following chapters:

3.7 - Maintenance message
3.8 - Alarm indication and actions
Appendix 1 - Flowchart (at the end of that document)
Legend
1 Attachment
2 Liquid trap
3 Vacuum gauge
4 Vacuum rubber hose
5 Vacuum valve
6 Sampling cylinder
7 Purge pump
8 Sampling service valve
9 Attachment
10 Vacuum rubber hose
11 Vacuum valve
12 Sampling cylinder
13 Rubber plug
14 Copper tube
15 Flare nut (brass)
16 Rubber hose
17 Steel wire
18 Copper tube
19 Flare nut (brass)
20 Copper tube
6 - INSTRUCTIONS

6.1 - Absorbent sampling method

This instruction describes the procedure for sampling a small amount of the absorbent.

6.1.1. Equipment to use
• Sampling cylinder and attachments for service valve
• Vacuum rubber hose
• Pliers
• Vacuum gauge (0-1 kPa)

6.1.2 - Precautions
• Because of the high vacuum condition inside the chiller/heater, ensure that air never leaks into the chiller/heater during this work.
• Handle the vacuum valve carefully so as not to damage it.
• Solution (absorbent and refrigerant) is sampled at SV5, SV6 and SV3 in the same manner.
• Pour the sampled solution into a container.

Refer to Figure 12.

6.1.3 - Procedure
• Confirm that manual purge valves (V1, V2 and V3) are closed.
• Remove the flare nut and the bonnet of SV1, and connect the attachment to the service valve.
• Connect the vacuum gauge to SV2 and open SV2.
• Remove the flare nut and the bonnet of SV4 when absorbent is sampled, and connect the attachment to the sampling service valve.
• Connect the vacuum rubber hose and the sampling cylinder to the attachment as shown in Figure 37.
• Run the purge pump and open up V1.
• Open SV1 and the vacuum valve.
• Once the vacuum gauge shows about 0.5 kPa, close the vacuum valve.
• Close SV1 and V1.
• Remove the vacuum rubber hose from SV1, and connect it to the attachment connected to SV4, as shown in Figure 36.
• Open the vacuum valve.
• Open SV4.
• When the sampling cylinder is filled with absorbent, close SV4.
• Close the vacuum valve and remove the vacuum rubber hose from the attachment on SV4.
• Upon completion of this work, remove the attachment, and replace the bonnets and flare nut. Also replace the caps of both service valves after checking their packing.
• Stop the purge pump.
• Finally, wash all tools with water.

6.2 - Concentration measurement method

This is the procedure used to measure the absorbent and refrigerant concentration.

6.2.1 - Equipment to use
• Sampling cylinder
• Gravimeter
  Scale: 1.0-1.2 (for refrigerant)
  Scale: 1.4-1.6 (for diluted absorbent)
  Scale: 1.6-1.8 (for diluted, intermediate and concentrated absorbent)
• Thermometer

6.2.2 - Precautions
• Take care not to damage the gravimeter and thermometer.
• Be careful not to spill any solution. Do not fill the sampling cylinder more than about 80%.
• Perform this measurement quickly.

6.2.3 - Procedure
• Fill the sampling cylinder to about 80% with the solution to be measured.
• Keep the sampling cylinder vertical, and insert the gravimeter into it.
• When the gravimeter stops moving up and down, read its scale which shows the gravity of the solution.
• Remove the gravimeter and put it aside. Then insert the thermometer into the sampling cylinder and stir the solution thoroughly.
• When the temperature stabilizes, read the scale on the thermometer.
• Remove the thermometer and put it aside.
• Store the solution in another bottle.
• Using the concentration diagram of the lithium bromide solution, read the concentration.
• Upon completion of the measurement, wash the gravimeters, thermometer and sampling cylinder with water, and store them so that they are not damaged.

Example:
The horizontal axis represents temperature and the vertical axis represents relative density. The lines going down from left to right represent the fixed concentrations.

For example, if the relative density is 1.77 and the temperature is 45°C, the concentration given by the point of intersection of the lines projected from these values will be 63%, as shown in Figure 37 below.

---

Fig. 37
Fig. 38a - Concentration vs temperature vs relative density

Relative density (kg/m³) × 10⁻³

Concentration (%)
Fig. 38b - Concentration versus temperature and relative density
7 - MAINTENANCE CONTRACT

To enjoy safe and efficient operation of the chiller/heater for a long time, daily maintenance and periodic inspection are essential. The main items are as follows:

- Verification of the function of safety devices and their adjustment
- Checking the operating conditions and recording the data

These procedures require special tools and a special skills.

We offer an annual maintenance contract to users of the chiller/heater. Under the contract we provide trained service personnel that will perform the periodic diagnosis and adjustment of the chiller/heater, using the latest technology. Consult your Carrier service agent for details.

7.1 - Annual maintenance contract

We offer an annual maintenance contract to our customers with periodic inspection and maintenance of the Carrier absorption chiller/heater. Under this contract your Carrier service agent will perform maintenance/inspection and adjustment works to keep your chiller/heater in its optimal condition, and you will be given priority for chiller/heater repairs, in case there is a problem.

It is recommended to perform a complete chiller/heater overhaul every few years to keep it in its optimal condition. Under the maintenance contract we advise our customers of the timing and the parts to be overhauled. There is an additional contract for water quality control and cleaning of the heat transfer tubes in the water system. We recommend that you also take out this contract.

7.2 - Inspection report

We issue an inspection report for the annual maintenance under the contract. The report contains a thorough description of the inspection/adjustment items and ensures that Carrier service personnel will not overlook any of the inspection items. At the time of inspection the Carrier service personnel will fill in the report, leave one copy with the customer, and take one copy back to the office to be available for future maintenance works.

We will not re-issue this report, so please be sure to keep it in a safe place. Show it to the Carrier service technicians when they visit you.

7.3 - Warranty

- Your Carrier service agent will fill in the warranty and leave it with you. Please check the warranty period, read the document carefully and keep it in a safe place.
- If the chiller/heater fails within the warranty period under normal operating conditions, we will replace all necessary spare parts or repair the chiller/heater free-of-charge.
- After the warranty period expires, all repair costs will be charged. Consult your service agent.
- For all other items please read your warranty document.

8. - CHILLER/HEATER DISPOSAL/REPLACEMENT

8.1 - Precaution

Only qualified personnel should perform welding and cutting operations.

8.2 - Procedure

1. Power supply circuit, gas piping, and oil piping of the absorption chillers/heaters are separated from each other.
2. Chilled/hot water and cooling water remaining in heat transfer tubes should be drained by opening the water header provided for this purpose and draining it from one side of the header. Safety measures should be taken to prevent drained water from spattering.
3. By closing the valve at the point where a purge pump of a purge circuit is connected to a service valve, the path of the purge circuit is separated from that of the purge pump. Nitrogen gas of 50 kPa should be charged through the service valve shown in Fig. 39.
4. A hose should be attached to SV3, SV4, SV5, SV6 and SV8. Use a bottle to collect the drained absorbent.
5. Open SV3, SV4, SV5, SV6 and SV8, and remove the absorbent.
6. After the absorbent has been drained through each valve, the absorbent pump and the refrigerant pump should be removed to drain the absorbent remaining at the bottom of the heat exchanger.
7. If it is difficult to remove the replaced absorption chiller/heater due to limited space, the chiller/heater can be cut into individual components. If gas is used to separate the machine, always wear a protective mask and protective goggles to prevent injuries which may be caused by the gas.
8. Dispose of the chiller/heater according to the local regulations.

Fig. 39

Legend
1 Refrigerant pump
2 Absorbent pump
3 Service valve
4 Plate to separate the purge pump
5 Purge pump
NOTE: The troubleshooting charts apply to all 16 series absorption chillers, and the service engineer should determine if the failure mode is relevant to the specific machine.
1 - Chiller does not run.

- Blower motor runs (16DJ).
  - Gas control valve moves.
    - Motor moves to fully open, but then does not move any more.
      - Protection relay is defective.
        - Check E1 of the solution level electrode.
        - The motor is defective.
        - Check if the air flow switch is ON.
        - Check setting of air flow switch.
        - Check E2 of the solution level electrode.
    - Motor moves to fully closed, but then does not move any more.
      - Protection relay is defective.
        - Check E1 of the solution level electrode.
        - The motor is defective.
        - Check if the air flow switch is ON.
        - Check setting of air flow switch.
  - Gas control valve does not move.
    - Protection relay is defective.
      - Check E1, E2 and E3 of the solution level electrodes.
      - The motor is defective.
  - Oil solenoid valve does not open.
    - Protection relay is defective.
      - The solenoid valve is defective.
      - Check if the air flow switch is ON.
      - Check setting of air flow switch.

- Interlock
  - Check if chilled-water pump interlock signal goes to the microprocessor.
  - Check if cooling water pump interlock signal goes to the microprocessor.
  - Check if fan interlock signal goes to the microprocessor (16DJ).

- Blower motor does not run (16DJ).
  - Check breaker on the burner control panel.
    - If solution level alarm exists at start-up, the blower does not run.
    - Air flow contact is welded.
    - Check if the motor is in fully closed position.
      - The motor may stop in the half-way position after a power failure.
      - Protection relay is defective.

- Fuse has blown.
## APPENDIX 1 - TROUBLESHOOTING FLOWCHART - CONT.

### 2 - Chilled-water temperature is high.

<table>
<thead>
<tr>
<th>Vacuum problem</th>
<th>Generating hydrogen gas 60%</th>
<th>Insufficient inhibitor.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Air leakage 30%</td>
<td>Pd cell is defective.</td>
</tr>
<tr>
<td></td>
<td>Insufficient air purging. 30%</td>
<td>Pd cell heater is defective.</td>
</tr>
<tr>
<td>Chilled water problem</td>
<td>Chilled-water flow rate is too high.</td>
<td></td>
</tr>
<tr>
<td>Cooling water problem</td>
<td>Flow rate is inadequate. 30%</td>
<td>Cooling water pump control malfunctions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strainer is clogged.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insufficient feed water.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Air in the cooling water line.</td>
</tr>
<tr>
<td></td>
<td>Cooling water temp. is too high. 50%</td>
<td>Ambient temperature and/or humidity are too high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooling water control valve malfunctions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooling tower water spray malfunctions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooling tower fan malfunctions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooling tower fan belt is broken.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooling water temperature control thermostat malfunctions.</td>
</tr>
<tr>
<td>Solution problem</td>
<td>Insufficient absorbent flow rate. 30%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solution flow rate is not adjusted properly.</td>
<td>Wrong inverter setting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check valve malfunctions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wrong damper adjustment.</td>
</tr>
<tr>
<td></td>
<td>Refrigerant contamination 25%</td>
<td>Condensed refrigerant pipe connected between the low-temperature generator and condenser is clogged.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heat transfer tubes in high/low-temperature heat exchangers leak.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heat exchanger is clogged with foreign material.</td>
</tr>
<tr>
<td></td>
<td>Insufficient refrigerant amount. 5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insufficient octyl alcohol. 10%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Refrigerant contamination 25%</td>
<td>Cooling water entering temperature is too low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Refrigerant blow-down is needed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heavy foaming condition in high-temperature generator due to absorbent contamination with foreign material.</td>
</tr>
</tbody>
</table>
APPENDIX 1 - TROUBLESHOOTING FLOWCHART - CONT.

(Chilled-water temp is high.)

**Crystallization**
- No.1 absorbent pump cavitation. 25%
  - Solution flow rate is not adjusted properly.
  - Cooling water entering temperature fluctuates strongly
  - Vacuum condition in the chiller is poor.
  - Insufficient absorbent solution.
  - Insufficient octyl alcohol.

- Ambient temperature is too low. 5%
- Cooling water entering temperature is too low with insufficient air purging. 70%

**Combustion problem (16DJ)**
- Gas/oil flow rate is insufficient.
  - Rank up set too low.
  - Air/gas/oil linkage has shifted to low combustion.
  - Gas supply pressure fluctuates.
  - Chilled water set too high.
  - Temperature sensor is defective.
  - Microprocessor is defective.

**Electrical problem**
- Parts, setting position 20%
  - Electric parts and sensors are defective.
  - Wrong setting on microprocessor and inverter.
  - Wrong position of select switches.

- Solution level electrode malfunctions. 80%
  - Electrode surface is contaminated.
  - Electrode is defective.
  - Teflon tube on electrode has been removed.
3 - Generator alarm

Vacuum problem
- Hydrogen gas is generated. 60%
- Insufficient inhibitor.
- Pd cell heater is defective.
- Pd cell is defective.

Air leakage 30%
- Purging is inadequate. 10%

Cooling water problem
- Flow rate is inadequate. 30%
- Cooling water pump control malfunctions.
- Strainer is clogged.
- Insufficient feed water.
- Air in cooling water line.

- Cooling water pump is too high. 50%
  - Ambient temperature and/or humidity are too high.
  - Cooling water control valve malfunctions.
  - Cooling tower water spray malfunctions.
  - Cooling tower fan malfunctions.
  - Cooling tower fan belt is broken.
  - Cooling water temperature control thermostat malfunctions.

- 20%
  - Partition plate in water box is removed.

  Absorber and condenser tubes are fouled.

Absorbent flow problem
- Absorbent flow rate is inadequate 75%
- Wrong adjustment
  - Wrong inverter setting.
  - Check valve malfunctions.
  - Wrong damper adjustment.

- Refrigerant is contaminated by absorbent 24%
  - Heat exchanger(s) tubes are damaged.
  - Heat exchanger(s) is (are) clogged.
  - Orifice in pipe betw. LT generator + condenser is clogged (16DJ/NK).

- Refrigerant blow-down is inadequate.
- Heavy absorbent foaming condition in HT generator because there is foreign material in the absorbent (16DJ/NK).

- LT generator tubes are damaged (16DJ/NK). 1%

Crystallization
- Absorbent pump cavitation 25%
  - Ambient temperature and/or humidity are too high.
  - Cooling water control valve malfunctions.
  - Cooling tower water spray malfunctions.
  - Cooling tower fan malfunctions.
  - Cooling tower fan belt is broken.

- Ambient temperature is too low. 5%
- Cooling water entering temperature is too low with insufficient air purging. 70%
APPENDIX 1 - TROUBLESHOOTING FLOWCHART - CONT.

(Generator alarm)

- Electrical parts problem
  - Electrical parts/sensors malfunction 20%
    - Microprocessor malfunctions.
    - Cam switches malfunction.
    - Pressure switch malfunctions.
    - Microprocessor solution level incorrect.
    - Temperature sensor malfunctions.

- Solution level electrode malfunctions 80%
  - Electrode surface is contaminated.
  - Electrode is defective.
  - Teflon tube on electrode has been removed.

- High-temp. generator problem (16DJ)
  - Combustion chamber and smoke tube are sooted 90%
    - Incorrect combustion adjustment.
    - Blower suction is clogged \(\rightarrow\) air/gas/oil ratio is incorrect.
    - Flue is clogged \(\rightarrow\) air/gas/oil ratio is incorrect.

- Too much gas/oil 8%
  - Gas pressure increases.
  - Incorrect gas/oil linkage adjustment.

- Baffles provided in smoke tube are defective. 2%
## Appendix 1 - Troubleshooting Flowchart - Cont.

### 4 - Combustion alarm (16DJ)

<table>
<thead>
<tr>
<th>Flowchart</th>
<th>Description</th>
<th>Possible Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flame failure (spark OK)</td>
<td>Flame failure occurs at the end of ignition spark</td>
<td>Protection relay is defective. Pilot burner is not properly adjusted. Pilot solenoid valve is defective. Pilot gas regulator is defective. Flame detector (UV tubes) is defective.</td>
</tr>
<tr>
<td>Flame failure (pilot burner ignites)</td>
<td>Flame failure occurs during main flame trial (50%)</td>
<td>Protection relay is defective. Pilot burner is not properly adjusted. Main gas regulator is defective. Flame detector cannot detect a flame. Main gas shut-off valve is defective. Gas supply pressure fluctuates. Flue is clogged.</td>
</tr>
<tr>
<td>Flame failure (pilot burner is OK)</td>
<td>Flame failure occurs after main flame was ignited for a while (30%)</td>
<td>Protection relay is defective. Gas/air linkage is not properly adjusted. Main gas regulator is defective. Gas/oil flow meter is locked. Flue is clogged. Voltage drops.</td>
</tr>
<tr>
<td>Ignition transformer is defective. Microprocessor is defective. Position of spark rod is not properly adjusted. Insulation of spark rod is defective. Ignition spark wire is removed or broken. Protection relay is defective. Flame detector is defective. Flame remains after stop of combustion.</td>
<td>Ignition transformer is defective. Microprocessor is defective. Position of spark rod is not properly adjusted. Insulation of spark rod is defective. Ignition spark wire is removed or broken. Protection relay is defective. Flame detector is defective. Flame remains after stop of combustion.</td>
<td></td>
</tr>
<tr>
<td>Gas pressure alarm</td>
<td>Measure gas supply pressure (80%)</td>
<td>Check gas regulator in main gas pipe line. Check gas strainer. Check other equipment installed in main gas pipe line. Check gas regulator installed in gas train.</td>
</tr>
<tr>
<td>Check gas pressure switch (20%)</td>
<td>Confirm movement of the switch. Check the setting.</td>
<td></td>
</tr>
<tr>
<td>Air flow alarm</td>
<td>Confirm air flow switch (80%)</td>
<td>Check the contact of the air flow switch. Check if the air flow switch is installed correctly.</td>
</tr>
<tr>
<td>Measure pressure inside the wind box (20%)</td>
<td>Check the wind box suction side for obstruction by foreign material. Check the tube between the box and the air flow switch for obstruction by foreign material.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 1 - TROUBLESHOOTING FLOWCHART - CONT.

5 - Water alarm

- **Electric system**
  - Electrical parts defective 60%
  - Interlock 40%

- **Water system**
  - Temperature 40%
  - Flow rate 60%

**Microprocessor**
- Flow switch
- Temperature sensor
- Auxiliary relay in chiller control panel

**Check wiring and electric parts of interlock wiring**

**Leaving chilled water temperature too low** 70%

**Temperature control function does not work properly.**

**Wrong operating order.**

**Holding water quantity in the chiller is too low.**

**Entering cooling water temperature too low** 20%

**Ambient temperature is too low.**

**Cooling water temp. control malfunctions.**

**Leaving hot water temperature too low** 10%

**Temperature control function does not work properly.**

**Wrong operating order.**

**Holding water quantity in the chiller is too low.**

**Check chilled-water flow switch**

**Air in water system?**

**Strainer in water system is clogged?**

**Valves in water system opened properly?**
APPENDIX 1 - TROUBLESHOOTING FLOWCHART - CONT.

6 - Motor alarm

**Absorbent pump**
- Measure operating current 60%
- Overcurrent 90%
  - Crystallization or foreign material in the pump.
  - Pump motor is defective.
- Open phase 10%
  - Magnetic contactor is defective.
  - Pump motor coil is defective.
- Check the setting of thermal relay 10%
- Measure insulation resistance 30%
  - Motor
  - Magnetic contactor with thermal relay.
  - Pump power wires

**Refrigerant pump**
- Measure operating current 60%
- Overcurrent 90%
  - Foreign material in the pump.
  - Pump motor is defective.
- Open phase 10%
  - Magnetic contactor is defective.
  - Pump motor coil is defective.
- Check the setting of thermal relay 10%
- Measure insulation resistance 30%
  - Motor
  - Magnetic contactor with thermal relay.
  - Pump power wires

**Blower motor (16DJ)**
- Measure operating current 60%
- Overcurrent 90%
  - Blower motor is defective.
- Open phase 10%
  - Magnetic contactor is defective.
  - Pump motor coil is defective.
- Check the setting of thermal relay 10%
- Measure insulation resistance 30%
  - Motor
  - Magnetic contactor with thermal relay.
  - Pump power wires
APPENDIX 1 - TROUBLESHOOTING FLOWCHART - CONT.

7 - System alarm

- Check if chilled water pump interlock signal goes to the microprocessor.
- Check if cooling water pump interlock signal goes to the microprocessor.
- Check if fan interlock signal goes to the microprocessor (16 DJ).