**Warning** Carefully read this manual before operating your instrument.

**Note** Information contained in this document is the property of Thermo Electron Corporation. It may not be duplicated or distributed without the owner’s authorization.

**Note** The validity of the guarantee is subject to the observation of the instructions and precautions described in this document.

---

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<th>ECN/ECR</th>
<th>Date</th>
<th>Description</th>
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<td>0</td>
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<td>1/04</td>
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**Manual Number 7000860**

| 1        | 23014   | 11/29/05 | Added and updated parts list with circuit breaker for 120V units            |
|          |         |          |                                                                             |

**Revision Status**

| d        | 1/04    | Corporate standards, replaced 600 with 650 |
| c        | 9/00    | 1st & 2nd page, 1-1, 1-3, 1-4, 1-5, 2-2, 3-1, 3-2, 4-1, 5-3, 5-4, 7-2, Environmental conditions, safety & communication devices |
| b        | 12/01   | Leveling feet                                 |
| a        | 09/04   | Initial release                               |

<table>
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<th>Index</th>
<th>Date</th>
<th>Amended Pages</th>
<th>Notes</th>
</tr>
</thead>
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Thermo Electron Corporation
**Guarantee Terms**

Thermo Electron Corporation guarantees that this unit is free from defects in materials and workmanship when it leaves the factory, and will replace or repair the unit if it proves defective in normal use or during service for a period of ONE YEAR from delivery.

Our liability under this guarantee is limited to repairing the defective unit or any part of the unit providing it is sent, postage paid, to an authorized service center or the Winchester, Virginia office.

This guarantee is invalid if the unit is incorrectly used, poorly serviced or neglected, misused or accidentally damaged. There is no explicit guarantee other than as stated above.

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Website: www.thermo.com
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NapCOIL™ is a trademark of Thermo Electron Corporation and its subsidiaries.
Section 1 Use and Function

NapCOIL™ Deep Freezers are designed to freeze samples rapidly from ambient temperature and to maintain them at a temperature as low as -86°C. At -70°C, the metabolism of most biological samples is virtually stopped. The samples can be stored several months or years without altering their properties.

General Presentation

Figure 1-1. Location of Main Parts on the Freezer
General Description

NapCOIL freezers are designed to optimize thermal transfer from the sample to ensure their optimal storage conditions. The NapCOIL design is a unique combination of a freezing system and storage system that places cooling coils in the top of each compartment.

Freezing System
- Material: anodized aluminum (top plate)
- Design: plain upper plate, perforated bottom plate, cooling coils inserted between

Storage System
- 4 insulated inner doors
- Material: painted steel with 10mm (0.4 in.) polyurethane insulation
- Magnetic closing system and “easy opening” handle

Insulation
- Design: blocks of 120 mm (4.7 in.) polyurethane 0%CFC

Inner Chamber
- Stainless steel
- Prefitted for CO₂ back-up
- Access for extra monitoring sensor, or 7-day recorder probe

Outer Door
- Single outer door
- Insulation: 90 mm (3.5 in.) polyurethane
- Door opening limiter located on the top of the door. The freezer is shipped without door opening limiter installed. After unit is unpacked, install door opening limiter to avoid damaging door hinges.

Chamber Gasket
- Easily changed chamber gasket
- Material: highly flexible silicone

Outer Body
- Material: sheet metal, epoxy painted

Handle
- Low-force single-handed operation handle, door key lock

Wheels
- 4 rotating wheels
- 2 leveling feet with anti-skid pads to prevent freezer from moving.
Options / Accessories  
Specific use and ordering information for options and accessories are described in the sections that follow.

## Storage Systems

### Table 1-1. Storage information

<table>
<thead>
<tr>
<th>Type of rack</th>
<th>To fit</th>
<th>Rack dims. (H x W x D)</th>
<th>Catalog number</th>
<th>No. of racks per freezer</th>
<th>No. of boxes per freezer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single drawer mm (in.) 1/4 width</td>
<td>UF 400</td>
<td>132 x 405 x 287 (5.2 x 15.9 x 11.3)</td>
<td>51500810</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UF 500</td>
<td>132 x 543 x 287 (5.2 x 21.4 x 11.3)</td>
<td>51500818</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UF 650</td>
<td>132 x 681 x 287 (5.2 x 26.8 x 11.3)</td>
<td>51500826</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UF 400</td>
<td>132 x 390 x 139 (5.2 x 15.4 x 5.5)</td>
<td>51500808</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>2 drawer box 1/2 width</td>
<td>UF 500</td>
<td>260 x 528 x 139 (10.2 x 20.8 x 5.5)</td>
<td>51500816</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UF 650</td>
<td>260 x 666 x 139 (10.2 x 26.2 x 5.5)</td>
<td>51500824</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UF 400</td>
<td>260 x 390 x 91 (10.2 x 15.4 x 3.6)</td>
<td>51500809</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>3 drawer box 1/2 width</td>
<td>UF 500</td>
<td>260 x 528 x 91 (10.2 x 20.8 x 3.6)</td>
<td>51500817</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UF 650</td>
<td>260 x 666 x 91 (10.2 x 26.2 x 3.6)</td>
<td>51500825</td>
<td>8</td>
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<tr>
<td>Pull out rack for box 135 x 135 x 70 mm 1/4 width</td>
<td>UF 400</td>
<td>135 x 135 x 74 (5.3 x 5.3 x 2.9)</td>
<td>51500807</td>
<td>16</td>
<td>192</td>
</tr>
<tr>
<td></td>
<td>UF 500</td>
<td>135 x 135 x 74 (5.3 x 5.3 x 2.9)</td>
<td>51500815</td>
<td>16</td>
<td>256</td>
</tr>
<tr>
<td></td>
<td>UF 650</td>
<td>135 x 135 x 74 (5.3 x 5.3 x 2.9)</td>
<td>51500823</td>
<td>16</td>
<td>320</td>
</tr>
<tr>
<td>Pull out rack for box 135 x 135 x 50 mm 1/4 width</td>
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<td>135 x 135 x 56 (5.3 x 5.3 x 2.2)</td>
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<td>135 x 135 x 56 (5.3 x 5.3 x 2.2)</td>
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<tr>
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<td>135 x 135 x 56 (5.3 x 5.3 x 2.2)</td>
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<td>400</td>
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<tr>
<td>Pull out rack for box 135 x 135 x 75 mm 1/4 width</td>
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<td>135 x 135 x 99 (5.3 x 5.3 x 3.9)</td>
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<td>144</td>
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<td>UF 500</td>
<td>135 x 135 x 99 (5.3 x 5.3 x 3.9)</td>
<td>51500835</td>
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<td>192</td>
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<td>UF 650</td>
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<td>240</td>
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<tr>
<td>Microplate rack 127 x 87 x 14/41 mm 1/4 width</td>
<td>UF 400</td>
<td>92 x 130 x 95 (3.6 x 5.1 x 3.7)</td>
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<td>1152/384</td>
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<td>UF 500</td>
<td>92 x 130 x 95 (3.6 x 5.1 x 3.7)</td>
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<td>1728/576</td>
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<td>UF 650</td>
<td>92 x 130 x 95 (3.6 x 5.1 x 3.7)</td>
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<td>2016/672</td>
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</table>
Optional Extras

The CO₂ back-up is designed to maintain the sample temperature below -60°C for several hours by injecting CO₂ into the freezer chamber. The CO₂ back-up must be installed by a qualified service technician. Catalog numbers are 51200715 for 120V units and 51200716 for 208V units.

Recorder Connection

If the freezer has an optional 7-day recorder, a power cable must be connected before use. To connect power to the recorder:

1. Disconnect power to the freezer.

2. Open the condenser filter access grille located on the lower front of the freezer (see Figure 1-1).

3. Locate the cable extending from the recorder and connect it to the cable secured to the bottom of the compressor compartment (mate-n-lock connection).

4. Replace the front grille.

To install the chart paper:

1. Open the glass door of the recorder and press button #3 until the pen begins to move outward.

2. Unscrew the knob at the center of the chart and remove the paper.

3. Install the new chart paper, position the paper to the correct time line and replace the knob.

4. Remove the cap from the felt pen and press button #3.

Figure 1-2. Recorder Buttons
The chart recorder contains eight temperature ranges and is factory-programmed for the freezer. To change the recorder range:

1. Press and hold button #3 for one second, then let the pen move off the chart paper.

2. Press and hold for five seconds either button #1 or button #2.

3. Release the button and the green LED will begin to flash. Count the number of flashes to determine the present program setting.

4. To change the program setting, press the left or right arrows to increase or decrease the count.

5. When the desired program number is flashing, press button #3 to bring the pen arm back onto the chart. Recording will begin in the new program.

**Table 1-2. Changing the Recorder Range**

<table>
<thead>
<tr>
<th>Program</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-40</td>
<td>30°C</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>60°C</td>
</tr>
<tr>
<td>3</td>
<td>-100</td>
<td>38°C</td>
</tr>
<tr>
<td>4</td>
<td>-5</td>
<td>50°C</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>100°C</td>
</tr>
<tr>
<td>6</td>
<td>-100</td>
<td>200°C</td>
</tr>
<tr>
<td>7</td>
<td>-115</td>
<td>50°C</td>
</tr>
<tr>
<td>8</td>
<td>-10</td>
<td>70°C</td>
</tr>
</tbody>
</table>
Before calibrating the recorder, make sure the recorder has been in service for 24 hours. The calibration procedure follows:

1. Place an accurate thermometer in the chamber next to the recorder probe.

2. Temperature probes for the recorder are located in the left front corner of the freezer chamber (Figure 1-3).

3. After about three minutes, compare the thermometer reading with the chart recorder reading.

4. If an adjustment is necessary, press the #1 button to move the pen to the left or the #2 to move the pen to the right. The button must be held about five seconds before the pen begins to move. Release the button when the pen position matches the thermometer.

**Note** The felt-tip pen on the recorder requires periodic replacement. Usually the ink will appear to fade before replacement becomes necessary. Additional pen tips may be purchased. ▲

![Figure 1-3. Recorder Probe Placement](image)
Section 2 Installation Procedures

Due to the weight of the machine, all lifting and transport must be performed using proper material handling equipment that complies with current regulations, and used by trained personnel. The machine must be supported from underneath. If it has to be transported without its pallet, for example on a staircase, professional handling assistance is required.

Unpacking

1. Referring to Figure 2-1, remove the straps and the cling film. Remove the plank located on the top of the freezer. Unscrew the nuts and remove the side bar by tilting the machine slightly.

2. Place the plank sideways in contact with the pallet and in line with the wheels of the machine. Remove the freezer from the pallet down the plank.

Note 2 people are needed for this operation. ▲
Environmental Conditions

This instrument is designed to operate safely under the following conditions:

- Indoor use
- Temperature of 5°C to 40°C
- Maximum relative humidity of 80% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C.
- Maximum altitude of 2000m
- Voltage fluctuations of ±10%
- Over voltage category II
- Pollution degree 2

Maximum performance is assured across the temperature range of 18°C to 25°C and maximum relative humidity of 70%.

Installation

1. Never transport the machine on its side.

2. Check that no accessories or printed matter are left in the packaging.

3. Install the machine in a suitable environment:

   To ensure proper ventilation of the cooling system and ensure correct functioning of the freezer, it is extremely important not to place any object within 20 cm (8 in.) of the front, back or side ventilation grilles.

   The room should be well ventilated and must be fitted with a mechanical air extraction if the freezer is fitted with the CO2 back-up. The environment must be non-corrosive and the floor must be level.

4. Check that the available electrical voltage is compatible with the instrument’s voltage.
Positioning the Leveling Feet

There are two leveling feet at the front of the freezer.

1. Unscrew the leveling feet.

2. Place an anti-skid pad beneath each one (2 anti-skid pads are provided with the accessories).

3. Using the 19 mm (0.75 in.) box spanner, provided with the accessories, continue to unscrew the leveling feet until the front of the freezer is lifted about one millimeter.

4. Check the level of the freezer by opening and shutting the door, then adjust the height of the feet accordingly.

Connection to Electrical Power

Remember that in order to respect the electrical safety standards related to protection of operators against indirect contact, the power supply to the instrument must be via a power socket fitted with a protection device ensuring automatic cut-off in the case of an insulation fault. A power supply fitted with a circuit breaker of the correct rating complies with this requirement.

Start-Up

Before starting the freezer, put the fuse in place at the back of the freezer.

On instrument start-up, the display shows the chamber temperature. The visual and audible alarms are activated.

During the cooling procedure, the freezer displays the chamber temperature. It takes about 6 hours to cool down the freezer from +20°C to -80°C.
Section 3 Specifications

Freezing system ................. NapCOIL
Temperature control ............ Analog control
Regulation range ................-65°C to -86°C
Minimal temperature .......... -86°C
Temperature control .......... ±0.5°C
Temperature uniformity ........ ±4°C

<table>
<thead>
<tr>
<th>External Dimensions</th>
<th>UF400</th>
<th>UF500</th>
<th>UF 650</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>1995 x 800 x 800</td>
<td>1995 x 800 x 940</td>
<td>1995 x 847 x 1080</td>
</tr>
<tr>
<td>H x W x D - mm (in.)</td>
<td>(78.5 x 31.5 x 31.5)</td>
<td>(78.5 x 31.5 x 37.0)</td>
<td>(78.5 x 33.4 x 42.5)</td>
</tr>
<tr>
<td>Weight net/packed - kg (lbs.)</td>
<td>240/260 (529/573)</td>
<td>260/280 (573/617)</td>
<td>290/315 (639/694)</td>
</tr>
</tbody>
</table>

*Without door opening limiter. The unit is shipped without door opening limiter installed. The door opening limiter has to be installed after unpacking the freezer.

<table>
<thead>
<tr>
<th>Inner Dimensions and Capacity</th>
<th>UF400</th>
<th>UF500</th>
<th>UF650</th>
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<tbody>
<tr>
<td>Compartment dimensions</td>
<td>308 x 550 x 430</td>
<td>308 x 550 x 568</td>
<td>308 x 597 x 707</td>
</tr>
<tr>
<td>H x W x D - mm (in.)</td>
<td>(12 x 22 x 17)</td>
<td>(12 x 22 x 22)</td>
<td>(12 x 24 x 28)</td>
</tr>
<tr>
<td>Chamber dimensions</td>
<td>1310 x 550 x 490</td>
<td>1310 x 550 x 630</td>
<td>1310 x 597 x 770</td>
</tr>
<tr>
<td>H x W x D - mm (in.)</td>
<td>(52 x 22 x 19)</td>
<td>(52 x 22 x 25)</td>
<td>(52 x 24 x 30)</td>
</tr>
<tr>
<td>Nominal capacity - litres (cubic feet)</td>
<td>355 (12.5)</td>
<td>455 (16.1)</td>
<td>602 (21.3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Packaging Dimensions</th>
<th>UF400</th>
<th>UF500</th>
<th>UF 650</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>2220 x 940 x 940</td>
<td>2220 x 940 x 1080</td>
<td>2220 x 990 x 1220</td>
</tr>
<tr>
<td>H x W x D - mm (in.)</td>
<td>(87 x 37 x 37)</td>
<td>(87 x 37 x 43)</td>
<td>(87 x 39 x 48)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Models with R508 (2nd stage)</th>
<th>UF400</th>
<th>UF500</th>
<th>UF 650</th>
</tr>
</thead>
<tbody>
<tr>
<td>230V/50Hz</td>
<td>51500901</td>
<td>51500905</td>
<td>51500912</td>
</tr>
<tr>
<td>208V/60Hz</td>
<td>51500902</td>
<td>51500906</td>
<td>51250911</td>
</tr>
</tbody>
</table>
Section 4 Operating Principles

The refrigeration system is a cascade, air-cooled, hermetically sealed, system.

The refrigeration system consists of 2 refrigeration systems put in cascade. The second stage fluid is evaporated in the chamber using the heat from the chamber. The heat is then transferred to the first system at the heat exchanger. The heat transferred to the first system is then transferred to the environment at the condenser.

The refrigerants used are R-507 (1st stage), R-508 + R-290 (2nd stage).

Figure 4-1. Refrigeration Diagram
Section 5 Instructions for Use

A description of control panel components follows. The display shows the following information:

- Measured temperature in 1°C increments
- Set temperature in 1°C increments

Temperature Setpoint

The freezers are factory preset at -80°C. To modify temperature setpoint:
While pressing the * key, use the screwdriver shipped with the unit to rotate the potentiometer. To check the set point, press the * key.

High Temperature Alarm Setpoint

The high temperature alarm setpoint is fixed at 10°C above temperature setpoint.
Alarms Conditions

NapCOIL freezers give an alarm signal in the following situations:

- High temperature alarm
- Short circuit on the probe
- Power Failure

In case of an alarm situation, the audible and visible alarms are activated.

In case of an alarm situation, check that the door is properly closed.

To silence the audible alarm, press the key to stop the audible alarm.

**Note** When there is no alarm condition, check both visual and audible alarms by pressing the key.

After pressing , the alarm will be reactivated if it has been more than one hour since was last pressed, or if the original alarm condition has cleared and another alarm condition occurred.

Battery

The freezers are fitted with a battery back-up system. This battery powers the control panel and alarms for 12 hours in case of a power failure.

Remote Alarm Contact

NapCOIL freezers are fitted with a remote alarm contact. The alarm contact is activated in the following conditions:

- Power failure
- High temperature alarm
- Short-circuit on the sensor

In an alarm situation, the contact is closed between pins 5 and 7.

These options must be installed by a qualified service engineer.
Caution For personal safety, this apparatus must be properly grounded. ▲

The power cord provided on this unit is equipped with a three-prong plug which mates with a standard three-prong grounding wall receptacle to minimise the possibility of electric shock hazard from this apparatus. If in doubt, the user should have the wall receptacle and circuit checked by a qualified electrician to make sure the receptacle can provide adequate current and is properly grounded. If a standard two-prong wall receptacle is encountered, it is the personal responsibility and obligation of the user to have it replaced with a properly grounded three-prong wall receptacle.

Warning Do not, under any circumstances, cut or remove the third (ground) prong from the power cord. Do not use a two-prong adapter plug. ▲

Wire colors in power cable: black 1 = Line, black 2 = Neutral, Earth/Ground = yellow; green

Power Supply Please refer to the power supply rating plate on the left side of the external cabinet.

230V ±10%, 50Hz, 4 Amp, 850W
208-220V ±10%, 60Hz, 4.3 Amp, 850W
115 V ±10%, 60Hz, 8.5 Amp, 850W

Fuse Information Power card F1, 100 mAmp, 5 x 20 mm
Battery F1, 100 mAmp, 5 x 20 mm
Rear panel F2, 500 mAmp, 5 x 20 mm
Section 6 Hazards, Precautions and Limitations of Use

Use gloves to handle frozen samples inside the freezer. Unprotected hands may get serious frost injuries.

Power to the freezer should be supplied only by a dedicated circuit through a circuit breaker. Do not use a common power source with other electrical appliances.

Warning All servicing on the refrigeration system must be performed by a Service Engineer qualified to service Cascade Refrigeration Systems.

Cleaning the Cooling Coil

The NapCOIL consists of:

- An anodized aluminum plate for the top of the shelf
- A perforated aluminum plate for the bottom of the shelf
- An aluminum cooling coil inserted between

To ensure maximum performance of the freezer, the NapCOIL must remain clean. As soon as dirt appears on the aluminum, clean the different aluminum parts using warm water mixed with soap and a nylon brush or a sponge. Rinse all parts with clean water. Then dry with a drying cloth.

Caution The use of corrosive chemical substances derived from sodium hydroxide or potassium hydroxide will damage the shelf.
Section 7 Servicing and Preventative Maintenance

All the heat removed from the chamber to keep the samples at -80°C is evacuated through the condenser. To provide maximum heat removal, the condenser must be kept clean of dust and dirt. For this reason, the condenser is protected by an air filter. To maintain efficient ventilation of the condenser, the filter must be kept clean.

To make cleaning easy, NapCOIL Deep Freezers are fitted with direct access to the condenser filter.

To clean the filter:

1. Open the ventilation grille located at the bottom of the unit as shown on the drawing.
2. Pull the filter out (affixed with Velcro).
3. Clean the filter with warm water.
4. Dry the filter properly before putting it back in place. Meanwhile, a spare filter can be used in the grille to protect the condenser (Cat N°: 86001847).
5. Write the next cleaning date on the label located next to the filter.

Figure 7-1. Condenser Filter Access
**Freezer Defrosting**

The frost that accumulates on the door gasket reduces the airtight seal. This results in an increase of frost inside the chamber and difficulty in keeping the chamber at the desired temperature. To avoid this, regularly clean the door gasket.

**Chamber Cleaning**

Clean the walls of the chamber with a surface disinfectant (70% alcohol, 2% glutaraldehyde). Avoid chlorinated solutions which might damage the interior of the freezer.

See Section 6 for the cleaning of aluminum parts.

**Fuse Replacement**

Changing of the fuse must performed by a qualified engineer to diagnose the fault before replacing the fuses.

**Accessories**

Catalog numbers for CO₂ back-up for NapCOIL freezer are 51200715 for 120V units, or 51200716 for 208V units.

**Spare Parts**

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<tr>
<th>Stock Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>3183014</td>
<td>CAJ2432ZSE compressor 60 Hz 1st stage</td>
</tr>
<tr>
<td>3182985</td>
<td>CAJ2432Z compressor 60 Hz 2nd stage</td>
</tr>
<tr>
<td>3182906</td>
<td>Starting box 60 Hz 1st stage/2nd stage</td>
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<tr>
<td>3182874</td>
<td>Fan 60 Hz</td>
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<tr>
<td>3182185</td>
<td>Drying filter</td>
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<tr>
<td>3182296</td>
<td>Chamber temperature sensor (PT100)</td>
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<td>3181943</td>
<td>Door switch</td>
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<tr>
<td>3181463</td>
<td>Condenser temperature sensor</td>
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<tr>
<td>3172686</td>
<td>Triac</td>
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<tr>
<td>3182082</td>
<td>Circuit breaker (230V units)</td>
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<tr>
<td>3185206</td>
<td>Circuit breaker 20 Amp (120V units)</td>
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<tr>
<td>3181466</td>
<td>Power pcb 208 V-60 Hz</td>
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<td>3181471</td>
<td>CPU pcb</td>
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<td>Battery pcb 231198</td>
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<td>Condenser filter kit</td>
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<td>Power card/Battery fuse</td>
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<td>3172452</td>
<td>Rear panel fuse</td>
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