30GSA Series
Nominal: 18-48 Tons
Air-Cooled Scroll Chiller

Installation, Start-Up and Service Instructions
1 – INTRODUCTION
Prior to the initial start-up of the units, the people involved should be thoroughly familiar with these instructions and the specific project data for the installation site.

The chillers are designed to provide a very high level of safety and reliability making installation, start-up, operation and maintenance easier and more secure. They will provide safe and reliable service when operated within their application range.

The procedures in this manual are arranged in the sequence required for machine installation, start-up, operation and maintenance.

Be sure you understand and follow the procedures and safety precautions contained in the instructions supplied with the machine, as well as those listed in this guide, such as: protective clothing such as gloves, safety glasses, safety shoes and appropriate tools, and suitable qualifications (electrical, air conditioning, local legislation).

To find out, if these products comply with European directives (machine safety, low voltage, electromagnetic compatibility, equipment under pressure, etc.) check the declarations of conformity for these products.

1.1 - Check equipment received
- Inspect the unit for damage or missing parts. If damage is detected, or if shipment is incomplete, immediately file a claim with the shipping company.
- Confirm that the unit received is the one ordered. Compare the name plate data with the order.
- The name plate is attached to the unit in two locations:
  - on the outside on one of the unit sides
  - on the inside of the control box
This shows the following information:
- Model number - size
- Serial number
- Year of manufacture and pressure and leak tightness test date
- Refrigerant used
- Refrigerant charge per circuit
- PS: Min./max. allowable pressure (high and low pressure side)
- TS: Min./max. allowable temperature (high and low pressure side)
- Globe valve cut-out pressure
- Pressure switch cut-out pressure
- Unit leak test pressure
- Voltage, frequency, number of phases
- Maximum current drawn
- Maximum power input
- Unit net weight
- Confirm that all accessories ordered for on-site installation have been delivered, and are complete and undamaged.

The unit must be checked periodically, if necessary removing the insulation (thermal, acoustic), during its whole operating life to ensure that no shocks (handling accessories, tools, etc.) have damaged it. If necessary, the damaged parts must be repaired or replaced. See also chapter “Maintenance”.

1.2 - Installation safety considerations

SERVICE
Excessive Condensation on Unit — Running chilled water through a fan coil unit with the unit fan off can cause excessive condensation. If fan cycling is used, a water flow control valve should be installed to shutoff the water when the fan stops.

Other methods of control, which avoids condensation problems, are as follows:
1. Continuous fan operation with motorized chilled water valve controlled by a thermostat.
2. Continuous fan operation with thermostat control to switch fan from high to low speed (instead of off).

To Clean Coil
1. Be sure electrical service switch is open, locked, and tagged while working on unit.
2. Remove return-air grille access panel and brush between coil fins with stiff wire brush. Care should be taken to not damage coil fins. Follow-up by cleaning with vacuum cleaner. If coil is cleaned with air hose and nozzle, take care not to drive dirt and dust into other components. Blow air through the coil fins from the leaving air face. This should again be followed by vacuuming. Units provided with the proper type of air filters, replaced regularly, will require less frequent coil cleaning.
3. Install clean filter. Refer to Clean or Replace Air Filters section.

Coil Air Vent (Manual or Automatic) — Turn vent cap clockwise (closed) while filling system; turn counterclockwise (open) to vent air. Tighten clockwise after venting. Turn automatic vent cap slightly counterclockwise until water leaks at about 10 drops per minute. Leak will stop within one-half minute.

Check Drain — Lock open and tag unit electrical service switch. Check drain pan, drain line and trap before initial start-up and at start of each cooling season. A standard type pipe cleaner for 3/4-in. ID pipe can be used to ensure that pipe is clear of obstruction so that condensate is carried away. Check the drain line at filter cleaning time during the cooling season. Be sure that debris has not fallen into unit through supply-air grille. Should the growth of algae and/or bacteria be a concern, consult an air conditioning and refrigeration supply organization familiar with local conditions for chemicals or other solutions available to control these agents.

Fan Motor Bearings — Lock open and tag unit electrical service switch. Standard motors are permanently sealed and lubricated. No lubrication.
is in operation, the other one is isolated. Never leave the reversing valve in the intermediate position, i.e. with both ways open (locate the control element in the stop position). If a safety valve is removed for checking or replacement please ensure that there is always an active safety valve on each of the reversing valves installed in the unit. Provide a drain in the discharge circuit, close to each globe valve, to avoid an accumulation of condensate or rain water. All precautions concerning handling of refrigerant must be observed in accordance with local regulations. Accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation or explosions. Inhalation of high concentrations of vapour is harmful and may cause heart irregularities, unconsciousness, or death. Vapour is heavier than air and reduces the amount of oxygen available for breathing. These products cause eye and skin irritation. Decomposition products can be hazardous.

1.3 - Equipment and components under pressure
These products incorporate equipment or components under pressure, manufactured by Surrey or other manufacturers. We recommend that you consult your appropriate national trade association or the owner of the equipment or components under pressure (declaration, re-qualification, retesting, etc.). The characteristics of this equipment/these components are given on the nameplate or in the required documentation, supplied with the products.

Do not introduce high static and dynamic pressure compared with the existing operating pressures - either service or test pressures in the refrigerant circuit or in the heat transfer circuit, especially:
• limiting the elevation of the condensers or evaporators
• taking the circulating pumps into consideration.

1.4 - Maintenance safety considerations
Engineers working on the electric or refrigeration components must be authorized, trained and fully qualified to do so.

All refrigerant circuit work must be carried out by a trained person, fully qualified to work on these units. He must have been trained and be familiar with the equipment and the installation. All welding operations must be carried out by qualified specialists.

Any manipulation (opening or closing) of a shut-off valve must be carried out by a qualified and authorized engineer, observing applicable standards (e.g. during draining operations). The unit must be switched off while this is done.

During any handling, maintenance and service operations the engineers working on the unit must be equipped with safety gloves, glasses, shoes and protective clothing. Never work on a unit that is still energized. Never work on any of the electrical components, until the general power supply to the unit has been cut. If any maintenance operations are carried out on the unit, lock the power supply circuit in the open position and secure the machine upstream with a padlock. If the work is interrupted, always ensure that all circuits are still deenergized before resuming the work.

ATTENTION: Even if the unit has been switched off, the power circuit remains energized, unless the unit or circuit disconnect switch is open. Refer to the wiring diagram for further details. Attach appropriate safety labels. If any work is carried out in the fan area, specifically if the grilles or casings have to be removed, cut the power supply to the fans to prevent their operation. It is recommended to install an indicating device to show if part of the refrigerant has leaked from the valve. The presence of oil at the outlet orifice is a useful indicator that refrigerant has leaked. Keep this orifice clean to ensure that any leaks are obvious. The calibration of a valve that has leaked is generally lower than its original calibration. The new calibration may affect the operating range. To avoid nuisance tripping or leaks, replace or re-calibrate the valve.

Operating checks:
• During the life-time of the system, inspection and tests must be carried out in accordance with national regulations.
• If there are no local regulations, the safety devices must be checked on site once a year (high-pressure switches), and every five years for external overpressure devices (safety valves).

At least once a year thoroughly inspect the protection devices (valves). If the machine operates in a corrosive environment, inspect the protection devices more frequently.

Regularly carry out leak tests and immediately repair any leaks.

Ensure regularly that the vibration levels remain accept-able and close to those at the initial unit start-up.

Before opening a refrigerant circuit, transfer the refrigerant to bottles, specifically provided for this purpose and consult the pressure gauges.

Change the refrigerant after equipment failures, following a procedure such as the one described in NFE 29-795 or carry out a refrigerant analysis in a specialist laboratory. If the refrigerant circuit remains open for longer than a day after an intervention (such as a component replacement), the openings must be plugged and the circuit must be charged with nitrogen (inertia principle). The objective is to prevent penetration of atmospheric humidity and the resulting corrosion on the internal walls and on non-protected steel surfaces.

1.5 - Repair safety considerations
All installation parts must be maintained by the personnel in charge, in order to avoid deterioration and injury. Faults and leaks must be repaired immediately. The authorized technician must have the responsibility to repair the fault immediately.
Each time repairs have been carried out to the unit, the operation of the safety devices must be re-checked. Comply with the regulations and recommendations in unit and HVAC installation safety standards, such as: EN 378, ISO 5149, etc.

Do not use oxygen to purge lines or to pressurize a machine for any purpose. Oxygen gas reacts violently with oil, grease, and other common substances. Never exceed the specified maximum operating pressures. Verify the allowable maximum high- and low-side test pressures by checking the instructions in this manual and the pressures given on the unit name plate.

Do not use air for leak testing. Use only refrigerant or dry nitrogen.

Do not unweld or flamecut the refrigerant lines or any refrigerant circuit component until all refrigerant (liquid and vapour) has been removed from chiller. Traces of vapour should be displaced with dry air nitrogen.

Refrigerant in contact with an open flame can produce toxic gases.

The necessary protection equipment must be available, and appropriate fire extinguishers for the system and the refrigerant type used must be within easy reach.

Do not siphon refrigerant.

Avoid spilling liquid refrigerant on skin or splashing it into the eyes. Use safety goggles. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, immediately and abundantly flush the eyes with water and consult a doctor.

Never apply an open flame (blowlamp) or overheated steam (high-pressure cleaner) to the refrigerant circuit.

Dangerous overpressure can result.

During refrigerant removal and storage operations follow applicable regulations. These regulations, permitting conditioning and recovery of halogenated hydrocarbons under optimum quality conditions for the products and optimum safety conditions for people, property and the environment are described in standard NFE 29795.

Refer to the certified dimensional drawings for the units. It is dangerous and illegal to re-use disposable (non-return-able) reclaim bottles or attempt to refill them. When reclaim bottles are empty, evacuate the remaining gas pressure, and move them to a designated place for recovery.

Do not incinerate.

Do not attempt to remove refrigerant circuit components or fittings, while the machine is under pressure or while it is running. Be sure pressure is at 0 kPa before removing components or opening a circuit.

Do not attempt to repair or recondition any safety devices when corrosion or build-up of foreign material (rust, dirt, scale, etc.) is found within the valve body or mechanism. If necessary, replace the device. Do not install safety valves in series or backwards.

ATTENTION: No part of the unit must be used as a walkway, rack or support. Periodically check and repair or if necessary replace any component or piping that shows signs of damage.

Do not step on refrigerant lines. The lines can break under the weight and release refrigerant, causing personal injury. Do not climb on a machine. Use a platform, or staging to work at higher levels.

Use mechanical lifting equipment (crane, hoist, winch, etc.) to lift or move heavy components. For lighter components, use lifting equipment when there is a risk of slipping or losing your balance.

Use only original replacement parts for any repair or component replacement. Consult the list of replacement parts that corresponds to the specification of the original equipment.

Do not drain water circuits containing industrial brines, without informing the technical service department at the installation site or a competent body first.

Close the entering and leaving water shutoff valves and purge the unit hydronic circuit, before working on the components installed on the circuit (screen filter, pump, water flow switch, etc.).

Periodically inspect all valves, fittings and pipes of the refrigerant and hydronic circuits to ensure that they do not show any corrosion or any signs of leaks.

It is recommended to wear ear defenders, when working near the unit and the unit is in operation.

Always ensure you are using the correct refrigerant type before recharging the unit.

Charging any refrigerant other than the original charge type (R-410A) will impair machine operation and can even lead to a destruction of the compressors. The compressors operating with R-410A are charged with a synthetic polyol-ester oil.

Before any intervention on the refrigerant circuit, the complete refrigerant charge must be recovered.

2 - Moving and sitting the unit
2.1 – Moving

See chapter “Installation safety considerations”.

2.2 - Sitting the unit

Always refer to the chapter “Dimensions and clearances” to confirm that there is adequate space for all connections and service operations. For the centre of gravity coordinates, the position of the unit mounting holes, and the weight distribution points, refer to the certified dimensional drawing supplied with the unit.

Typical applications of these units do not require earthquake resistance. Earthquake resistance has not been verified.
**CAUTION:** Only use slings at the designated lifting points which are marked on the unit.
Before sitting the unit check that:
• the permitted loading at the site is adequate or that appropriate strengthening measures have been taken.
• the unit is installed level on an even surface (maximum tolerance is 5 mm in both axes).
• there is adequate space above the unit for air flow and to ensure access to the components (see dimensional drawings).
• the number of support points is adequate and that they are in the right places.
• the location is not subject to flooding.
• for outdoor installations, where heavy snowfall is likely and long periods of sub-zero temperatures are normal, provision has to be made to prevent snow accumulating by raising the unit above the height of drifts normally experienced. Baffles may be necessary to deflect strong winds. They must not restrict air flow into the unit.

**CAUTION:** Before lifting the unit, check that all casing panels are securely fixed in place. Lift and set down the unit with great care. Tilting and jarring can damage the unit and impair unit operation.

If units are hoisted with rigging, it is advisable to protect coils against crushing while a unit is being moved. Use struts or a lifting beam to spread the slings above the unit. Do not tilt a unit more than 15°.

**WARNING:** Never push or lever on any of the enclosure panels of the unit. Only the base of the unit frame is designed to withstand such stresses.

### 2.3 - Checks before system start-up

Before the start-up of the refrigeration system, the complete installation, including the refrigeration system must be verified against the installation drawings, dimensional drawings, system piping and instrumentation diagrams and the wiring diagrams.

During these verifications observe all national regulations. If no national regulations exist, please refer to annex G of standard EN378-2, specifically:

External visual installation checks:
• Compare the complete installation with the refrigeration system and power circuit diagrams.
• Check that all components comply with the design specifications.
• Check that all safety documents and equipments that are required by current European standards are present.
• Verify that all safety and environmental protection devices and arrangements are in place and comply with the current European standard.
• Verify that all document for pressure containers, certificates, name plates, files, instruction manuals that are required documents required by the current European standards are present.
• Verify the free passage of access and safety routes.
• Verify the instructions and directives to prevent the deliberate removal of refrigerant gases.
• Verify the installation of connections.
• Verify the supports and fixing elements (materials, routing and connection).
• Verify the quality of welds and other joints.
• Check the protection against mechanical damage.
• Check the protection against heat.
• Check the protection of moving parts.
• Verify the accessibility for maintenance or repair and to check the piping.
• Verify the status of the valves.
• Verify the quality of the thermal insulation and of the vapour barriers.
• Ensure that the ventilation in the machine room is sufficient.
• Check the refrigerant detectors.
Unit dimensions

<table>
<thead>
<tr>
<th>Unit Model</th>
<th>Dimension (mm.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>30GSA018</td>
<td>780.2</td>
</tr>
<tr>
<td>30GSA024</td>
<td>745.2</td>
</tr>
</tbody>
</table>

Model: 30GSA018-024

Model: 30GSA030
Model: 30GSA036

Model: 30GSA048
### Physical Data

<table>
<thead>
<tr>
<th>Description</th>
<th>Air Cooled Condensing Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>30GSA018</td>
</tr>
<tr>
<td>kW</td>
<td>60.8</td>
</tr>
<tr>
<td>Btu/Hr</td>
<td>207,586</td>
</tr>
<tr>
<td>Ton</td>
<td>20.7</td>
</tr>
<tr>
<td>Power Input</td>
<td>kW</td>
</tr>
<tr>
<td>kWe/Ton</td>
<td>1.285</td>
</tr>
<tr>
<td>EER</td>
<td>9.34</td>
</tr>
</tbody>
</table>

### Type of conductor is installed
- Insulated single core cables up to 3 lines. Or
- Insulated sheathed cables up to 3 axes in a pipe in the air in a pipe buried in the wall plaster. or in a pipe in the ceiling

### Refrigerant
- R-22

### Unit Size
- Width mm: 2,254, 2,254, 2,002, 2,254, 2,254
- Height mm: 2,286, 2,286, 2,050, 2,538, 2,538
- Depth mm: 2,254, 2,254, 2,002, 2,254, 2,254

### Electrical Data

<table>
<thead>
<tr>
<th>Unit Model</th>
<th>Nominal Voltage</th>
<th>Voltage Range</th>
<th>Compressor</th>
<th>Fan Motor</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>RL(A)</td>
<td>LRA(A)</td>
<td>RLA(A)</td>
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<tr>
<td>30GSA018</td>
<td>380V/3Ph/50Hz</td>
<td>342 415</td>
<td>2 35</td>
<td>175</td>
<td>5.10</td>
</tr>
<tr>
<td>30GSA024</td>
<td>380V/3Ph/50Hz</td>
<td>342 415</td>
<td>2 35</td>
<td>175</td>
<td>5.10</td>
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<tr>
<td>30GSA030</td>
<td>380V/3Ph/50Hz</td>
<td>342 415</td>
<td>4 19.6</td>
<td>118</td>
<td>1.75</td>
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<tr>
<td>30GSA036</td>
<td>380V/3Ph/50Hz</td>
<td>342 415</td>
<td>4 22.1</td>
<td>125</td>
<td>5.10</td>
</tr>
<tr>
<td>30GSA048</td>
<td>380V/3Ph/50Hz</td>
<td>342 415</td>
<td>4 35</td>
<td>175</td>
<td>5.10</td>
</tr>
</tbody>
</table>

### Remark
- Rating at
  1. Ambient Temperature 95 F
  2. Leaving Chilled Water Temperature 55 F
  3. Entering Chilled Water Temperature 55 F

### Type of conductor is installed
- Insulated single core cables up to 3 lines. Or
- Insulated sheathed cables up to 3 axes in a pipe in the air in a pipe buried in the wall plaster. or in a pipe in the ceiling

### Code
- THW
3 - Application data
3.1 - Unit operating range

<table>
<thead>
<tr>
<th>Evaporator</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entering water temperature at start-up °C</td>
<td>7.5</td>
<td>30</td>
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<tr>
<td>Leaving water temperature during operation °C</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Entering/leaving water temperature difference K</td>
<td>3</td>
<td>10</td>
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</table>

<table>
<thead>
<tr>
<th>Condenser</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entering air temperature*** °C</td>
<td>-10</td>
<td>48</td>
</tr>
</tbody>
</table>

Note:
Do not exceed the maximum operating temperature.

### 3.2 - Evaporator water flow

<table>
<thead>
<tr>
<th>UNIT SIZE</th>
<th>MINIMUM COOLER FLOW RATE</th>
<th>MINIMUM LOOP VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gpm</td>
<td>L/s</td>
</tr>
<tr>
<td>30GSA018</td>
<td>15</td>
<td>1.0</td>
</tr>
<tr>
<td>30GSA024</td>
<td>19</td>
<td>1.2</td>
</tr>
<tr>
<td>30GSA030</td>
<td>24</td>
<td>1.5</td>
</tr>
<tr>
<td>30GSA036</td>
<td>30</td>
<td>1.9</td>
</tr>
<tr>
<td>30GSA048</td>
<td>38</td>
<td>2.4</td>
</tr>
</tbody>
</table>

### 3.3 - Minimum water flow rate

If the installation flow rate is below the minimum flow rate, there is a risk of excessive fouling.

### 3.4 - Maximum evaporator water flow rate

This is limited by the permitted evaporator pressure drop. Also, a minimum evaporator ΔT of 2.8 K must be guaranteed, which corresponds to a water flow rate of 0.09 l/s per kW.

### 3.5 - Water loop volume

#### 3.5.1 - Minimum water loop volume

The minimum water loop volume, in litres, is given by the following formula:

\[
\text{Volume (l)} = \text{CAP (kW)} \times N
\]

where CAP is the nominal cooling capacity at nominal operating conditions.

<table>
<thead>
<tr>
<th>Application</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air conditioning</td>
<td>2.5</td>
</tr>
<tr>
<td>Industrial process cooling</td>
<td>(See note)</td>
</tr>
</tbody>
</table>

**NOTE:** For industrial process cooling applications, where high stability of the water temperature levels must be achieved, the values above must be increased.

This volume is required to obtain temperature stability and precision.

To achieve this volume, it may be necessary to add a storage tank to the circuit. This tank should be equipped with baffles to allow mixing of the fluid (water or brine). Please refer to the examples below.

**Fluid loop volume** — The volume in circulation must equal or exceed 3 gal. per nominal ton (3.25 L per kW) of cooling for temperature stability and accuracy in normal air conditioning applications. In process cooling applications, or for operation at ambient temperature below 32 F (0°C) with low loading conditions, there should be from 6 to 10 gal. per ton (6.5 to 10.8 L per kW). To achieve this volume, it is often necessary to install a tank in the loop. Tank should be baffled to ensure there is no stratification and that water (or brine) entering tank is adequately mixed with liquid in the tank.

**NOTE:** Tank installation is shown below.
4 - ELECTRICAL CONNECTION

4.1 - Control box

Please refer to the certified dimensional drawings, supplied with the unit.

4.2 - Power supply

The power supply must conform to the specification on the chiller nameplate. The supply voltage must be within the range specified in the electrical data table. For connections refer to the wiring diagrams and the certified dimensional drawings.

**WARNING:** Operation of the chiller with an improper supply voltage or excessive phase imbalance constitutes abuse which will invalidate the Surrey warranty. If the phase imbalance exceeds 2% for voltage, or 10% for current, contact your local electricity supply at once and ensure that the chiller is not switched on until corrective measures have been taken.

4.3 - Voltage phase imbalance (%)

100 x max. deviation from average voltage

Average voltage

Example:
On a 400 V - 3 ph - 50 Hz supply, the individual phase voltages were measured to be:
AB = 406 V; BC = 399 V; AC = 394 V
Average voltage = (406 + 399 + 394)/3 = 1199/3 = 399.7 say 400 V
Calculate the maximum deviation from the 400 V average:

\[(AB) = 406 - 400 = 6\]
\[(BC) = 400 - 399 = 1\]
\[(CA) = 400 - 394 = 6\]

The maximum deviation from the average is 6 V.
The greatest percentage deviation is: 100 x 6/400 = 1.5%
This is less than the permissible 2% and is therefore acceptable.

4.4 - Recommended wire sections

Wire sizing is the responsibility of the installer, and depends on the characteristics and regulations applicable to each installation site. The following is only to be used as a guide-line, and does not make Surrey in any way liable.

After wire sizing has been completed, using the certified dimensional drawing, the installer must ensure easy connection and define any modifications necessary on site.

The connections provided as standard for the field-supplied power entry cables to the general disconnect/isolator switch are designed for the number and type of wires, listed in the table below.

The calculations are based on the maximum machine current (see electrical data tables), and standard installation practises, in accordance with IEC 60364 have been applied (30GSA units are installed outside):
- No. 17: suspended aerial lines,
- No. 61: buried conduit with a derating coefficient of 20.

The calculation is based on PVC or XLPE insulated cables with copper core. A maximum ambient temperature of 46°C has been taken into consideration. The given wire length limits the voltage drop to < 5% (length L in metres - see table below).

**IMPORTANT:** Before connection of the main power cables (L1 - L2 - L3) on the terminal block, it is imperative to check the correct order of the 3 phases before proceeding to the connection on the main disconnect/isolator switch.

Power cable entry

The power cables can enter the control box from below or from the side of the unit, at the bottom of the angle iron. Pre-punched holes facilitate the entry. Refer to the certified dimensional drawing for the unit. A removable aluminium plate below the control box allows introduction of the cables.

4.5 - Field control wiring

Refer to the Controls IOM and the certified wiring diagram supplied with the unit for the field control wiring of the following features:
- Evaporator pump interlock (mandatory)
- Remote on/off switch
- Demand limit external switch
- Remote dual setpoint
- Alarm, alert and operation report
- Heating/cooling selection

4.6 - Power supply

After the unit has been commissioned, the power supply must only be disconnected for quick maintenance operations (one day maximum). For longer maintenance operations or when the unit is taken out of service and stored (e.g. during the winter or if the unit does not need to generate cooling) the power supply must be maintained to ensure supply to the heaters (compressor oil crankcase heaters, unit frost protection).
5 - WATER CONNECTIONS

For size and position of the unit water inlet and outlet connections refer to the certified dimensional drawings supplied with the unit. The water pipes must not transmit any radial or axial force to the heat exchangers nor any vibration.

The water supply must be analysed and appropriate filtering, treatment, control devices, shut-off and bleed valves and circuits built in, to prevent corrosion (example: damage to the protection of the tube surface if the fluid is polluted), fouling and deterioration of the pump fittings.

Before any start-up verify that the heat exchange fluid is compatible with the materials and the water circuit coating. In case additives or other fluids than those recommended by Surrey are used, ensure that the fluids are not considered as a gas, and that they belong to class 2, as defined in directive 97/23/EC.

Surrey recommendations on heat exchange fluids:
• No NH4+ ammonium ions in the water, they are very detrimental for copper. This is one of the most important factors for the operating life of copper piping. A content of several tenths of mg/l will badly corrode the copper over time.
• CI- Chloride ions are detrimental for copper with a risk of perforations by corrosion by puncture. If possible keep below 10 mg/l.
• SO42- sulphate ions can cause perforating corrosion, if their content is above 30 mg/l.
• No fluoride ions (<0.1 mg/l).
• No Fe2+ and Fe3+ ions with non negligible levels of dissolved oxygen must be present. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l.
• Dissolved silicon: silicon is an acid element of water and can also lead to corrosion risks. Content < 1mg/l.
• Water hardness: >0.5 mmol/l. Values between 1 and 2.5 mmol/l can be recommended. This will facilitate scale deposition that can limit corrosion of copper. Values that are too high can cause piping blockage over time. A total alkalimetric titre (TAC) below 100 is desirable.
• Dissolved oxygen: Any sudden change in water oxygenation conditions must be avoided. It is as detrimental to deoxygenate the water by mixing it with inert gas as it is to over-oxygenate it by mixing it with pure oxygen. The disturbance of the oxygenation conditions encourages destabilisation of copper hydroxides and enlargement of particles.
• Specific resistance - electric conductivity: the higher the specific resistance, the slower the corrosion tendency. Values above 30 Ohm•m are desirable. A neutral environment favours maximum specific resistance values. For electric conductivity values in the order of 20-60 mS/m can be recommended.
• pH: Ideal case pH neutral at 20-25°C (7 < pH < 8).

ATTENTION: Charging, adding or draining fluid from the water circuit must be done by qualified personnel, using air vents and materials suitable for the products. The water circuit charging devices are field-supplied.

Charging and removing heat exchange fluids should be done with devices that must be included on the water circuit by the installer. Never use the unit heat exchangers to add heat exchange fluid.

Operating precautions and recommendations

The water circuit should be designed to have the least number of elbows and horizontal pipe runs at different levels. Below the main points to be checked for the connection:
• Comply with the water inlet and outlet connections shown on the unit.
• Install manual or automatic air purge valves at all high points in the circuit.
• Use an expansion device to maintain pressure in the system and install a safety valve as well as an expansion tank.
• Units with a hydronic module include the safety valve and the expansion tank.
• Install thermometers in both the entering and leaving water connections.
• Install drain connections at all low points to allow the whole circuit to be drained.
• Install stop valves, close to the entering and leaving water connections.
• Use flexible connections to reduce vibration transmission.
• Insulate all pipework, after testing for leaks, both to reduce thermal leaks and to prevent condensation.
• Wrap the insulations with a demisting screen.
• If the external unit water pipes are in an area where the ambient temperature is likely to fall below 0°C, they must be protected against frost (frost protection solution or electric heaters).

NOTE: For units not equipped with a hydronic module a screen filter must be installed. This must be installed on the water entering pipes upstream of the pressure gauge. It must be located in a position that is easily accessible for removal and cleaning. The mesh size of the filter must be 1.2 mm.

The plate heat exchanger can foul up quickly at the initial unit start-up, as it complements the filter function, and the unit operation will be impaired (reduced water flow rate due to increased pressure drop). Units with hydronic module are equipped with this type of filter.

Do not introduce any significant static or dynamic pressure into the heat exchange circuit (with regard to the design operating pressures).

The products that may be added for thermal insulation of the containers during the water piping connection procedure must be chemically neutral in relation to the materials and coatings to which they are applied. This is also the case for the products originally supplied by Surrey.

IMPORTANT: Depending on the atmospheric conditions in your area you must do the following when switching the unit off in winter:
• Add ethylene glycol or propylene glycol with an adequate concentration to protect the installation up to a
Check the chilled water circulation pumps, air handing units and all other equipment connected to the evaporator. Refer to the manufacture instructions. For units without hydronic module, the water pump overheat protection device must be connected in series with the pump contactor power supply.

- Refer to the wiring diagram supplied with the unit.
- Ensure that there are no refrigerant leaks.
- Confirm that all pipe securing bands are tight.
- Confirm the the electrical connections are secure.

6.2-Actual start-up

- Commissioning and start-up of the chiller must be supervised by a qualified refrigeration engineer. Start-up and operating tests must be carried out with a thermal load applied and water circulating in the evaporator.
- All setpoint adjustments and control tests must be carried and before the unit is started up.
- Please refer to the control manual.

The unit should be started up in Local ON mode. Ensure that all safety devices are satisfied, especially the high pressure switches.

6.3-Operation of two units in master/slave mode

The control of a master/slave assembly is in the entering water and does not require any additional sensors (standard configuration). It can also be located in the leaving water. In this case two additional sensors must be added on the common piping.

All parameters, required for the master/slave function must be configured using the Service Configuration menu. All remote controls of the master/slave assembly (start/stop, setpoint, load shedding, etc.) are controlled by the unit configured as master and must only be applied to the master unit.

Depending on the installation and control type, each unit can control its own water pump. If there is only one common pump for the two units, the master unit can control this. In this case shut-off valves must be installed on each unit. They will be activated at the opening and closing by the control of each unit (and the valves will be controlled using the dedicated water pump outputs).

Standard configuration: return water control
7.2 - Lubricant
The compressors installed in these units have a specific oil charge, indicated on the name plate of each compressor. The oil level check must be done with the unit switched off, when then suction and discharge pressures are equalised. The oil level must be visible and above the middle of the sight-glass in the oil equalisation line. If this is not the case, there is an oil leak in the circuit. Search and repair the leak, then recharge oil, so that it reaches a level between the middle and three quarters of the sight-glass (unit in vacuum).

**ATTENTION:** Too much oil in the circuit can cause a unit defect.

**NOTE:** Use only oils which have been approved for the compressors. Never use oils which have been exposed to air.

7.3 - Condensers
The coils are condensers with internally grooved copper tubes with aluminium fins.

7.4 - Fans
The fans are axial fans equipped with rotating shroud and made of composite recyclable material. The motors are three-phase, with permanently lubricated bearings and insulation class F.

7.5 - Moisture indicator
Located on the liquid line, permits control of the unit charge and indicates moisture in the circuit. The presence of bubbles in the sight-glass indicates an insufficient charge or non-condensables in the system. The presence of moisture changes the colour of the indicator paper in the sight-glass.

7.6 - Filter drier
This is a one-piece, brazed filter drier, located in the liquid line. The role of the filter drier is to keep the circuit clean and moisture-free. The moisture indicator shows when it is necessary to change the filter drier. A difference in temperature between the filter inlet and outlet shows that the element is dirty.

7.7 - Evaporator
The evaporator is a plate heat exchanger with one or two refrigerant circuits. The water connection of the heat exchanger is a Victaulic connection. The evaporator shell has a thermal insulation of 19 mm thick polyurethane foam. As standard the evaporator is equipped with frost protection. The products that may be added for thermal insulation of the containers during the water piping connection procedure must be chemically neutral in relation to the materials and coatings to which they are applied. This is also the case for the products originally supplied by Surrey SCS.

**NOTES - Monitoring during operation:**
• Follow the regulations on monitoring pressurised equipment.
• It is normally required that the user or operator sets up and maintains a monitoring and maintenance file.
• If they exist follow local professional recommendations.
• Regularly check for possible presence of impurities (e.g. silicon grains) in the heat exchange fluids. These impurities maybe the cause of the wear or corrosion by
In these conditions, the following maintenance operations are recommended. Carry out all level 1 operations, then:

**Electrical checks**
- At least once a year tighten the power circuit electrical connections (see table with tightening torques).
- Check and retighten all control/command connections, if required (see table with tightening torques).
- Remove the dust and clean the interior of the control boxes, if required.
- Check the status of the contactors, disconnect switches and capacitors.
- Check the presence and the condition of the electrical protection devices.
- Check the correct operation of all heaters.
- Check that no water has penetrated into the control box.

**Mechanical checks**
- Check the tightening of the fan tower, fan, compressor and control box fixing bolts.

**Water circuit checks**
- Check the water connections.
- Check the expansion tank for signs of excessive corrosion or gas pressure loss and replace it, if necessary.
- Purge the water circuit (see chapter ‘Water flow control procedure’).
- Clean the water filter (see chapter ‘Water flow control procedure’).
- Replace the stuffing box packing of the pump after 15000 hours of operation with defrost solution or after 25000 hours of operation with water.
- Check the operation of the low water flow rate safety device.
- Check the status of the thermal piping insulation.
- Check the concentration of the anti-freeze protection solution (ethylene glycol or polyethylene glycol).

**Refrigerant circuit**
- Fully clean the condensers with a low-pressure jet and a bio-degradable cleaner (counter-current cleaning - see chapter ‘Condenser coil - level 2’).
- Check the unit operating parameters and compare them with previous values.
- Carry out an oil contamination test. Replace the oil, if necessary.
- Check the operation of the high-pressure switches. Replace them if there is a fault.
- Check the fouling of the filter drier. Replace it if necessary.
- Keep and maintain a maintenance sheet, attached to each HVAC unit.

All these operations require strict observation of adequate safety measures: individual protection garments, compliance with all industry regulations, compliance with applicable local regulations and using common sense.

8.3 - Level 3 (or higher) maintenance
The maintenance at this level requires specific skills/approval/tools and know-how and only the manufacturer, his representative or authorised agent are...
permitted to carry out these operations. These maintenance operations concern for example: • A major component replacement (compressor, evaporator), • Any intervention on the refrigerant circuit (handling refrigerant), • Changing of parameters set at the factory (application change), • Removal or dismantling of the HVAC unit, • Any intervention due to a missed established maintenance operation, Any intervention covered by the warranty.

To reduce waste, the refrigerant and the oil must be trans-ferred in accordance with applicable regulations, using methods that limit refrigerant leaks and pressure drops and with materials that are suitable for the products. Any detected leaks must be repaired immediately.

The compressor oil that is recovered during maintenance contains refrigerant and must be treated accordingly.

Refrigerant under pressure must not be purged to the open air.

If a refrigerant circuit is opened, plug all openings, if the operation takes up to one day, or for longer periods charge the circuit with nitrogen.

NOTE : Any deviation or non-observation of these maintenance criteria will render the guarantee conditions of the HVAC unit null and void, and the manufacturer, Surrey SCS, will no longer be held responsible. Responsible.

8.4 - Tightening torques for the main electrical connections

Component/screw type          Designation in the unit    Value (N.m)  
Soldered screw (PE) customer connection  
M8                  PE             14.5  
Screw on switch inlet Zones    QS_            8-15  
Compressor earth connection  
M6                  Gnd            5.5  
M8                  Gnd            2.83  
Tunnel terminal screw,  
Disconnect switch (fan, pump)   QM_        1.7  
Tunnel terminal screw,  
Control power transformer   TC          0.6  
Compressor earth terminal in the power wiring control box  
M6                  Gnd            5.5  
Compressor earth connection  
M8                  Gnd            2.83  
Tunnel terminal screw,  
Tunnel terminal screw,  
Contactor (fan, pump)       KM*        0.8 to 1.3

8.5 – Tightening torques for the main bolts and screws

<table>
<thead>
<tr>
<th>Screw type</th>
<th>Used for</th>
<th>Torque(N.M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressor strut</td>
<td>compressor support</td>
<td>30</td>
</tr>
<tr>
<td>M8 unt</td>
<td>BPHE* fixing</td>
<td>15</td>
</tr>
<tr>
<td>M10 unt</td>
<td>Compressor fixing</td>
<td>30</td>
</tr>
<tr>
<td>M16 unt</td>
<td>Compressor fixing</td>
<td>30</td>
</tr>
<tr>
<td>Oil unt</td>
<td>Oil equalization line</td>
<td>75</td>
</tr>
<tr>
<td>Taptite screw M6</td>
<td>Fan support</td>
<td>7</td>
</tr>
<tr>
<td>Taptite screw M8</td>
<td>Fan motor fixing</td>
<td>13</td>
</tr>
<tr>
<td>H M8 screw</td>
<td>Fan motor fixing</td>
<td>18</td>
</tr>
<tr>
<td>Metal screw</td>
<td>Sheet metal plates</td>
<td>4.2</td>
</tr>
<tr>
<td>H M6 screw</td>
<td>Stauff clamps</td>
<td>10</td>
</tr>
<tr>
<td>Earth screw</td>
<td>Compressor</td>
<td>2.8</td>
</tr>
</tbody>
</table>

8.6 – Condenser coil

We recommend, that finned coils are inspected regularly to check the degree of fouling. This depends on the environment where the unit is installed, and will be worse in urban and industrial installations and near trees that shed their leaves.

For coil cleaning, two maintenance levels are used, based on the AFNOR X60-010 standard:

Level 1
- If the condensers are fouled, clean them gently in a vertical direction, using a brush.
- Only work on condensers with the fans switched off.
- For this type of operation switch off the HVAC unit if service considerations allow this.
- Clean condensers guarantee optimal operation of your HVAC unit. This cleaning is necessary when the condensers begin to become fouled. The frequency of cleaning depends on the season and location of the HVAC unit (ventilated, wooded, dusty area, etc.).

Level 2
The two cleaning products can be used for any of the following coil finishes : Cu/Cu, Cu/Al, Cu/Al with Polual, Blygold and/or Heresite protection.

Clean the coil, using appropriate products. We recommend TOTALINE products for coil cleaning:
Part No. P902 DT 05EE : traditional cleaning method
Part No. P902 CL 05EE : cleaning and degreasing.

These products have a neutral pH value, do not contain phosphates, are not harmful to the human body, and can be disposed of through the public drainage system.

Depending on the degree of fouling both products can be used diluted or undiluted.

For normal maintenance routines we recommend using 1 kg of the concentrated product, diluted to 10%, to treat a coil surface of 2 m². This process can either be carried out using a high-pressure spray gun in the low-pressure position. With pressurised cleaning methods care should be taken not to damage the coil fins. The spraying of the coil must be done:
• in the direction of the fins
• in the opposite direction of the air flow direction
• with a large diffuser (25-30°)

at a minimum distance of 300 mm from the coil.
It is not necessary to rinse the coil, as the products used are pH neutral. To ensure that the coil is perfectly clean, we recommend rinsing with a low water flow rate. The pH value of the water used should be between 7 and 8.

WARNING: Never use pressurised water without a large diffuser. Do not use high-pressure cleaners for Cu/Cu and Cu/Al coils.

8.7 – Evaporator maintenance

Check that:
• the insulating foam is intact and securely in place.
• the cooler heaters are operating, secure and correctly positioned.
• the water-side connections are clean and show no sign of leakage.
Electrical wiring diagrams

Model: 30GSA018-024
NOTES:
1. Wiring and piping shown are general points of connection guides only and are not intended for or to include all details for a specific installation.
2. All wiring must comply with applicable local and national codes.
3. All piping must follow standard piping techniques. Refer to Carrier System Design Manual for details.
12 - start-up checklist for Liquid chillers (use for job file)

Preliminary information
Job name: .........................................................................................................................
Location: ..........................................................................................................................
Installing contractor: .........................................................................................................
Distributor: ........................................................................................................................
Start-up preformed by: ........................................... Date: ..............................................

Equipment
Model 30GSA: ................................................................. S/N: ............................................
Compressors
Circuit A  Circuit B
1. Model No. ....................................................... 1. Model No. ....................................................
   Serial No. ........................................................... Serial No. ...........................................
2. Model No. ....................................................... 2. Model No. ....................................................
   Serial No. ........................................................... Serial No. ...........................................
3. Model No. ....................................................... Serial No. .............................................
   Serial No. ...........................................................

Air handling equipment
Manufacturer: ..................................................................................................................
Model No. .......................................................................................................................
Serial No. ......................................................................................................................

Additional air handling units and accessories:
........................................................................................................................................
........................................................................................................................................

Preliminary equipment check
Is there any shipping damage? ....................................... If so, where? ...................................
........................................................................................................................................
........................................................................................................................................
Will this damage prevent unit start-up? .................................................................
   __Unit is level in its installation
   __Power supply agrees with the unit name plate
   __Electrical circuit wiring has been sized and installed properly
   __Unit ground wire has been connected
   __Electrical circuit protection has been sized and installed properly
   __All terminals are tight
   __All cables and thermistors have been inspected for crossed wires
   __All plug assemblies are tight

Check air handling systems
   __All air handlers are operating
   __All chilled water valves are open
   __All fluid piping is connected properly
   __All air has been vented from the system
   __Chilled water pump is operating with the correct rotation. CWP amperage: Rated: ........ Actual: ........

Unit start-up
   __Chilled water pump control has been properly interlocked with the chiller
   __Oil level is correct
   __Compressor crankcase heaters have been energised for 12 hours
   __Unit has been leak checked (including fittings)
   __Locate, repair, and report any refrigerant leaks
........................................................................................................................................
........................................................................................................................................

Check voltage imbalance:  AB........... AC........... BC...........
Average voltage = ........................................ (see installation instructions)
Maximum deviation = .......................... (see installation instructions)
Voltage imbalance = .............................. (see installation instructions)
   __Voltage imbalance is less than 2%

WARNING: Do not start chiller if voltage imbalance is greater than 2%. Contact local power company for assistance.
   __All incoming power voltage is within rated voltage range
Check evaporator water loop
Water loop volume = ................. (litres)
Calculated volume = ................. (litres)
3.25 litres/nominal kW capacity for air conditioning
6.5 litres/nominal kW capacity for process cooling
Proper loop volume established
Proper loop corrosion inhibitor included........litres of.........................
Proper loop freeze protection included (if required)...........litres of............... 
Water piping includes electric tape heater up to the evaporator
Return water piping is equipped with a screen filter with a mesh size of 1.2 mm

Check pressure drop across the unit evaporator (without hydronic module) or the external static pressure (with hydronic module)
Entering evaporator = ..................... (kPa)
Leaving evaporator = ..................... (kPa)
Pressure drop (entering - leaving) = ...... (kPa)

WARNING (unit without hydronic module): Plot the pressure drop on the evaporator flow/pressure drop curve to determine the flow rate in l/s at the nominal operating conditions for the installation. For units with hydronic module, a flow rate indication is displayed by the unit control (consult the control manual).
__ Flow rate from the pressure drop curve, l/s = ........
__ Nominal flow rate, l/s = ....................
__ The flow rate in l/s is higher than the minimum unit flow rate
__ The flow rate in l/s corresponds to the specification of ............ (l/s)

Carry out the QUICK TEST function (see control manual):
Check and log on to the user menu configuration

Load sequence selection..........................................................................................................................................................
Capacity ramp loading selection.............................................................................................................................................
Start-up delay........................................................................................................................................................................
Burner section........................................................................................................................................................................
Pump control...........................................................................................................................................................................
Setpoint reset mode.............................................................................................................................................................
Night-time capacity setback.......................................................................................................................................................

Re-enter the setpoints (see controls section)
To start up the chiller

WARNING: Be sure that all service valves are open, and that the pump is on before attempting to start this machine. Once all checks have been made, start the unit in the “LOCAL ON” position.
Unit starts and operates properly
Temperatures and pressures
warning: Once the machine has been operating for a while and the temperatures and pressures have stabilized, record the following:
Evaporator entering water..................................................................................................................................................
Evaporator leaving water..................................................................................................................................................
Ambient temperature .........................................................................................................................................................
Circuit A suction pressure..................................................................................................................................................
Circuit B suction pressure..................................................................................................................................................
Circuit A discharge pressure..................................................................................................................................................
Circuit B discharge pressure..................................................................................................................................................
Circuit A suction temperature.............................................................................................................................................
Circuit B suction temperature.............................................................................................................................................
Circuit A discharge temperature..........................................................................................................................................
Circuit B discharge temperature..........................................................................................................................................
Circuit A liquid line temperature......................................................................................................................................
Circuit B liquid line temperature......................................................................................................................................
notes:_________________________________________________________________________________________________________________________________
_________________________________________________________________________________________________________________________________