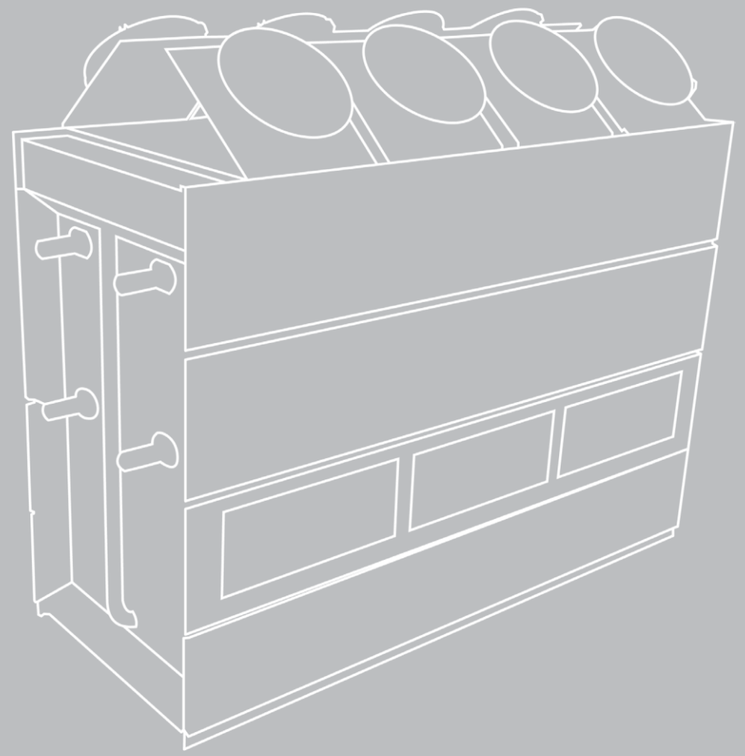
Installation and Operation Manual

# ECOSS

Stainless Steel Evaporative Condenser / Fluid-Cooler



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# A New Concept in Evaporative Cooling

Güntner, a German multinational company with over 80 years of “know-how” and world leader in development of heat exchanger technologies presents the ECOSS (Evaporative Condenser Stainless Steel) a new concept in evaporative condensing.

The ECOSS is an innovative technology that has emerged from the Güntner Group. The ECOSS meets all requirements for thermal performance, quality, safety, environment and reliability. Its thermal and operational performance is tried and tested according to ANSI / ASHRAE 64-2011 in Güntner’s own laboratory, the EC LAB (Evaporative Condenser Laboratory).

The EC-LAB is the only laboratory in the Southern Hemisphere with the ability to simulate climatic conditions for evaporative products, adiabatic tests, dry coolers, air condensers and heat exchangers. This technology center was developed through international partnership between the companies Güntner, Güntner Brazil and Güntner USA. This significant investment will provide Güntner customers with proven equipment performance and warranty.

The Installation and Operating Manual or short IOM, among other documentation should always be available for your reference. If you have questions or are in need of spare parts, please contact the Commercial Department of Güntner, which will strive to meet your needs in a speedy and effective fashion.



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# Responsibilities

## 1.1 Responsibilities of the manufacturer

The observations given in these instructions for maintaining functional safety of the equipment, avoiding possible hazards during transportation, assembly and installation, startup and operation, and the maintenance activities (cleaning, repairs and technical assistance) refer only to the unit, and do not apply to other series of equipment or equipment from other manufacturers.

Construction materials are configured such as that they resist foreseeable mechanical, thermal and chemical stresses and are resistant to fluids and mixtures of fluids or oils and coolants as outlined in the specifications.

The welded parts containing fluids (central tube, headers or distributors) are designed to withhold caustic chemicals (see specifications), mechanical or thermal stress and to resist the maximum allowable working pressure (MAWP).

Materials, wall thickness of tubes (central, headers, distributors and collectors), tensile strength, corrosion resistance (during testing) are suitable for fluids (defined in the specifications) to resist design pressures, voltages and temperatures.

## 1.2 Owner / Operator Responsibilities

The owner and or operator shall verify that the all operational staff are trained and skilled enough to operate, monitor and perform service on the equipment / system.

Operational staff should have sufficient knowledge and experience with relation to the mode of operation as well as daily monitoring of this system.

Before starting the system, the owner or operator responsible should check that the operating personnel are sufficiently informed with respect to the product documentation (operating instructions) system configuration, monitoring, operation and technical assistance, safety measures, and with respect to the properties and handling of refrigerants to be used.

The owner or operator responsible must properly operate, monitor and perform maintenance on the system. He or she must ensure that fluids should not be changed or substituted with fluids not specified in the project document; exception only by authorization from Güntner.

Planning and preparing emergency measures: A suitable warning system should be installed on owner's premises to avoid consequential damage caused by operational disturbances or if failures occur. Emergency measures should be in place to prevent consequential damage to persons and equipment.

Owner or operator (as specified in project documents) shall be responsible in case the equipment is used by third parties (not specified in project documents), unless a prior agreement with Güntner has been made.

## 1.3 Legal Notes

A warranty claim will expire upon the following:

•Any defects and damages due to non-conformances as outlines in the specifications or operating instructions;
•Any claims due to usage of non-original manufacturers' parts or replacement parts not specified in the proposal or project documents;
•Any unapproved changes to the unit (refrigerants, function parameters, operational changes, etc.) in relation to specifications or project documents or related to the application design without authorization Güntner;
•The operating instructions shall not be reproduced, circulated, amended, passed on to third parties translated or otherwise used, in whole or in part without the express written permission of Güntner.

## 1.4 Remarks to Operations - Attention

These operating instructions apply to all models of ECOSS evaporative condensers for operation in accordance with the recommended fluids, pressures and temperatures specified in the project documents.

WARNING

You will find the parameters and the exact model of your equipment in project documents related to the application; if you do not have the same, please contact the Güntner technical team.

### 1.4.1 Documentation- Attention

The operating instructions of the unit include the following items:

•Equipment Guide (shipping instructions, assembly, operation and maintenance manual);
• Documents related to the project application:
-Description regarding technicians trained in the proper use of equipment;
-Drawings of the equipment related to the application, specifying the client, project number and the application number;
- Electrical Motor circuit diagram.

WARNING

It is the customer's responsibility to request the aforementioned documentation above.

# Safety

DANGER

Addresses a hazardous situation which, if found, may result in death or serious injury.

HEADS UP

Addresses a situation or statement that must be strictly followed and not to result in irreparable damage to equipment.

WATCH OUT

Addresses a safety risk to operators or which may cause damage to equipment.

WARNING

Indicates instructions that pertain to the operation and Safety of the equipment. Failure to follow these instructions can result in damage to equipment.





## 2.1 Warning Signs

Notification / Attention

Potential to injure hands. Hands or fingers can be crushed, pulled or otherwise damaged.

Be aware of Cold surfaces . The temperature is below 0 º C and may cause irritation or cold-burns.

Be aware of Cold surfaces . The temperature is below 0 º C and may cause irritation or cold-burns.

Be aware of High voltages. Risk of electric shock or injuries if handled without care.

Be aware of potentially explosive substances. Use of ignition sources can cause explosion, damage and / or injuries.

Be aware of substances with fire risk upon contact. Use of ignition sources can cause fire, damage and / or injuries.

Be aware of corrosives and acids. Contact and / or inhalation can cause severe irritation, injury or health problems.

Be aware of harmful irritant. Contact and / or inhalation can cause severe irritation, injury or health problems.

Be aware of toxic substances. Contact and / or inhalation can cause severe irritation, injury or health problems.

### 2.1.2 Prohibition Signs

No sources of ignition permitted.

Warning, No Smoking allowed

### 2.1.3 Mandatory Safety Sign

Eye Protection: Wear goggles or face shield.

Hand protection. Protective gloves against mechanical and chemical hazards shall be used.

Use respiratory protection. The breathing equipment must be suitable to protect against chemicals in use.
The breathing apparatus shall consist of:
At least two independent breathing devices (device self-contained breathing);
For ammonia: additional breathing apparatus with filter (full mask) or self-contained breathing apparatus (standalone);

Use protective clothing. Individual protective clothing must be suitable to resist any liquids in use as well as protection against low temperature.

De-activate the electrical system; use lock-out devices during maintenance work and repairs



## 2.2 Basic safety

### 2.2.1 What to do in an emergency

Danger of personal injury and property damage.
The equipment may contain ammonia refrigerant (NH3).

Ammonia is a potentially explosive and a fire hazardous substance. It may be flammable if transported in oil residues; mixed with other coolants it could ignite or explode, causing serious injuries or loss of limbs.

Ammonia is a corrosive, toxic and irritating gas. Prolonged exposure to air containing ammonia with a concentration of 0.2 vol% (20ppm) can be life threatening or fatal.

First Aid measures and safety procedures.

- In case of unexpected large coolant leaks, activate the Emergency STOP Switch and leave the area immediately to a safe place;
- Activate the alarm to warn others;
- Have experienced, trained staff with protective clothing perform all necessary safety and security measures.
- Use respiratory protection;
- Use a self-contained breathing apparatus (not relying on room air) during maintenance work or work with high concentrations of refrigerant present.
- Verify that the working area is well ventilated;
- Avoid vapor and liquid refrigerant to escape to other areas;
- First Aid Procedures:
  - Call a physician immediately.
  - Some coolant fluids ask cause corrosive injury to the skin and eyes;
  - The injured shall use a respirator until further notice
  - Bath the victim five to fifteen minutes in clear lukewarm water. Remove clothing carefully while bathing. If a bath-tub or similar is unavailable available, use a safety shower or a water hose.
- The machine must be started, operated, serviced and repaired by qualified, trained and experienced. All personnel responsible for operation, maintenance, repair and evaluation of the systems and its components must be trained and possess specialized knowledge required to carry out their work. Qualified or specialized means the ability to perform satisfactorily all necessary operations, maintenance, repair and evaluation of the systems activities and all of its components;
- Personnel without specific experience in refrigeration engineering with respect to the mode of the systems operation, perform any intervention or system configuration;

- Any changes to the units original manufacturers start-up parameters have to be first authorized in writing and may only be performed by trained and qualified personnel;
- Electrical installation: Work on electrical equipment may only be performed by people who have the specific knowledge required (eg, an electrician, or a person trained in electrical engineering), and are authorized by the operator in accordance with all respective safety regulations and PPE.

### 2.2.2 Use an overall Adequate Design

The ECOSS evaporative condenser / liquid cooler series are intended for installation in a refrigeration system and are used for cooling / condensation in large refrigeration systems, such as in meat plants, slaughterhouses, food industry, beverage, power industry, and other applications. The unit is delivered for operation with a specific operating point:

- Temperature / Condensation Pressure;
- Air flow rates;
- Mass flow of gas / liquid, volumetric flow rate;
- Wet bulb temperature of inlet air;
- Altitude;
- Thermal capacity.

WARNING

You will find the parameters and the exact model of your equipment in the related project documents. In case you do not have them,





### 2.2.3 Operating Conditions

- The equipment is a component of a refrigeration system including all coolant fluids. The purpose of this manual, as part of the operating instructions manual (which are part of these operating instructions), is to minimize hazards to people, property and the environment of the unit and all its components including coolant fluids being used . These risks are mainly related to the physical and chemical properties of the coolant fluids and with the pressures and temperatures that occur in the components carrying the coolant fluids in the equipment. Refer to the respective MSDS of compounds (Material Safety Data Sheet of chemicals) available from your suppliers. The MSDS contains additional information regarding your specific refrigerant as well as its characteristics and dangers and safety measures.
- The equipment may only be used in accordance with proper intended. During operation the operator shall monitor all relevant data as to manufactures recommendations and not allow deviations of measured data to be out of permissible range. The operator may use this data to advance maintenance procedures as outlined in the manufactures recommended maintenance intervals.
- The operator shall verify that the maintenance measures are being carried out according to the operating manual of the system and / or additional instructions from the manufacturer.
- Do not exceed the MAWP (Manufactures recommended Working Pressures as specified on the nameplate and /or otherwise specified in the project documents.

### 2.2.4 Misuse and deviations from design

Coolant fluids and their combinations with water and other substances in the components carrying the Coolant fluids has chemical and physical effects within the materials surrounding them. The unit shall only be pressurized with the compound defined in related project documents. High pressures with another coolant fluids and / or liquids or solids may result in:

- If modified or replaced, structural and other welding joints or materials may not withstand the mechanical, thermal and chemical tensions and pressures (as per design) during operation; frequent shutdowns or undesirable operation may occur.
- The materials, wall thickness, tensile strength, corrosion resistance and process tests are suitable for the coolant fluid (as per design) and may not resist the possible variations of stresses and strains that may occur;
- The ECOSS may not operate as designed for other coolant fluids unless otherwise specified in the project documents and / or specifications or otherwise authorized by Güntner;
- The ECOSS may not remain watertight during operation while disconnected from the system or plant;
- A sudden escape of coolant fluids may harm persons and / or property and / or the environment.

HEADS UP

Specified pressures (Maximum allowable working pressures / MAWP) or other design parameters as mentioned on the nameplate as well as in the documentation shall not be exceeded! If the working pressure is exceeded:

1. Structural and other welding joints or materials may not withstand the mechanical, thermal and chemical tensions and pressures (as per design) during operation; frequent shutdowns or undesirable operation may occur;

2. The ECOSS may not remain watertight during operation while disconnected from the system or plant;

3. A sudden escape of coolant fluids do to pipe / tube leaks may have following risks:

- Hazardous materials leak;
- Risk of poisoning;
- Risk of fire;
- Risk of explosion;
- Risk of chemical burns;
- Risk of suffocation;
- Hazards caused by panic reactions;
- Environmental Pollution.

## 2.3 Mechanical hazards waste

### 2.3.1 Tables, corners and sharp edges of equipment

Be aware of hand or limb injuries. Risk of cuts to hand, fingers and limbs caused by sharp edges and corners of equipment.

Use correct PPE (Personal Protection Equipent) such as gloves

### 2.3.2 Misuse, deviations from design

Risk of losing limbs. Risk of injuries to hand and limbs by spinning fan blades or other moving parts. Wear PPE to protect hair and clothing etc.

Do not operate fans without Fan-Guard. Automatic Starting of fans during operation or maintenance may hold a risk of personal injuries. Stay clear of rotating parts.

Turn off and unplug the equipment before starting maintenance work when removing fan-guard is necessary. Protect the unit against unintentional restart by using Lock-Out procedures by locks or removal of applicable electrical fuses of the unit. Protect the unit with an adequate sign that work is in progress to prevent unintentional starting. Fans should be opened only by trained personnel using adequate tools and only for the purpose of maintenance and repairs. Re-install fan guards after completing the work, and protect them against unintentional or unauthorized opening! Make sure electricity is disconnected before removal of safety-bolt!

Beware of hinged side plates. These should only be opened by trained personnel with proper tools, and only for the purpose of maintenance and repairs. Close the hinged side plates after completing the work, and protect them against unintentional or unauthorized opening!

Attention
Maintenance work on fan blades should only be done with fan power disconnected and proper protection in place.

## 2.4 Electrical Hazards

### 2.4.1 Fans, electric motors, water pumps and electric box

High Voltage Risks
The direct and indirect contact with parts carrying a voltage such as motors and electrical lines can cause serious injury or death. Unplug the unit before starting maintenance work. To do so, see the cooling system documentation. Protect the unit against unintentional restart by removing the electric fuses or 'lock-out' of the unit. Protect the unit with an adequate warning sign to prevent unintentional starting.
Note that the network cables may also be carrying voltage, even if the unit is turned off. Work on electrical equipment may only be performed by trained technicians with sufficient knowledge to perform the required work (for example, an electrician, or a person trained in electrical engineering), and are authorized by the responsible operator.

## 2.5. Residual thermal hazards

### 2.5.1. Risk of burns

Be aware of hot surfaces during an electrical service, heat exchanger tubes and piping (hot gas) and any other parts of the equipment that may carry residual heat. Any temperatures above +45 °C may cause burns.

Use proper PPE Equipment such as gloves.

## 2.6. Residual Refrigerant Hazards

DANGER

These risks are mainly related to the physical and chemical properties of the coolant fluid and with the pressures and temperatures that occur in the components carrying the coolant fluid in the equipment. Refer to the respective MSDS of compounds (Material Safety Data Sheet of caustic chemicals and refrigerants) available from your suppliers. The MSDS contains additional information regarding your specific coolant fluids as well as its characteristics and dangers.

DANGER

If the fans are damaged during the operation, loose fan blade parts can injury to persons and / or damage to property. Fans, cables and components in the system are designed, constructed and integrated to prevent hazards caused by individual vibration or vibration by other parts of the system.
Excessive vibration caused by imbalance of fan blades may be due to dirt or damage to fan assembly and are transferred to the unit where additional damage to unit or injury to personnel may occur.
Check the propellers and the guardrail or fan guards regularly to be free of dirt or scale formation to assure and smooth fan operation.

## 2.8. Combined residual hazards

### 2.8.1. Hinged Side Panels and Plates

Beware of hot surfaces
Temperatures above 45 ° C and can cause severe burns.

Risk of injury to hands and limbs
Opening removable side panels may expose hot surfaces or sharp edges. Take precaution to prevent scalding of skin by hot surfaces or cuts of hands due to sharp edges. Removable side plates should be opened only by trained personnel with proper tools, and only for the purpose of maintenance and repairs. Close removable side plates after completing the work, and protect them against unintentional or unauthorized opening.

# Components

Fans shall be connected and ran 2-4 hours every month after periods of prolonged storage or prolonged shutdown of fans. If using fans of types IP54 or IP55 protection, any sealed condensate outlet drain at fan motor must be opened at least every six months.
The drain should be positioned in ideal position for water drainage. In case of opening and / or closing the terminal box cover, proper care should be taken to control torque for tightening and sealing the same. Important: Excessive tightening will cause cracks to the terminal box cover and allow water entrance and water damage, thus consequently damaging the fan.

HEADS UP

## 3.1. AC Technology (see annex for details)

- In terms of aerodynamics, axial fans have the highest level of technology and performance in the market. They are designed to deliver highest performance in terms of throughput with low backpressure and low noise;
- Corresponding delays must be taken into account in the case of star / delta connection;
- if frequency inverters for speed control are being used following items should be observed for fan motors:

A sine-wave filter must be installed on all poles between the frequency inverter and the motor, (Effect output voltage filter with sinusoidal shape between phase to phase and phase to ground), observe Figure 1.
Alternative control with Güntner note figure 2; Three phase fan motors can be operated by means of a star / delta connection with two speeds design and / or speed control. The direction of rotation must be checked. If the direction is wrong, it can be changed by interchanging the two phases.

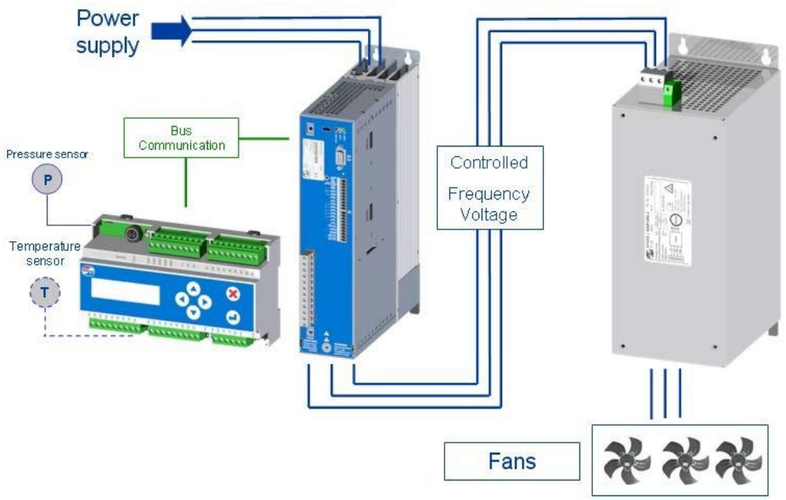



Figure 2: Güntner solution with frequency inverter and GMM Controller.

| Component | Manufacturer | Manual |
|---|---|---|
| AC Fan | EBM-PAPST | Anex |
| AC Fan | ZIEHL-ABEGG | Anex |

## 3.2. EC Technology (Electronically Commutated)

- In terms of aerodynamics, axial fans have the highest level of technology and performance in the market. They are designed to deliver highest performance in terms of throughput with low backpressure and low noise;
- Optimization of energy efficiency through continuous fan control EC;
- Reduced energy and maintenance costs;
- Reduction in the total number of electrical parts compared to a control system using 'Step Control' or a frequency inverter control.

### 3.2.1. GMM (Güntner Motor Management)

- The GMM system is a single, unique solution developed especially for Güntner heat exchangers for EC motors and specific refrigeration applications;
- Ease of parameter settings and accessibility ;
- Reduced maximum noise level (adjusting for night operation);
- Alarm and operational messages capability;
- Ensuring safe and reliable operation with a BYPASS function;
- Full integration with the main control system capability by using simple communication standards;
- Considerably reducing commissioning time by simple controller adjustments (without addressing the fans);

- The combination of exclusive EC fans with GMM provides a unique solution and a „State of the Art" system of intelligent heat exchanger. The GMM manages and controls the fan speed according to the preset pressure or temperature control of the process and consequently results in an energy-optimized system;
- In addition to providing greater reliability and quality installation, the „Plug and Play" system ensures correct commissioning and maintenance of fans due to the automatic programming by the GMM, ie, no software,

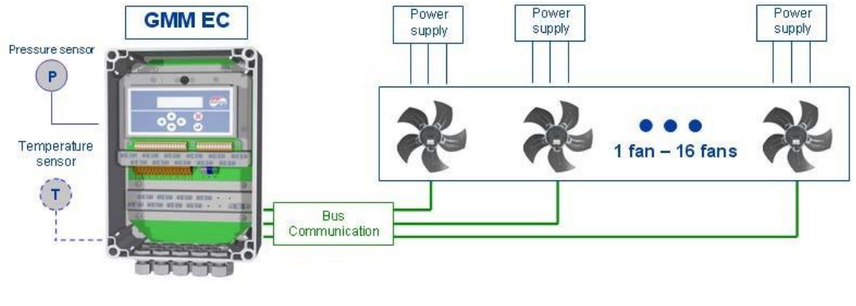
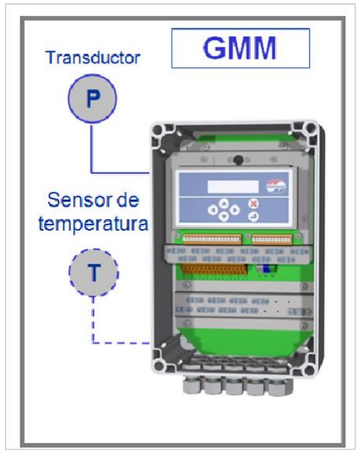



Figure 3: System Configuration with EC fans + GMM.

| Component | Manufacturer | Manual |
|---|---|---|
| EC Fan | EBM-PAPST | Anex |
| GMM | Güntner | Anex |

### 3.2.1.1 Speed control and management sensors

With the „Plug-and-Play" system in automatic mode, the fan speed control, commissioning and management are possible via temperature / pressure sensors.



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These are connected to the GMM and will be applied as follows:

| Application | Sensor Type |
|---|---|
| Evaporative Condenser | Pressure Sensor |
| Gas Cooler | Temperature Sensor |
| Liquid Cooler | Temperature Sensor |
| Closed-Circuit Cooling Tower | Temperature Sensor |

Sensor Installation and their position shall be considered as per table below:

| Application | Installation Position of Sensor/Transducer |
|---|---|
| Evaporative Condenser | General Collector Inlet or Outlet |
| Gas Cooler | General Collector Outlet |
| Liquid Cooler | General Collector Outlet |
| Closed-Circuit Cooling Tower | General Collector Outlet |

Common Header refers to connections that link collector inlet / outlet equipment. The sensors / transducers are not recommended to be installed in a single inlet / outlet of the equipment but rather in a common header facilitating other equipment or are interconnected with other equipment.

### 3.3 Water pump

- Centrifugal pumps used in condensers have to ensure sufficient water flow at low pressures. The ECOSS Pumps have been designed to assure lowest power consumption in relation to the flow required;
- The next table shows various ECOSS models including pump make, model and quantities as well asquantities electrical information:

| Model | Qty | Manufac - turer | Design FlowRat e m3/h | Motor Powe r HP | Rated Voltage Volt | Rated Current Amper e |
|---|---|---|---|---|---|---|
| ECOSS-850 | 1 | Grundfos | 87 | 4 | 3 x220-240 D/380-415 YV | 11.0/6.30 |
| ECOSS-1000 | 1 | Grundfos | 87 | 4 | 3 x220-240 D/380-415 YV | 11.0/6.30 |
| ECOSS-1250 | 1 | Grundfos | 126 | 4 | 3 x220-240 D/380-420 YV | 12.0-11.0/7.00-6.40 |
| ECOSS-1500 | 1 | Grundfos | 126 | 4 | 3 x220-240 D/380-420 YV | 12.0-11.0/7.00-6.40 |
| ECOSS-1700 | 1 | Grundfos | 200 | 5 | 3 x380-415 D V | 9.3 |
| ECOSS-2000 | 1 | Grundfos | 200 | 5 | 3 x380-415 D V | 9.3 |
| ECOSS-2500 | 2 | Grundfos | 304 | 4 | 3 x220-240 D/380-420 YV | 12.0-11.0/7.00-6.40 |
| ECOSS-3000 | 2 | Grundfos | 304 | 4 | 3 x220-240 D/380-420 YV | 12.0-11.0/7.00-6.40 |

*Note: actual pump selection may vary.

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# Transport and Storage

## 4.1 Safety

- Improper Handling;
- All models weigh between 1000 kilogram and 4,000 kilogram respectively (combined weight of top and bottom). Top and/ or Bottom may slip or fall if handled improperly during transport possibly causing serious injury or even death. Erratic movement or strong vibrations during transport may damage the unit;
- Only have experienced personnel load or unload or handle the unit during transport.
- Use appropriate means of transport or handling capable of proper weight distribution. Necessary weight specifications are available in your project documents. Keep unit clear during loading or transport to prevent injuries.
- Maintain even weight distribution during transport. Follow the instructions on the shipping labels for special handling instructions (if applicable);
- Keep unit away from hazardous areas to prevent damage to property and personnel.
- Using a crane: Connect hooks, shackles or any other lifting devices secured only at the lifting points as specified by the manufacturer;
- Use auxiliary transport equipment when necessary. Only use appropriate transport vehicles capable of handling specified loads;
- Do connect any lifting devices to pipes, headers, pull plates, casing etc. as there are not designed for load handling;
- Transport the unit carefully. Avoid sudden movments.

DANGER

## 4.2 Transport

- Read and observe transport instructions;
- Excessive vibrations caused by uneven road surfaces, potholes during transport may cause equipment damage;
- Only load or unload with suitable equipment (crane, hoist, crane, etc) unit;
- The equipment may only be transported with original packaging design to assure adequate for protection.

HEADS UP

## 4.3. Storage

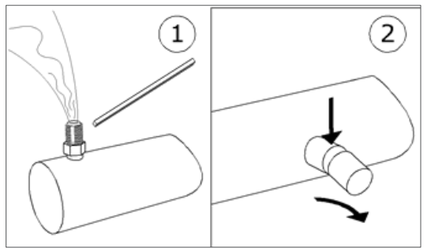
- Avoid possibility of corrosion or undesirable dirt accumulation during storage;
- Protect the unit against dust, dirt, moisture, pollution and other contaminations;
- Do not store the unit any longer than necessary;
- Only store the units in their original packaging;

- Only stack units of same size and in their original packaging, consult your Güntner partner for clarification;
- Store the unit in a protected location away from dust, dirt, moisture and contamination-free until the time of installation (enclosed storage);
- Unexpected installation delay: protect the unit from the elements, dirt and other contaminants with adequate coverage.

## 4.4. Packing

- The units are packaged as to their respective installation position;
- Remove all packing including special protection for all drive modules (if applicable)before installation;
- Caution! Transport or lifting devices shall be rated minimum 1,5 times the weight of the ECOSS;
- Verify Packing list at the time of delivery / unloading. Packing list and instructions are also part of the project documents.
- Any damage during transport shall be properly; inform manufacturer immediately along with proper documentation.
- Unit is send from manufacture in a pressurized condition (compressed dry air). Refer to project documentation and / or refer label at unit inlet piping. Verify existing pressure at Schrader valve and contact manufacturer of any discrepancies;
- Check the pressure as indicated in Fugure 4. Do not install the unit if lower pressure is detected. Lower pressure may indicate a leak and thus shall not be installed; condensing fluids may be hazardous when in contact with skin or inhaled by personell. Contact manufacturer immediately.

HEADS UP




1 - Remove protecting caps
2 - Verify existing pressure and take a note

Danger of corrosion and dirt buildup!
Protect the unit against dust, dirt, moisture, damage, contamination and other harmful influences.
Start the installation as soon as possible!

WARNING

## 4.5 Handling and assembly of modules

The movement of equipment modules must be performed by suitable means (crane, hoist, etc)., Take weight and size of the unit in consideration.
Do not use connecting parts or piping including headers to lift, pull, fix or assemble. Doing so may cause leaks!

The capacity of the transport device should be at least 1.5 times the weight of the unit. See table below for dimensional and weight of the modules.

WATCH OUT

Figure 5 below gives detailed instructions on handling and assembly of upper and lower modules

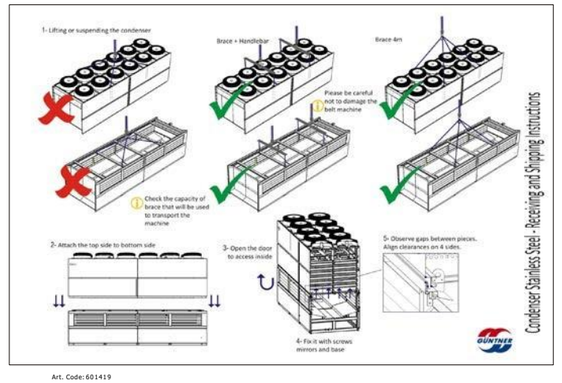



Figure 5: Instructions for receiving, handling and assembly of upper and lower modules.



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# Installation

## 5.1 Notes on installing the unit

- Risk of injury and property damage due t leakage of refrigerant (see residual hazards of caustic chemicals and refrigerants);
- Improper installation may cause leakage of condensing fluid during system operation, which can lead to personal injury or property damage;
- Avoid leakage of any condensing fluid from the unit to the environment (see residual hazards of caustic chemicals and refrigerants);
- Prevent any damage to lines carrying fluids;
- Check all connections within the unit; make sure no force is exerted to any points of distributor and collector. Any excessive force exerted may cause leaks at the unit or interconnected piping.

HEADS UP

## 5.2. Tray water pipe connections

- Do not tighten threaded connections with tools! Do not use pipe wrench or any other wrench! Tighten by hand only;
- Install the drain pipe completely without any tension. The drainage pipe should be installed at least one pipe diameter from the unit with a slope of 3 to 5 °;
- Risk of damage! The plastic threads can be damaged by over-tightening; excessive force could result in water leaks.

HEADS UP

## 5.3. System Installation

- Incorrect connection may could cause refrigerant leaks, refrigerants can be toxic (see esidual hazards of caustic chemicals and refrigerants);
- The soldering, brazing and welding on pressurized parts can result in fire or explosion;
- Smoking or open flame can cause fires or explosions. Make sure there is no stress and vibration being transferred to the unit;
- Install only connections that are free of condensing fluids! The piping system should be secured in place with fastening or lifting devices before being connected to the unit;
- The use of soft solder is allowed in units; Despressurize! Ecacuate the unit correctly;
- The use of open flame at or near the installation site is prohibited. Fire extinguishers and extinguishing agents used to protect equipment and operating personnel shall meet the requirements of safety standards;

DANGER

- Make sure refrigerant detectors and a sufficient fire warning system are in place and working properly to prevent fire and / or explosions. Make sure all initial control parameters are set to standard settings before operating the system.

Install piping in accordance with safety standards. Verify that:

- Connections are easily accessible;
- The installation of pipe is kept as short as possible;
- Allow for sufficient space around the unit to avoid risk to the unit and to allow for regular maintenance of components as well as the repair of components, tubing and fittings;
- Provide easy access to allow the unit to be shut-down in case of an emergency;
- Allow access to any part of the system to divert condensing fluids to a safe storage location;
- Ambient conditions such as temperature and humidity as well as seasonal changes shall be considered during design; the entire system shall be designed not to harm or interfere with the normal operation of fans, pumps and any other parts of the ECOSS system;

All connections should be welded in accordance to standards and with good welding practices. Check:

- Weld with precision and care to prevent leaks
- Prevent overheating when soldering or brazing as it may cause fouling
- Use shielded gas during welding to prevent excessive fouling.

The equipment is manufactured with stainless steel sinks and equipped with carbon steel ferrules already welded on them for easier connection to the system.
Observe the stickers the equipment connections with following statement considered:


HEADS UP

### 5.3.1. Installing units in parallel

WARNING

Observe following notes for connecting or installing units in
Adhere to the minimum distance specifications below:

| Description | Minimum Distances |
|---|---|
| Without Güntner Streamer | 3,0 m |
| With Güntner Streamer | 2,5 m |

*For more information regarding the Güntner Streamer or other accessories, please contact the technical staff of Güntner.

#### 5.3.1.1. Trap for evaporative condensers in parallel

- Different manufacturers may have different mounting positions of coils, thus different pressure losses may occur in the circuits after a unit shutdown. To offset such losses of load, interconnection is shall be done using a siphon.
- The liquid condenser output of each unit must inter-connected using a siphon upstream of the liquid reservoir.
- Height of the liquid outlet to the center of the common header should be at least 1500 mm;
- It is recommended to use 90 ° block valves with a low pressure drop;
- Figure 6 below provides detailed instructions on handling and assembly of upper and lower modules.

WARNING

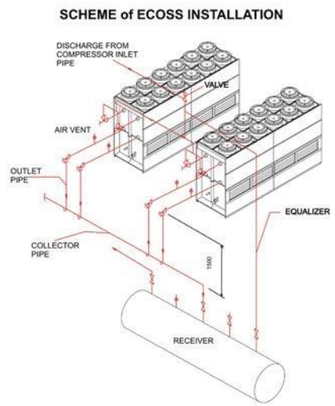


Figure 6: Installation of evaporative condensers with siphon for equalization of pressure loss.

The minimum recommended height of the siphon is 1500 mm. This is a reference only; different manufactures may use different measurements depending on equipment.

HEADS UP

Please consult Güntner technical support if unsure as to common header inlet and outlet dimensions.

WARNING

### 5.3.2. Important Notes to the installer.

Make sure that no ferrus materials left by grinding or welding remain in direct contact with stainless steel piping of paneling. Not cleaning the unit after welding or grinding may result in contamination by carbon dioxide causing the change in the aesthetics and durability of the equipment.
always cover unit or parts of the unit to prevent ferrus contamionation; failing to so may void equipment warranty .

HEADS UP

Note the labeling at the equipment!

HEADS UP

## 5.4. Performance acceptance test

The release of refrigerant can cause injury or even death (see residual hazards of caustic chemicals and refirgerants). Perform the following acceptance test with an expert before operating the equipent and / or after major changes, modifications or complete unit-exchange:

- Make sure the temperature and humidity cmply with the recommended specifications of the ECOSS;
- Make sure the power supply is sufficient as per ECOSS specifications. Take special precautions when interconnecting the ECOSS to the main plant. Refer to electrical diagrams and mechanical drawings.
- Verify that vibrations and movements of the ECOSS caused by the fans and / or the system are within guidelines. Consult the fan manufacturer or Güntner before altering the unit;
- Perform visual inspection structural design, media and devices (materials, connections, etc);
- Check and tighten all threaded connections;
- Verify installation of connections and pipes;
- Make sure the unit is protected against mechanical damage;
- Make sure the unit is protected against inadmissible over heating and over cooling;
- Make sure the unit is under ull control and accessible;
- Make sure the unit is installed so that it can be monitored and controlled from all sides and at all times;
- Verify that you provided enough space for maintenance;
- Ensure all components such as connections, lines carrying liquids and all electrical connections are within easy reach;
- Make sure the tubing is easily identifiable;
- Check heatexchanger for surface dirt;
- Perform function tests on the fans (speed, direction, energy, power, etc.);
- Check for damage to electrical connections of fans;
- Verify the quality of weld connections, electrical connections and all other general connections;
- Performpressure test with test gas at a pressure of 1.1 times the MAWP test: check the seals of the connections by using a leak detector such as professional refrigerant detecto, a foaming agent or similar;
- Check for corrosion protection: Perform a visual inspection of all equipment, including all bends, components and media components that are not insulated against heat. Document and file the test results;
- Perform a test run. Observe and check the unit during the test operation, in particular:

1. Smooth operation of the fans (noisy bearings, contactor noise, imbalance etc);
2. Energy consumption of fans;
3. Leaks
4. Immediately report all defects to the manufacturer. Remove defects after consultation with the manufacturer;
5. Check the unit and the interactions with the system after 48 hours of first time operation, verify all connections and fans, document the test results.

HEADS UP

## 5.5. Test readiness before operation

- Make sure all electrical protective measures are ready to operate;
- Make sure all connections that carry refrigerants are properly connected or welded;
- Check that all electrical connections (fans, motors, water pump, electrical panel, etc.) were connected according to local and / or Güntner safety standards;
- Check that all water connections of the unit are installed correctly.

## 5.6. Operating the ECOSS for the first time

HEADS UP

The release of refrigerant can cause injury or even death (see reesidual hazards with caustic chemicals or refrigerants);

Place the unit in operation only when:

- The units have been mounted and connected properly;
- After performing and accepting all preliminary tests;
- After performing a test to check the readiness of systems for operation and all safety precautions have been taken. Follow the systems operating instructions!
- Immediately contact the manufacturer if you want to operate the unit under different operating conditions from those defined in the project documents and operating manual;
- Turn on the system, including the electrical system;
- Enable the drive(s):

-Open the valves on the intake and outletside of the unit;
- Turn on the fans
- Open the water lines and enable the drainage of the water system;
-Wait until the operating point is reached. Once the operating point is reached, the unit is ready to operate;
-See operating manual and project documents for operating point and other system parameters,
Operating points:

1. Condensing temperature and pressure
2. Air flow volume
3. Mass flow and volume of gas and liquid line
4. Air inlet wet-bulb temperature
5. Altitude
6. Thermal capacity
7. To ensure that the operating point / paramaters are as specified and that all adjustments are protected against unauthorized access.

## 5.7. Disassembling the ECOSS

The ECOSS and its components are part of the refrigeration system. The ECOSS must be removed from service by disconnectingit from the the system according to the instruction manual and the operation of the cooling system installation. To do so, the fans must be turned off and unplugged from the general electrical system and the pipe lines of the refrigerant or other media must be disconnected from the system according to the recommendations of the installation and operation manual:

- Turn off fans;
- Turn off the system and disconnect the electric fans;
- Close the pipes carrying the working fluid;
- Perform vacuum for 24 hours;
- Disconnect the equipment.

NOTE! Take precaution when disconnecting the ECOSS; DO NOT EXCEED the maximum operating pressure!
With shutdowns greater than or equal to 30 days run each fans for about 2-4 hours each month to maintain their functionality.

HEADS UP

## 5.8. Unit Shutdown

Danger of injury and damage to property!
The release of refrigerants can cause injury or even death (see Residual hazards with Chemicals).
Check that the maximum operating pressure may never be exceeded at any time, even after shutdown!

DANGER

HEADS UP

- When the machine is operating with Ammonia (NH3) the following recommendations should be strictly followed:

1. Danger of corrosion and dirt buildup! Ammonia as a coolant is extremely soluble, ie it attracts moisture. Prevent moisture and dirt from entering the unit at all times
2. Protect the unit against dust, dirt and moisture to prevent personal injury or any damage to property.
3. With shutdowns greater than or equal to 30 days run each fans for about 2-4 hours each month to maintain their functionality.
4. Remove the unit following Loading and Unloading instrucions in this manual.

5. 1. Protection

-Check that the maximum operating pressure may never be exceeded at any time, even after shutdown!

-Make sure that all electrical switched including electric heater and fans are properly 'locked-out' or 'tagged-out'.

-Special precautions must be taken during prolonged storage of the ECOSS. Protect the unit of any physical damage or any environmental damages. including corrosion.

-The ECOSS shall be properly evacuated of any refrigerant or oils before long term storage.

## 5.9. Startup after prolonged Shut-Down.

After prolonged shutdown, make sure that all system configurations and parameters are according the design parameters. Refer to the Instruction and Operational Manual for special considerations; follow instrcutions below:

HEADS UP

- Check the readiness of the entire systems before operation. Perform all pressure tests as well as visual inspection.
- NOTE! Pressure tests for recommissioning the ECOSS should only be conducted by appropriate means and in accordance with the technical instructions and parameters of the equipment.
- Before Start-Up, make sure you have read and understood the Instruction and Operational Manual(s).



## 5.10. Changing Refrigerants

The refrigerant of the unit should NOT be exchanged with another refrigerant without prior written consent of the Güntner.

HEADS UP

- Make sure that Güntner has approved and authorized any changes.
- Verify the correct refrigerant has been used according to Güntner. Ensure that all materials used within the cooling system are compatible with the new refrigerant.
- Make sure that MAWP (Maximum allowable Working Pressure) has not been exceeded.
- Verify that a new test certificate may or may not be required when changing refrigerants
- Ensure that you are in compliance with all local and national regulations.
- Ensure that all safety devices are in place and operationg before re-commissioning.
- Make sure that all documentation as well as the unit itself shows all information needed as to the new refrigerant.
- Full documentation, including the operating instructions and the instructions for the entire system should be changed accordingly.
- Perform a full Acceptance Test as required by local and national regulations.

Condensers
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# Emergency Response

## 6.1 Safety

- Danger of personal injury and damage to property
- Possible malfunction or abnormal conditions not addressed in these operating instructions should be reported to Güntner. Please contact your Güntner Technical Support.
- Possible defects not addressed in these operating instructions should be resolved by an authorized technician.
- Contact your Güntner Technical Support with any abnormal conditions of the entire systems during operation, monitoring and maintenance.

HEADS UP

## 6.2. Emergency Measures

- Use personal protective equipment while evaluating the extend of the leak.
- Prevent further leakage by isolating all relevant piping.
- Activate the alarm if any leakage has been detected. Ensure safety of all persononel near or around the cooling system. Close all access doors to prevent any refrigerant escaping to other areas.
- Activate the emergency STOP. Close all Valves;, make sure all motors and other components are turned off to prevent further escape of the refrigerant.
- Close valves in sections where possible, to minimize refrigerant contamination. If possible, bleed / drain sectios of these systems. If possible move remaing refrigerant to another section of the system.
- Cover any accumulation of refrigerant with a protective film (PE, for example) or in a synthetic expansion foam (fire department). Minimize any heat dissipation of the refrigerant to prevent possible steam formation.

DANGER

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# Maintenance

## 7.1. Safety

### 7.1.1. Repair preparations

- Risk of personal injury and property damage with the release of the refrigerant (refer to MSDS sheets regarding residual haszards).
- Remove any refrigerants before performing maintenance work such as welding work brazing etc.
- Perform following safety measures before performing any maintenance work:

Drain the system and hold recommended vaccum for at tleast 24 hours.

DANGER

HEADS UP

### 7.1.2. Maintenance Preperations

Risk of personal injury and property damage with the release of the amonia (refer to MSDS sheets regarding residual haszards).

Refrigerant leaks can cause hazards or injuries such as:
Unintensional accumulation of waste oil and ammonia can cause Fire or Explosions. Unintensional accumulation of waste oil and ammonia may cause burns or irritaions.

DANGER

HEADS UP

- Make sure there are no unintentional contaminations of refrigerants and waste oils;
- Keep the area free from direct and indirect ignition sources;
- Obtain all necessary approvals that may involve ignition sources (eg, grinding, welding, etc) before commencing any maintenance or repair work.
- Have suitable and up to date fire extinguishers at hand before commencing any repair or mainteneance work that may include welding, grinding etc.
- Some refrigerants are corrosive. Contact with the skin, mucous membranes and eyes can cause burns;
- Use Eye protecion
- Wear protective gloves or body protection
- Refrigerants in general are toxic and hazardous substances! Ammonia (NH3) is poisenous;

DANGER

- Use respiratory protection;
- Verify that the ECOSS has been depressurized and all refrigerant has been evacuated before commencing maintenance or repair work.
- Verify that power has been properly disconnected; make sure that the ECOSS has been properly 'locked-out' to prevent unintentional reconnection;
- The fans and side panels are designed with hinges for easy access to fans motors, coil and connections.
- Verify that all areas are free of foreign objects after work has been completed to prevent damage or injury to others.
- Turn off the fans before starting maintenance work, and secure them against unintentional closing;
- After all work has been completed, assure that no objects between the fan-inlets and fan-oulets have been left behind.

#### 7.1.3. Safety measures after repair work has been completed.

Perform the following safety measures after completeing maintenance work:

- Make sure that the switching devices, activation devices, measuring devices, display and all safety devices are functioning properly;
- Verify that all piping connedtions have been reconnected properly and are not leaking.
- Make sure the fans and the side hinged lids have been installed in their original positions and protected against unintentional or unauthorized opening;
- Verify that all piping has been properly labeled and that they are clearly visible and legible;
- Verify corrosion protection of the components;
- Verify all electrical connections (fans and pumps) are installed properly and functioning;
- Perform a visual acceptance test;
- Perform a torque test where required before pressure testing the unit;



## 7.2. Maintenance Procedures

### 7.2.1. Filter and Tray

- Check tray water level regualry;
- Periodiacally check and remove any dirt or debris from tray;
- Regularly drain tray water, rinse and clean with clean water to remove salts and sediments which may have accumulated in the tray or heat exchanger;
- Filters have to be kept in the correct position during rinsing to prevent sediment re-entering the system;
- After rinsing the unit, filters must be removed, cleaned and replaced before the unit can be tested with clean water.

WARNING

Only use environment friendly cleaning agents.
Only use cleaning agents authorized by Güntner!

### 7.2.2. Water level, supply and operation

- Regularly check the water level for optimal performance of the unit;
- Verify that all motorized valves are functioning as expected;
- Check for valve leaks and repair immediately
- Verify free movement of makeup-water float and that the valve is closing properly;
- Ensure that the drain vent is not clogged and suitable for water drainage.

### 7.2.3. Fans and Pump

For the maintenance and adjustment of the cooling fans and pumps, please refer to the manuals of the manufacturers

### 7.2.4. Droplet eliminator (arrestor)

Observe following procedures when working with the Droplet Elimiator:

- With fans and pumps running, visually check the areas around the droplet eliminators to observe obstructions, damage, cleanliness, proper fit, fouling etc .;
- Make sure fans and pumps are turned off durng maintenance work;
- Clean debris and foreign matter from the droplet eliminators;
- Remove any dirt and obstructions;
- If necessary, replace damaged eliminator sections;
- Reinstall eliminator sections and make sure they are well seated and sealed;
- DO NOT STEP DIRECTLY ON ELIMINATOR at any time,

OBSERVE THE RIGHT SIDE OF THE DROPLET ELIMINATOR

## 7.3 Recommended Maintenance Intervals

| Evaporative Condenser ECOSS Maintenance and Monitoring Program | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Periodically performed operations | | | |
| Type | Operation | Start-up | daily | 15 days | 30 days | 90 days | 180 days |
| Verification and Regulations | Read and understand the ECOSS IOM | X | | | | | X |
| | Verify Water Distribution System | X | | X | | | |
| | Verify Pump Rotation | X | | X | | | |
| | Check water levels | X | X | X | | | |
| | Check make-up water float | X | | | | | X |
| | Check axial Fan rotation | X | | X | | | |
| | Check funvtionality of all accesories | X | | | | | |
| | Check and verify all GMM (Guentner Control Module) paramaters | X | | | X | | |

## Evaporative Condenser ECOSS Maintenance and Monitoring Program

| | | Periodically performed operations | | | | | |
|---|---|---|---|---|---|---|---|
| Type | Operation | Start-up | daily | 15 days | 30 days | 90 days | 180 days |
| Maintenance and Cleaning | Clean and sanitize water distribution system | X | | | | X | |
| | Tray cleaning and sanitation | X | | X | | | |
| | Cleaning and sanitizing of the side, top and bottom closures (fairings) | X | | X | | | X |
| | Drip Eliminator cleaning and sanitation | X | | | | X | |
| | Cleaning and sanitizing of the water loop system (WLS) | X | | X | | | |
| | Lubrication of all motors according too manufactures recommendations | X | | X | | | |

## Evaporative Condenser ECOSS Maintenance and Monitoring Program

| | | Periodically performed operations | | | | | |
|---|---|---|---|---|---|---|---|
| Type | Operation | Start-up | daily | 15 days | 30 days | 90 days | 180 days |
| Inspections | Verify fan motor safety (according to the fan manufacturer's manual) | X | | X | | | |
| | Verify the level of fouling in the water collecting tray | X | | X | | | |
| | Check for water accumulation in electrical areas such as motors fans etc. | X | | X | | | |
| | Verify tightness of bolts, fans, electrical junction boxes, etc. | X | | X | | | |

## Evaporative Condenser ECOSS Maintenance and Monitoring Program

| | | Periodically performed operations | | | | | |
|---|---|---|---|---|---|---|---|
| Type | Operation | Start-up | daily | 15 days | 30 days | 90 days | 180 days |
| Controls Monitoring | Check water level control mechanism in the reservoir of the closed water circuit (where applicable) | X | X | | | | |
| | Monitoring of GMM (where applicable) | X | | X | | | |
| | Control of chemical treatment according to the analytical parameters to maintain minimum water quality required | X | | | X | | |
| | Check Purge Water | X | | | | | |
| | Monitoring of fouling in heat exchanger coils | X | | X | | | |
| | Check running amperage of all electrical motors and pumps. | X | | X | | | |
| | Check running amperage of all fans | X | | X | | | |
| | Monitoring of thermal protection devices (according to the manual the fan motors manufacturer) | X | | X | | | |
| | Monitoring the functionality of circuit breakers (according to the manual the fan motors manufacturer) | X | | X | | | |
| | Monitoring temperature of water in tray | X | | X | | | |
| | Monitoring of Air inlet and Outlet temperatures | X | | X | | | |
| | Trending and Record keeping is strongly recommended | X | | | | | |

### 7.3.1. Water distribution system – sprinkler

For the maintenance of Droplet eliminators, observe the procedure below:

- Turn off the fans;
- Remove droplet eliminators;
- With the fans off and the pumps running, visually check the areas of water spray and droplet eliminators to observe obstructions, damage, cleanliness, proper fit, fouling etc .;
- Turn off the pumps;
- Remove the spray nozzle;
- Clean dirt and debris from the water distribution system;
- Make sure that the spray nozzles are clean and well suited for operation;
- Replace damaged or missing nozzles;
- Install nozzles and make sure that they are well fitted and leak-free;
- Connect the pump and observe the distribution of water;
- Install droplet eliminators and make sure that they are well fitted and leak-free;
- Turn on the fans.

HEADS UP


Figura 7: Position and distribution of water from the nozzle

## 7.4. Cleaning procedures

### 7.4.1. General Cleaning

- Fans, side rails and access doors are hinged for pump removal and for easy cleaning;
- The operator shall ensure that the cleaner is environmentally friendly. Only use cleaning agents authorized by Güntner!
- Make sure electrical connections are disconnected;
- Make sure the connections that carry the refrigerant are covered up.

### 7.4.2. Cleaning the coil, side panels and tray

Cleaning the coil, side panels and tray can be accomplished through:

- Cleaning with compressed air:

1. Use compressed air at a maximum pressure of 80 bar with a minimum distance of 200 mm to remove dirt and contaminants from coil,
2. Use compressed air at a maximum pressure of 10 bar with a minimum distance of 200 mm to remove dirt and contaminants from side panels and water tray.

- Hydraulic cleaning:

1. Watch out! Water and cleaning agents conduct electricity.
2. Turn off fans and water pump for cleaning with water or steam jet.
3. Watch out! Water or steam jets can damage fans, electrical connections or other components.
4. Make sure the electrical connections, motors or other components were not affected by water or steam. Protect them, if necessary.
5. Neutral cleaning agents should be considered if using high pressure water or steam jet; the maximum pressure of 50 bar for coil and 10 bar to side panels and tray shall not be exceeded; maintain a minimum distance of 200 mm.
6. Make sure the cleaner is environmentally friendly.
7. Make sure that the chemical cleaning agents are non agressive. Rinse the unit after the treatment.

- Cleaning with brushes

1. Remove dust or dirt with a dry brush.
2. Use soft brushes (never use a wire brush or similar)!

### 7.4.3. Cleaning Fans and water pumps

For cleaning of fans and water pumps, please consult the manufacturer‘s manuals as shown below:

HEADS UP

ONLY USE CLEANING AGENTS APPROVED BY GÜNTNER!

### 7.4.4. Cleaning the coil, side panels and tray in case of contamination by iron oxide (corrosion)

HEADS UP

The presence of contamination from carbon steel (waste, grinding, sanding, welding spatter, residues left by tools and abrasives, and the like) on the surface of stainless steel, may lead to galvanic corrosion; this process begins with the waste carbon steel to act as an anode (which will erode quickly) and the stainless steel itself is the cathode (which is protected); spots may occur due to corrosion of the carbonsteel; these spots can be iron oxide or iron hydroxide.
These surface deposits or spots should be removed as the may cause cracks, which, if combined with the presence of halide ions, especially chloride (present in marine shore, from the salty air, and by the wind), can cause a type of corrosion in stainless steels called crevice corrosion, with perforations located on the surface of stainless steel.

- In case of corrosion and contamination following procedures for cleaning and surface recovery of evaporative condensers must be carried out :

1. Evaluation of contamination amount present on the surface of stainless steel. This contaminatione can be removed with a scraper or even a knife, making sure that the blade does not damage the stainless steel surface.
2. Sanding the surface with sandpaper is possible; choose grain size based on the amount and grade of contamination.
3. It is recommended to start the wet sanding with # 320 sandpaper, continuing with finer sandpaper, in sequence, # 400 and # 600 or even # 1000; periodically change the sanding direction by 90 degrees. Only use new sandpaper that is clean of and contamination esppecioally abrasive particles of iron oxides. You may not use sandpaper that has already been used for grinding carbon steel or iron.
4. After sanding clean surface with a clean, damp cloth. After this cleaning, apply a layer of stainless steel pickling and passivation gel.
5. Apply the pickling and passivation gel or similar with a brush; follow instructions on next page:

-The stainless steel pickling and passivation gel, or the like is a repassivation agent for stainless steel surfaceses.
-Depending on the amount of contaminant, the reaction time of the pickling and passivation gel shall be modified.
-Only use enough gel to cover the contamination area and for the gel to remain wet during the exposure time.
-After gel has been applied for the recommended time, clean the surface with plenty of clear water.
-Clean with a dry cloth to prevent staining caused by drying of the water itself. Water comes in different hardnesses (DTS) and therefore may leave slight stains around the water droplets itself.
- Follow guidelines below if paint stripper is used:
-The application by brush or roller should be done with rubber gloves, goggles, boots, apron and nox type face mask.
- Only apply chemical cleaners in open and well ventilated environments.
- In case of contact with skin, wash with running water and a mild detergent.
-If eye contact occurs, seek medical attention and inform medical team of chemical name or any other chemical indicated by the stripping agents packaging label.
-For vertical surfaces, apply the gel moving from the bottom up, with the brush handle facing up, so there is no runoff that may cause additional damage to fasteners or nearby cables etc.
- For horizontal surfaces apply paint stripper gel with brush or roller.
- Avoid squeezing the brush or roller.
-Avoid contact of paint stripper with any other metallic surfaces such as rivets, washers, screws and nuts made of aluminum or carbon steel; severe corrosion can occur .

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# Water Treatment and Purging

## 8.1. Purging (Devolution of water)

Periodic or continuous purging is required to avoid an excessive concentration of salts which increase water hardness; excessive fouling or excessive oil accumulation may also occur. The total water lost by evaporation, drag and purging (devolution) is replaced by makeup water. While evaporative loss tends to concentrate impurities entrainment, the vent tends to limit this concentration. The water circulation with normal steady loss as described above will allow impurities to concentrate to the extent to which water has to be added or replaced; even fresh water will have some impurities. We use the term „cycles of concentration“ to indicate the level of impurities during normal water circulation against the degree of impurities in the makeup water. Thus a cycle of concentration of 5.0 indicates that the circulating water is 5 times the concentration of impurities in the makeup water. The characteristics of water replacement and anti-fouling as well as anti-corrosive additives determine the cycles of allowable concentration limit to minimize fouling or corrosion.

Recommended Cycles of Concentration can be calculated by companies specializing in water treatment. Cycles of Concentration are based on a thorough analysis of the characteristics of the makeup water. Based on this analysis as well as the loss of water through evaporation, recommended water changes as well as makeup water can be calculated.

The manufacturers of antifouling and anti-corrosion additives also formulated biocides required to inhibit the growth of micro-organisms especially in contaminated water and low flow rate purging.

The table on the next page indicates replacement rates based on the rates of evaporation and purging with drag and a concentration cycle of 5.0:

## 2. Treatment and minimum standards of water quality

In evaporative condensers condensing of refrigerants is achieved by water evaporation. When the water evaporates, impurities such as salt remain present in the water. If the water is not drained (purging) from the system, the dissolved solids concentration rapidly increases and cause fouling and / or corrosion.
In addition to the impurities present in the feedwater, all impurities present in the air such as biological materials are carried to the equipment and water recirculation.
Besides the need for purging a quantity of water, a treatment program specifically designed to cope with fouling, corrosion and biological control must be in place. Monitoring water analysis to ensure water quality must be implemented.

### 1. Biological Control

The growth of algae, slimes and other microorganisms, if not controlled, will reduce the efficiency of the system and can contribute to the growth of potentially harmful micro-organisms, such as Legionella,in the tray and water recirculation system .

Thus, a treatment program designed specifically to implement biological control should be started; regular monitoring and recording of bacteriological contamination of water recirculation is strongly recommended. For this, a chemical water addidive should be used; the additive must comply with material compatibility.

### 8.2.2. Chemical treatment

- The chemicals must be compatible with the construction materials used of the entire system;
- The chemicals must be specified by companies specialized in chemical industrial wastewater treatment;
- Chemicals should be placed in the recirculating water to avoid high localized concentrations, which can cause fouling and or corrosion. The dosing of chemicals is allowed directly on the discharge line of the pump;
- Placing lots of chemicals deviating from the recommended dosage specified by manufacturer may not maintain adequate control of water quality and is not recommended as chemical treatment;
- Monthly check of minimum water quality parameters is recommended. See table on the next page for minimum quality parameters;

| Analytical Parameter | Recommended limit |
|---|---|
| pH | 6,5 a 9,0 |
| Total Alkalinity (pp $CaCO_3$) | 750 |
| Calcium Hardness (ppm $CaCO_3$) | 500 |
| Chlorides (ppm like Cl) | 100 |
| Chlorides (ppm like NaCl) | 250 |
| Soluble Silica (ppm like $SiO_2$) | 150 |
| Sulfates (ppm like $SO_4$) | 250 |
| Dissolved solids (ppm) | 1500 |
| Conductivity (uS/cm) | 3000 |

HEADS UP

- All test results shall be recorded. If necessary, sent results to the Güntner technical support team for analysis.

## After-Sales Service Contact

Our After Sales department is specialized and committed to answer any question, provide technical assistance and support. The range of services includes everything from start-up to emergency repairs.

Please contact your nearest Güntner Representative Office

www.guentner.asia

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Condensadores a Ar

Condensadores Evaporativos / Fluidcoolers

Drycoolers

Evaporadores / Aircoolers

Máquinas de Gelo

Trocadores de Calor a Placas

Vasos de Pressão

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