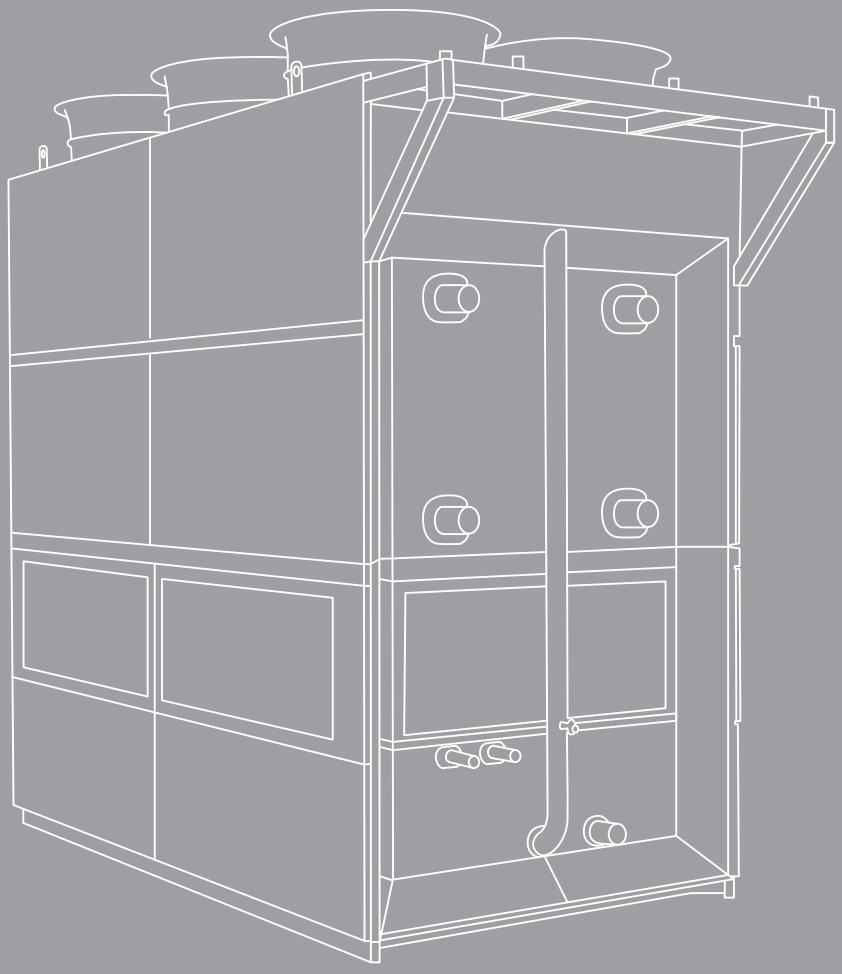
Transport, Assembly, Operation
and Maintenance Manual

ECOSS G3

Stainless Steel Evaporative Condenser/
Stainless Steel Fluid Cooler



Güntner

ECOSS G3:
The best solution in evaporative cooling even more efficient and sustainable

The line of stainless steel evaporative condensers, ECOSS, is a consolidated concept in the world market that demonstrates our ecological commitment to the environment and our concern to offer the industry a unique and highly efficient solution. Allows the offer of more than one product, a solution that exceeds the expectations of owners, operators and installers.

ECOSS, produced entirely of stainless steel, eliminates the need for galvanized coating, avoiding possible environmental liabilities, the absence of white corrosion and the reduction of chemical products to treat the recirculation water.

The new generation of this equipment maintains the concepts of lower operating costs, lower maintenance costs, easy installation, accessibility, performance reliability, durability and presents an evaporative cooling solution developed in efficiency and sustainability.

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Güntner

Evaporative Condenser /
Fluid Cooler

Responsibilities

1.1 Manufacturer responsibilities

The considerations provided in this manual are exclusive for this equipment and does not apply to other series or other manufacturers.

Components used in this equipment, welded joints, pipe thicknesses, safety devices and automated electronic systems are designed to withstand the foreseeable mechanical, thermal and chemical stress, as well as the working fluids or components of a cooling system in the design data.

1.2 User responsibilities

The user must have the qualified workmanship to operate and monitor the equipment.

Requiring equipment operation, maintenance and care trainings, Güntner provides technical reports and customized guidelines.
Güntner shall not be held responsible for the non-observation of this manual. Users that are not properly trained should not operate the equipment.

The user responsible should make sure that, during operation, monitoring and maintenance in the system, the working fluids should not be changed from the data specified in the design documents related to the order. **Except when authorized by Güntner Brazil.**

Accident mitigation measures, pressure relief systems and operation control devices must be installed by the user in order to mitigate operating disorders.

1.3 Warranty conditions

Güntner Brazil maintains the Technical Support available for consultations and doubts. Any abnormality or failure detected in this product should be communicated immediately to the email address assistance.br@guntner.com or telephone number 55 (54) 3220 8165.
For more information, consult the Warranty Term.

During the effective warranty period, if the defects observed are from manufacture, Güntner will replace the part free of charge to the customer. However, if the product does not present any defect or presents improper use, the costs of service shall be passed on to the customer.

Safety

DANGER

Addresses a dangerous situation that, if observed, may result in death or serious injuries.

ATTENTION

Addresses a critical situation or instruction that must be followed strictly so as not to result in irreparable damage to the equipment.

WARNING

Indicates instructions on the operation of the safety equipment. The noncompliance with these instructions may result in damages to the equipment.

2.1 Warning signs

Warning

Warning against hand injury.
The hands or fingers may be smashed, pulled and/or injured in some way.

Warning against hot surfaces.
The temperature is above +45 °C (protein coagulation) and may cause burns.

Warning against cold surfaces.
The temperature is below 0 °C and can cause ulcerations and lesions.

Warning against electrical voltages.
Danger of electric shock or discharges in energized parts.

Warning against potentially explosive substances.
Use of ignition sources may cause explosions at the indication point.

Warning against potentially flammable substances.
Use of ignition sources may cause fires at the indication point.

Warning against corrosive substances.
Contact with corrosive substances may cause injuries, especially with the eyes.

Warning against substances harmful to health or irritants.
Contact with inhalant substances that are harmful to health or irritants can cause injuries or damages to health.

Warning against toxic substances.
Contact with toxic inhalant substances may cause injuries, damages to health or death.

2.1.2 Prohibition signs

Do not use sources of ignition or flame propagation.
Ignition sources should be kept distant and should not be generated.

Do not smoke.
Smoking is prohibited.

2.1.3 Mandatory signs

Use ear protection.
The following eye protections should be used: Protection goggles or face mask.

Use hand protection.
Protective gloves should be worn against mechanical and chemical hazards.

Use respiratory protection.
The breathing apparatus must be suitable for the working fluid used. The breathing apparatus must consist of:

- At least two self-contained breathing devices (self-contained breathing apparatus);
- For ammonia: an additional breathing apparatus with filter (full mask) or a self-contained breathing apparatus also called “SCBA”.

Use protective clothing.
The personal protective clothing should be suitable for the working fluid used and for low or high temperatures, and it must have heat insulating properties.

Activate before work.
Activate the electrical and protection system against new connections in the installation before performing maintenance and repair works.

2.2 Basic safety warnings

2.2.1 How to act in case of emergency

Danger of injury and damage to property.
The equipment may contain ammonia (NH_3) as liquid refrigerant (R717).

Ammonia (NH_3) is a potentially explosive substance with the risk of fire. It may burn if unintentionally transported in oil residues or unintentionally transported in the refrigerant. An explosion may cause serious injuries and loss of limbs.

Ammonia (NH_3) is a corrosive, toxic and irritant gas.
An ammonia (NH_3) concentration of 20ppm or over in environment air or a long stay in an environment containing ammonia (NH_3) can be life-threatening or fatal.

Safety measure and procedures.

- With unexpected high refrigerant leak, leave the operating room immediately and activate the emergency STOP system in a safe place;
- Activate the refrigerant alarm device (refrigerant concentration);
- Have experienced and trained employees with the established protective clothing to carry out all the protection measures and other necessary measures;
- Use respiratory protection;
- Use a self-contained breathing apparatus that does not depend on the environment air during the maintenance work with high refrigerant concentrations;
- Check to see if the operating room is well ventilated;
- Safely divert the refrigerant vapor and liquid that leaked;
- Instructions on how to treat injuries:

- Call an emergency physician immediately
- Some refrigerants may cause corrosive injuries on the skin and eyes;
- The victim should keep the breathing apparatus on until told otherwise, in order to avoid the inhalation of vapors from the clothing contaminated with ammonia (NH_3) or another refrigerant;
- Wash the victim with water for five to fifteen minutes. Carefully remove the clothing during the shower. The shower should be with warm water as much as possible in order to avoid thermal shock. If available, use an emergency shower; otherwise, use a water hose in abundance.

- The equipment should be commissioned, operated, maintained and repaired by trained, experienced and qualified employee. The people responsible for operation, maintenance, repairs and evaluation of the systems and their components must be trained and have specialized knowledge necessary for their work to be qualified. Qualified or specialized means the ability to satisfactorily perform the activities necessary for the operation, maintenance, repairs and evaluation of the cooling systems and their components;
- The equipment cannot be operated by operating employees that do not have specific knowledge and experience in refrigeration engineering, in relation to mode of operation, operation and daily monitoring of this system. This operating employees cannot carry out any intervention or configuration of the system;
- In the unit with prior written authorization from the manufacturer can only be carried out by trained and qualified employees;
- Electrical installation: work on electrical equipment may only be carried out by people who have the necessary specific knowledge (for example, an electrician or a person trained in electrical engineering), and who are authorized by the operator, in compliance with the respective safety and PPE regulations.

2.2.2 Intended proper use

The evaporative condenser / fluid cooler of the ECOSS G3 series is intended for installation in a cooling system and is used for cooling/condensation in large cooling systems such as refrigeration industries, slaughterhouses, food industry, beverages, energy industry, and other applications.
The unit is delivered for operation with a specific operating point:

- Condensation Temperature / Pressure;
- Volumetric air flow;
- Volumetric liquid flow;
- Air inlet wet-bulb temperature;
- Altitude;
- Thermal capacity.

WARNING

You will find the parameters and exact model of your equipment in the design documents related to the order, and in case you do not have it, request it as soon as possible from the technical team of Güntner Brazil.

2.2.3 Operating conditions

- equipment is a component of the cooling system, including its working fluid circuit. The purpose of these operating instructions, as part of the operating instructions manual (of which these operating instructions are a part), is to reduce to a minimum the dangers to people, property and the environment. These dangers are essentially related to the physical and chemical properties of the working fluids and with the pressures and temperatures that occur in the components that transport the working fluid in the equipment.
- In order to know the residual hazards of refrigerants, it is imperative to know the MSDS of the compounds (Chemical Safety Data Sheet) supplied by the refrigerant manufacturers;
- equipment should be used only according to the appropriate intended use. The operator should make sure that, during operation, monitoring and maintenance in the system, the working fluid should not deviate from the data specified in the design documents related to the order;
- Operator should check to see if the maintenance measures are being performed according to the operating instruction manual of the system;
- Do not exceed the MAWP [Maximum Allowable Working Pressure] informed on the identification plate and specified in the design documents related to the order.

ATTENTION

2.2.4 Improper use

Working fluids and their combinations with water and other substances in the components that transport the working fluid have chemical and physical effects inside the materials that surround them. The unit should only be pressurized with the compound defined in the design documents related to the order. The pressurization of the unit with another working fluid may result in:

- The structural and welding materials used will not withstand the expected mechanical, thermal and chemical stresses, and the pressure that may occur during the operation and when switched off will be too high;
- Materials, wall thickness, tensile strength, corrosion resistance, process and testing are suitable for the working fluid and do not withstand the possible variations in pressures and stresses that may occur;
- Equipment will not withstand other working fluids and other mixtures of working fluids. With the exception of that authorized by the technical team of Güntner;
- The equipment will not remain leak-proof during the operation and when switched off;
- Possible sudden leak of the working fluid may put people and/or properties and/or the environment at risk.

ATTENTION

The MAWP specified on the identification plate and in the design documentation related to the order should not be exceeded! In case the working pressure is exceeded:

1. The structural and welding materials used will not resist the expected mechanical, thermal and chemical stresses, as well as the pressure that may occur during the operation;

2. The equipment will not remain leak-proof during the operation;

ATTENTION

3. Sudden escape of the working fluid may occur after a rupture or leakage in the components that transport the working fluid, which may result in the following risks:

- Danger of the leak of working fluids;
- Danger of poisoning;
- Risk of fire;
- Risk of explosion;
- Risk of burns by chemical products;
- Risk of asphyxiation;
- Risks caused by panic reactions;
- Pollution of the environment;
- Fatalities.

2.3 Residual mechanical hazards

2.3.1 Frames, corners and sharp edges of the equipment

Warning against hand injury
Danger of cuts on the hands and fingers on the sides, corners and sharp edges of the equipment.

Use reliable hand protection.

2.3.2 Improper use

Danger of amputation and pulling.
There is the risk of amputation of fingers on the fan blades, danger of hand injuries and pulling in case of loose elements like hair, necklace, neckties or other clothing items.

Caution:
Under no circumstances operate the fans without protection grid!
With the automatic start of the fans during the maintenance work, there is the risk of trapping hands and fingers.

DANGER

Shut down the equipment before starting maintenance work, of which you have to remove the protection grade. Protect the unit against unintentional restart by removing the electrical fuses to the unit. Protect the unit with a suitable warning plate in relation to unintentional restart.
The fans should be opened only by trained specialists and with the proper tools and only for the purpose of maintenance and repairs. Close the fans after completing the work and protect them against unintentional or unauthorized opening! Only open the safety screw connection after switching off the electricity of the fan.

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

Caution
When handling the articulated plates of the fans, these should be switched off and the operator must check the protection.

2.4 Residual electrical hazards

DANGER

2.4.1 Fans, electric motors, water pumps and electrical panels

Warning against dangerous electrical voltages.
Direct or indirect contact with electrical parts or cables may cause serious injuries or death.
Shut down the unit before starting the maintenance work. For this, consult the documentation of the cooling system. Protect the unit against unintentional restart by removing the electrical fuses to the unit. Protect the unit with a suitable warning plate in relation to unintentional restart. Note that the cables of the mains may be energized even if the unit is switched off.
The work on electrical equipment can only be carried out by people who have specific knowledge and who are authorized by the operator responsible.

DANGER

2.5. Residual thermal hazards

2.5.1. Risk of burns

Warning against hot surfaces
During a maintenance service, the coil of the heat exchanger of the unit, the pipe (hot gas) and some parts of the equipment have temperatures above +45 ºC. Contact may cause burns.

Use hand protection

2.6. Residual hazards with refrigerant

DANGER

These hazards are essentially related to the physical and chemical properties of the working fluid and with the pressures and temperatures that occur in the components that transport the working fluid in the equipment. In order to know the residual hazards of refrigerants, it is imperative to know the MSDS of the compounds (Chemical Safety Data Sheet) supplied by the refrigerant manufacturers.

2.7. Residual hazards with refrigerant caused by vibrations

DANGER

In case the fans are damaged during the operation, loose parts by the blades may injure people or cause damages to people/property that are near the fans.
Fans, components and cables in the system should be designed, built and integrated such that the hazards caused by vibrations are reduced to an absolute minimum, while incorporating all the means available to reduce the vibration, preferably at the source.
The vibrations that are increased by imbalances or damages to the blades are transferred to the unit, and this may cause damages and damage the unit set or components connected to the unit.
Check the blades and protection grade regularly for dirt or the formation of crusts, as well as the smooth operation of the fans.

2.8. Combined residual hazards

2.8.1. Articulated side doors

Warning against hot surfaces
The temperature is above +45 °C and may cause burns.

Danger of hand injury
With unauthorized access inside the open equipment, there is danger of burns on hot surfaces and danger of cuts on sharp edges. All articulated parts should be opened only by trained specialists and with the proper tools and only for the purpose of maintenance and repairs. Close the articulated side doors after completing the work and protect them against unintentional or unauthorized opening.

2.9. Safety in the operation with ammonia (NH_3)

2.9.1. Characteristics of ammonia (NH_3)

Ammonia (NH_3 - R-717), at NTP (Normal temperature and pressure) conditions, is in the form of a colorless gas, lighter than air (only 9 gases in the atmosphere are lighter than air, of which ammonia is fifth on the list) and has a very strong smell, which is easily noticed, even at very low concentrations (from 5 ppm).
Ammonia is a gas produced naturally in the biological process and is an important part of the nitrogen cycle on earth. The volume of ammonia produced by man is equivalent to only 3% of the total quantity present in nature and the volume used for cooling systems is about 0.5% of the total produced by man. In addition, ammonia is highly soluble in water forming a solution known as Ammonium Hydroxide. (NH4OH), normally used in domestic cleaning.
Ammonia is commercially produced from the combination of free nitrogen with hydrogen at high pressure and temperature in the presence of a catalyst. Anhydrous ammonia required for the cooling systems should have a purity grade of 99.95%, with a minimum water concentration of 33 ppm. The main physical properties of anhydrous ammonia are shown below.

2.9.2 Environmental impact

Ammonia does not destroy the ozone layer (ODP= 0) and, because it has a very short lifetime in the atmosphere (maximum 15 days), it also does not contribute to the greenhouse effect (GWP=0).
Due to its excellent thermodynamic properties, ammonia requires less primary energy to produce a certain cooling capacity than almost all other refrigerants, so the indirect effect of global warming is also one of the lowest available.

2.9.3 Flammability

Ammonia is considered a flammable fluid, but within a very restricted range. The flammability limits of ammonia at atmospheric pressure are 15-16% ((Lower Flammability Limit - LFL) and 25-28% (Upper Flammability Limit - UFL) by volume in air, with an ignition point of 651°C. These limits, associated with low combustion heat, greatly reduce the flammability potential of ammonia. According to ANSI/ASHRAE 34-2007, ammonia is classified as a fluid of Group B2 (high toxicity and low flammability).
The flammability potential of the ammonia-air mixture is influenced by a series of factors like pressure, temperature, turbulence of the mixture, power of the ignition source and the presence of steam, oil or other components.
An important characteristic of the flammable mixtures is the speed of the flame, which can be classified as subsonic or supersonic. The propagation of a flame at subsonic speed will result in deflagration. One of the characteristics of deflagration is that the overpressure generated by the event is relatively low (i.e., the ratio between final pressure and initial pressure is slightly higher than 1.0, which is different from detonation, which can generate a pressure ratio of 40.0). Despite the overpressure generated by a deflagration being low, these may cause damages to the structures of surrounding buildings and equipment (in case of detonation, there will certainly be devastating damages). The deflagration events are characterized by a significantly low energy level during ignition of the flammable mixture.

2.9.4 Toxicity

Ammonia in gaseous or liquid phase is an extremely irritant product. The aggressive odor caused by ammonia is a significant characteristic. Due to the high ease in which it dissolves in water, ammonia ends up impregnating the skin, nasal mucosa, throat and eyes. This causes a very strong irritation and by reflex it causes the eyes to close and breathing becomes difficult.
At very high concentrations there is a corrosive effect in the nasal mucosa, causing, in addition to breathing difficulty, chest pain, cough and dyspnea. At very high concentrations, it can cause respiratory failure and, even hours after exposure, it can cause pulmonary edema. However, symptoms disappearing soon after (cough, chest pain) mean that there are no major risks.

NR-15 establishes that the Tolerance Limit of exposure of a worker to an environment contaminated with ammonia during a weekly work hours of 48 hours is 20 ppm in volume in air. The limit values in most countries are between 25-35 ppm (40 hours) and a maximum exposure limit of 35-50 ppm for 15 minutes during the work hours. The value established as an immediate life-threatening limit for anyone exposed to an environment with ammonia for more than 30 minutes is 500 ppm.
Liquid or gaseous ammonia at low temperature can also cause strong burns on the skin if there is no protection. The ammonia-water solution can also cause burns due to the high pH of the solution. Therefore, after an ammonia purge in a tank with water, care should be taken when emptying it. Its characteristic and unpleasant odor normally provides ample warning before any hazardous condition exists. It can be detected by human smell as form 10 ppm, but the operators of plants end up getting used to concentrations up to 100 ppm without any undesirable effects.

2.9.5 Reactivity

Copper and all its alloys, zinc and cadmium are readily attacked by ammonia. Ammonia causes severe stress corrosion in copper and all copper based alloys, which should therefore be avoided for contact with any fluid containing even tiny amounts of ammonia.
Anhydrous ammonia can also cause stress corrosion in carbon steel, therefore the use of carbon steel plates suitable for ammonia cooling systems is required. In any case, contamination with air, oil, carbon dioxide, etc. significantly aggravates the problem; on the other hand, the addition of a small amount of water inhibits stress corrosion.
According to ANSI/ASME Standard B31.5 - 2019, the use of welded tubes in ammonia cooling systems is forbidden, except for the tubes of coils or tubes of heat exchangers that must be subjected to non-destructive tests according to recognized standards.
Teflon, buna N, neoprene and butyl and nitrile rubbers are polymers acceptable for services with ammonia, especially as sealing. Polyester resins, polysulfonated rubbers, viton, and phenolic resins should not be used. Non-plasticized PVC is acceptable, but it becomes brittle at temperatures lower than 0ºC.

2.10. Safety

Before starting any procedure it is necessary that the team has full knowledge of the applicable safety measures. Below are some points that require attention, remembering that any safety procedure must follow the effective regulations.

2.10.1. Ammonia handling precautions

PPE – Personal Protective Equipment – do not replace the safe working conditions, but certain operations require certain minimum protection, while emergency situations demand a high degree of personal protection.
Any person who eventually needs to use this equipment should be fully trained and know their limitations. Below are some recommendations on the use of PPEs and precautions in ammonia handling operations:

- Wide vision safety goggles and neoprene or rubber gloves are the minimum equipment to be used by any person working in an open plant, under normal conditions;
- For oil drainage, purge, sample taking operations, the body should be protected against splashes and projections, rubber boots, gloves and, in addition, use of panoramic mask for respiratory protection. In some cases it is necessary to use PVC or chlorobutyl rubber apron;
- Use masks with the appropriate filter and within the expiry date always when working with ammonia;
- The work site should have suitable ventilation;
- Know where to find the self-contained breathing systems and how to use them. In case of an emergency use the self-contained breathing equipment, which provides the full protection necessary in a rescue maneuver or control of critical situations;
- At the slightest smell of ammonia, wear the mask and look for the leak, warning maintenance and blocking the area;
- Prevent people with vision and/or lung diseases from moving through the area and much less working in this location;
- When there is liquid ammonia in pipes or vessels, this should be completely evaporated before any service in these items, leaving the area free and flagged during the operation;
- The safety supervisor should authorize the maintenance services through a work permit;
- Keep any other gaseous compounds away from the ammonia, such as Chlorine, LPG, acids, etc.

WARNING

ATTENTION

When there is ammonia in liquid state in pipes or vessels, the fluid should be completely evaporated before any intervention, leaving the area free and flagged during the operation. In addition, the confinement of ammonia in liquid state in the pipe is expressly forbidden. Once confined, the fluid is capable of expanding exponentially, drastically increasing its pressure/temperature in a short period of time and causing serious accidents involving leakage. The expansion of liquid ammonia in confined environments causes damages that are not covered by the warranty, due to reaching pressures that are much higher than the Maximum Allowable Pressure.

2.10.2 First-aid treatment

It is important that in all services the rescuers use suitable respiratory protection and remove the victim from the site to a free, decontaminated area as close as possible, and immediately request medical assistance and ambulance.
Speed is vital if the product has reached the eyes. The eyes should be washed with an eye-wash or water for at least 10 minutes. If there is no medical service available, the wash should continue for another 20 minutes.

In case the product has reached the skin, the clothes that came in contact with the product should be removed and the affected parts of the body should be washed abundantly.

In case of inhalation of vapors, the injured person should be placed directly on the floor for a possible artificial respiratory treatment and/or cardiac massages. In case breathing is difficult, apply oxygen with controlled breathing apparatus. If the victim is not breathing, apply artificial respiration. In case of cardiac arrest, apply external cardiac massage.

In case of swallowing, provide large quantities of water to drink if the victim is still conscious. Do not induce vomiting.

A symptomatic treatment and general strengthening will be necessary after the critical poisoning phase. The consequences of poisoning by ammonia do not normally exceed more than 72 hours, but the eye injuries may be permanent. If the exposure is severe, the patient should be kept under medical observation for at least 48 hours, since there is the possibility of delayed onset pulmonary edema.

2.11 Applicable Codes and Standards

The ammonia cooling systems have national and international applicable codes and standards as reference.
Below are the main documents available related to the application of ammonia in cooling systems.

2.11.1 National and International Standards

NR-13 - 2019– Boilers and Pressure Vessels - Regulatory Standards of Occupational Safety and Health Legislation - Ministry of Labor – Act no. 6514– 12/22/1977;

ANSI/ASHRAE Standard 15-2019 - Safety Code for Mechanical Refrigeration - American Society of Heating, Refrigerating and Air Conditioning Engineers;

ANSI/IIAR 2-2014 - Equipment, Design & Installation of Ammonia Mechanical Refrigerating Systems – International Institute of Ammonia Refrigeration;

EN 378 Part 1-4 - 2016: Refrigerating systems and heat pumps - Safety and environmental requirements – European Committee for Standardisation.

ISO 5149:2014 – Mechanical Refrigerating Systems used for Cooling and Heating – Safety Requirements – International Organization for Standardization;

ANSI/ASME Refrigeration Piping and Heat B31.5 - 2019 – Transfer Components – American Society of Mechanical Engineers;

ANSI/IIAR Standard 3-2013: Ammonia Refrigeration Valves. ASME Code for Sizing of Pressure Vessels;

ASME - Pressure Vessel Code - 2019 - Section VIII - Div. 1 - Rules for Construction of Pressure Vessels – American Society of Mechanical Engineers;

ASME - Pressure Vessel Code - 2019 - Section II - Materials - Part A – Ferrous Material Specifications – American Society of Mechanical Engineers;

ASME - Pressure Vessel Code - 2019 - Section II - Materials - Part C – Specifications for Welding Rods Electrodes and Filler Metals – American Society of Mechanical Engineers;

ASME - Pressure Vessel Code - 2019 - Section II - Materials - Part D – Properties – American Society of Mechanical Engineers;

ASME - Pressure Vessel Code - 2019 - Section V – Nondestructive Examination – American Society of Mechanical Engineers;

ASME – Pressure Vessel Code – 2019 – Section IX – Welding and Brazing Qualifications – American Society of Mechanical Engineers.

Evaporative Condenser /
Fluid Cooler

Components

3.1 EC (Electronically Commutated) Technology

The *Plug-and-Play* system with EC fans and GMM (*Güntner Motor Management*) provides a unique solution with intelligent control system for an energetically perfect operation, providing an excellent heat exchange solution.

- Axial fans have the highest technological grade and yield in the market in terms of aerodynamics and performance. They were designed to offer the highest yield in terms of flow and excellent noise level;
- Optimization of the energy efficiency through continuous control of the EC fans;
- Reduced energy and maintenance costs;
- Total number of electrical parts is reduced compared to control systems using Step Control (or frequency inverter control).

WARNING

For more information consult the EC fan manual or request support form the Technical Department of Güntner Brazil.

3.2 GMM (*Güntner Motor Management*)

The Güntner Controls Division developed an exclusive control system for the EC fans and their solutions, the GMM (Güntner Motor Management). This combination of EC fans with the GMM creates a unique solution, with the intelligent control system for an energetically perfect operation, providing a complete solution.

- The GMM system is a unique and exclusive solution that was developed especially for Güntner heat exchangers with EC fans;
- Accessibility and ease in parameter settings;
- Reduction and definition of the maximum noise level (setting for night operation);
- Guarantee of safety due to emission of alarm and operation messages;
- Guarantee of a safe and reliable operation due to the *BYPASS* function;
- Total integration with the main control system through communication protocols sued by the industry;
- Commissioning time considerably reduced due to simple settings of the controller (without having to address the fans);
- The combination of EC fans exclusively with the GMM provides a unique solution and an intelligent heat exchanger. The GMM managers and controls the speed of the fans according to the preset pressure or temperature to control the process, resulting in an energetically optimized system;
- The fans are factory set to operate at minimum rotation of 10%, and never turned off. This setting prevents a reduction in pressure/temperature inside the electric box of the motor, providing longer service life;
- *Plug-and-Play* , in addition to providing greater reliability and quality in

the installation, it ensures the correct commissioning and maintenance of the fans due to the automatic setting by the GMM, this way no software, expert or configuration is required.

Due to the use of electronically commutated (EC) axial fans, the electrical panel and installation in combination with the GMM controller becomes simple and easy to install, as can be observed in image 1.

3.2.1. System with EC fans + GMM

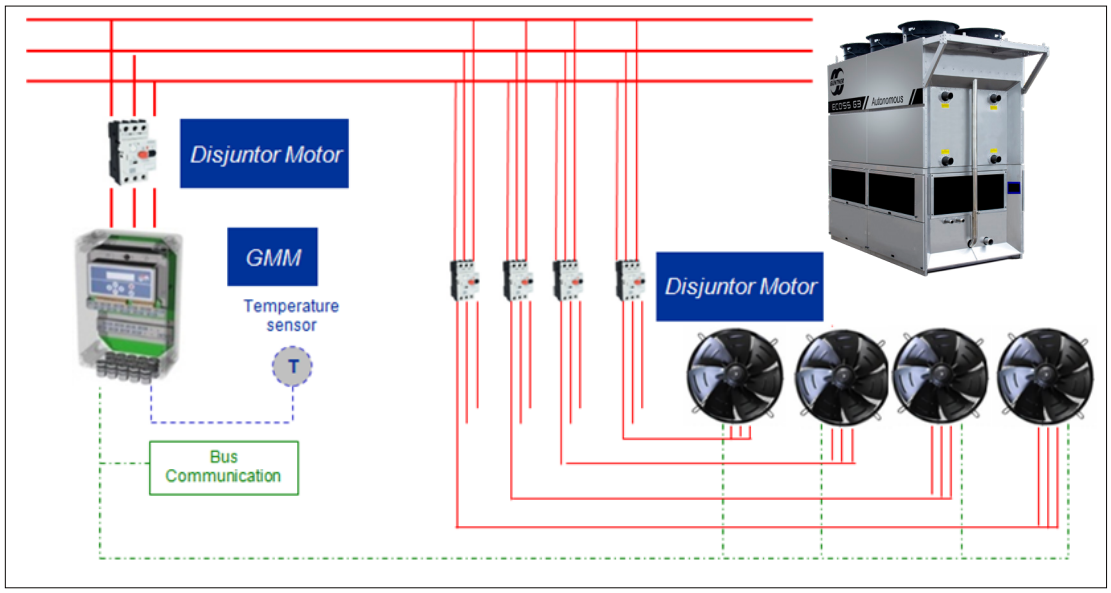


Image 1: Configuration of the EC fans + GMM.

WARNING

For more information consult the GMM (Güntner Motor Management) manual or request support form the Technical Department of Güntner Brazil.

WARNING

In case any of the GCM communication modules are used (Available as accessories), the integration of the automation system component should be carried out by a duly qualified automation professional.

In the Plug-and-Play system, when on automatic mode, the speed control of the fans, commissioning and management occurs through the reading of signals emitted by the temperature/pressure transducer sensors.

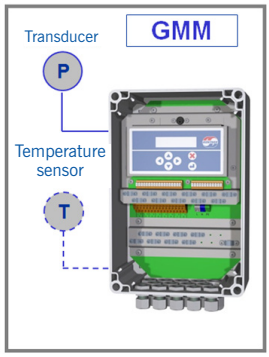


Image 2: GMM

In case any of the components of the control system needs to be replaced, contact our support team and request the component according to the spare part table below:

Description	ERP Code
Controller GMM-EC 08/RD.2 UL	5206153.2
Controller GMM-EC 16/RD.2 UL	5206154.2
Communication module GCM (W)LAN - WIFI - MODBUS TCP/IP Rail.1	5206123
Communication module GCM MODBUS/RS485 Rail.2	5204182.2
Communication module GCM PROFIBUS Rail.1	5204543
Pressure sensor	734.1
Stop valve 3/8» for pressure sensor	61940
Adapter for pressure sensor	62686
Temperature sensor	737
Threaded well for temperature sensor	738

Table 1: Electronic components and spare parts

The pressure or temperature sensors are responsible for emitting signals that make the GMM controller adjust the speed of the fans. The choice on the type of sensor should be based on the table below:

Type of Application	Type of Transducer Sensor
Evaporation Condenser	PRESSURE transducer sensor
Gas cooler	TEMPERATURE transducer sensor
Liquid cooler	TEMPERATURE transducer sensor
Closed Circuit Cooling Tower	TEMPERATURE transducer sensor

Table 2: Type of sensor for each application

The pressure or temperature sensors should be connected in the installation according to the table below:

Type of Application	Installation Position of the Transducer Sensor
Evaporation Condenser	General Collector of the INLET equipment (compressor discharge)
Gas cooler	General collector of the OUTLET equipment
Liquid cooler	General collector of the OUTLET equipment
Closed Circuit Cooling Tower	General collector of the OUTLET equipment

Table 3: Sensor position for each application.

ATTENTION

General collector refers to the collector that interconnects the inlet/outlet connections of the equipment when applicable. The transducer sensors should never be installed in a single inlet/outlet of the equipment or in the general collectors of the installation that are interconnected to other equipment.

3.3 Water pumps

- The centrifugal pumps used in the condensers have constructive shape to prioritize the flow of water at low pressure. The optimized points were developed to ensure the lower consumption based on the necessary flow.
- ECOSS G3 will be provided with a *Plug-And-Play* system including all cabling and electrical connection of the water pump, i.e., no intervention is required because the unit will be ready for operation.

WARNING

For more information consult the water pump manual or request support form the Technical Department of Güntner Brazil.

ATTENTION

Interventions in the electrical connection are not authorized without the consent of the manufacturer during the warranty period. Not following the procedures described in the manual may result in loss of warranty.

ATTENTION

When cleaning the equipment do not direct the water jet to the damages in the electrical installation.

WARNING

Before removing the cover of the terminal boxes and dismounting the pump, check to see if the power is switched off. The pump should be connected to an external general circuit breaker.

The operating frequency and voltage are indicated in the characteristic plate. Check to see if the motor is compatible with the power supply provided at the installation site. The electrical connection should be carried out according to the connection diagram inside the cover of the terminal box.

WARNING

Whenever motorized equipment is used in potentially explosive settings, respect the general or specific rules and regulations imposed by the authorities responsible or by the competent organizations.

3.3.1 Motor protection

All EC motors installed in the equipment have individual protection system. However, the version with external rotor motors coupled to propellers (NEMA Motors) does not have factory electrical installation. Therefore, it is necessary to provide the motors with individualized protection, like motor circuit breakers, electrical and thermal protection contactors. According to the effective standards.

WARNING

Before starting any repair work on motors with a thermal circuit breaker or thermistor, check to see if the motors cannot start automatically after cooling.

3.3.2 General information

The pump was not designed to pump liquids containing solid particles, debris or dirt. Before starting the pump, it is necessary to carefully clean and wash the system and supply it with clean water.
The warranty does not cover damages caused from washing or any damage caused by improper operation.

ATTENTION

The pump should be fully supplied with liquid during the verification of the rotation direction.

3.3.3 Verification of rotation direction

The correct rotation direction is indicated by arrows on the body of the pump.
Seen from the end of the pump, the rotation direction should be contrary to the hands on the clock.

1. Completely open the isolation valve on the inlet side of the pump and leave the isolation valve on the outlet side almost closed.
2. Proceed with starting the pump.
3. Purge the pump during start.

Güntner

Evaporative Condenser /
Fluid Cooler

Transport and Storage

4.1 Safety

- Danger of crushing with falling;
- The modules (upper and lower) weigh between 500kg and 8,000kg. These may slide and fall from the transport means, causing serious injuries or death. Strong impacts or vibrations may damage the unit;
- Check if the people indicated are trained for the proper unloading;
- Use an appropriate transport device for the weight of the units. You will find the weight of your packaged unit in the design documents related to the order. Check to see if there is nobody under the unit or close to the loading area during transport.
- Observe the balanced weight distribution of the unit for transport. Observe the instructions on the transport tags on the packaged units;
- Protect the unit against sliding and mechanical damages;
- When transporting by crane: The hooks and suspension mechanism of the load lifting equipment should be locked only at the points specified by the manufacturer;
- Use auxiliary transport equipment when necessary.
- Use an appropriate transport device for the weight of the unit;
- Do not use connection parts or collectors as points for inserting the hooks to suspend, pull, attach or assemble. This can cause leaks;
- Carefully transport the unit. Particularly avoid suddenly lowering the unit.

ATTENTION

4.2 Transport

- Read and observe all the transport stickers on the packages of the units;
- Extended mechanical stresses caused by unleveled road surfaces, holes and vibrations during the transport may cause damages to the equipment;
- Transport and unloading the packaged unit with a suitable transport equipment (crane, etc);
- The equipment can only be transported in packaging suitable for protection.

ATTENTION

4.3 Storage

- Danger of corrosion and accumulation of dirt;
- Protect the unit against dust, dirt, moisture, contamination and other harmful effects;
- Do not store the unit longer than necessary;
- Only store the units in their original packages until installation;

- Store the unit in a protected place away from dust, dirt, moisture and free from contamination until the time of installation (protected storage site);
- In case the installation delays in relation to the expected time: protect the unit from bad weather, from other harmful effects, from dirt and other contaminants with a suitable covering.

4.4 Packaging

- The units are delivered packaged in the installation position;
- Remove the transport protection in order to move the modules;
- **CAREFUL! The capacity of the transport means should be at least 1.5 times the weight of the unit;**
- Check the scope of delivery after completion. For the complete scope of delivery, consult the design documents specific for the order.
- Any damage due to transport and/or missing parts should be recorded in the delivery note. The facts should be informed immediately to the manufacturer in writing;

ATTENTION

- Check the transport pressure: The units are delivered by the manufacturer with transport pressure of approximately 2.0 bar (clean and dry air). Check the transport pressure of the Schrader valve (pressure measurement). For units with lower pressures: inform the manufacturer immediately and record the pressure observed in the delivery note;
- The lower pressure in the unit indicates leakage due to damages during transport. Escape of working fluid due to leakage in the unit may lead to injuries or even death (see residual hazards with refrigerants). Do not switch on the unit!
- Check the pressure according to the figure below.

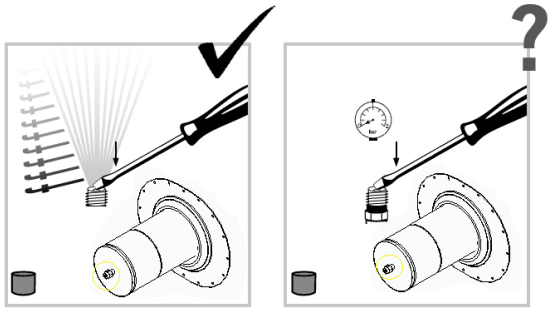


Image 3: Schrader valve positioned in the connections of the equipment

1 - Remove the sealing covers

2 - Check and unload the excess transport pressure

WARNING

Protect the unit against dust, dirt, moisture, damages, contamination and other damaging influences.

Start the installation as soon as possible!

4.5 Movement and assembly of the modules

The movement of the equipment modules should be carried by a suitable means for the weight and size of the unit (crane, etc).
Do not use connection parts or collectors as points for inserting the hooks to suspend, pull, attach or assemble. This can cause leak!

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

ATTENTION

Image 4 below shows detailed instructions of the movement and assembly of the upper and lower modules.

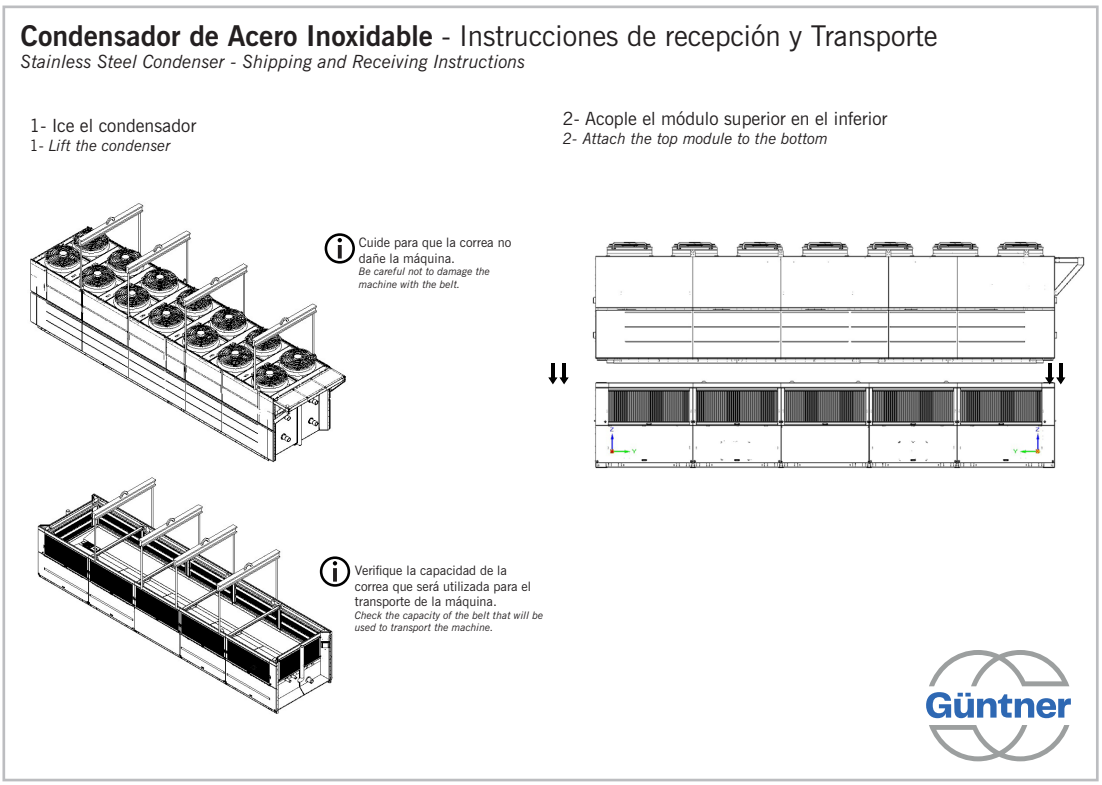


Image 4: Receiving, movement and assembly instructions of the upper and lower modules.

Model	Transport Weight Upper Module (kg)	Transport Weight Lower Module (kg)	Total weight for Transportation (kg)	Total Operation (kg)	Length Packaging Upper Module (mm)
GCHE 0404-8.1I/01A.E	781	498	1.279	1.497	2.510
GCHE 0404-12.1I/01A.E	852	498	1.350	1.635	2.510
GCHE 0408-8.1I/02B.E	1.053	590	1.643	2.055	3.610
GCHE 0408-12.1I/02B.E	1.180	590	1.771	2.303	3.610
GCHE 0608-8.1I/02B.E	1.422	673	2.096	2.798	3.610
GCHE 0608-12.1I/02B.E	1.613	673	2.286	3.170	3.610
GCHE 0808-8.1I/04C.E	1.772	750	2.523	3.561	3.610
GCHE 0808-12.1I/04C.E	2.029	750	2.779	4.059	3.610
GCHE 0812-8.1I/04D.E	2.295	843	3.138	4.695	4.800
GCHE 0812-12.1I/04D.E	2.675	843	3.518	5.438	4.800
GCHE 0812-8.1I/06D.E	2.382	843	3.225	4.782	4.800
GCHE 0812-12.1I/06D.E	2.762	843	3.605	5.525	4.800
GCHE 0818-8.1I/06E.E	3.209	1.191	4.400	6.736	6.630
GCHE 0818-12.1I/06E.E	3.783	1.191	4.974	7.854	6.630
GCHE 0818-8.1I/08E.E	3.280	1.191	4.471	6.806	6.630
GCHE 0818-12.1I/08E.E	3.857	1.191	5.048	7.928	6.630
GCHE 0824-8.1I/010F.E	4.379	1.684	6.063	9.177	8.600
GCHE 0824-12.1I/010F.E	5.148	1.684	6.832	10.671	8.600
GCHE 0824-8.1I/012F.E	4.482	1.684	6.166	9.280	8.600
GCHE 0824-12.1I/012F.E	5.253	1.684	6.938	10.777	8.600
GCHE 0830-8.1I/014F.E	5.398	1.961	7.359	11.252	10.420
GCHE 0830-12.1I/014F.E	6.360	1.961	8.321	13.121	10.420
GCHE 0836-8.1I/016G.E	6.292	2.217	8.508	13.180	12.220
GCHE 0836-12.1I/016G.E	7.441	2.217	9.657	15.417	12.220

Table 4: Technical information for transport and movement

Length Packaging Lower Module (mm)	Width Packaging Upper Module (mm)	Width Packaging Lower Module (mm)	Height Packaging Upper Module (mm)	Height Packaging Module Lower (mm)
1.910	1.400	1.400	2.750	2.000
1.910	1.400	1.400	2.750	2.000
3.010	1.400	1.400	2.750	2.000
3.010	1.400	1.400	2.750	2.000
3.010	1.900	1.900	2.750	2.000
3.010	1.900	1.900	2.750	2.000
3.010	2.400	2.400	2.750	2.000
3.010	2.400	2.400	2.750	2.000
4.200	2.400	2.400	2.750	2.000
4.200	2.400	2.400	2.750	2.000
4.200	2.400	2.400	2.750	2.000
4.200	2.400	2.400	2.750	2.000
6.030	2.400	2.400	2.750	2.000
6.030	2.400	2.400	2.750	2.000
6.030	2.400	2.400	2.750	2.000
6.030	2.400	2.400	2.750	2.000
8.000	2.400	2.400	2.750	2.000
8.000	2.400	2.400	2.750	2.000
8.000	2.400	2.400	2.750	2.000
8.000	2.400	2.400	2.750	2.000
9.820	2.400	2.400	2.750	2.000
9.820	2.400	2.400	2.750	2.000
11.620	2.400	2.400	2.750	2.000
11.620	2.400	2.400	2.750	2.000

Piping - Evaporative Condensers

5.1 Introduction

Evaporative condensers are used as an efficient means of heat rejection in refrigeration. Its installation and specifically the design of the pipes, up to and from the evaporative condensers, have direct consequences on its operation and on the energy efficiency of the cooling system. Güntner's recommendations for pipe installations for evaporative condensers are described in this manual, starting with individual condensers and exploring condenser installations in parallel, as well as piping systems with thermosyphons and sub cooling.

5.2 Theoretical Basis

Evaporative condensers have become common for almost all cooling systems due to the operating advantages offered and the energy efficiency.

Although all condensation systems perform similar work, differences in the operating characteristics resulting from load loss require some modifications in the inlet and outlet connections of the refrigerant pipes in the evaporative condensers. These changes are particularly important when dealing with multiple units installed.

Majority of evaporative condensers, in most designs, use coil systems where the hot gas from the refrigerant enters the top of the coil passing through the numerous pipe lines while it is cooled, and this way the fluid changes from overheated gas to saturated liquid. Generally this route run by the fluid generates a small load loss which, although insignificant for most part of the cooling system, requires attention in the suitability of the evaporative condensers. Dedicated attention should be given to the liquid line in the outlet from the evaporative condenser to the high pressure liquid tank.

5.3 Compressor discharge line (condenser inlet)

An evaporative condenser may be connected to the pipe in a system that contains one or more compressors. The discharge line of the compressor should be sized according to the length of the pipe, between the compressor and the condenser, and the total pressure drop allowed for piping. The good practices normally recommend a pressure drop that corresponds to 1.5˚C in condensation temperature loss every 100 m, according to ASHRAE Handbook of Fundamentals.

WARNING

ASHRAE recommendation for pressure drop, in the discharge line, in the sizing corresponding to 1.5°C / 100 m.

WARNING

Piping calculation softwares can easily help in the sizing.
The technical team of Güntner should be consulted in case of any doubt.

The use of this recommendation in most installations will result in insignificant load loss between the current pressure of the discharge line and the inlet of the condenser.
In any system, even whether new or old, measurable pressure drops in the discharge lines need to be considered in the sizing of the evaporative condenser and compressor.

5.4 Liquid Line– Single coil

Image 5 shows the piping recommendations for a single coil.

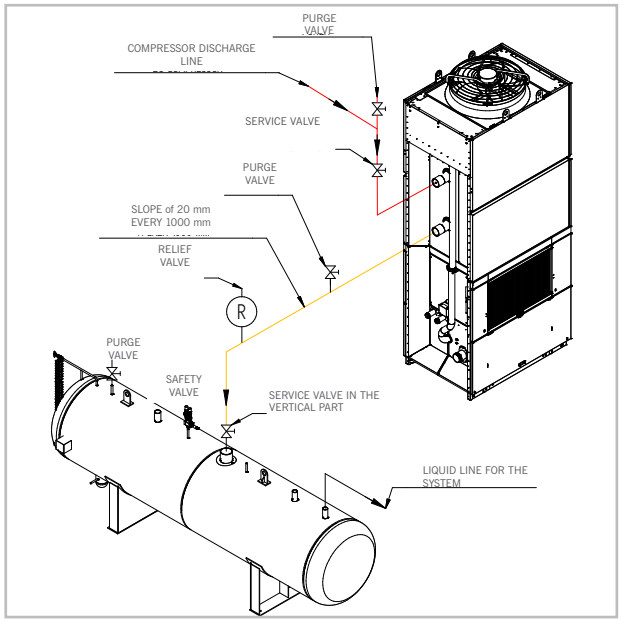


Image 5: Installation of a single evaporative condenser

The image shows the correct piping connection for a single coil connected to the system with liquid inlet from the high pressure tank entering through the top part. The discharge line of the compressor consists of a purge valve at a high point followed by a stop valve. The liquid line of the condenser should be suitably inclined together with the relief valve, a purge valve in the horizontal piping and a stop valve installed in the vertical piping.

The liquid tank should be installed with an additional purge valve and a double safety valve.

For more information consult the pressure vessel manual.

The condensed liquid line from the evaporative condenser to the liquid tank as previously mentioned should receive closer attention.

WARNING

It is very important for the condensed liquid line to be designed to enable to liquid to flow freely, by gravity, to the liquid tank at a speed below 0.5 m/s.

The size of the line depends on whether the liquid will flow directly from the condenser to the top of the liquid tank or if it will be designed to work with a siphon entering through the lower part of the liquid tank.

When the connection is made from the top part of the liquid tank, as shown in image 5, the condensed liquid line should be sized so that the low speed ensures the drainage of the liquid in the line. Such that the vapor contained in the space above the liquid flows freely in any direction

This allows the pressure in the liquid tank to be equalized with the outlet pressure of the coil and this allows the fluid to flow freely from the condenser to the liquid tank. The liquid line should also be inclined by at least 20 mm every 1.0 m towards the liquid tank to facilitate flow.

When the condensed liquid has its deviated flow entering through the lower part of the liquid tank, as shown in image 6, a vapor free flow and consequently the pressure between the liquid tank and the outlet collector cannot be equalized through the liquid line. In this case, a separate line should be installed from the top of the liquid tank to the liquid piping serving as an equalizing line.

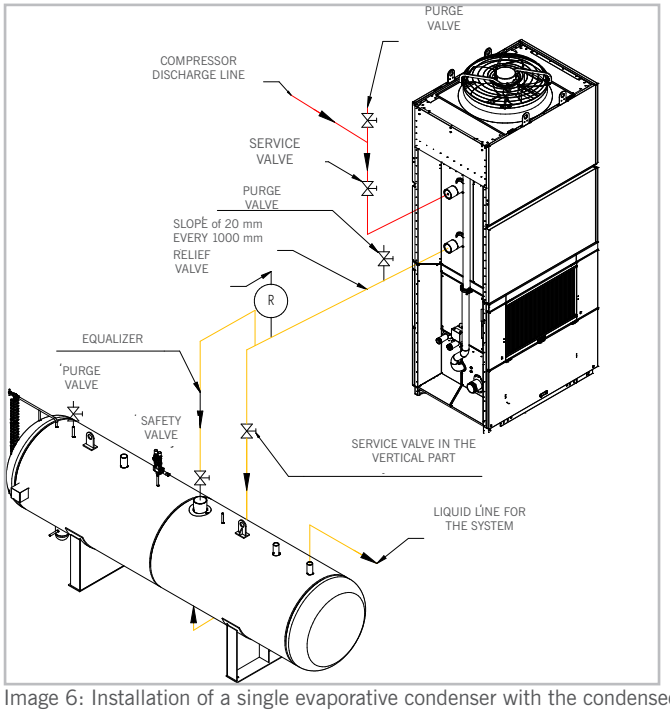


Image 6: Installation of a single evaporative condenser with the condensed liquid through the bottom of the liquid tank.

WARNING

Piping calculation softwares can easily help in the sizing.
The technical team of Güntner should be consulted in case of any doubt.

WARNING

The outlet connections of the evaporative condensers were designed according to international standards and recommendations, as well as all the Research and Development work, therefore the reduction of these lines is not recommended.

Evaporative condensers are generally designed with oversized outlet connections. In this case, the condensed liquid line supplied by the factory may be reduced and even meet the requirements. The reduction of the piping is allowed, but it is recommended to perform it on the vertical part of the line. If this method is used, then the installation of the stop valve is preferable on the vertical part of the line, and for at least 300 mm below the horizontal part. According to ASHRAE recommendation, as shown in image 7.

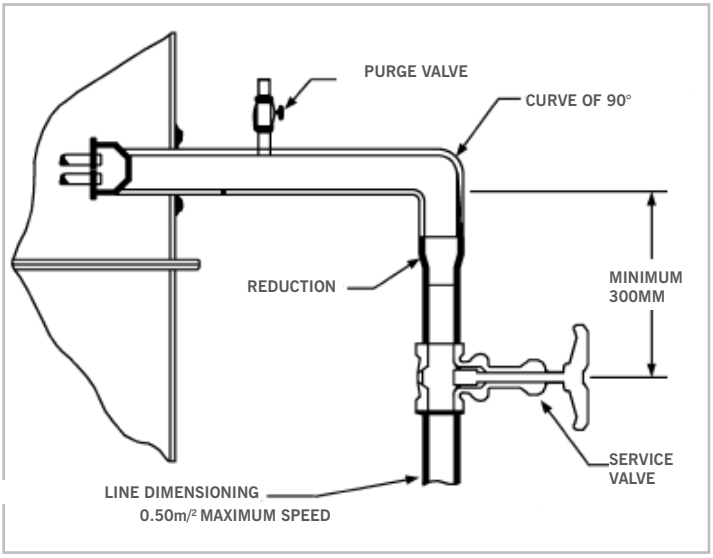


Image 7: Method of reduction of the condenser outlet - ASHRAE Handbook, 2018.

There are many condensers in operation with concentric reductions and valves in the horizontal part of the liquid lines, this arrangement should NEVER be considered. This unit will be operating with liquid accumulated in the coil, causing loss of capacity and other potential problems.

For optimization of the capacity and minimum load loss, carefully observe the recommendations established sing the sizing criteria of the line under maximum load conditions.

WARNING

Maximum Reduction Allowed in the Outlet Piping - ECOSS G3	
Model	**Diameter**
GCHE 0404	2"
GCHE 0408	2"
GCHE 0608	2.1/2"
GCHE 0808	3"
GCHE 0812	4"
GCHE 0818	4"
GCHE 0824	4"
GCHE 0830	4"
GCHE 0836	4"
Data in the following condition: **Condensation Temperature: 35 °C** **Wet Bulb Temperature: 23 °C**	

Table 5 - Maximum Reduction Allowed in the Outlet Piping - ECOSS G3

There is the possibility that the ECOSS G3 uses part of its circuit to cool the head of the compressor, in this case, the additional inlet and outlet piping are provided with the equipment with connection diameter for block CF according to the table below: **The other connections intended for condensation remain unchanged.**

ECOSS Pipe Sizing		
Model	**NH3 Connections: Inlet / Outlet**	**Fluid Cooler Connections: Inlet / Outlet**
ECOSS Standard	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40
CF 8	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40	2" ASTM A106 GrB SCH 40 / 2» ASTM A106 GrB SCH 40
CF 12	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40	2" ASTM A106 GrB SCH 40 / 2» ASTM A106 GrB SCH 40
CF 20	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40
CF24	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40
CF 36	2" ASTM A106 GrB SCH 40 / 2» ASTM A106 GrB SCH 40	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40
CF 40	2" ASTM A106 GrB SCH 40 / 2» ASTM A106 GrB SCH 40	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40
CF 48	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40	4" ASTM A106 GrB SCH 40 / 4» ASTM A106 GrB SCH 40

Table 6 - ECOSS Pipe Sizing

5.5 Condensed liquid lines - Multiple condensers in parallel

Multiple condensers in parallel should be correctly connected to enable an operation with maximum capacity and stable at any load condition and environmental variation.
Some installations that are connected incorrectly will operate under normal load conditions when all the units are in operation. However, under partial or total load conditions or with a low environmental temperature when the units enter in shutdown cycles, the system will become unstable. There may levels of the liquid tanks or some condensers may even start to operate with low efficiency due to possible drowning. All these symptoms may be attributed to deficiencies in the piping.

Image 8 shows two evaporative condensers connected in parallel to a single high pressure liquid tank. Note that the piping of this discharge line of the compressor must be as symmetrical as possible. The previous comments regarding the sizing of these lines also apply to multiple condenser installations.

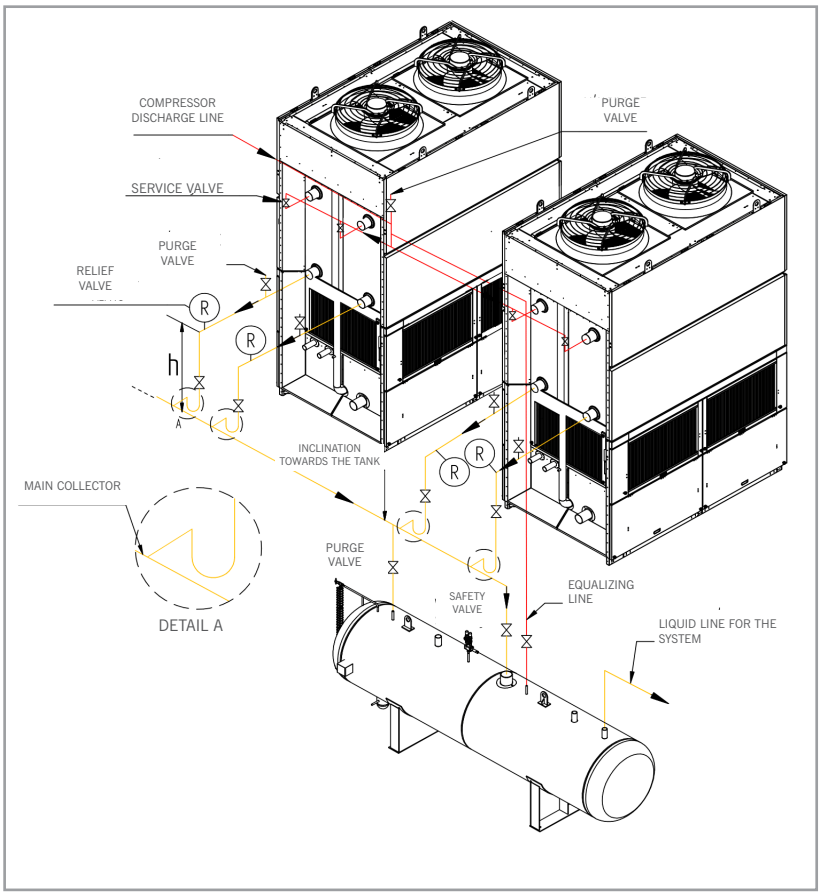


Image 8: Installation of evaporative condensers in parallel

According to image 9 the vertical part of the liquid column should be sized as a liquid line. This line from the horizontal collector to the liquid tank should be inclined 20 mm/m towards the liquid tank and sized according to the previously mentioned flow speed. Note that the horizontal collector itself is not siphoned.

The most important aspect of the connections of multiple condensers in parallel is the connection of the condensed liquid line from the condensers to the liquid tank.

THE USE OF THE SIPHON IS ESSENTIAL! The outlet liquid line of each condenser should have a siphon in the vertical part of the line. This can be accompanied by a small siphon as shown in image 9 or using a pipe with the entry in the liquid tank through the lower part as shown in image 11.

WARNING

The use of siphoning in the liquid outlet, the equalization between the liquid tank and the condenser, and the individualization of the evaporative condenser blocks, when installed in parallel, are very important for the correct functioning of the equipment and non-holdup of liquid in the condenser coil. The use of siphon prevents load loss differences between the coils and/or the condensers from interrupting the free flow of liquid up to the liquid tank. The equalizing line is used to ensure the free drainage of the condensers, keeping the liquid tank and the condensers at the same pressure. Image 9 shows how the correct installation of the piping ensures the correct operation of the system.

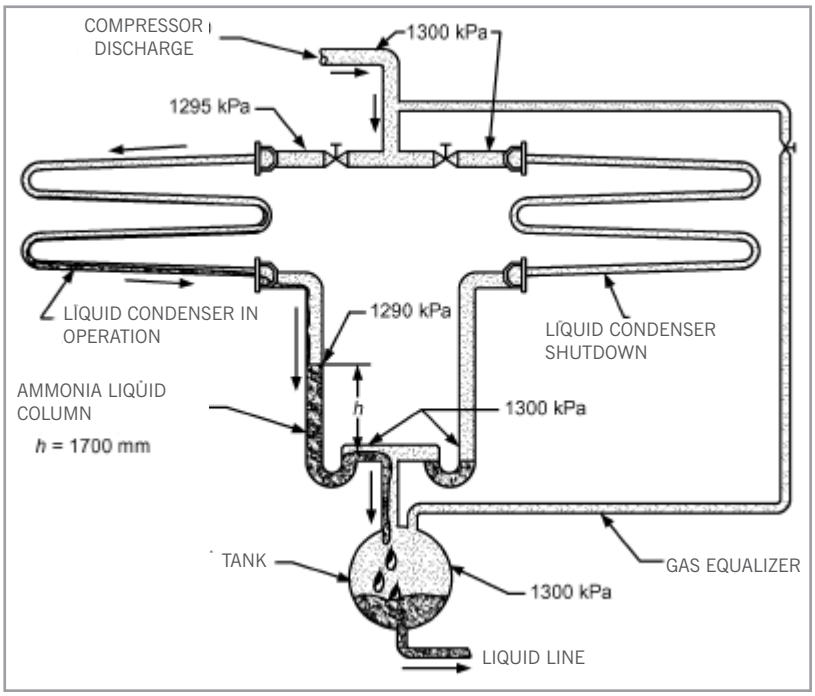


Image 9: Two evaporative condensers with siphoning for the liquid tank. - ASHRAE Handbook, 2018.

Güntner's standard recommendation for the minimum height of the vertical column of the siphon is:
1.5 m for ammonia (NH_3)
3.0 m for halocarbon refrigerants

WARNING

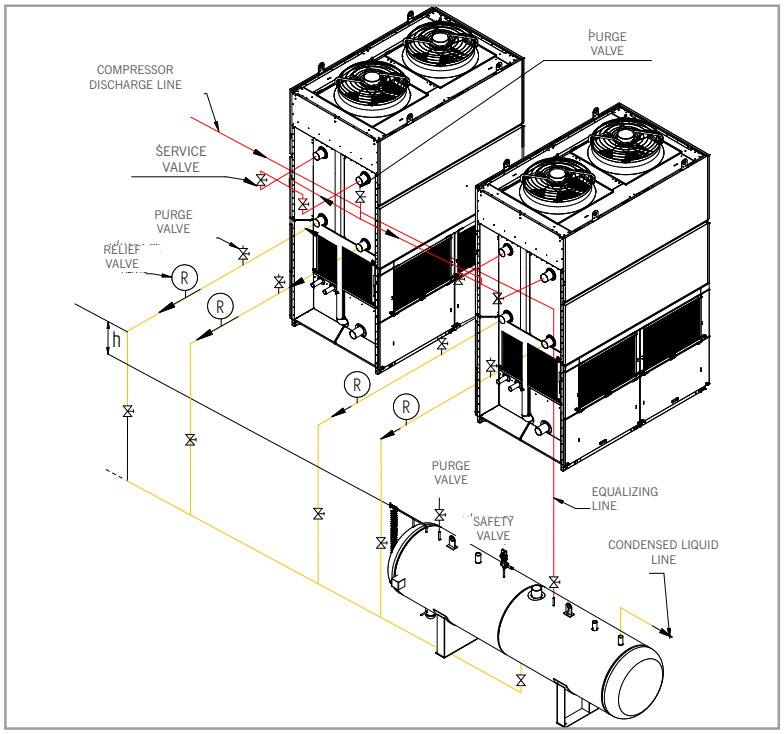


Image 10: Installation of evaporative condensers in parallel with condensed liquid line through the lower part of the liquid tank.

In multiple condenser systems in parallel that use an inlet on the lower surface of the liquid tank as shown in image 10. The minimum height "h" is calculated from the highest liquid level of the tank. Both the vertical liquid column and the new horizontal siphoned collector should be sized as a siphoned liquid line.

An alternative method for use of siphons in the liquid outlets in multiple condenser installations is shown in image 11. All outlet pipes are connected in a single liquid collector. A single inverted siphon is used to create a liquid seal in the entire collector. In order to prevent the accumulation of liquid in the collector, the equalizing line should be connected on top of the inverted siphon to prevent the formation of vacuum as shown in detail in image 12.

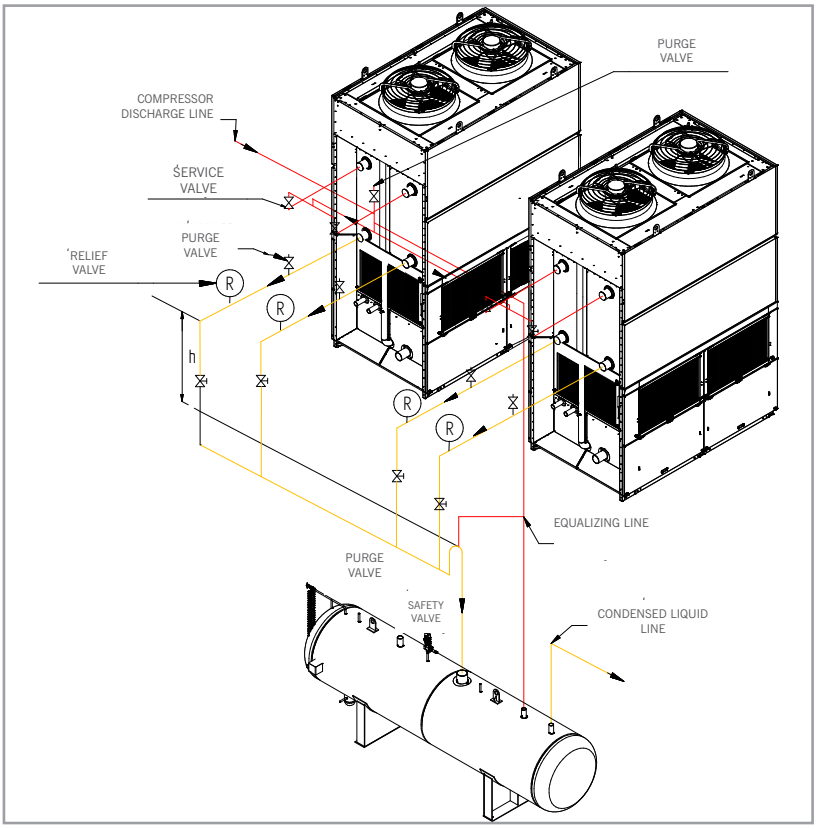


Image 11: Installation of evaporative condensers in parallel

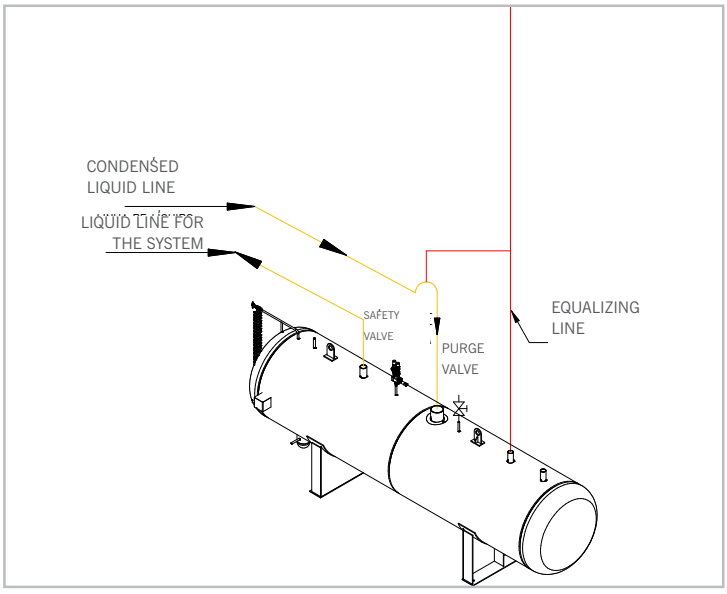


Image 12: Detail of the installation of the inverted siphon

It is essential to use siphons in these lines in order to build a vertical liquid column to compensate potential pressure variations between the outlet piping of the condensers. Without these siphoned liquid columns, the refrigerant will remain in the coil causing a huge load loss (or low outlet pressure), consequently reducing the capacity available and causing an unstable operation.

This is the same dimension "h" indicated in images 10 and 11. These are the minimum heights of the column for a satisfactory operation with reasonable intervals around the nominal design conditions and are primarily based on the maximum condensation pressure drop of the coil. If stop valves are included in the inlet and/or outlet of the coil, the load loss imposed by these valves should be considered by increasing the minimum height of the liquid column, recommended above, by an equivalent quantity of pressure drop of the valve in meters of refrigerant liquid column.

Under low environmental temperature conditions, the condenser will have an additional capacity increase. Sometimes this capacity increase allows switching off one or more condensers, allowing that condenser in operation to work with the maximum load of the compressor. As a result of this, there will be an increase in fluid flow through the unit, the pressure drop of the coil and piping will be greater than the pressure drop under “normal design” conditions.
Also in low temperatures environments, the condensation pressure is sometimes reduced considerably to reduce energy consumption at low thermal conditions of the environment. The resulting low density of the gas has the effect of increasing the load loss. For the condenser to operate with maximum efficiency, in a low energy consumption system at low environmental temperature conditions, higher liquid columns are necessary.

Whenever possible the liquid columns should be designed approximately 50% higher than the recommended minimum height.

WARNING

The equalizing line runs from the central separator to a centralized position of the discharge line that supplies the condenser.

WARNING

Under no circumstance the equalization line should be connected to the multiple condeser outlet as this will have the same effect as eliminating the siphons. This will cause accumulation of liquid in the condensers with even lower outlet pressures.

WARNING

An evaporative condenser can often be installed in parallel to a plate heat exchanger condenser, as shown in image 13.

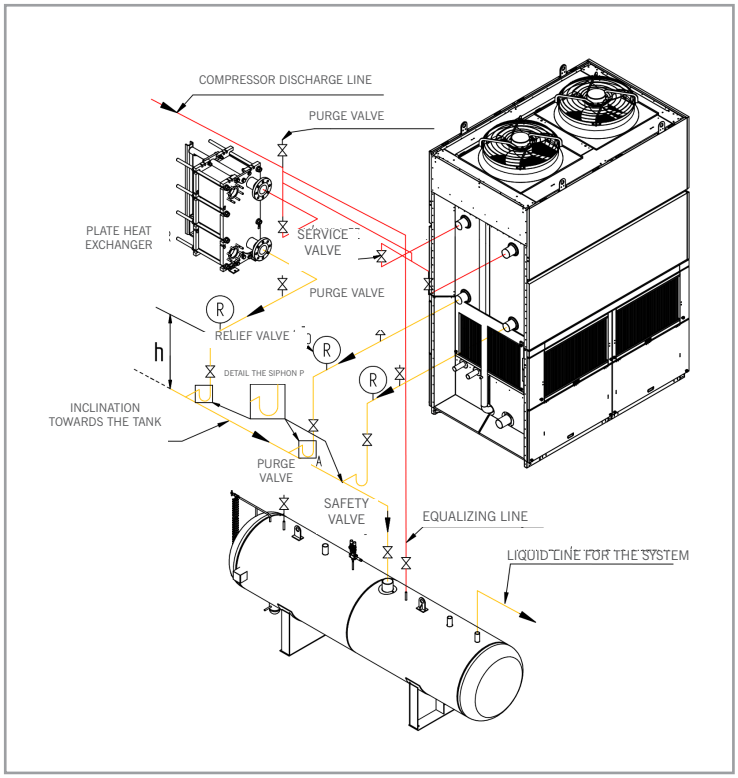


Image 13: Installation of an evaporative condenser in parallel with plate heat exchanger

The same considerations of the pipes apply in this case. The load loss in the plate heat exchanger is generally very small, so the height of the liquid column of the plate heat exchanger can be reduced to up to 0.3m.
Basically this type of condenser only needs to be located sufficiently above the liquid tank to obtain liquid flow.

5.6 Liquid tanks and equalizers

The liquid tank allows the reservation of refrigerant liquid for periods when the system works with the necessary load fluctuations of refrigerant both for the high or low line of the system, as well as for maximum load and change of operating conditions. This also allows the complete drainage of the condenser so that there is no effective loss of the condensation surface due to the liquid remaining stored in the coil.

Depending on the environmental conditions in which the liquid tank is subjected to, there may be either sub-cooled gas or overheated liquid inside it. An equalizing line is required to relieve this potential pressure difference condition. Therefore, to enable the liquid to be drained freely from the condenser, the liquid tank should be equalized with the pressure of the hot gas discharge line.

In the case of a single condenser unit as shown in image 6, where the condensed liquid line is not siphoned, the equalization can occur in the condensate line itself provided it is properly sized.

If the liquid of the condensate line for a single condenser unit is siphoned, as shown in image 7, then the equalizing line should be connected to the liquid line directly through the outlet of the condense or through the discharge line just in front of the inlet of the condenser. If connected with the discharge line, then the height of the liquid column should be sufficient to compensate the load loss of the coil of the condenser as explained in previous items.

For multiple condenser installations as shown in images 9, 10, 11, 12, 13 and 14, the equalizing line always interconnects the liquid tank to the point of the discharge line positioned at the inlets of the condenser as symmetrically as possible. Never equalize at the outlet of the condensers in multiple unit installations since it destroys the effect of the liquid column of the siphon.

Sizing of the equalizing lines takes table 5 into consideration as it provides the recommendations for the suitable selection of the sizes of the equalizing line that should be used satisfactorily for majority of the typical ammonia cooling systems.

ECOSS G3 RECOMMENDATIONS FOR EQUALIZING LINE	
Maximum System Capacity [kW]	**Nominal Diameter**
225,0	3/4" (DN20)
375,0	1" (DN25)
700,0	1.1/4" (DN32)
975,0	1.1/2" (DN40)
1.950,0	2" (DN50)
2.800,0	2.1/2" (DN65)
4.300,0	3" (DN80)
7.750,0	4" (DN100)

Table 7: Recommendation for equalizing lines - Reference ASHRAE Handbook, 2018.

5.7 Thermosiphon Oil Cooling

Thermosiphon oil cooling is one of the most popular means of compressor oil cooling. The condensed liquid refrigerant flows from the evaporative condenser to a distribution tank. This feeds the oil thermosiphon by gravity. In oil thermosiphon part of the liquid is vaporized during the cooling process of the oil. The mixture of refrigerant in liquid and gas states return to the distribution tank and the vapor generated is separated in the tank and returns to the condenser through the equalizing line/gas return. The remaining liquid refrigerant from the distribution tank to the main tank and then to the system.

The distribution tank serves as a tank for refrigerant and its main function is to feed the oil thermosiphon of the compressor. Priority is given to the oil cooling liquid over the liquid feed system. In addition, the outlet of the liquid to the oil thermosiphon is located on the lower part of the distribution tank and is sized using the criteria of the liquid lines described. The refrigerant is released after flooding the distribution tank from the liquid drain. The height of the liquid column is measured from the liquid line of the condenser to the drain height of the distribution tank presented by the size “h” in image 14.

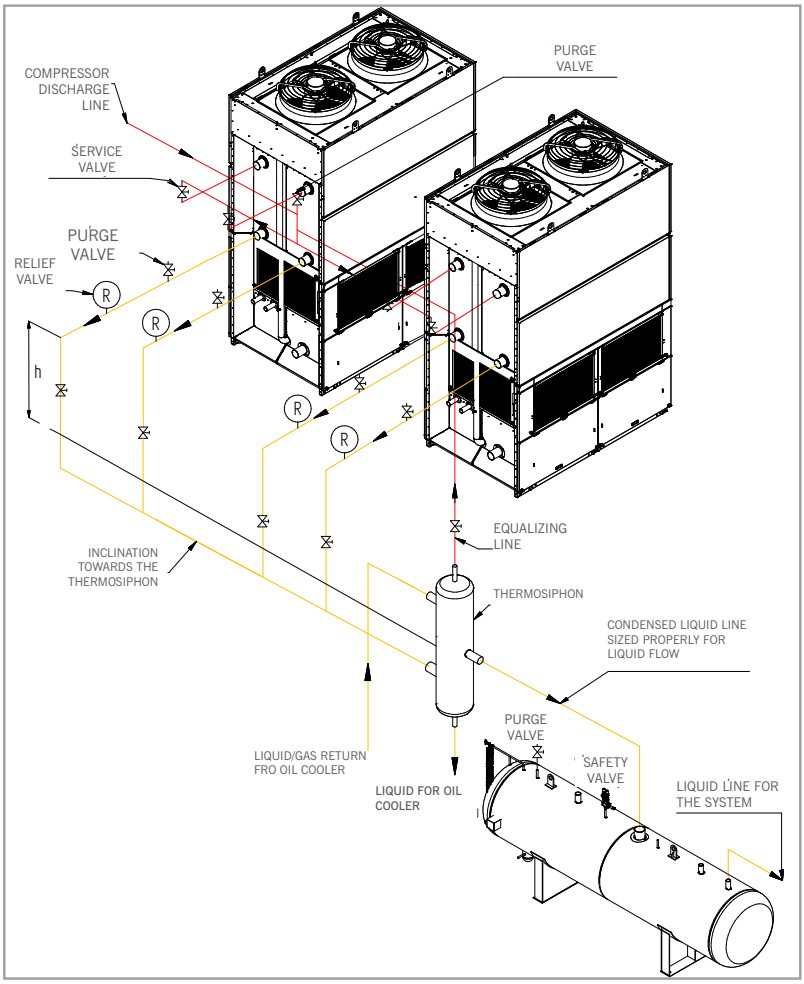


Image 14: Installation of evaporative condensers with thermosiphon

5.8 Sub-cooling

For applications involving long liquid lines or applications involving evaporators feed by thermal expansion, sub-cooling coils may be installed in the evaporative condensers to sub-cool the condensed liquid.
The sub-cooling of the refrigerant will prevent the formation of bubbles/ flash gas in the liquid line which affects the thermostatic operation of the expansion valves.

5.9 Purge

All the layouts of the sampled pipes show one or more purge connections. The design and appropriate use of these purge connections are to remove the non-condensable gases from the system and are important to obtain maximum efficiency and low operating costs in the condensers and in the cooling system. Air and other non-condensable gases are present and are accumulated in the cooling system in various ways:

1) Insufficient vacuum before the load or after the system has been opened for repairs;
2) Leaks in the low pressure side of the system for pressures below the atmospheric pressure;
3) Addition of low quality refrigerant containing non-condensables;
4) Chemical collapse of the oil and/or refrigerant.

During the operation of the system the non-condensable gases will be dragged through the condenser and, in addition, become much more concentrated in the outlet of the condenser and in the liquid tank. When the system is closed they tend to accumulate at the highest point of the system which, normally, is in the discharge line next to the inlet of the condenser. The purge connections should be located in each of these places: liquid tank, outlet of each connection of the coil and at the highest point of the system. Each connection should be separated by a valve, but it may also be interconnected at a single point of the purge line that may or may not be connected to an automatic purge.

WARNING

The normally accepted safety procedures and precautions should be observed when the purge is carried out.

Purge during the operation is the most common procedure and is generally considered the most effective. This is carried out by opening of the purge valves outlets of the coil one at a time and also in the liquid tank. If the purge connection of the coil outlet is interconnected, opening more than one valve at a time will cause the interconnection effect of the condenser outlet. This will prevent the outlet of liquid, which may possibly cause the return of liquid to the coils of the condenser. The purge at the highest point of the system is only effective when the system is out of operation.

WARNING

The purge of some refrigerants into the atmosphere is regulated by federal and local agencies.

5.10 General observations

1) Plan for the possibility of future expansions. This is especially important in the sizing of the line. Determining elevations above the liquid tank and providing suitable space to obtain suitable air flow.

2) Make sure that the piping is suitably designed to allow some flexibility in terms of expansion, contraction and vibration.

3) Any cooling valve in a horizontal pipe should be installed with the shaft of the valve also in the horizontal position.

4) In NH^3 systems with multiple compressors in parallel, always interconnect the discharge line and connect a single discharge line to the condensers. In Freon systems with multiple compressors, isolate each compressor circuit or provide suitable return of oil from the system to the compressors.

5) Insert relief/safety valves in the condensers when the service valves are installed both at the inlet and outlet of the condenser. Incidents have happened when the coil of the condenser is filled with refrigerant liquid and when the service valves remain closed. This is because a change in environmental temperature generates sufficient hydraulic forces to break the pipes of the coil.

6) Angular valves are commonly used in cooling piping and are acceptable. They should be properly guided with the full size of the holes and provide the same resistance to flow as a normal “elbow” connection (90°).

7) The piping should be installed according to the appropriate standards and good engineering practices. All piping should be supported with suitably designed crosspieces and supported with clearances that allow possible expansions and contractions. No external load should be placed on the connections of the coil or piping support brackets on the structure.

Evaporative Condenser /
Fluid Cooler

Base Installation

6.1 Equipment Layout

The ECOSS is a product line with induced airflow, using a four-sided air inlet configuration. Correct evaluation of the location of the equipment leads to a successful installation and subsequently suitable operation. This manual provides recommendations for various layout scenarios, including the placement of equipment near an obstruction (for example, wall). Side-by-side applications should be evaluated together with the Product Engineering department of Güntner.

The minimum distance listed between one obstruction and the air inlet side (or end) is simply a recommendation. There are always external circumstances not covered (for example, prevailing winds), together with the field experience that lead to alternative layouts and would therefore increase the minimum distance presented in this manual to achieve good operation.

It is recommended that the equipment is installed in an open environment to ensure airflow quality and prevent recirculation of saturated air (By-pass). The installation of units on open roofs and at ground level without any obstruction such as walls or buildings would be the appropriate place. However, this may not be possible in many situations. The positioning in wells, on high walls, adjacent buildings, occupied areas or specific cabinets represent the risk of recirculating saturated air. This will increase the wet bulb temperature and definitively compromise the performance of the condenser, normally resulting in higher levels of condensation. Discharge covers or duct extensions should be used in such cases. Units that are located in a well, an enclosure or close to adjacent walls or buildings should be positioned so that the condenser discharge is above these adjacent objects.

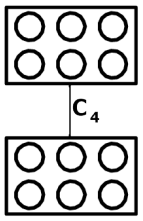
If the unit is located in occupied areas or close to adjacent buildings, it is good engineering practice that the discharge air is not in the direction of or near any ventilation system air inlet of the building.

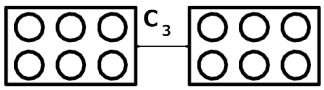
6.2 Equipment layout and installation base

All the recommended minimum distance values Cl, C2, C3, C4, etc, are only for ECOSS G3 units. In addition, the values are recommended for each size of ECOSS G3 unit.
For example: a double unit can be made with two ECOSS G3 0812 units assembled end to end by the heads of the units, as shown in the image below. The following tables show different potential layouts in which the unit can be installed correctly.

No obstruction / parallel units		
Unit Configuration	**Unit length**	**C3 and C4**
Single unit	04 to 08	2,000mm
Single unit	12 to 36	3,000mm
Dual (end-to-end)	all models	3,000mm

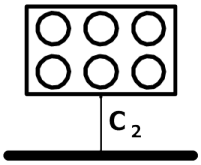
Table 8: No obstruction / two parallel units configuration

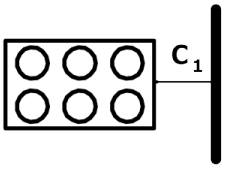




One wall / one unit		
Unit Configuration	**Unit length**	**C1 and C2**
Single unit	04 to 08	1,200mm
Single unit	12 to 36	1,800mm
Dual (end-to-end)	all models	1,800mm

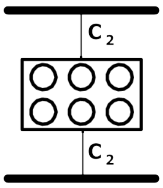
Table 9: One wall / one unit configuration

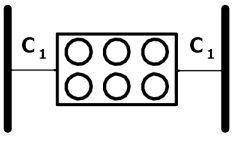




Two walls / One unit		
Unit Configuration	**Unit length**	**C1 and C2**
Single unit	04 to 08	1,200mm
Single unit	12 to 36	1,800mm
Dual (end-to-end)	all models	1,800mm

Table 10: Two walls / one unit configuration



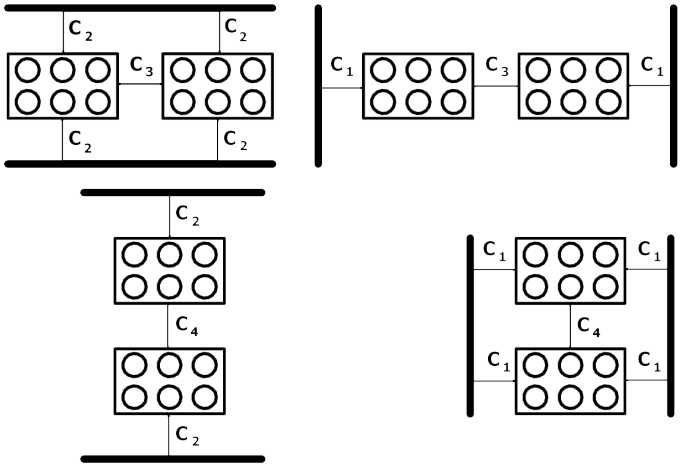


ATTENTION

The recommendations of distances from walls or obstructions apply for constructions in which the height of the fans is above the height of the wall.

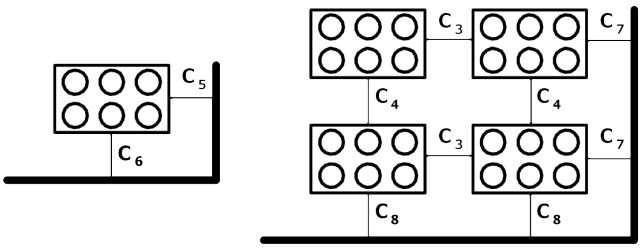
Two walls / parallel units			
Unit Configuration	**Unit length**	**C1 and C2**	**C3 and C4**
Single unit	04 to 08	1,200mm	2,500mm
Single unit	12 to 36	1,800mm	3,000mm
Dual (end-to-end)	all models	1,800mm	3,000mm

Table 11: Two walls / parallel units configuration



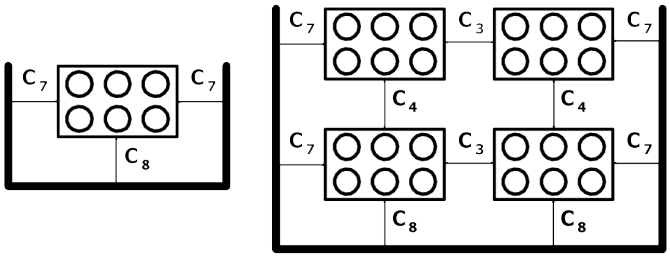
Two walls / parallel units			
Unit Configuration	**Unit length**	**C5 and C6 C7 and C8**	**C3 and C4**
Single unit	04 to 08	1,200mm	2,500mm
Single unit	12 to 36	1,800mm	3,000mm
Dual (end-to-end)	all models	1,800mm	3,000mm

Table 12: Two walls / parallel units configuration



Three walls / parallel units			
Unit Configuration	**Unit length**	**C7 and C8**	**C3 and C4**
Single unit	04 to 08	1.200mm	2.500mm
Single unit	12 to 36	1.800mm	3.000mm
Dual (end-to-end)	all models	1.800mm	3.000mm

Table 13: Three walls / parallel units configuration



ATTENTION

The recommendations of distances from walls or obstructions apply for constructions in which the height of the fans is above the height of the wall.

6.3 Support Structure

The units need to be structurally supported with at least two parallel beams that cross the entire length of the unit (see the drawing below).

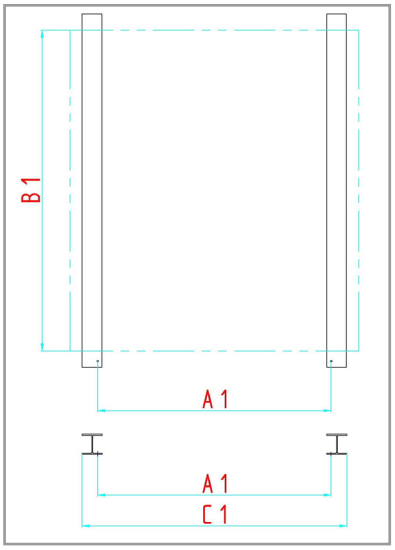


Image 15: Supporting structure

Dimensions of the ECOSS G3 steel supporting structure				
Nomenclature	“Installed Width [mm]"	"A1 – Between Holes [mm]"	"B1 [mm]"	"C1 [mm]"
G_HE 0408-8.1I/02B.E	1.219	861	2.702	1.102
G_HE 0408-12.1I/02B.E	1.219	861	2.702	1.102
G_HE 0608-8.1I/02B.E	1.756	1.392	2.702	1.639
G_HE 0608-12.1I/02B.E	1.756	1.392	2.702	1.639
G_HE 0808-8.1I/04C.E	2.278	1.914	2.702	2.161
G_HE 0808-12.1I/04C.E	2.278	1.914	2.702	2.161
G_HE 0812-8.1I/04D.E	2.278	1.914	3.895	2.161
G_HE 0812-12.1I/04D.E	2.278	1.914	3.895	2.161
G_HE 0812-8.1I/06D.E	2.278	1.914	3.895	2.161
G_HE 0812-12.1I/06D.E	2.278	1.914	3.895	2.161
G_HE 0818-8.1I/06E.E	2.278	1.914	5.722	2.161
G_HE 0818-12.1I/06E.E	2.278	1.914	5.722	2.161
G_HE 0818-8.1I/08E.E	2.278	1.914	5.722	2.161
G_HE 0818-12.1I/08E.E	2.278	1.914	5.722	2.161
G_HE 0824-8.1I/010F.E	2.278	1.914	7.689	2.161
G_HE 0824-12.1I/010F.E	2.278	1.914	7.689	2.161
G_HE 0824-8.1I/012F.E	2.278	1.914	7.689	2.161
G_HE 0824-12.1I/012F.E	2.278	1.914	7.689	2.161
G_HE 0830-8.1I/014F.E	2.278	1.914	9.516	2.161
G_HE 0830-12.1I/014F.E	2.278	1.914	9.516	2.161
G_HE 0836-8.1I/016G.E	2.278	1.914	11.343	2.161
G_HE 0836-12.1I/016G.E	2.278	1.914	11.343	2.161

Table 14: Dimensions of the ECOSS steel supporting structure

For more information the technical drawing of the equipment shows the supporting points.

ATTENTION

It is mandatory to use insulation material in case the base or supporting structure is manufactured in carbon steel.

When this insulation component is not used, corrosion may occur between the materials.
Wedges cannot be used to raise the unit, because this compromises the supporting surface of the load.
Consult the certified technical drawing of the Güntner unit for the fixation screw locations.
All supporting beams and anchor screws are not supplied by Güntner and should be selected according to the structural engineering standards. The selection of these supporting beams should be calculated using 55% of the operating weight of the unit as a uniform load on each beam.

The supporting beams should be leveled at the top and meet the acceptable tolerance of the industry related to the total length of the installed unit. Do not leave any unit without wedges.

Evaporative Condenser /
Fluid Cooler

Installation

7.1 Notes on the installation of the unit

- Danger of injuries and property damages with the escape of refrigerant (see residual hazards with refrigerants);
- In case of incorrect installation, working fluid may escape during the installation operation, which may lead to injuries or property damages;
- Prevent leakage of the working fluid of the unit to the environment (see residual dual hazards with refrigerants);
- Protect all the lines that transport fluids against mechanical damages;
- Check to see if the connections at the site do not exert any force on top of the distribution points and the collector. This may cause leaks at the connection points of the working fluid of the unit and at the connection points of the local piping.

ATTENTION

7.2 Tray water piping connection

- Do not tighten the threaded connections with the inappropriate tool;
- Install the drainage piping completely stress free. The diameter of the water drainage piping should be at least that of the water drain of the unit, and the water drainage piping should be installed with inclination of 3º to 5°;
- Danger of damages! The plastic threads may be damaged due to excess torque.

ATTENTION

DANGER

7.3 Installation of the unit to the system

- Incorrect connection to the system generates leaks that cause escape of working fluid, which this may be toxic (see residual hazards with refrigerants);
- Welding on pressurized parts may result in fires or explosions. This work is only allowed on depressurized units. Empty the equipment correctly;
- Install only stress-free working fluid connections! The piping system at the site should be fastened with clamps before being connected to the unit;
- The use of open flame at the installation site is forbidden. Fire extinguishers and extinguishing agents used to protect the equipment and the operation employees should observe the requirements of the safety standards;

- Check the refrigerant fluid detectors and the alarm systems to warn of explosion or fire hazards, concentrations dangerous to health, and for control purposes at the configuration point of the unit, they are provided according to the safety standards.

Install the piping according to the safety standards. Check to see if:

- The connections have easy access;
- The installation of the piping is kept as short as possible;
- The free space around the unit should be enough to ensure that there is no risk to the unit and enable regular maintenance of the components, and should enable verification and repair of components, piping and connections;
- It should be possible to shut down the unit in case of leakage;
- It should be possible to activate al the devices intended to deviate the working fluid to a safe storage site.
- Electrical components, for example, for operation of the fan, for operation of the water pump and for the alarm system at the installation site, must be designed considering the temperature and humidity conditions of the environment.

All connections should be welded according to the good welding practices and standards. Check:

- Leak prevention tests;
- There is prevention against excess heating during welding;
- The use of purge gas during welding.

The equipment are manufactured with collectors in stainless steel and sent with carbon steel pointers already welded to facilitate the connection to the system.
Observe the stickers attached to the equipment connections and the following indication should be respected:

7.3.1 Important Considerations to the unit installer

During interconnection of the inlet and outlet connectors of the equipment with the cooling circuit, pay attention to the weld and grinder remnants. This is to prevent their contact with the equipment fairing, which results in the carbon oxide contamination and change in the esthetics and closing durability of the equipment.
It is important for the interconnection with the isolated fairings be carried out, so that contamination does not occur. In case this guideline is not strictly followed, it will imply in the loss of warranty of the equipment fairing.

ATTENTION

Observe the stickers on the fairing of the equipment!

ATTENTION

7.4 Performance acceptance test

The release of the refrigerant may cause injuries or even death (see residual hazards with refrigerant). Conduct the acceptance test below with a specialist before starting the unit and after making important changes, as well as after changing a unit:

- Check if the temperature and humidity of the air at the operating point correspond to the technical data corresponding to the order;
- Check to see if the power source is enough for the necessary energy. Compare the unit in the system with the system plans and electrical diagrams;
- Test for vibrations and movements in the unit that may be caused by the fans and the operation of the system. Remove the oscillations, vibrations and movements after consulting the manufacturer or independently;
- Conduct visual inspection of the structural design, supports and devices (materials, connections, etc);
- Check and retighten all threaded connections;
- Check the installation of the piping connections;
- Check to see if the unit is protected against mechanical damages;
- Check to see if the unit is protected against inadmissible heating and cooling;
- Check to see if maximum control and accessibility of the unit is guaranteed;

ATTENTION

- Check to see if the unit is installed in a way that it can be monitored and controlled from all sides and at all times;
- Check to see if there is sufficient space for maintenance;
- Check to see if all the components, connections and lines that transport liquids and all the electrical connections and piping have easy access;
- Check to see if the piping is easy to identify;
- Check for dirt on the surface of the coil;
- Conduct function tests on the fans (rotation, direction, energy consumption, current, etc);
- Check for damages on the electrical connections of the fans;
- Check the quality of the welds of the connections, the electrical connections and the general connections;
- Conduct pressure test with the test gas and with a test pressure 1.1 times the MAWP [Maximum Allowable Working Pressure]: check the seals of the connections and detect leaks, for example, with foaming agent, or similar;
- Check the protection against corrosion: Conduct a visual inspection of the entire equipment, including all the curves, components and supports of components that are not insulated against heat. Document and file the test results;
- Conduct functioning test. Observe and check the unit during the functioning test, especially the following:

1. Smooth functioning of the fans (noise in the bearings, contact noises, unbalancing, etc);
2. Energy consumption of the fans;
3. Leakages;

Immediately inform all defects to the manufacturer. Remove the defects after consulting the manufacturer;
Check the unit and the interactions of the unit with the system again, after 48 hours of operation, especially in the connections and in the fans, and document the test results.

7.5 Operational readiness test

- Check to see if all the electrical protection measures are ready for operation;
- Check to see if all the connections that carry working fluid are well connected and welded;
- Check to see if all the electrical connections (fans, engines, water pump, electrical panel, etc) were connected according to the effective safety standards;
- Check to see if all the water connections of the unit were installed correctly.

Evaporative Condenser /
Fluid Cooler

Start-up and Comissioning

8.1 Putting the unit in operation for the first time

The release of the refrigerant may cause injuries or even death (see residual hazards with refrigerant);

Put the unit in operation only when:

- After carrying out all the stages described in Chapter 7;
- The units have been assembled and connected correctly;
- After conducting the test to check the readiness of the systems for operation and all the safety precautions have been taken. Follow the operating instructions manual of the system!
- Immediately contact the manufacturer in case you want to operate the unit under operation conditions different from those defined in the design documents related to the order.
- Switch on the system, including the electrical system;
- Activate the unit:

ATTENTION

Open the valves on the admission and outlet side of the system;
- Activate the fans;
- Put the water replacement line and purge piping in operation;
- Wait until the operating point is reached. After the operating point has been reached, the unit is ready to operate;
- For setting parameters of the operating point, see the design documents related to the order. Operating point:

1. Condensation temperature / pressure;
2. Volumetric air flow;
3. Volumetric liquid flow;
4. Air inlet wet-bulb temperature;
5. Altitude;
6. Thermal capacity;
7. In order to that the specified operating point is in compliance with the actuators, the setting should be protected against unauthorized access.

8.2 Removal of the unit from operation

The units are components of the cooling system. The unit should be removed from operation by switching off the system according to the installation instruction and operating manual of the cooling system. To do so, the fans must be switched off and disconnected from the general electrical system and the piping of the working fluid lines must be disconnected from the system according to the recommendations of the installation and operating manual:

- Shut down fans;
- Shut down the electrical system and disconnect the fans;
- Close the pipes that transport the working fluid;
- Carry out vacuum for 24 hours;
- Disconnect the equipment.

ATTENTION

NOTE! Consider the maximum operating pressure during shutdown! If necessary, take precautions so that it is not exceeded.
The EC fans should always be connected to the electric power with minimum operating rotation in order to keep the inner temperature higher than the outer temperature. In order to ensure this it is necessary to set the GMM to operate with minimum rotation of 10%.

DANGER

Danger of injury and damage to property!
The release of the refrigerant may cause injuries or even death (see residual hazards with refrigerant).
Check to see if the maximum operating pressure has also not been exceeded after shutdown!

When the equipment is operating with Ammonia (NH_3) the following recommendations should be strictly followed:

1. Danger of corrosion and accumulation of dirt! Ammonia as refrigerant liquid is extremely soluble, i.e., it attracts moisture. Moisture and dirt should be prevented from entering the unit.
2. Protect the unit against dust, dirt, moisture, damages and other damaging influences that may occur.
3. Remove the unit from operation according to the unit removal instructions.
4. Protect the unit:

ATTENTION

- Consider the maximum operating pressure during shutdown! If necessary, take precautions so that it is not exceeded.
- Protect the fan motor drivers and, when applicable, the heater rods with electrical defrosting against restarting.
- Protect the unit against damaging influences in the installation or at the storage site in order to keep all components in good condition for suitable use and to preserve the usability of the unit. For this purpose, special storage conditions and preventive measures for protection against corrosion must be observed.
- Purge the unit: Completely release the working fluid and, if applicable, the cooling oil.

8.3 Restart operation after shutoff

The unit should be put back in operation after shutoff according to the specific settings of the system and according to the operating instructions manual, as shown below:

- Readiness test of the systems for operation. Conduct the pressure and visual inspection test.
- NOTE! The pressure test with re-commissioning should be conducted only with the appropriate means and with the appropriate and recommended test pressures in the technical report of the equipment.
- Put the unit in operation according to the instructions of this document.

ATTENTION

8.4 Change the working fluid in the unit to another working fluid

The working fluid of the unit should NOT be changed to another working fluid without the prior written consent from Güntner.

- Check to see if the manufacturer of the unit agrees with the change.
- Check to see if the correct working fluid was loaded. Check to see if all the materials used in the unit are compatible with the new working fluid.
- Check to see if the MAWP was not exceeded
- Check to see if the new working fluid can be used without requiring a new test certificate for the unit. Check the compliance with the classification.
- Check to see if the safety device for the unit should be changed or restored.
- All information related to the new working fluid should be changed in a compatible way.
- The complete documentation, including these operating instructions and the operating instructions manual of the system should be changed in a compatible way.
- Conduct the acceptance test.

ATTENTION

8.5 Start-up and commissioning of new installations

A summary of the procedures applied during the commissioning and Start-up for a cooling system with ammonia and is based on Bulletin 110 - 1993: *Guidelines for Start- Up, Inspection and Maintenance of Ammonia Mechanical Refrigerating Systems.*

8.6 Initial Precautions

It is initially considered that the installation was correctly for its performance; all interconnection piping, electrical components and thermal insulation were correctly installed; all the protection devices were tested and adjusted and are working; the entire system was subjected to pressure test; and all elements necessary for the start-up of the system were previously provided.
The installation supervisor should have all the relevant drawings of the system, including engineering flowchart, electrical diagrams and the operating design data of the system, as well as the operating limit conditions.
The person responsible for the design should have all the qualification documentation for the start-up activities and should carry out the process together with the installation supervisor.
Before the first ammonia load in the system, all emergency systems must be checked for functionality, including the escape routes and eyewash stations and showers, and all PPEs (personal protection equipment) necessary must be available and easily accessible by the professionals involved.
All employees of other areas of the unit (outside the cooling installation) should be notified that ammonia loading will take place. The access to the area should be restricted only to authorized employees and those not involved in the operation should be kept out of the area of risk.
A visual inspection should be performed on all piping, electrical interconnection and opening condition of the stop valves (according to their normal operating condition) to check if the system is ready to receive the load of ammonia.

8.7 Electrical Installation Comissioning

Qualification of the installation to be performed before the first load of ammonia in the system.
During commissioning of the electrical installation, the control panels of the equipment should be inspected internally and externally to ensure that the whole equipment and specified components were correctly installed and all circuit breakers and fuses of the panels were sized correctly as indicated in the specification.
Before energizing any part of the electric circuit of the installation, an insulation test should be conducted on all the cables to ensure that there are no insulation defects. It is recommended to issue a certificate of the test. Below are the minimum procedures recommended for the test:

- For control panel tests, all fuses and circuit breakers of the motors of the main and auxiliary equipment (including motors of compressors, pumps, fans, etc.) should be removed to prevent unexpected operation.

- With the removal of the fuses of the motors of the equipment, the coupling (or belts) between the compressors and their motors should be disconnected and the equipment should be manually rotated to confirm that they rotate freely.

- Then as the fuses are installed back, the motors should be tested one by one to check the correct direction of the rotation. The adjustment value of the thermal protection of each motor should be confirmed based on the nominal current of the motor.

- For compressor motors, in certain cases, it would be necessary to deactivate some electrical interlocks to test the motor. In this case the deactivated interlocks should be flagged for the correct reactivation after the test.

- After checking the rotation direction of the motors, the power cables of the motors should be insulated and the motors should be re-coupled. The motors will be aligned with all equipment and the coupling protections will be reinstalled.

- After completing these electric circuit tests, all electrical shutdown protections (of motors) should be inspected to ensure that the setting values are according to the values required in the specifications.

- Finally, the electrical interlocks of the various control and protection elements (such as level floats with electrical contact, pressure switches, thermostats, flow sensors, etc.) must be tested to certify that the electrical contacts are working on the motors of the respective equipment.

- All test results must be recorded and attached to the final commissioning report of the electrical installation.

8.8 System Leak Test

After completing the installation and before application of thermal insulation, the cooling system should be tested to certify the leak tightness or eventual leaks. All parts of the system that are not previously tested (at the factory or on the field) should be pressurized according to the required design pressures (considering the specific values for the high and low pressure sides). All leaks detected should be repaired and the material or defective parts should be replaced.
Oxygen or any other combustible gas or mixture should not be used for pressurization. Carbon dioxide (CO_2) or halogen fluids (HFCs, HCFCs, CFCs) cannot be used as gases for pressurization in systems with ammonia. It is recommended to use dry Nitrogen or dry air as pressurization gas for the leak test.

8.8.1 Preparation

The following components should be closed, blocked and/or insulated against pressurization:

- Compressor units;
- Safety valves (use shield disc and joints);
- Level indicators (the purge valves, after the stop valves, should remain open);
- Level controllers;
- Ammonia pumps;
- Pressure indicators (pressure meters);
- Every and any eventual low pressure instrument and accessories;
- All solenoid valves should remain open, through electrical energy (if normally closed), or through the manual operation devices;
- Motorized and/or pneumatic valves should also remain in the open condition;• Air extractor (Purge);
- Check valves located in the discharge of the compressor valves should be disassembled to remove the inner core in order to enable pressure to pass through to the shut-off valves;
- All flanges of the piping (if any) should be coated at the joint and a small hole should be made on the top part.

Note: It should be previously verified that, through the plant flowchart, the entire piping to be tested (welds, fittings, connections, flanges, joints, etc.) will be reached by the pressure to be introduced; and the flowchart, duly marked by color indication, should be attached to the Pressure Test Certificate.
In the case of systems with different test pressures between the low and high pressure sides, the sides should be isolated and the tests should be conducted at different stages, considering the respective pressures required.

8.8.2 Precautions regarding the protection of people

The entire installation area to be pressurized should be interdicted, and the presence of people will be only allowed from a minimum distance of 10 meter from the end of the installation, protected through concrete screens. Suitable warnings should be placed at strategic locations to prevent the unintentional entry of people.
The safety equipment of the company and/or fire department of the location (previously called by the company) should ensure the isolation of the area, only allowing access to the test team.
Attention should be paid to the existing risk of possible rupture of pipes and/or components, putting the lives of nearby people at risk. Therefore, everyone present at the test should be properly protected.

8.8.3 Equipments to be used

- Air compressor with discharge pressure up to 6.0 bar and air compressor with discharge pressure up to the test pressure, to be installed at the appropriate location and distant from the installation, in order to ensure the protection of the operators;
  Note: The air compressors should have a safety valve and pressure gauge.
- Nitrogen cylinders;
- Calibrated mercury thermometer, with minimum scale division of 0.1ºC and high pressure meters calibrated and with minimum scale division of 0.10 bar, to be installed in the machine room, to control the different variations of the environmental conditions that directly influence the test results.

8.8.4 Procedure

1st Stage

a) Pressurization of the installation with dry compressed air and/or nitrogen, up to a pressure of 2.0 bar;
b) Carefully check all the welds and connections for leaks using water and soap solution;
c) Marking of eventual leaks observed for later correction;
d) Increase the pressure to 4 bar and check again for leaks;
e) Depressurization of the installation and execution of eventual repairs. Do not execute any repair with the system pressurized.

2nd Stage

f) Injection of dry compressed air and/or nitrogen to obtain the test pressure under stable condition;
g) Keep the test pressure for 2 hours, with variation less than 1% and then reduce it to 10.5 bar;
h) The pressure of 10.5 bar (with variation less than 1%) should be maintained for a period of 12 hours;
i) All welds and connections should be checked again using water and soap solution before the complete depressurization of the installation;
j) In case a leak is detected after the depressurization of the system, the eventual repairs should be performed and the test should be conducted again until total leak-proof is guaranteed;
k) Issuance of leak-proof test certificate.

8.9 Vacuum and dehydration procedure

After the leak proof test certification, before the application of the thermal insulation and before the ammonia load, the system should be carefully evacuated to remove all non-condensable gases and moisture contained inside the system. Evacuation can last from 25 to 40 hours to reach the required pressure, depending on the internal volume of the installation, the moisture content inside the system and the capacity and condition of the vacuum pump used. The vacuum level to be reached for systems that will operate with ammonia is about 5.0 mmHg.

8.9.1 Preparation

All components that were isolated for the execution of the leak proof test, except ammonia compressors and pumps (which in vacuum will allow the penetration of air through the mechanical seals), should be opened and/or unlocked:

- Ammonia pumps (when hermetic);
- Safety valves (remove the shield discs);
- Level indicators (close the purge valve and open the stop valves);
- Level controllers (close the purge valve and open the stop valves);
- Air extractor (Purge);
- Pressure indicators (pressure meters) and pressure controllers (pressure switches);
- All and any eventually isolated low pressure instrument and accessories;
- All solenoid valves should remain open, through electrical energy, or through the manual operation devices;
- The motorized and/or pneumatic valves should also remain in the open condition;
- The check valves located in the discharge of the compressor units should be reassembled.

8.9.2 Equipments to be used

- Vacuum pump of suitable size (capacity of 10 to 25 Nm^3/h);
- Pressure vacuum meter with vacuum scale and manifold for service;
- Carbon steel tube or flexible hose with appropriate stainless steel weft with female connections on both ends;
- Nitrogen cylinders.

8.9.3 Procedure

The connection of the pump during the vacuum process will be performed from the load valve located at the liquid container piping discharge, through a tube or flexible hose.

8.9.4 Primary Vacuum

Start the evacuation and, during the process, the pressure can be checked in the pressure-vacuum meter, where the pressure inside the installation is observed (approximately 760 mmHg) to reduce rapidly to about 20 mmHg or slightly lower. To date, only the air and the non-condensable gases have been removed. The pressure then reduces more slowly, because only then the water begins to evaporate. It is recommended to check the low points where there may be encapsulation of water and heat these points to accelerate the evaporation process.
When the pressure reaches about 5.5 mmHg, after about 15 hours from the start of the process, the pump will shut down for a period of 1 hour and the pressure will be checked in the pressure-vacuum meter. An increase in pressure indicates that evaporation of the moisture that is still in the system.

In this case, continue with the process for another 10 hours and then shut down the pump again to check the stability of the pressure.
The process should continue until the pressure reaches the value of 5.0 mmHg and remains stable. Then the pump is shut down and isolated from the circuit and these conditions will be maintained for another 6 hours.

8.9.5 Vacuum breaking

The vacuum reached will be “broken” using nitrogen injection in the system until the pressure returns to the initial atmospheric pressure.

8.9.6 Secondary Vacuum

The evacuation is carried out again until the pressure reaches the value of 5.0 mmHg.

8.10 Primary Ammonia Load

After the secondary vacuum process, the installation will be ready to receive the first load of ammonia. Initially the load will be performed until the system reaches 7.0 bar. It is also recommended during this period that the system is inspected with ammonia detectors. Appropriate masks should be available in case of emergency.
In the end, all the components, valves and control elements should be returned to the normal operating position with the system shutoff.

8.10.1 Ammonia load

In case cylinders are used for the ammonia load, it is recommended to connect only one cylinder at a time. In case of supply by more than one cylinder, care must be taken to prevent flow from one cylinder to another through the use of check valves in each supply connection of each cylinder, so as to prevent e flow into the cylinders.
The ammonia load valve to the system should be compatible with the size of the system and must have a check valve to prevent the backflow from the system to the loading element (cylinder or tank truck).
The loading point and the cylinder should be positioned outside, in a protected location where there is no risk to the rest of the operating team. The area should be isolated and a warning should be placed informing that the system is being loaded with ammonia.
When a tank truck is used, it is recommended to pump ammonia to the liquid container using the ammonia pumps of the truck (when applicable).

In the case of tank truck, the ammonia supplier should present the following documentation for clearance of supply:

- Identification of the ammonia load, with information of the ammonia manufacturer, certificate of origin and certificate of purity (minimum of 99.95%);

- Certificate of vacuum procedure in the truck tank before ammonia loading;
- Written procedure of the ammonia supply operations;
- Certificate of integration of the professional for the activity of risk in the area and certificate of training of the professional for the ammonia supply operating procedure.

The supplier should provide the appropriate hose and quick coupling connection for the ammonia loading point of the installation. In case of diameter difference between the hose and loading connection of the system, reductions in series (assembled on the spot) cannot be used for the connection. The supplier must provide an appropriate reduction device that is assembled on the hose.
Before starting the operation, inspect the hose of the supplier checking to see if it is suitable for the operation and if there is any drainage point for final emptying of the hose after loading.
Provide plenty of water at the site (hose with running water) and use the proper PPE for the service (at least boots, gloves and specific mask).
After installing the hose that connects the tank truck to the ammonia load connection point of the installation, the following loading procedure should be carried out:

- Record the initial ammonia volume in the liquid container;
- Open the ammonia load connection valve of the installation (100%);
- Execute the operation according to the written procedure of the supplier;
- During the procedure, the ammonia load operator should remain beside the set of valves of the truck to immediately close the load valves in case of emergency;
- When loading is completed, close the ammonia load connection valve of the installation;
- Close the ammonia connection valve of the tank truck;
- Drain the ammonia residue from the hose section into a drum with water;
- Remove the hose from the ammonia load connections of the installation and tank truck;
- Record the mass of the ammonia load injected into the installation.

To calculate the total mass injected, in addition to the record of the volume variation in the liquid container (and later calculation of mass through the density of ammonia at room temperature), it is recommended to weigh each cylinder before and after loading and weigh the tank truck before and after loading (when possible).
During the loading procedure, one of the compressors (preferably two stage and of smaller capacity) should be prepared, with the due oil load and electrical connection, to enter into operation. During this period it should be taken into consideration that the compressor will be operating outside the normal operating conditions (pressure and temperature) for which the system was designed.

8.11 System Protection Device Tests

The tests of the protection devices of the compressors should be conducted by the professional responsible for the “start-up” of the compressors (assigned by the manufacturer of the compressors). The other devices should be executed by the professional responsible for the “start-up” of the system

(assigned by the installer)
and/or responsible for other supplied equipments. The tests should be conducted and supervised by the engineer assigned by the customer as Commissioning Authority.
All devices should be checked previously to verify if the field setting values are according to the setting value established by the Commissioning Authority.
All devices should be checked previously to verify if the field setting values are according to the setting value established in the design for each device.

8.11.1 High discharge pressure

This should be the first device to be tested. The setting value of the high discharge pressure protection device of the pressure relief installed on the same operating pressure side of the protection device of the compressor.
For the test, the discharge pressure of each compressor should be increased gradually (by closing the valve in the discharge line, after the pressure outlet point where this device is installed), until the protection device activates, causing the immediate shutdown of the compressor when the pressure reaches the setting value.
In case the discharge pressure exceeds the setting pressure of the protection device, the compressor should be shut down immediately (through the emergency button or instant shutdown). In this case, the device should be replaced or repaired (the mechanical and electrical elements of the device should be checked) and the test should be conducted again after the correction.
In compressors with microprocessor control panels, the setting value of the discharge pressure for shutdown may be reduced during the test to facilitate the procedure and prevent very high pressure in the system. After completion of the test, the setting value should be corrected for the condition established in the design.

8.11.2 Low suction pressure

For the test, the suction pressure of each compressor should be reduced gradually (through the closing of the valve in the suction), until the protection device activates, causing the immediate shutdown of the compressor when the pressure reaches the setting value.
In case the suction pressure exceeds the setting value of the protection device, or the compressor should be shut down or the suction pressure increased (by opening the valve). In this case, the device should be replaced or repaired (the mechanical and electrical elements of the device should be checked) and the test should be conducted again after the correction.

8.11.3 Low oil differential pressure

The protection device of the compressor oil differential pressure is normally associated to a timer to prevent the shutdown of the compressor during

start-up when the differential pressure of the oil is low. This should be taken into consideration during the test procedure.
The timer test can be performed on a specific bench assembled on site or by isolating the pressure outlets of the oil differential pressure device (if there are stop valves of the pressure outlets).
The oil differential pressure protection device can be tested by changing the setting value to a value higher than the design value to facilitate the design of each device.

8.11.4 High discharge temperature/high oil temperature

In compressors with microprocessor control panels, it is recommended to change the setting value of the shutdown temperature to a lower value during the test. After completion of the test, the setting value should be corrected for the condition established in the design.

8.12 Other protection devices

All other alarm and shutdown protection devices of the compressors should be tested, including devices for low temperature and external protection devices, such as liquid level controllers (alarm and shutdown by high or low level).
The protection devices of other equipments like ammonia pumps and ice making machines should also be tested.
The tests should be performed according to the recommendations of the manufacturer.

8.13 Emergency protection systems

The following auxiliary systems should also be tested:
- Normal Ventilation System of the Machine Room;
- Emergency Ventilation System;
- Emergency Buttons (instant shutdown of equipment and the installation);
- Main Solenoid Valve of the Liquid Line;
- Eyewash Stations and Emergency Flood Showers;
- Ammonia detectors.

The tests should be performed according to the recommendations of the manufacturer.

8.14 Assisted operation

After completion of the tests of the protection devices, the “start-up” routines can continue with the settings of the control valves and other control elements for the correct operation of the equipment and the system.
During the “start-up” procedure there should be monitoring of the operating pressures and temperatures of the system and constant inspection on ammonia leaks. In case of any abnormality, the system should be shutdown immediately and the causes should be identified and corrected before returning to operation.

Evaporative Condenser /
Fluid Cooler

Guardrail assembly

9.1 Assembly instructions: ECOSS G3 Guardrail

1º Step:
The Guardrail Support Base is already factory assembled. These are inserted in the space between the fans.

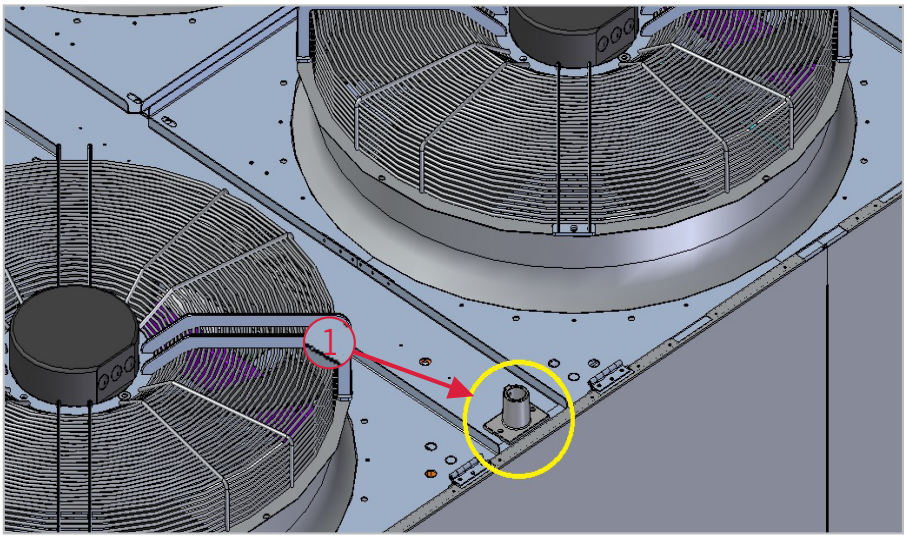


Image 16: Guardrail support base

2º Step:
The columns of the guard-rails arrive pre-assembled from the factory and identified, and the screws are already in their positions only requiring tightening at the end of assembly.

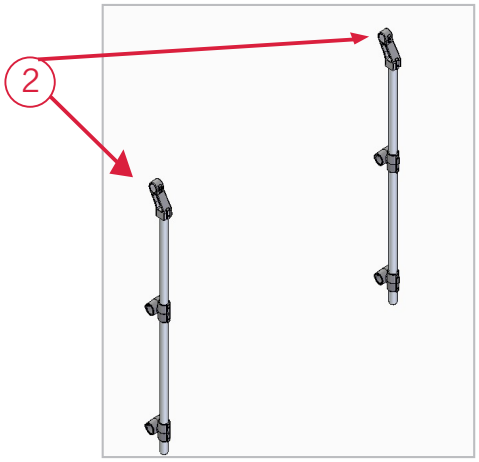


Image 17: Guardrail assembly

3rd Step:

Insert all the columns in the Guardrail Support Bases. Without screwing them.

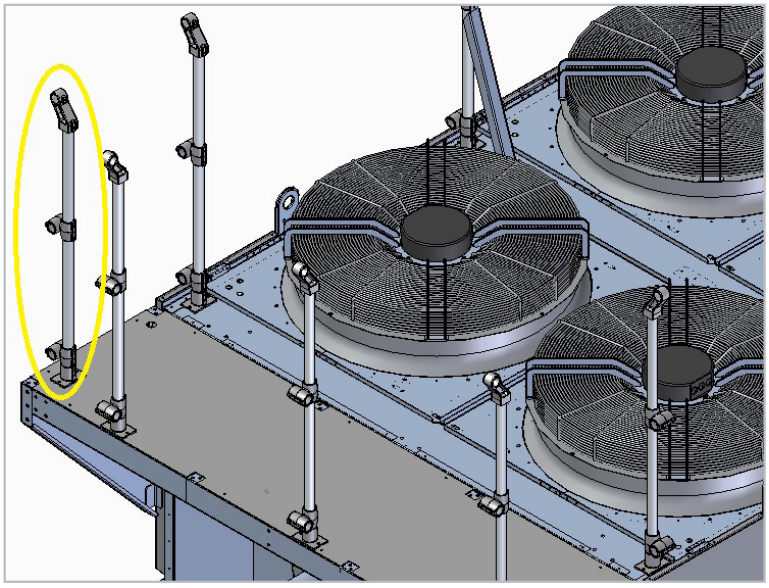


Image 18: Guardrail columns assembly

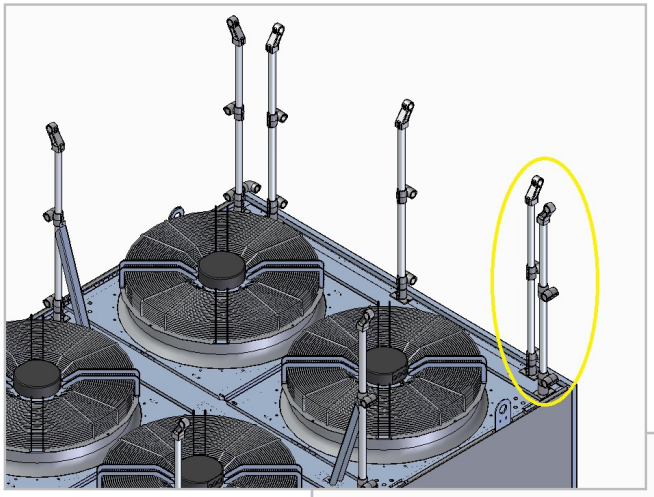


Image 19: Guardrail columns assembly

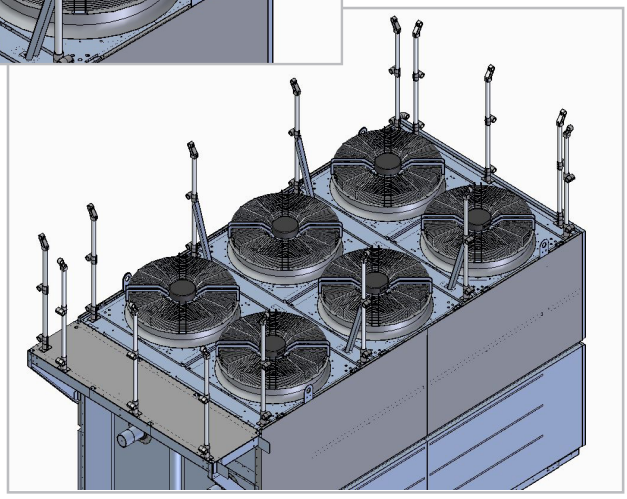


Image 20: General assembly of the guardrail columns

4º Step:
Insert the 2 tubes (4) and then insert the tube (3) on the side of the ECOSS G3 as shown in the drawing. But do not screw them in yet.

NOTE: The length of the tubes may vary depending on the model of the equipment.

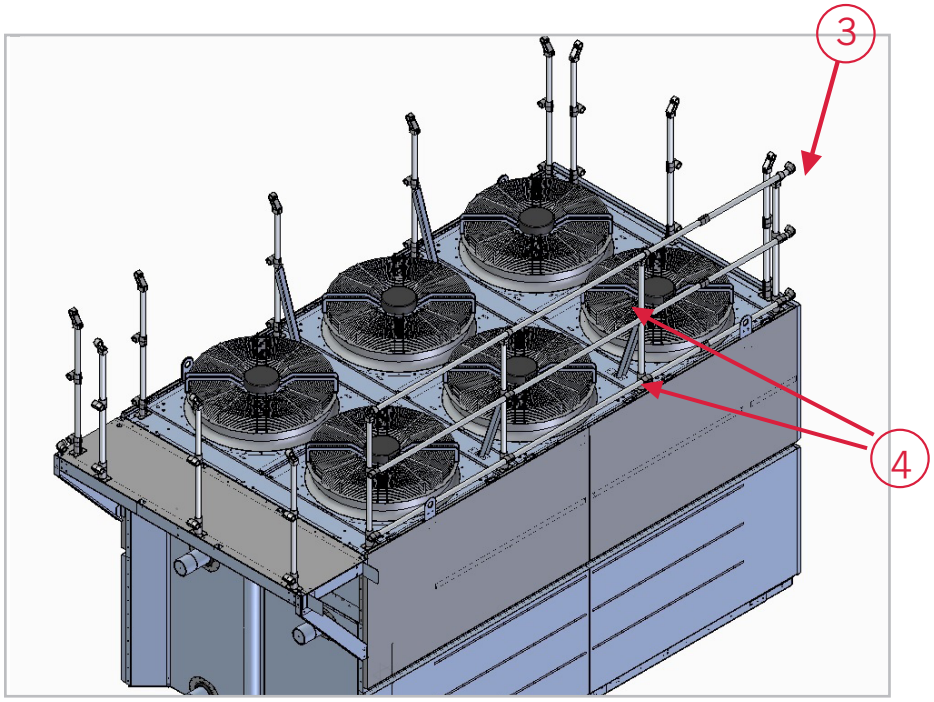


Image 21: General assembly of the guardrail columns

5º Step:
Insert the 2 Tubes (6) on the opposite side. And also the tube (5) on the side of the ECOSS G3 as shown in the drawing. But do not screw them in yet.

NOTE: The length of the tubes may vary depending on the model of the equipment. Therefore, it may have to be carried out in two stages as shown in the images.

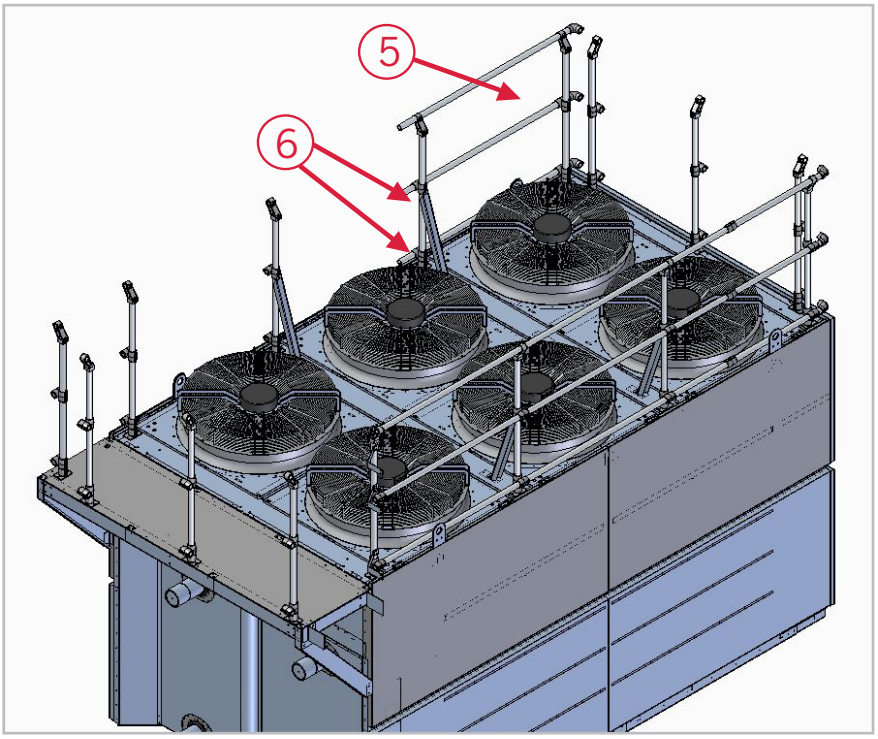


Image 22: Guardrail lateral tubes

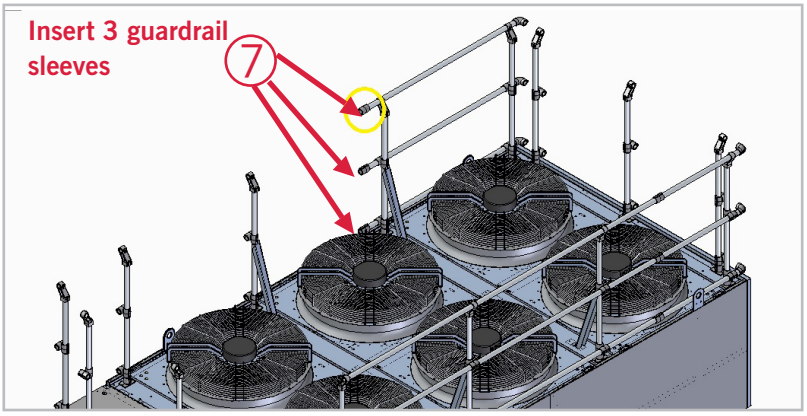


Image 23: Guardrail sleeves

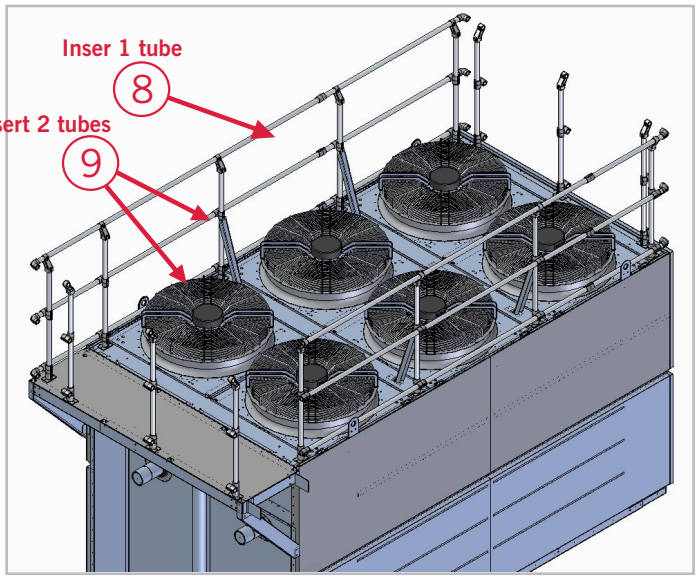


Image 24: Guardrail lateral tubes

6º Step:
In the position opposite the collectors, insert the 2 tubes (11) and the tube (10) on the rear part of the ECOSS G3 as shown in the drawing. But do not screw them in yet.

NOTE: The length of the tubes may vary depending on the model of the equipment.

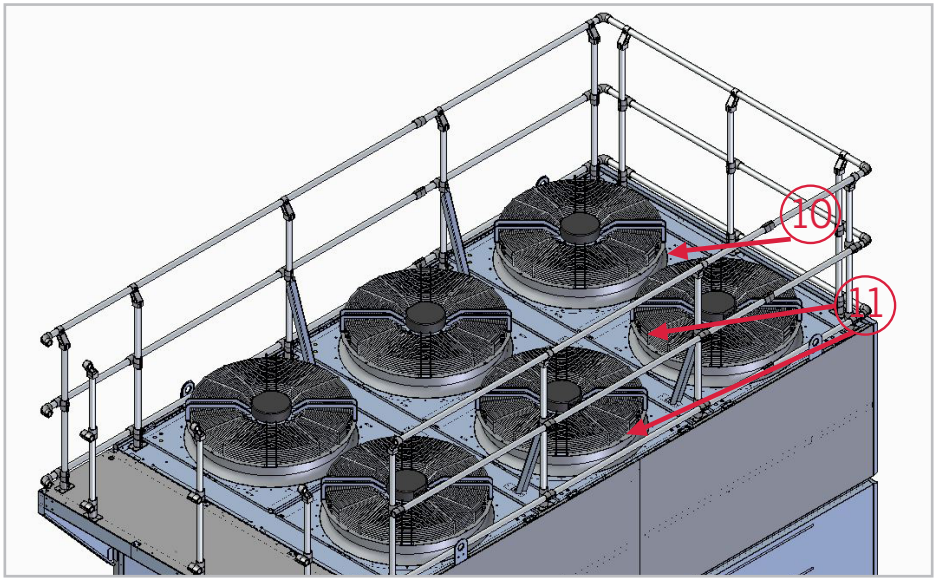


Image 25: Rear tubes of the guardrail

7º Step:
Attach the reinforcements of the guardrail. The holes for insertion of the reinforcements are factory-made and are located in the spaces between the fans as shown in the image.

8º Step:

In the position immediately above the collectors, insert the 2 tubes (13) and the tube (14) on the front part of the ECOSS G3 as shown in the drawing. But do not screw them in yet.

NOTE: The length of the tubes may vary depending on the model of the equipment.

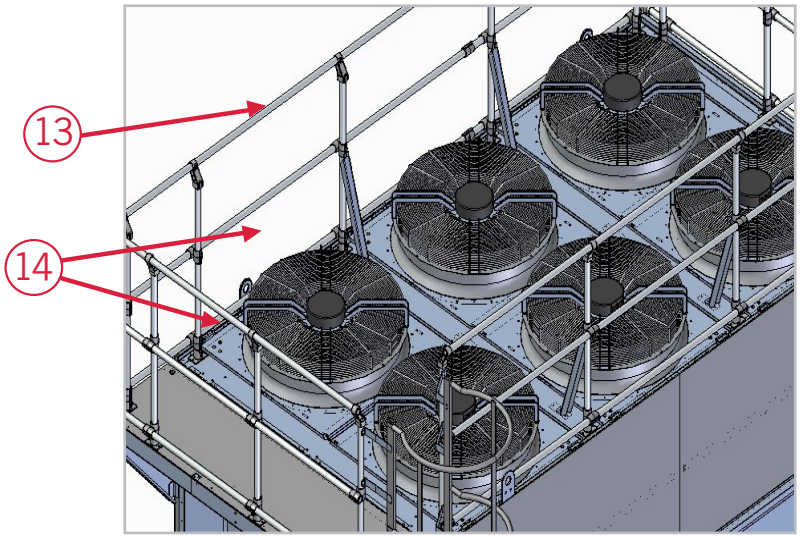


Image 26: Guardrai front tubesl

9º Step:

After the assembly of the guardrail structure according to the instructions above. Place all the screws that had already been pre-attached from the factory. With an Allen key No. 4.

9.2 Table of Components

ECOSS G3 0608 (2 Fans)			
No.	Description	Qty.	Comp. (mm)
1	Guardrail support base	11	-
2	Column	11	1031
3	Right lateral horizontal tube 1	1	2500
4	Right lateral horizontal tube 2	2	2575
5	Left lateral horizontal tube 1	1	3182
6	Left lateral horizontal tube 2	2	3265
7	Guardrail joint sleeve	-	-
8	Left lateral horizontal tube 3	-	-
9	Left lateral horizontal tube 4	-	-
10	Rear horizontal tube 1	1	1474
11	Rear horizontal tube 2	2	1557
12	Front horizontal tube 1	1	1467
13	Front horizontal tube 2	2	1539

Table 16: ECOSS G3 G_HE 0608

ECOSS G3 0808 (4 Fans)			
No.	Description	Qty.	Comp. (mm)
1	Guardrail support base	13	-
2	Column	13	1031
3	Right lateral horizontal tube 1	1	2505
4	Right lateral horizontal tube 2	2	2577
5	Left lateral horizontal tube 1	1	3184
6	Left lateral horizontal tube 2	2	3268
7	Guardrail joint sleeve	-	-
8	Left lateral horizontal tube 3	-	-
9	Left lateral horizontal tube 4	-	-
10	Rear horizontal tube 1	1	1996
11	Rear horizontal tube 2	2	2080
12	Front horizontal tube 1	1	1989
13	Front horizontal tube 2	2	2061

Table 17: ECOSS G3 G_HE 0808

ECOSS G3 0812			
No.	Description	Qty.	Comp. (mm)
1	Guardrail support base	15	-
2	Column	15	1031
3	Right lateral horizontal tube 1	1	3698
4	Right lateral horizontal tube 2	2	3770
5	Left lateral horizontal tube 1	1	4419
6	Left lateral horizontal tube 2	2	4461
7	Guardrail joint sleeve	-	-
8	Left lateral horizontal tube 3	-	-
9	Left lateral horizontal tube 4	-	-
10	Rear horizontal tube 1	1	1996
11	Rear horizontal tube 2	2	2080
12	Front horizontal tube 1	1	1989
13	Front horizontal tube 2	2	2061

Table 18: ECOSS G3 G_HE 0812

ECOSS G3 0818			
No.	Description	Qty.	Comp. (mm)
1	Guardrail support base	17	-
2	Column	17	1031
3	Right lateral horizontal tube 1	1	5525
4	Right lateral horizontal tube 2	2	5597
5	Left lateral horizontal tube 1	1	3103
6	Left lateral horizontal tube 2	2	3145
7	Guardrail joint sleeve	3	-
8	Left lateral horizontal tube 3	1	3101
9	Left lateral horizontal tube 4	2	3143
10	Rear horizontal tube 1	1	1996
11	Rear horizontal tube 2	2	2080
12	Front horizontal tube 1	1	1989
13	Front horizontal tube 2	2	2061

Table 19: ECOSS G3 G_HE 0818

ECOSS G3 0836			
No.	Description	Qty.	Comp. (mm)
1	Guardrail support base	25	-
2	Column	25	1031
3	Right lateral horizontal tube 1	3	3710
4	Right lateral horizontal tube 2	6	3745
5	Left lateral horizontal tube 1	1	5900
6	Lateral horizontal tube. Left 2	2	5950
7	Guardrail joint sleeve	9	-
8	Lateral horizontal tube 5	1	5900
9	Lateral horizontal tube 6	2	5950
10	Rear horizontal tube 1	1	1995
11	Rear horizontal tube 2	2	2100
12	Guardrail reinforcements	14	0
13	Front horizontal tube 1	1	1995
14	Front horizontal tube 2	2	2080

Table 20: ECOSS G3 G_HE 0836 -12

9.3 Drawings

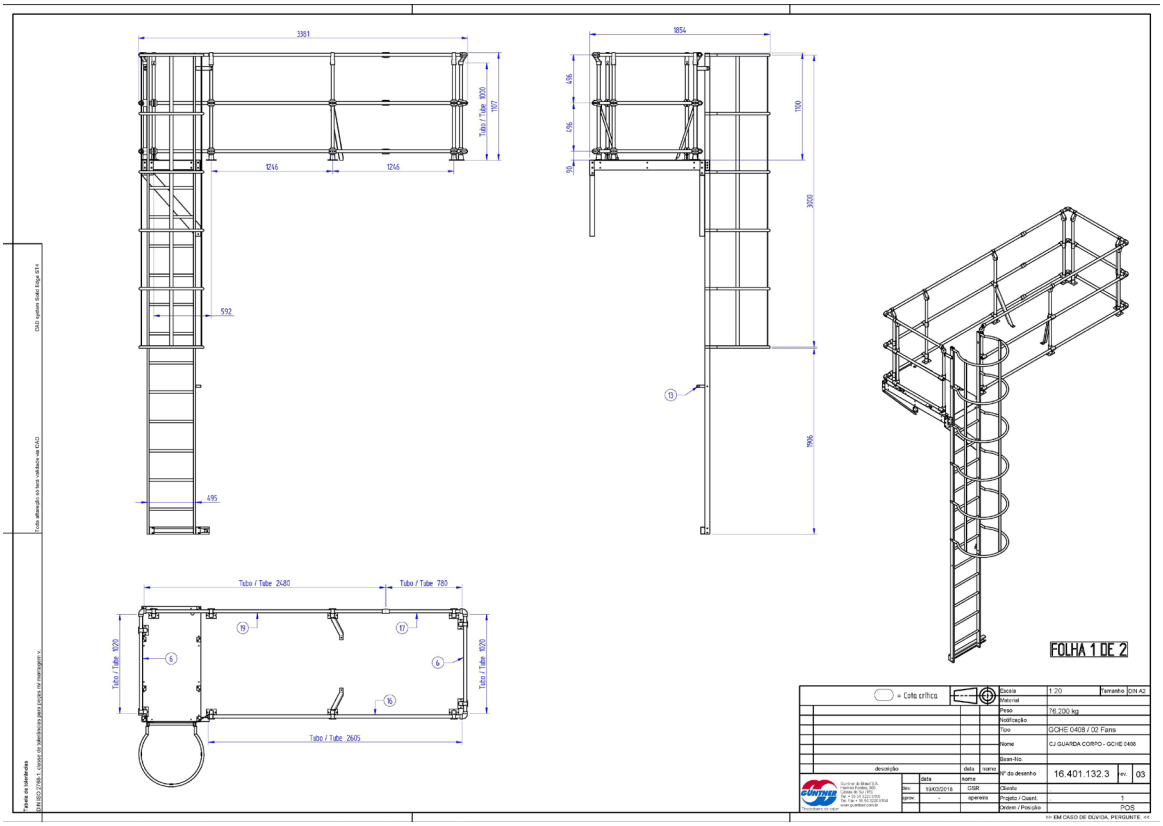


Image 27: G_HE_0408-8 and 0408-12

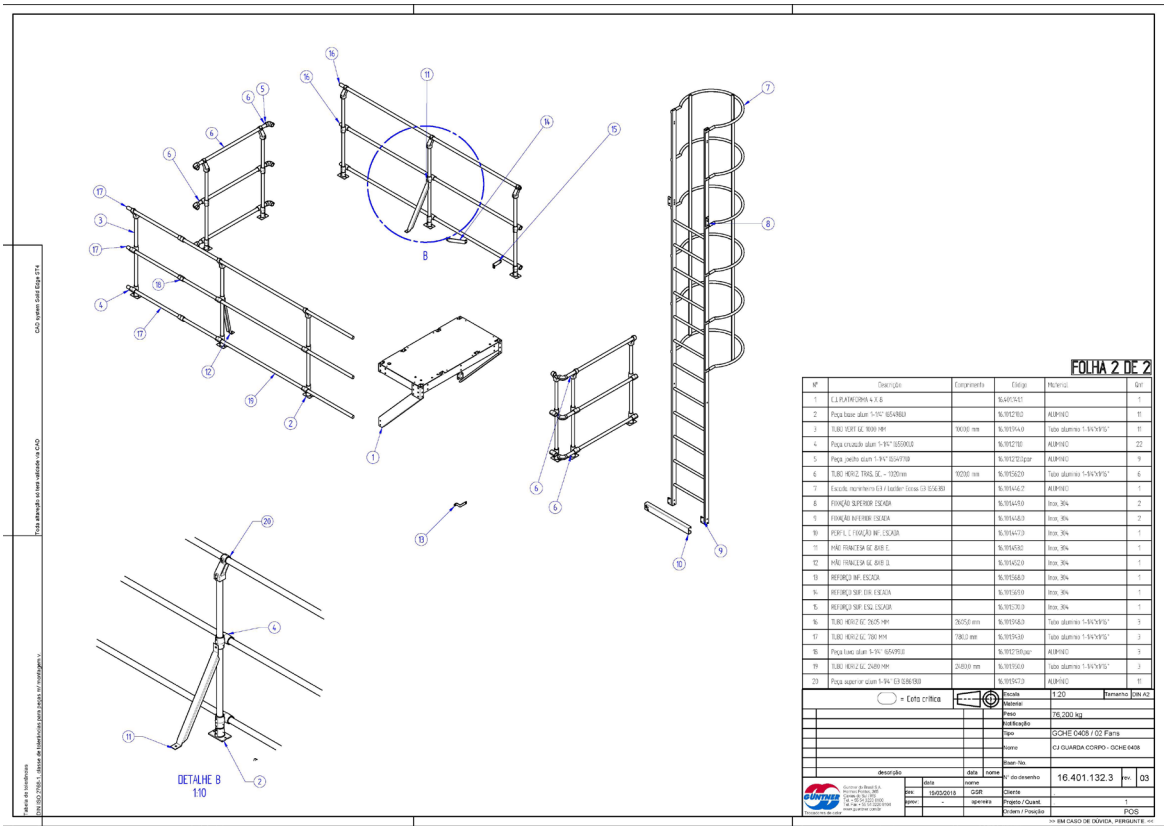


Image 28: G_HE_0408-8 and 0408-12

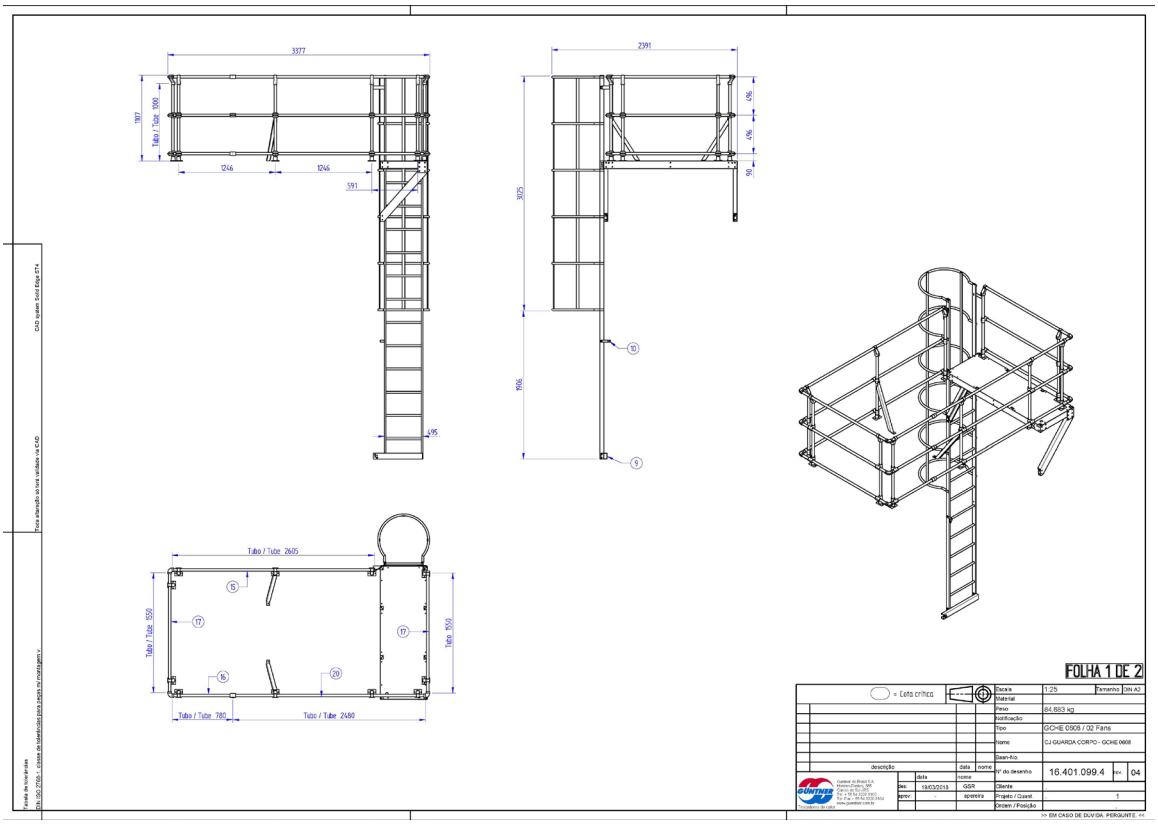


Image 29: G_HE_0608-8 and 0608-12

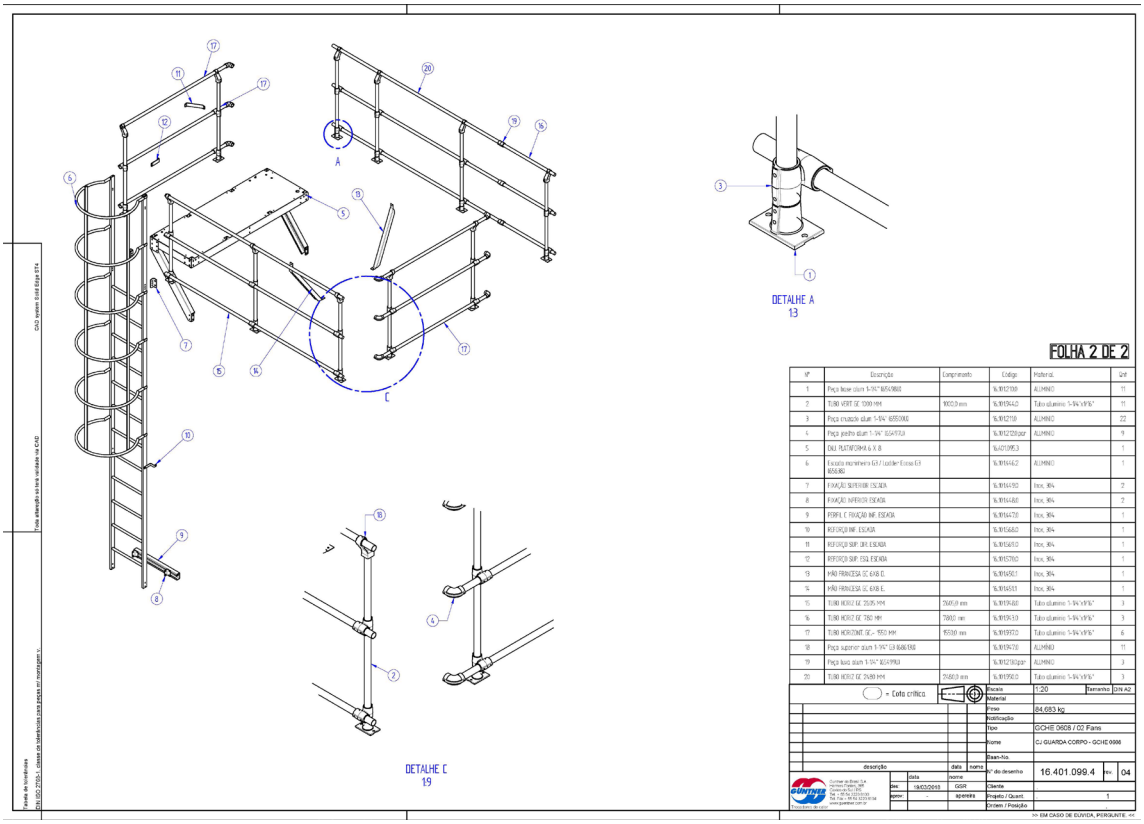


Image 30: G_HE_0608-8 and 0608-12

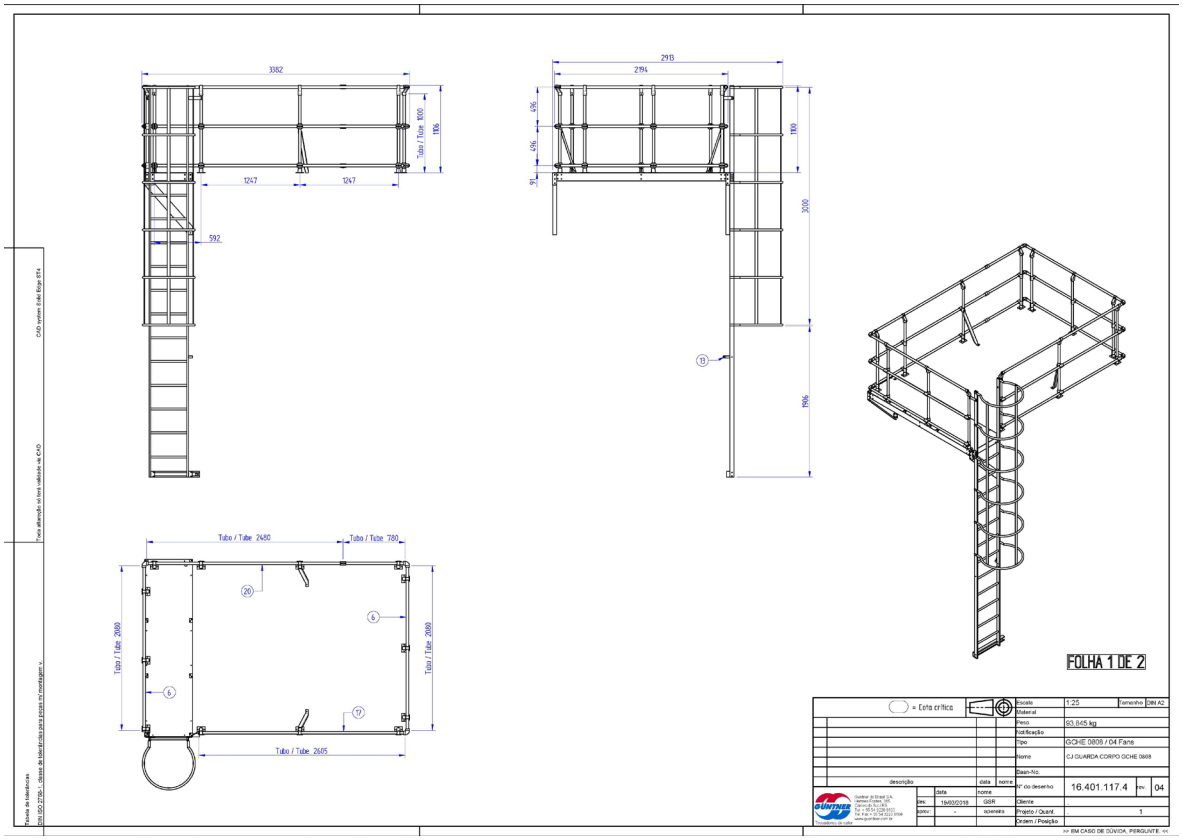


Image 31: G_HE_0808-8 and 0808-12

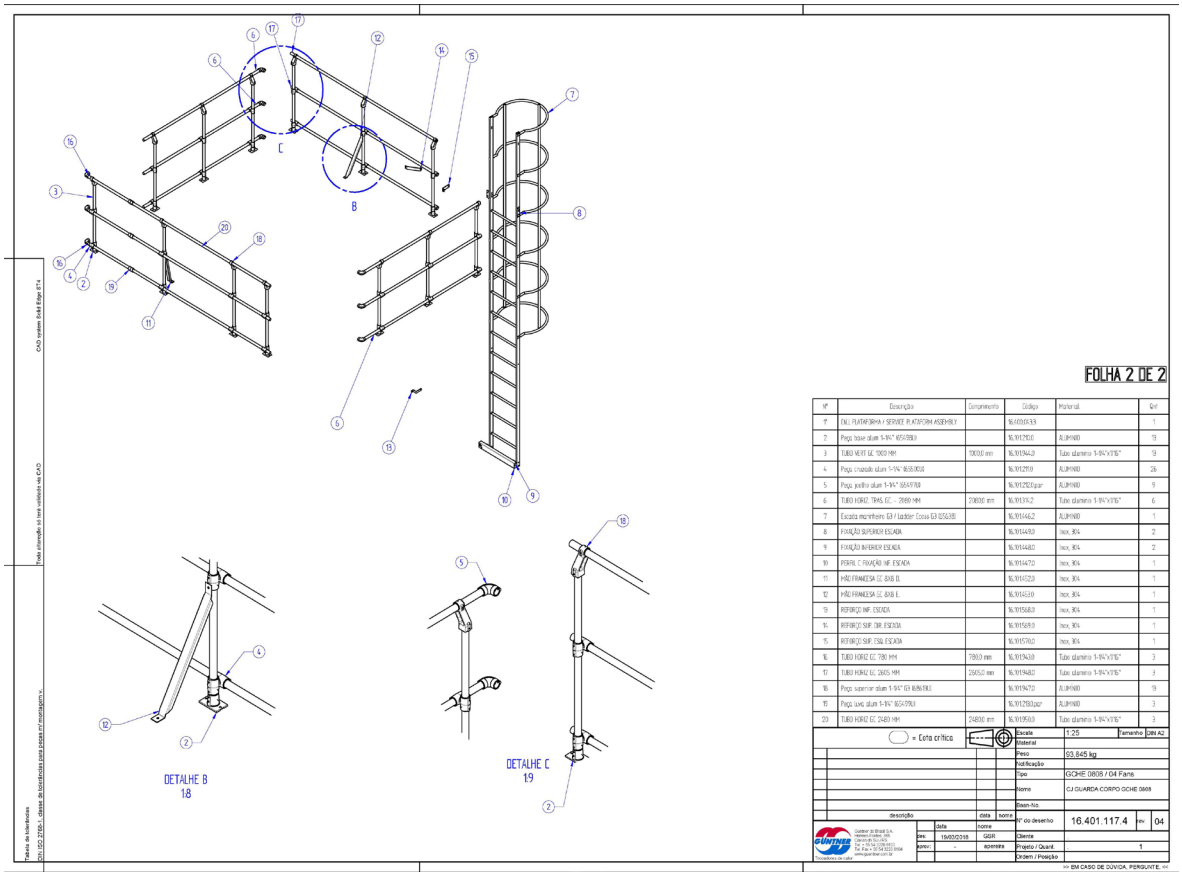


Image 32: G_HE_0808-8 and 0808-12

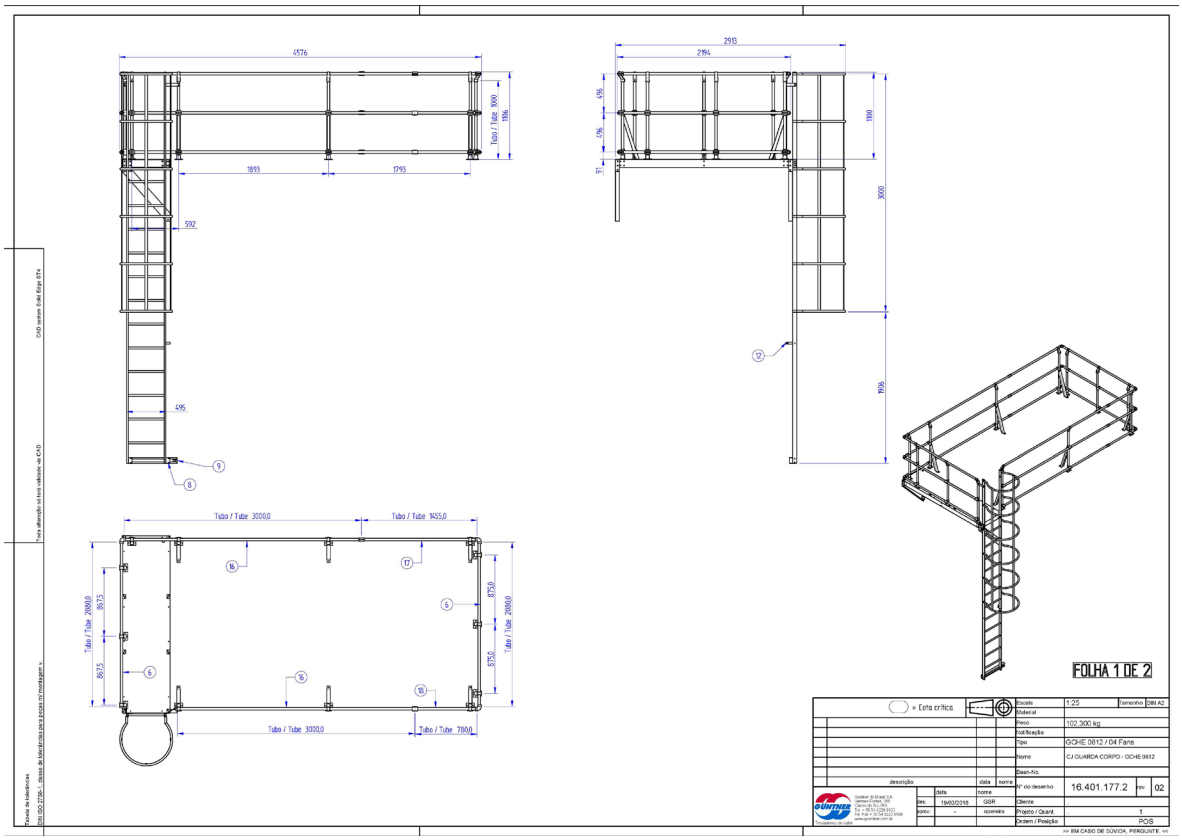


Image 33: G_HE_0812-8 and 0812-12

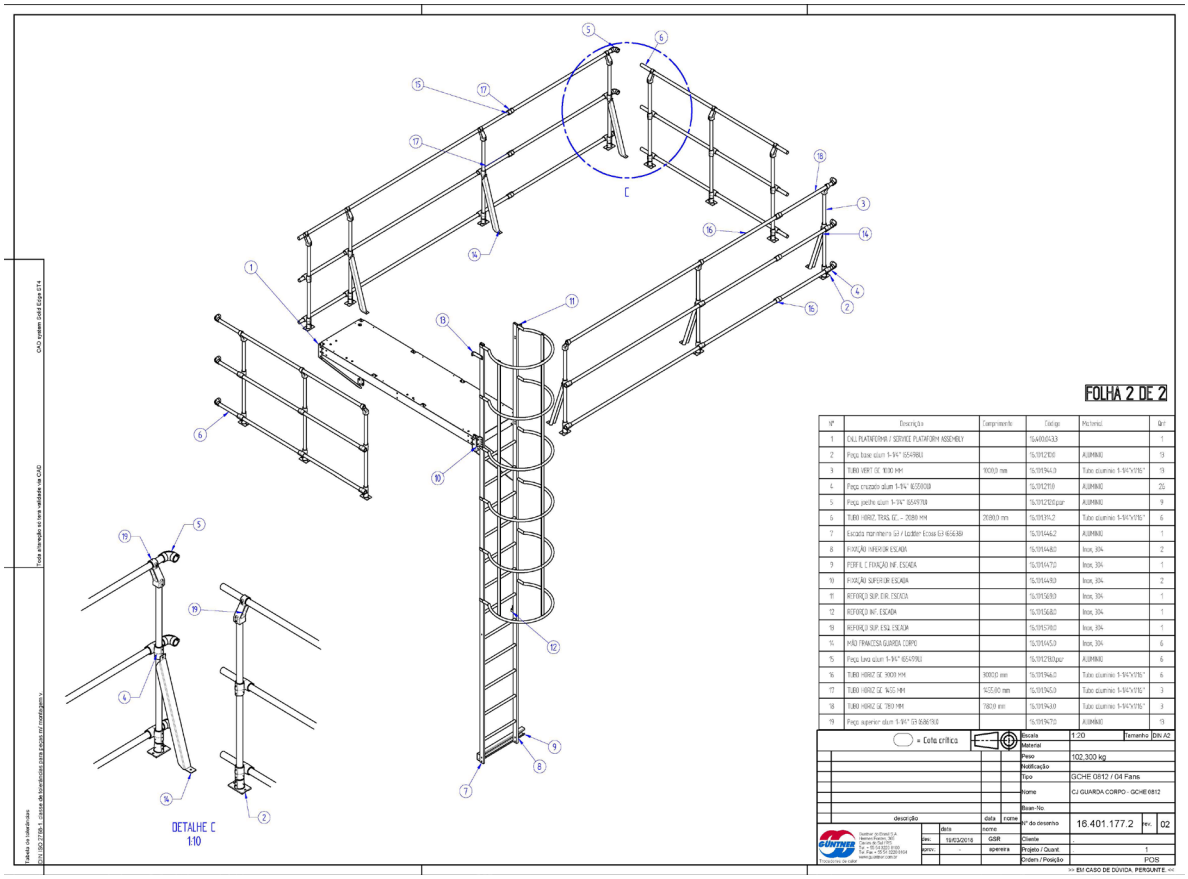


Image 34: G_HE_0812-8 and 0812-12

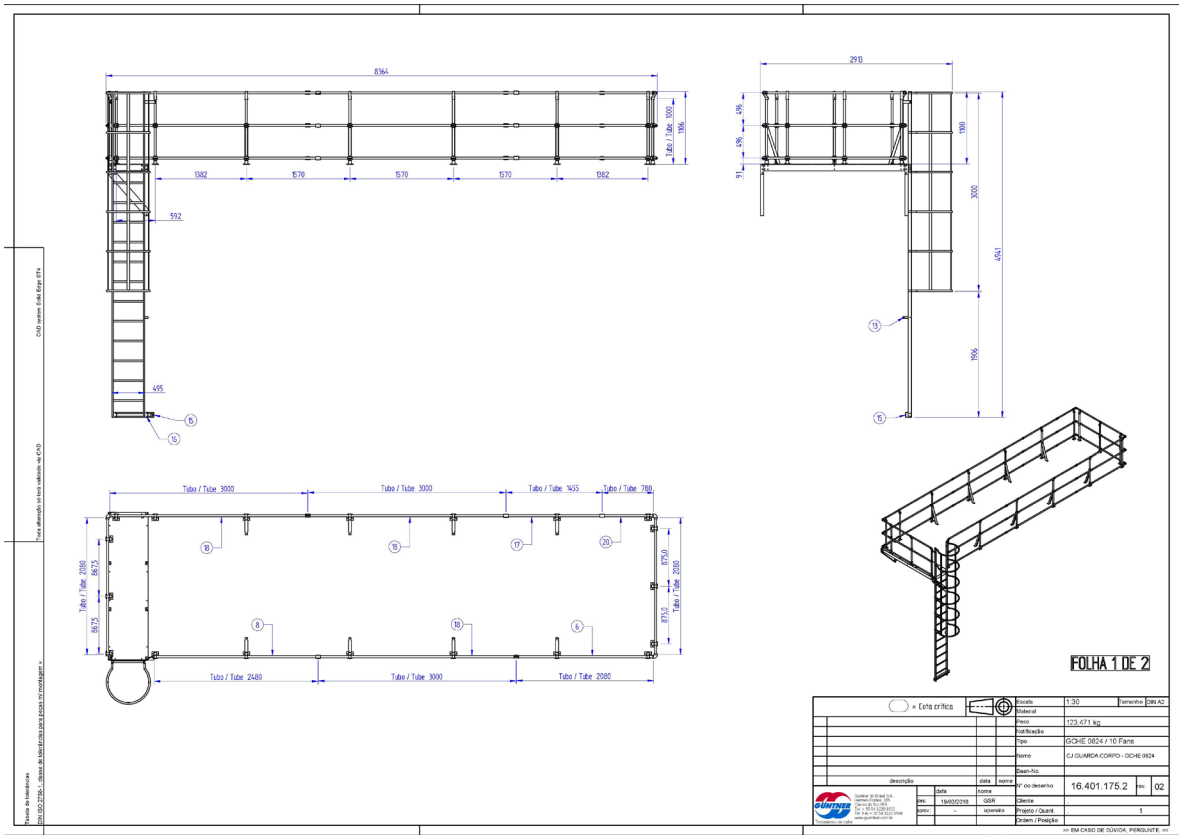


Image 35: G_HE_0824-8 and 0824-12

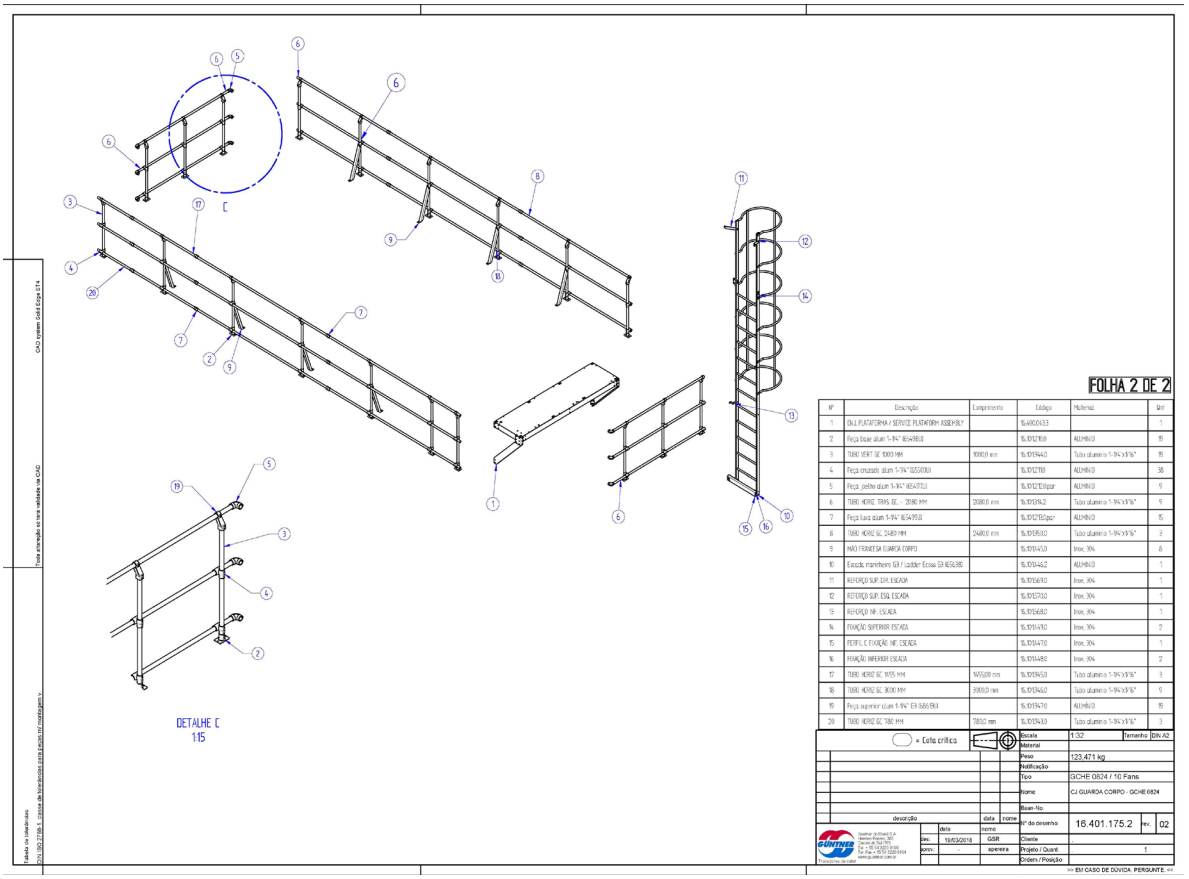


Image 36: G_HE_0824-8 and 0824-12

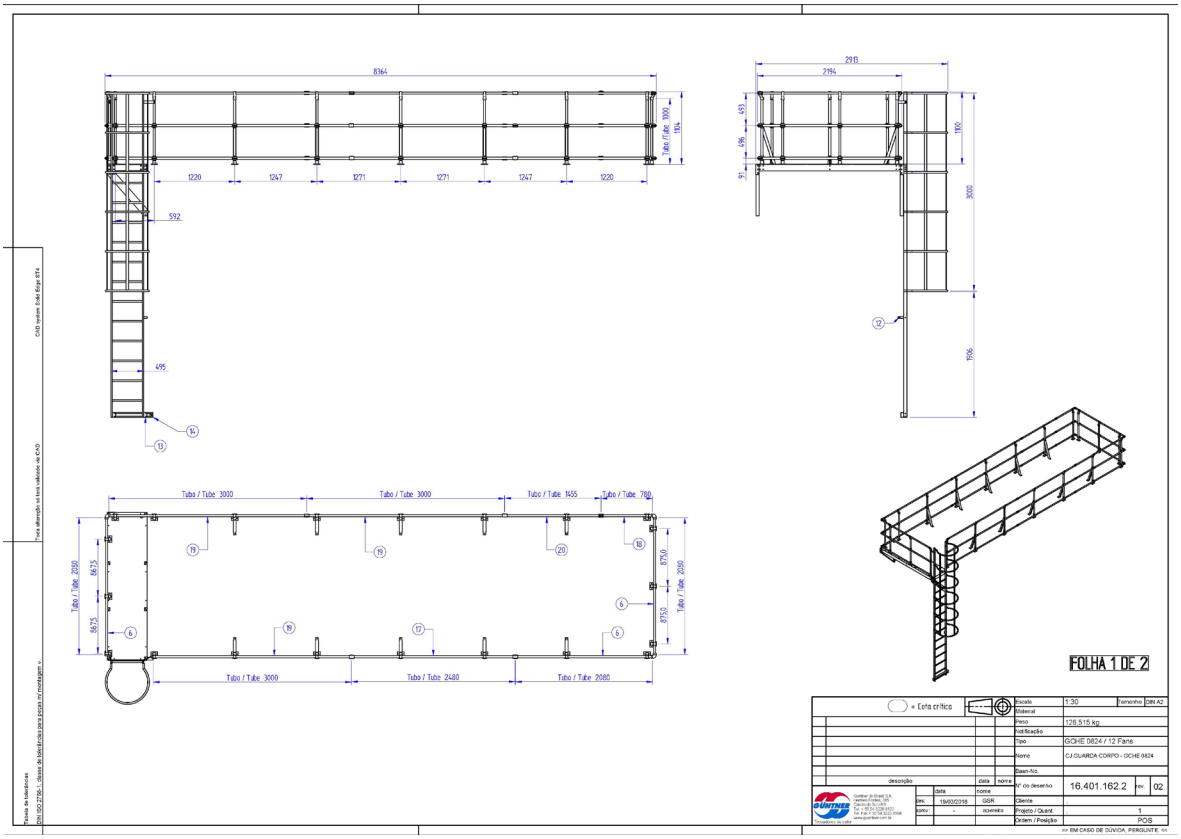


Image 37: G_HE_0824-8 and 0824-12

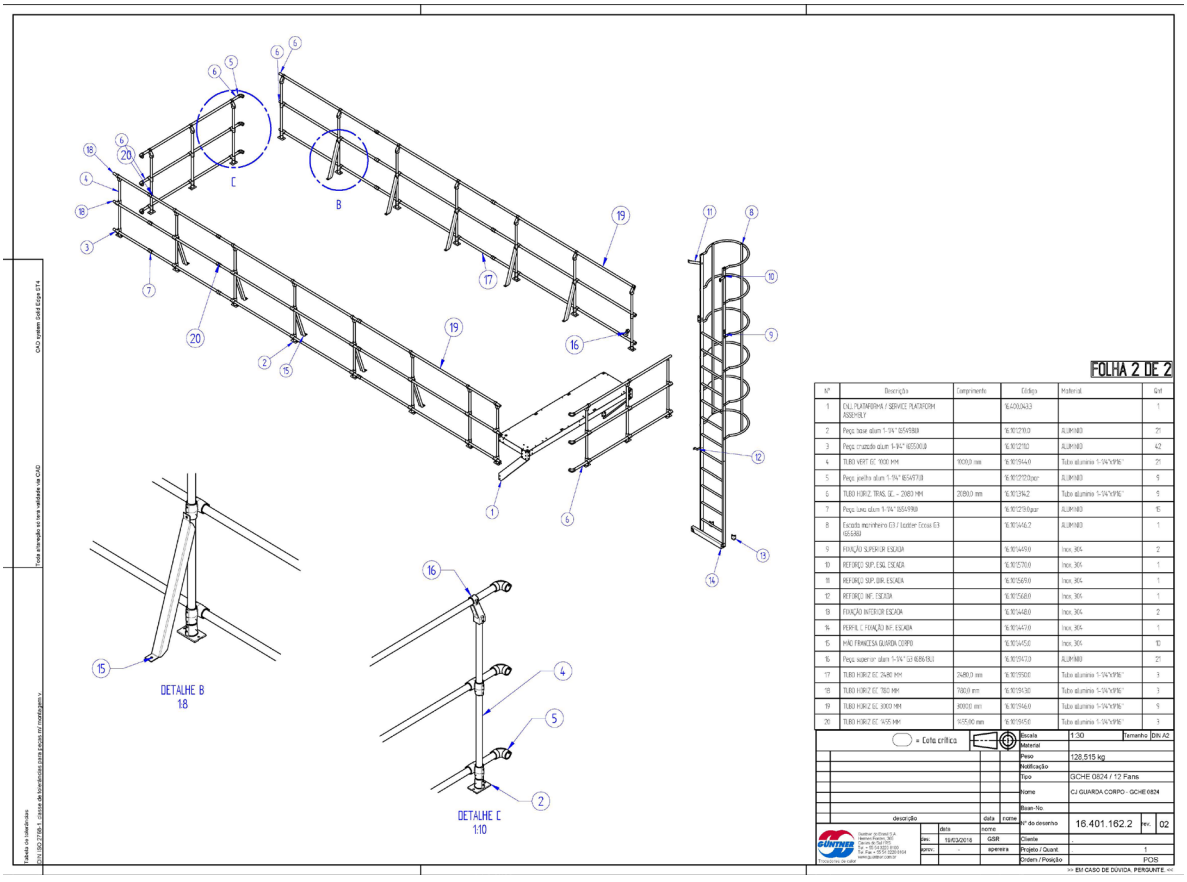


Image 38: G_HE_0824-8 and 0824-12

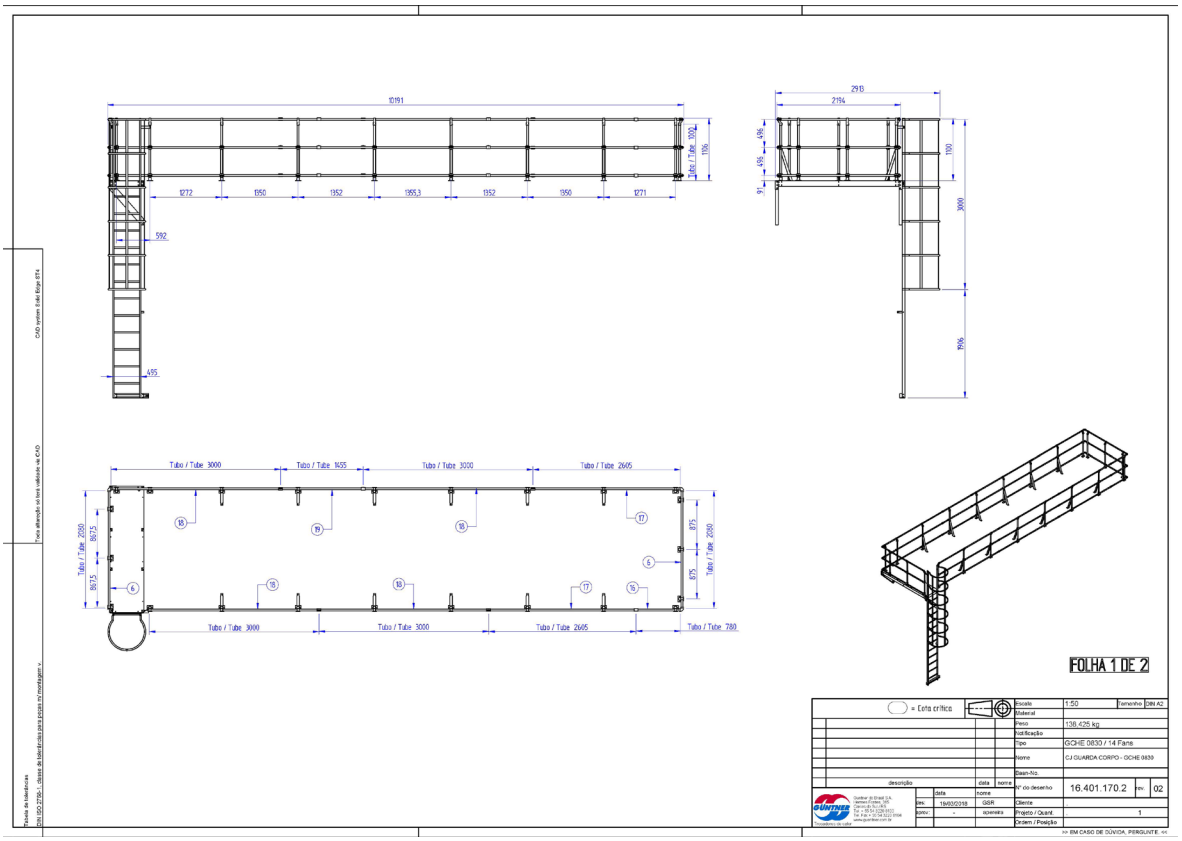


Image 39: G_HE_0830-8 and 0830-12

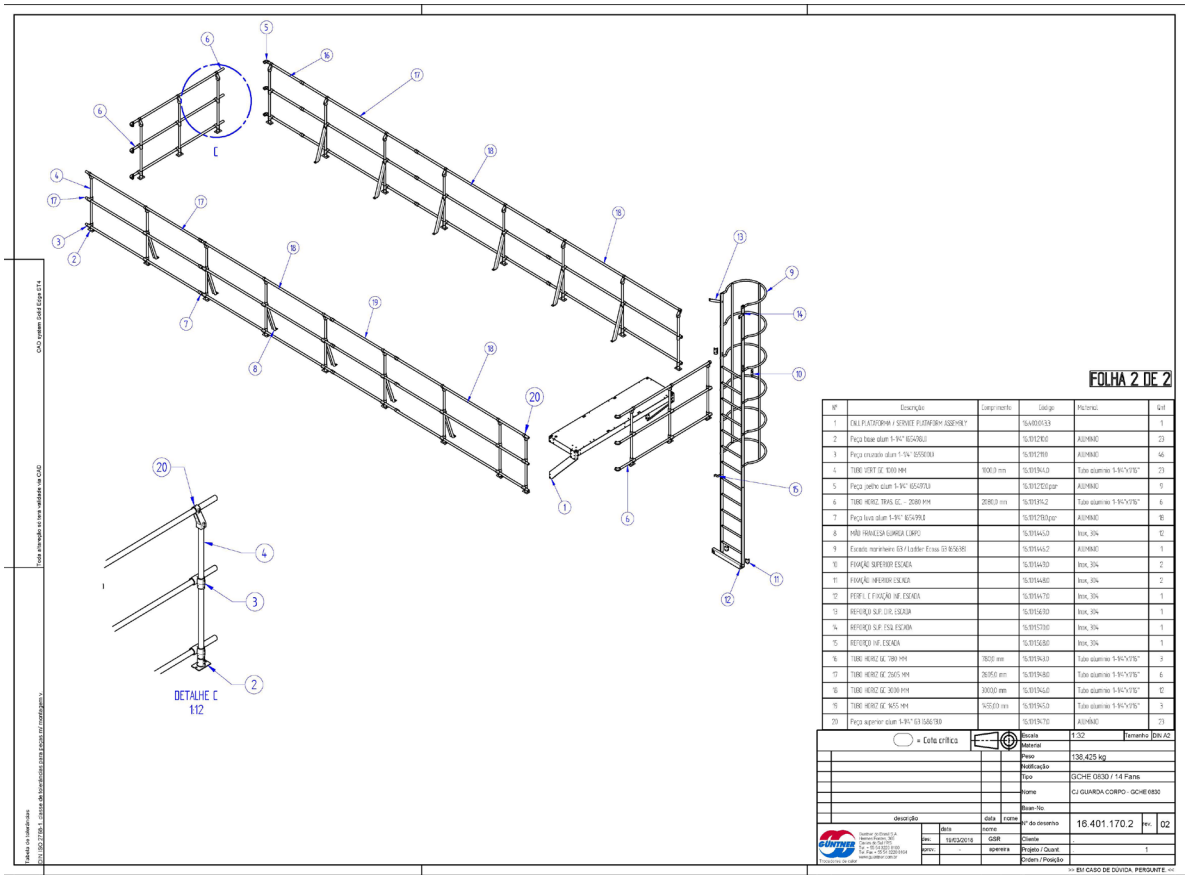


Image 40: G_HE_0830-8 and 0830-12

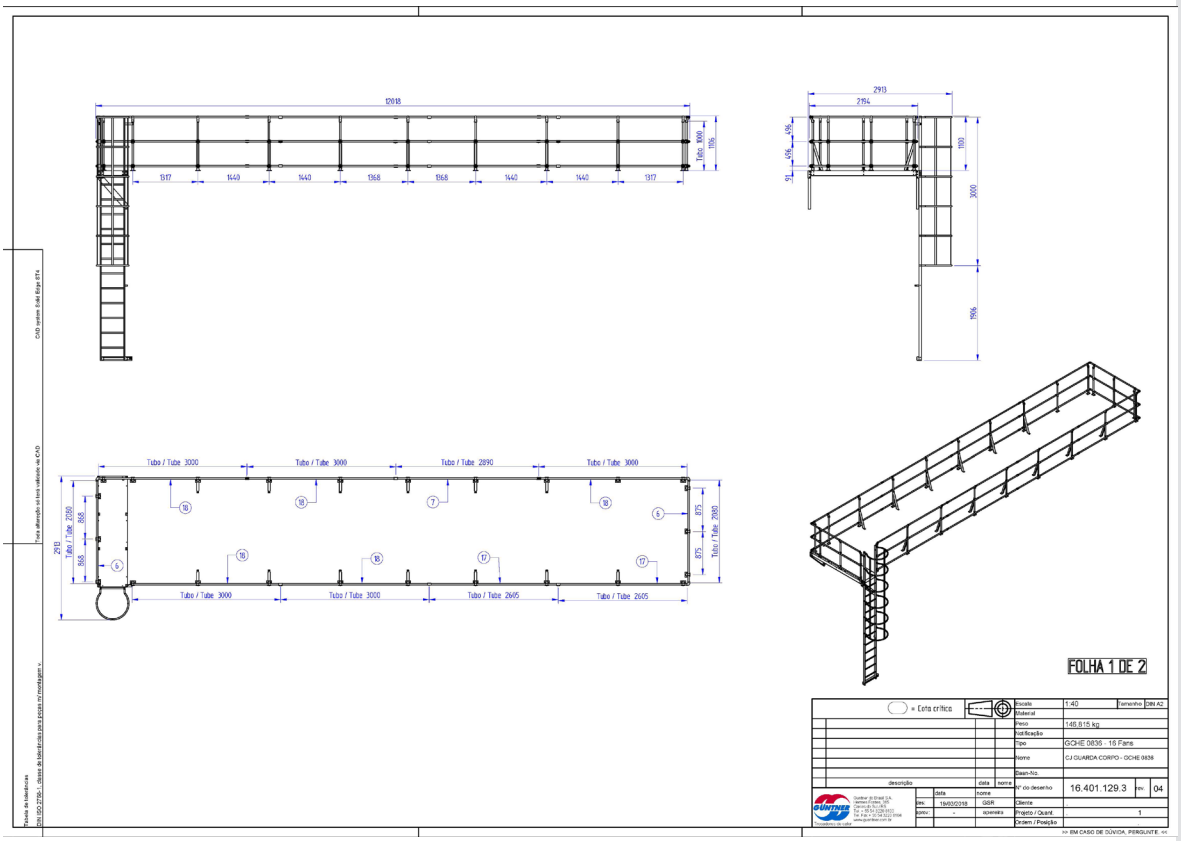


Image 41: G_HE_0836-8 and 0836-12

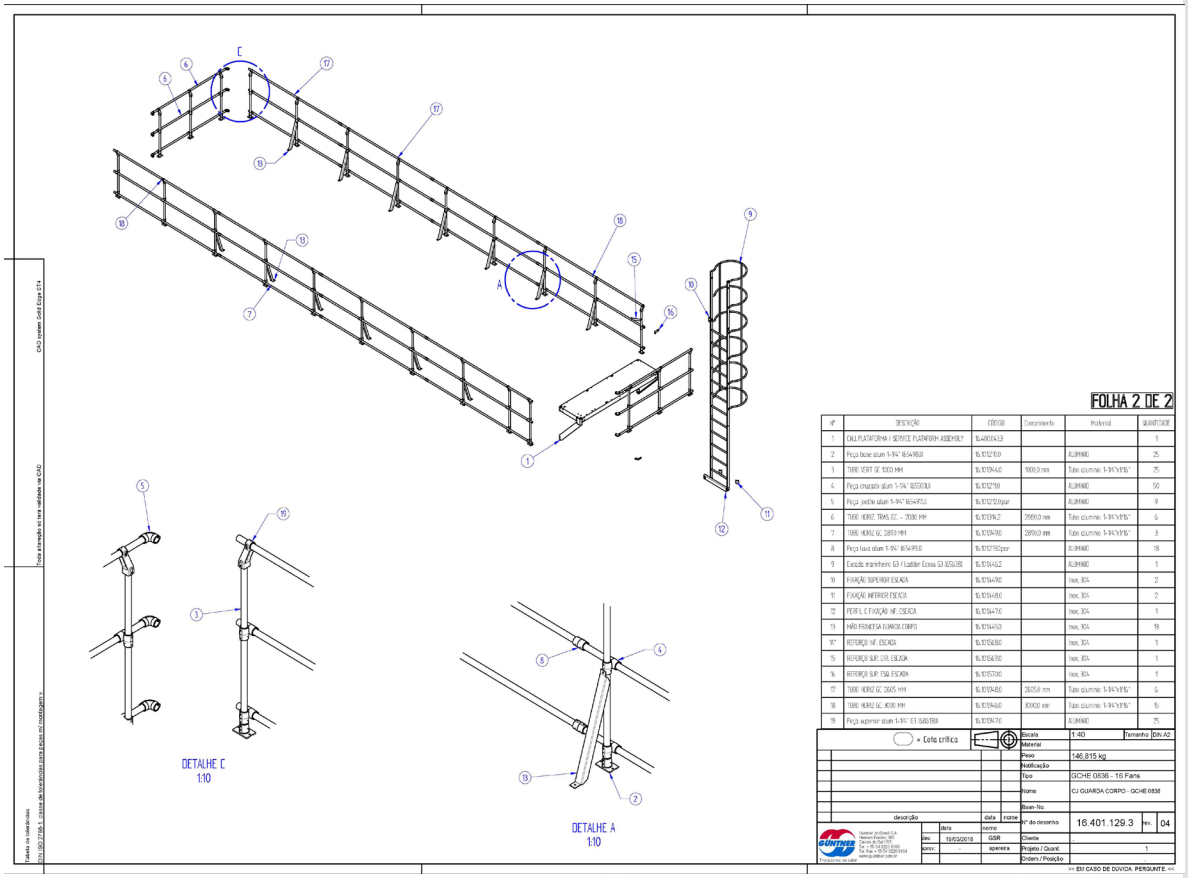


Image 42: G_HE_0836-8 and 0836-12

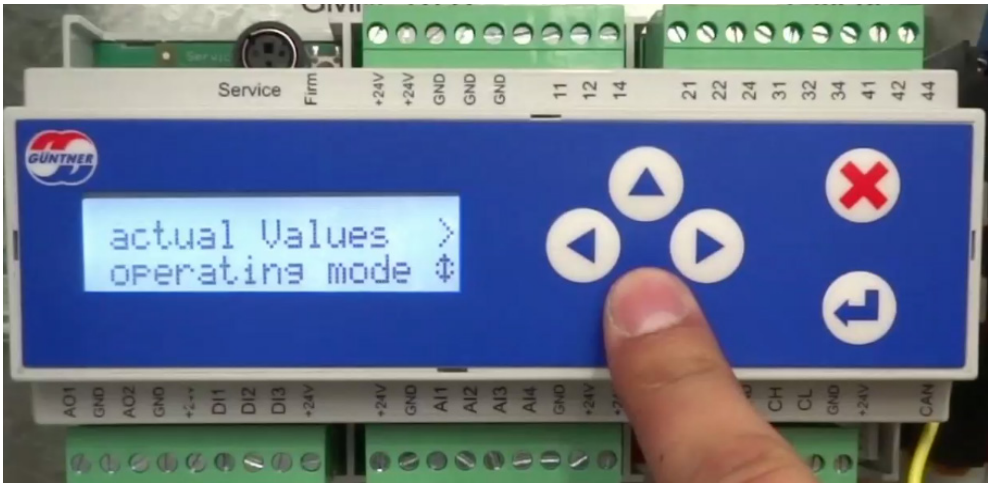
Evaporative Condenser /
Fluid Cooler

GMM Controller

10.1 Setting the Setpoint of the GMM

1) Press the down arrow key, as indicated in the image below.

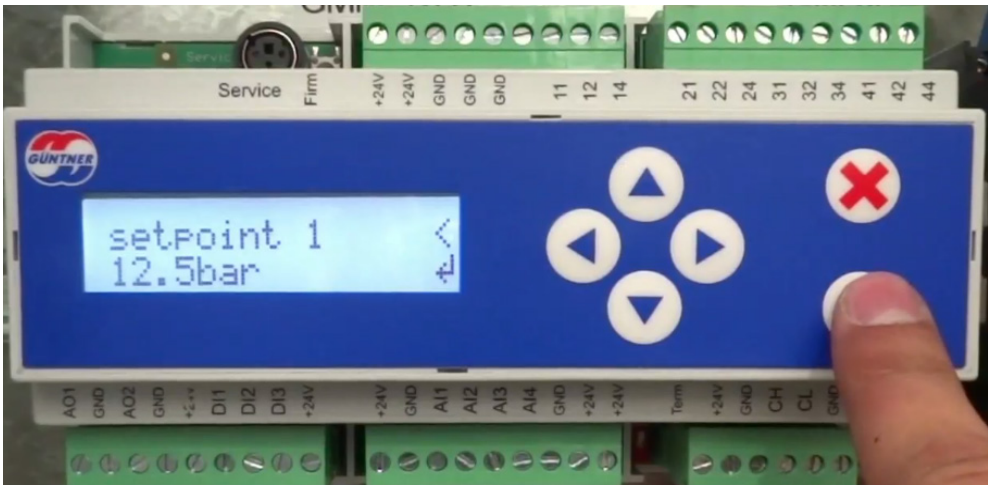
2) After being directed to the menu, look for the setpoint menu.



3) After finding the setpoint menu, press the right key.

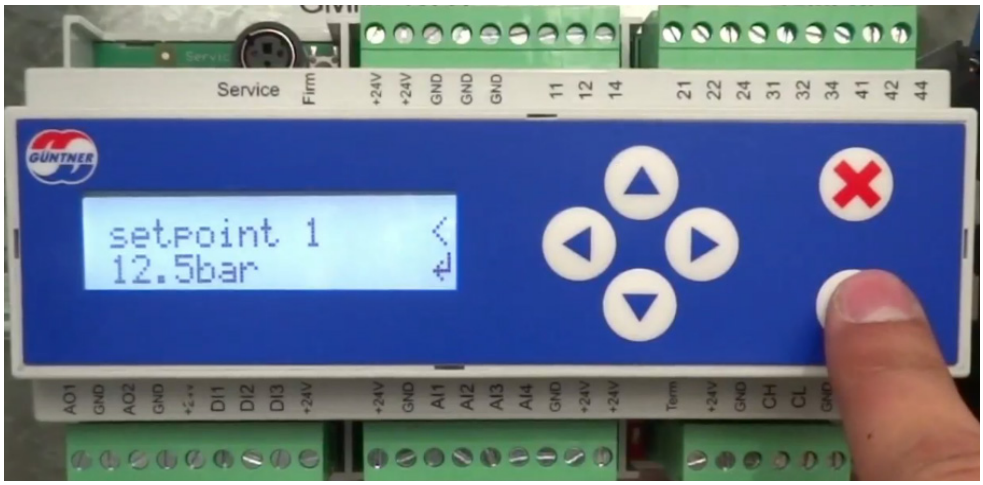
4) After being directed to the setpoint submenu. Then press the right arrow key again to change the setpoint 1.

5) Press the “Enter” key to change the setpoint to the desired value. This way the setting of the desired value is enabled.



6) The setpoint value will start to blink. Then select the desired value using the directional arrow keys.

7) Press “Enter” again after setting the desired value. And press the “X” key to return to the Status menu.



10.2 GMM Parameterization

1) Delivery Settings

1A) Press the down arrow key, as indicated in the image below.

2) Language settings

2A) Press “Enter”

2B) Select the language and press “Enter”.

3) Date settings

3A) Press “Enter”

3B) Select the date and press “Enter”

4) Time and fans

4A) Select the time and press “Enter”.

4B) Press “Enter” to inform the number of fans connected in the GMM.

5) Number of fans

5A) Select the number of fans and press “Enter”.

5B) Wait for the reading of the fans.

5C) The image above will appear if all the fans are found and then press “Enter”

5D) Press “Enter” again to inform the ID of the fans

6) Fans ID

6A) Enter with ID “9999” and press “Enter

6B) Press “Enter” again

6C) Press “Enter”

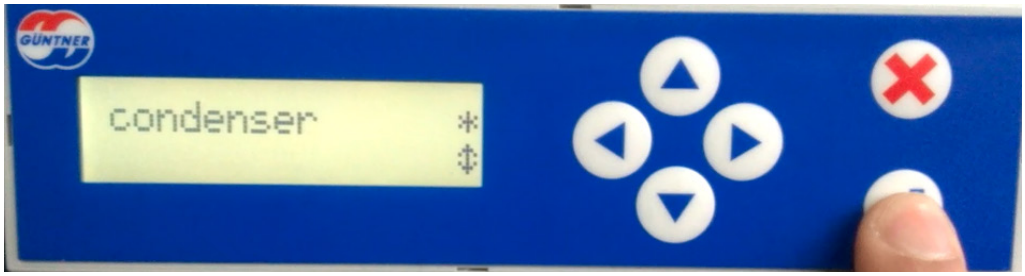
6D) Select the maximum speed and press “Enter”

7) Type of heat exchanger

7A) If the maximum speed is selected press “Enter”

7B) Press “Enter” to select the type of heat exchanger

7C) Select the type of heat exchanger and press “Enter”



7D) Press “Enter” again.

8) System Control

8A) Press "Enter" to select the control by temperature or pressure

8B) For control by pressure select “Bar”, for temperature select the refrigerant

8C) Press “Enter” again

8D) Press “Enter” to inform the mode of operation

9) Mode of operation

9A) Select the mode of operation and press “Enter”.

9B) Wait for the parameterization.

10) System parameterization

10A) “Startup” completed press “Enter”

10B) Wait for system to boot.

11) System parameterization

1) Select the mode of operation and press “Enter”

2) Setpoint and actual value information

12) Setting of minimum RPM

12A) In the Main Menu, press the down arrow key.

12B) After accessing the Menu, search for the “Service” Submenu using the up arrow key

12C) After finding the “Service” submenu, press the right arrow.

12D) Through the GMM keys, insert the password “3795” and press “Enter”

12E) In the Service Submenu, press the right key to access the “Control param” item

12F) In the “Control Param.” Item, use the directional arrows to search for the “Ctrl. function. Exp.: Base”.

12G) Access the function by pressing the right key.

12H) In the “Ctrl. Exp.: Base” function, press Enter to enable the definition of a new value.

12I) In the Service Submenu, press the right key to access the “Control param” item

12J) Through the directional arrow keys, define the value of 10% and press the “Enter” key to confirm the change. Then press the “X” key to return to the Main Menu

Evaporative Condenser /
Fluid Cooler

Maintenance

11.1 Safety

11.1.1 Before starting maintenance

- Danger of injury and damage to property with the release of the working fluid (see Residual hazards with working fluid).
- Carry out maintenance work – especially after completely removing the working fluid from the unit!
- Carry out the following safety action before starting the maintenance work: Drain the equipment and carry out vacuum for 24 hours.

DANGER

ATTENTION

11.1.2 Every maintenance works

Danger of injury and damage to property with the escape of ammonia liquid refrigerant!
The release of the working fluid may cause the following hazard and injury situations with leaks in the equipment: Warning against the risk of explosion and substances with risk of fire! Oil residues transported unintentionally and NH_3 transported unintentionally cause burns.

DANGER

ATTENTION

- Check for working fluid and/or oil transported unintentionally;
- Keep the area of risk free from direct and indirect ignition sources;
- Before releasing for maintenance, obtain the necessary approvals for work that may involve sources of ignition (for example, grinding, welding, etc);
- With the execution of works involving sources of ignition (for example, grinding, welding, etc.) keep at hand suitable firefighting equipment that comply with the effective standard requirements;
- Some working fluids present are corrosive. Contact with the skin, mucosal membranes and eyes may cause burns;
- Use eye protection!
- Use hand protection!
- Warning against toxic and hazardous substances! Ammonia (NH_3) is poisonous;

DANGER

- Use respiratory protection;
- Check to see if the unit in question is free of pressure before starting the maintenance work or if the working fluid was completely removed from the unit.
- Shut down the electric system and protect it from unintentional restart;
- With the articulated fans and articulated side panels, you will have easy access to the coils of the equipment, the motors of the fans and the connections;
- With the work on admission and outlet sources of fans, objects may be left in the fans and, therefore, cause failures and damages to the components;
- Shut down the fans before starting the maintenance work and protect it against restarting;
- After completing the work, do not allow any object to enter the sources of admission and outlet of the fans.

11.1.3 After every maintenance works

Carry out the following safety actions after completion of maintenance:

- Check to see if the switching and activation devices, measuring and display devices and the safety devices are working correctly;
- Check to see if the working fluid connections are working;
- Check to see if the fans and articulated side covers were attached in their original positions and protected against unintentional or unauthorized opening;
- Check the identification of the piping and make sure that they are visible and legible;
- Check if the electrical connections (fans and pumps) are working;
- Conduct a visual acceptance test;
- Conduct a pressure test and leak proof test.

11.2 Maintenance Procedures

11.2.1 Filter and tray

- The water tray should be inspected regularly;
- All sediments accumulated on the tray and in the filters have to be removed frequently;
- The water tray should be drained, cleaned and rinsed with clean water regularly to the remove the salts and sediments that normally accumulate on the container and below the surface of the heat exchanger during operation of the equipment;
- When rinsing the tray, the filters should be kept in the correct position to prevent the sediments from re-entering the system of the unit;
- After rinsing the container, the filters have to be removed, cleaned and replaced before the container can be tested with clean water.

WARNING

In case a cleaning agent is used, the operator should ensure that the cleaning agent is environmentally friendly. Substances hazardous to the environment are not indicated.
Only use cleaning agents authorized by the technical team of Güntner Brazil!

11.2.2 Operating and feed water level

- Regularly check the water level for the ideal operation of the unit;
- Observe that the feed valve is working properly;
- Check for the existences of leaks in the valves and replace these when necessary;
- Check to see if the level float can move freely and if the level float closes the valves when necessary;
- Ensure that the purge drain and bleeder are free and suitable for water drainage;
- The minimum operating pressure of the float is 1 bar. Its working range is between 1 and 3 bar.

11.2.3 Drip eliminators (drag)

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

- With the fans and pumps in operation, visually check the areas with the drip eliminators to check for obstructions, damages, cleanliness, correct insertion, scales, etc.;
- In case maintenance is required, shut down the fans and the water pumps;
- Remove the debris, dirt and obstructions from the drip eliminators;
- If necessary, replace the damaged or inefficient eliminators;
- Reinstall the eliminators and check to see if the assembly was performed properly, not allowing empty spaces between the parts and closings.
- During the maintenance work, DO NOT STEP DIRECTLY ON THE ELIMINATORS.

WARNING

OBSERVE THE CORRECT POSITION OF THE DRIP ELIMINATORS ON THE SIDE.

Image 43: Drip eliminator - export

11.3 Recommended maintenance monitoring

Maintenance and Monitoring Program ECOSS Evaporative Condenser							
			Operation to be performed every period of				
Operation type	**Operation**	**Start-up**	**7 days**	**15 days**	**30 days**	**90 days**	**180 days**
Verifications and adjustments	Reading of transport, assembly, operation, maintenance manual	X					X
	Verification of the water distribution in the upper module	X		X			
	Verification of the rotation direction of the water pump	X					X
	Verification of the water level of the tray and adjustment of the water float of the equipment	X	X				
	Verification of the installation of additional accessories	X					
	Adjustment of the GMM operating parameters	X					

Table 21: Maintenance Program

Maintenance and Monitoring Program ECOSS Evaporative Condenser							
		Operation to be performed every period of					
Operation type	**Operation**	**Start-up**	**1 day**	**15 days**	**30 days**	**90 days**	**180 days**
Maintenance and Cleaning	Cleaning and sanitizing the water distribution system (sprinkler nozzles)				X		
	Cleaning and sanitizing the tray	X		X			
	Cleaning and sanitizing the side, bottom and top closings (fairings)						X
	Cleaning and sanitizing the drip eliminators				X		
	Cleaning of the equipment coils						X
	Lubricating the water pump motor(s) (according to the manual of the wa-ter pump manufacturer)			X			
	Cleaning of the cooler filters of the electrical panels			X			

Table 22: Maintenance Program

Maintenance and Monitoring Program ECOSS Evaporative Condenser							
		Operation to be performed every period of					
Operation type	**Operation**	**Start-up**	**1 day**	**15 days**	**30 days**	**90 days**	**180 days**
Inspections	Cleaning of the propellers according to the manual of the fan manufacturer				X		
	Verification of the fans: Scales, rotation direction, conditions of the grids				X		
	Verification of the scale level of the water collector tray				X		
	Verification of the closings and sealing of the electrical panels and fans	X			X		
	Verification of the retighte-ning of the electrical box(s) of the fan(s) and screws in general	X			X		

Table 23: Maintenance Program

Maintenance and Monitoring Program
ECOSS Evaporative Condenser

		Operation to be performed every period of					
Operation type	**Operation**	**Start-up**	**1 day**	**15 days**	**30 days**	**90 days**	**180 days**
Control and Monitoring	Monitoring through GMM (when applicable)			X			
	Control of the chemical treatment according to the minimum analytical parameters required for water quality	X			X		
	Water purge control	X					
	Control of the scale level of the heat exchanger coils				X		
	Control of the current of the electrical motor(s) of the water recirculation pump(s)	X					
	Control of the fan current	X					
	Monitoring of the tray water temperature	X		X			
	Monitoring of the inlet and outlet temperature of the working fluid	X		X			
	Control and registration of the recommended maintenance and monitoring program	X					
	Monitoring of the conditions of the sealing profiles of the side covers.				X		
	Monitoring of the conditions of the sealing profiles of the side covers.				X		

Table 24: Maintenance Program

11.3.1 Water distribution system – sprinkler nozzles

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

ATTENTION

- Shut down the fans;
- Remove the droplet eliminators;
- With the fans shut down and pumps in operation, visually check the water sprinkler areas with the droplet eliminators to check for obstructions, damages, cleanliness, correct insertion, scales, etc.;
- Shut down the pumps;
- Remove the sprinkler nozzles;
- Clean the dirt and debris from the water distribution;
- Make sure that the sprinkler nozzles are well cleaned and suitable for operation;
- Replace the damaged or missing nozzles;
- Install sprinkler nozzles and make sure that they are well inserted and without leaks;
- Turn on the pumps and observe the water distribution;
- Install the droplet eliminators and make sure that these are well inserted and without leaks;
- Turn on the fans.

Image 44: Installation position and water distribution of the spray nozzles

11.4 Cleaning procedures of the unit

Before starting any work on the product, shut down the power supply. Make sure the electric power cannot be turned on unintentionally.

ATTENTION

Before starting any work on the product, close all the connections that transport fluid. Make sure that there is no fluid in the equipment and that it will not return unintentionally.

ATTENTION

- The fans, side covers and access doors are articulated and removable for easy cleaning;
- The operator should ensure that the cleaning agent is environmentally friendly. Substances hazardous to the environment are not indicated;
- Only use cleaning agents authorized by the technical team of Güntner Brazil;
- The cleaning agents should be compatible with the construction materials of the equipment.

11.4.1 Casing Cleaning

To conserve the quality and durability of the Stainless Steel condenser, it is important to keep it free from contaminations from the environment; welding splashes, grinding particles, carbon steel particles and similar contaminants. When using high pressure water jet, the maximum pressure is 10 bar for the fairing at a distance of 200 mm.

Usual cleaning and conservation materials:

- Liquid scale remover
- Protective oil or liquid vaseline
- Application brush
- Sponge for removing
- Flannel for drying
- Water hose or jet wash
- PPE's for operator protection: plastic coveralls, gloves, waterproof boots, goggles and mask

Cleaning process stages

1. Regarding the fairing, apply acidic scale remover to remove the impurities. In the proportion indicated by the manufacturer, it is suggested that a spray and a clean flannel/brush should be used to distribute the solution on the surface. It is important to allow it to act for a maximum of 5 minutes before starting the next stage. Do not exceed this time in order to prevent stains.
2. Carry out cleaning of the fairing with plenty of potable water. It is recommended to use jet wash. Before moving to the next stage, make sure the stainless steel is free from contamination.
3. With the aid of clean flannels, completely dry the fairing. Application of protective oil or liquid vaseline to protect from harmful agents.

4. According to the environment where the equipment is installed, cleaning and re-passivation are recommended between the periods of 6 months to 1 year.

Cleaning of the fairing can be performed according to BT_001 Cleaning and Casing Conservation.

11.4.2 Coil Cleaning

For chemical cleaning of ECOSS Evaporative condensers, the chemical compound used is the Sulfamic Acid (CAS Number: 5329-14-6). The volume required for cleaning is between 50 to 75 kg for every 1000 liters of water of the tray (this quantity may vary according to the thickness of the scales). When using high pressure water jet, the maximum pressure is 50 bar for the coil at a distance of 200 mm.

Cleaning process stages

1. Shut down the entire system, i.e., chemical cleaning should occur without thermal load and without discharge from the compressors;
2. Keep the fans shut down during the cleaning procedure;
3. Remove clean water at minimum level in order to reduce the volume of the chemical agent and replace a sufficient volume to prevent cavitation of the water recirculation pump. Use a level below that suitable for normal operation in order to use a smaller quantity of product.
4. With the recirculation pump in operation, check to see if all the sprinkler nozzles of the condenser are completely unobstructed. Ensuring that the solution contemplates all the points of the coils to be cleaned;
5. Keep the recirculation pump in operation, and add the Sulfamic Acid powder gradually (~1 kg) up to a pH between 0.0 and 1.0. This addition should be carried out near the suction of the pump for better homogenization of the mixture;
6. Carry out pH control every hour and gradually add more product (~1 kg) whenever the pH is higher than 1;
7. Maintain this procedure up to a maximum of 16 hours of operation of recirculation of the chemical product;
8. In order to completely remove all the scales it may be necessary to use water jet at some points, because the coverage of the sprinkler nozzles is not enough. However, the removal of the scales will happen easily, and this should be carried out especially on the sides and close to the headers;
9. After completely removing the scales, shut down the water recirculation pump and remove all the dirty water from the tray;
10. Carry out complete cleaning of the tray to remove the scale that remains at the bottom of the tray;
11. Put clean water up to a minimum volume to prevent cavitation of the water recirculation pump;
12. Put the water circulation pump in operation for 1 hour for complete neutralization of the acid used;
13. Shut down the recirculation pump and remove the water used for the neutralization;
14. Check to see if the sprinkler nozzles are not obstructed, add clean water to the suitable level and turn on the equipment for normal operation;
15. In case the scale is not completely removed, the same procedure should be repeated weekly until a 100% clean coil is obtained.

For any noncompliance during the procedure, the operation should be stopped and the technical team of Güntner should be contacted for full support.
Cleaning of the coil can be carried out according to BT_014 Chemical Cleaning – Scale Removal.

11.4.3 Tray cleaning

The tray should be cleaned whenever there are solids or coloring in the water.

For this, follow the stages below.

1. Close the water inlet valve of the condenser;
2. Open the drain valve of the ECOSS;
3. Remove all the water from the tray. The remaining residues can be removed with the jet-wash;
4. Remove the suction filter of the pump, clean it with jet wash and put it back;
5. Remove the suction clamp of the pump, clean inside with the jet wash and attach it back;

After complete cleaning of the tray:

6. Close the drain;
7. Adjust the float valve and adjust the water level to the “Water level” mark;
8. After starting the condenser, check to see if the direction of the water distribution is in the direction of the middle of the tray, in V position. Close the inspection windows and release the equipment for use.

Cleaning the tray can be carried out according to o BT_010 Tray, Float, Filter and Water Distribution.

11.4.4 Sprinkler nozzles cleaning

Cleaning of the sprinkler nozzles should always be performed when dirt is observed. The sprinkler nozzles should be free from any obstruction, because they interfere in the useful life of the equipment (water distribution).

Cleaning process stages:

1. Remove the sprinkler nozzles from the equipment;
2. Use container with water and diluted neutral detergent;
3. Leave the nozzles immersed for at least 2 hours;
4. Use a bar to clean inside the nozzle;
5. Install it back in the condenser.

11.4.5 The drip eliminators cleaning

Cleaning of the droplet eliminators should be carried out after cleaning the sprinkler nozzles. Their main function is to prevent dragging water during the operation of the equipment

Cleaning process stages:

1. Removal of the droplet eliminators;
2. Washing with high pressure water jet;
3. Installation of the droplet eliminators of the equipment (observe the direction and make sure they are facing down).

11.4.6 The fans cleaning

Cleaning of the fans should be carried out to prevent failures due to corrosion or imbalance.
Cleaning should be carried out according to the instructions of the manual of the fan manufacturer.

11.4.7 Water pump cleaning

The water pump does not require maintenance.
The manual of the manufacturer is kept for consultation.

11.4.8 Coil, casing and tray cleaning in case of contamination by iron oxide (corrosion)

ATTENTION

The presence of carbon steel contaminations (residues from grinding, sanding, welding splashes, residues left by tools and abrasives, and similar) on the stainless steel surface, whatever they may be, leads to the presence of moisture, the formation of a galvanic pair, where the carbon steel residues are the anode (which corrodes rapidly) and the stainless steel itself is the cathode (which would be protected), but which at the end of the process will show stains and the adhesion of the corrosion product of carbon steel, which can generally be iron oxide or hydroxide.
These surface deposits should be removed, because in continuation of the process, under these deposits there may be a differential aeration condition, leading to the generation of crevices, which, if allied to the presence of halogen ions, especially chlorides (present in the coast line, from the ocean breeze, and through the action of winds), may cause a type of corrosion in the stainless steel called crevice corrosion, with holes located on the surface of the stainless steel.

- In case of contamination and indications of corrosion, the procedures for surface cleaning and recovery of evaporative condensers should be carried out as follows:

1. Evaluation of the adhesion and quantity of contamination present on the stainless steel surface. This adhesion can be carried out with a stylus or folding knife, taking care that the blade does not damage the surface of the stainless steel.
2. Sanding the surface with abrasive sandpaper, with granulometry that will depend on the adhesion of the contamination.
3. It is recommended to start with wet sanding, using sandpaper grain #320, and then, finer sandpaper, in sequence, #400 and #600, or even #1000, changing the sanding direction by 90 degrees when changing the sandpaper. Evidently the sandpapers should be new and cannot have abrasive particles of iron oxide in their constitution. Never use sandpapers on stainless steel that have been used to file carbon steel or iron.
4. After sanding, clean the surface with a clean and wet cloth. After this cleaning, apply the stripping gel or passivation solution.
5. Apply the stripping gel or similar using a brush, with the following precautions:

- The stripping gel or similar is a re-passivation agent of the stainless steel surface.
- Depending on the adhesion and quantity of contaminating agent, the reaction time of the stripping gel should be defined.
- The quantity of the stripping gel is only that necessary to cover the contamination and keep it wet for the exposure time.
- After the time necessary for the stripping gel to act, wash with plenty of water.
- Dry with a clean and dry cloth to prevent the appearance of stains caused by the natural drying of the water. In this natural drying process, there may be residues of salt in the water, in the contours of the droplets, which may cause slight staining.
- Follow the guidelines below when applying the stripping gel:
- After application with a brush should be carried out with rubber gloves, goggles, boots, apron and face mask for gases, nox type.
- Carry out the services in open and ventilated environments.
- In case of skin contact, wash the affected area with running water and detergent.
- In case eye contact occurs, seek medical care and inform that the product contains nitric acid and hydrofluoric acid in its formulation.
- In case of vertical surfaces apply the stripping gel from bottom to top, with the brush handle facing up, in order to prevent run-off on the handle or attack in the metal fixation of the bristles of the brush.
- On horizontal surfaces, proceed with the careful application of the stripping gel with a brush, regardless of the direction of the movement of the brush.
- Always avoid run-off of the stripping gel on the brush handle.
- With non-oxidizing metallic materials in contact with stainless steel, prevent them from being wet or touched with the stripping gel. For example, in case of rivets, washers, screws and nuts, if made of aluminum or carbon steel, for example, severe corrosion process may occur on these components.

Evaporative Condenser /
Fluid Cooler

Purge and Chemical treatment of water

12.1 Purge (Water deconcentration)

Periodic or continuous purge is necessary to prevent the excess concentration of salts that increase the hardness of water, or even for the drainage of oils and other impurities that may be in the recirculation water.

The excess increase in water hardness may accelerate the scale formation process on the heat exchanger coil, and consequently yield loss over time, and in worst cases, when this high concentration of salts have chlorinated base (high concentrations of chlorides), the occurrence of pitting corrosion in the stainless steel coil may occur.

Therefore, the total replacement water flow is given by the evaporation rate plus the water drag rate due to air saturation plus the purge rate for water deconcentration.

Replacement Flow = Evaporation Rate + Drag Rate + Purge Rate

ATTENTION

The heat exchange process in the condenser or evaporative cooler has water evaporation process in its nature and principle, this phenomenon occurs only in pure water and tends to concentrate the impurities, especially salts.

The evaporation rates are related to the operation data, these are influenced by the total air flow, total recirculation flow, wet bulb temperature, capacity and installation altitude, as well as the concentration of salts and analytical parameters of the water can cause them to vary.

The exact value of the evaporation rate at the design point can be found in the technical sheet of the product. In case of doubt or need for more information, consult our Technical Department.

As the natural heat exchange process tends to concentrate salts, the purge rate has the opposite function of deconcentrating, i.e., limiting and controlling the concentration of salts within the maximum analytical parameters required for the safe operation of the equipment.

The table below indicates the maximum analytical parameters for a safe operation:

Analytical Parameter	Recommended limit
pH	6,5 to 9,0
Total Alkalinity (pp $CaCO_3$)	750
Calcium Hardness (ppm $CaCO_3$)	500
Chlorides (ppm as Cl)	250
Soluble silica (ppm as SiO_2)	150
Sulfates (ppm as SO_4)	250
Dissolved solids (ppm)	1500
Conductivity (μS/cm)	3000

Table 25: Recommended water quality limits

The definition of the purge rate is based on the concept of Cycles of Concentration (COC), and a determined cycle of concentration indicates how many times the recirculation water can increase its concentration without allowing the equipment to operate outside recommended maximum analytical parameters.

For example, a cycle of concentration equal to 5 means that the concentration of the replacement water may concentrate 5 times during the operation and is still within the maximum analytical parameters recommended for a safe operation.
The number of cycles of concentration is determined by the characteristics of the replacement water, as well as the anti-scale chemical additives, anti-corrosives and biocides used in the chemical treatment when applied.

Below is a practical example of the determination of the number of cycles of concentration:
Equipment = GFHE 0824-8.1I/012F.E
Capacity = 1,890 kW
Evaporation Rate = 2.550 m3/h
Analytical analysis of the replacement water:

Test	Results
Total alkalinity (methyl orange)* (mg/L)	19.60
Chloride* (mg Cl-/L)	16.99
Conductivity* (μS/cm)	104.30
Calcium hardness (mg CaCO3/L)	20.00
pH* (25˚C)	6.57
Reactive silica (soluble) (mg SiO2/L)	48.77
Total solids dissolved* (mg/L)	150

Table 26: Example of analytical analysis of replacement water

Therefore, we have the following analysis:

Parameter	Replacement Water	Recommended Limit	COC	
pH	6.57	6.5 to 9.0	acceptable	
Total Alkalinity [mg/L]	19.6	750.0	38.3	
Calcium Hardness [mg/L]	20.0	500.0	25.0	
Chlorides [mg/L]	17.0	250	14.7	Critical Parameters
Soluble Silica [mg/L]	48.8	150.0	3.1	
Conductivity [μS/cm^2]	104.3	3.000.0	28.8	

Table 27: Example of COC analysis and critical parameter for operation

The analysis shows us that we have the concentration of Chlorides and concentration of Soluble Silica as critical parameters in the replacement water, and these show us that the values of the cycles of concentration (COC) are 14.7 and 3.1, respectively. As the values shown suffer variation, this analysis should be conducted constantly in order to ensure that the equipment is operating under safe conditions, and also to prevent unnecessary water purge.
For definition of the purge rate, it is possible to assume the value with the lowest COC (3.1) or the mean of the critical values (8.9).
Assuming the most critical value for COC, 3.1, the purge rate is calculated as shown below:

Replacement Flow = 2.550m³/h + 0.822 m³/h = 3.372 m³/h

ATTENTION

Therefore, for the example in question:

Purge rate = 2.550 m³/h / 3.1 = 0.822 m³/h

Lastly, the total water replacement rate:

Replacement Flow = 2.550 m³/h + 0.822 m³/h = 3.372 m³/h

Companies specialized in the chemical treatment of circulating or industrial waters can easily perform the indication of COCs based on an analysis of the mentioned parameters of the replacement water. In case of doubt or need of more information, consult our Technical Department to help in the determination of the purge rate.

12.2 Chemical treatment of water

Some applications use industrial waters from artesian wells or residual wells. Most times these present analytical parameters outside the recommended limits for safe operation of the equipment, and therefore, chemical treatment is necessary for quality control of the water and safety in the operation.

In addition, with the purpose of saving water from the purge rate, some treatments with strict control can be applied by using anti-scale and anti-corrosives.

Also, during the operation of the equipment, in addition to the impurities present in the replacement water, all the impurities present in the air, and/or biological materials, are transported and can accumulate or proliferate in the basin of the equipment and recirculation water. Therefore, to inhibit the growth of microorganisms like algae, fungi, slime and bacteria such as Legionella, the treatment with biocides can be applied for biological control together with continuous monitoring of water quality.

12.2.1 Chemical treatment

The chemical products applied in the treatment should IMPERATIVELY be compatible with the materials used in the manufacture of the equipment. In other words, these should be compatible with AUSTENITIC STAINLESS STEEL (construction material of the closings, structure and coil), ALUMINUM (fans) and CAST IRON (water pump), therefore, they should be FREE from any CHLORINE, BROMINE and IODINE **based compounds.**

The definition of the chemical products as well as the doses and chemical treatment methods should be specified by companies specialized in chemical treatment of industrial waters. Products and/or treatment methods specified wrongly may damage components like fan, water pump, valves, metal plates, piping and even condemn the equipment.

As a good dosing practice of the chemical treatment, dosing directly in the water replacement line close to the pump suction is recommended for better homogenization.

In addition, proper monthly control of the dosed quantities, quality of the water and analytical parameters is recommended. In case of doubts or need for more information, consult our Technical Department.

12.3 Automatic Purge

In order to ensure that the water parameters of the Evaporative Condenser are maintained within the levels recommended by Güntner, the ECOSS is equipped with an automatic purge system. This deconcentration method was designed in the water conductivity concept due to the concentration of salts in the recirculation water during the machine operation.
During the equipment operation there is a conductivity sensor that constantly reads the conductivity of the recirculation water, in μS/cm2, and based on the pre-established laboratory factors, it automatically carries out the deconcentration of salts from the recirculation water.

Through the conductivity meter, located in the discharge pump, it is possible to read the conductivity ($\mu S/cm^2$) and temperature of the water (°C), as shown in image 45. The conductivity parameter is constantly analyzed and the purge is started through a controller and a motorized valve.

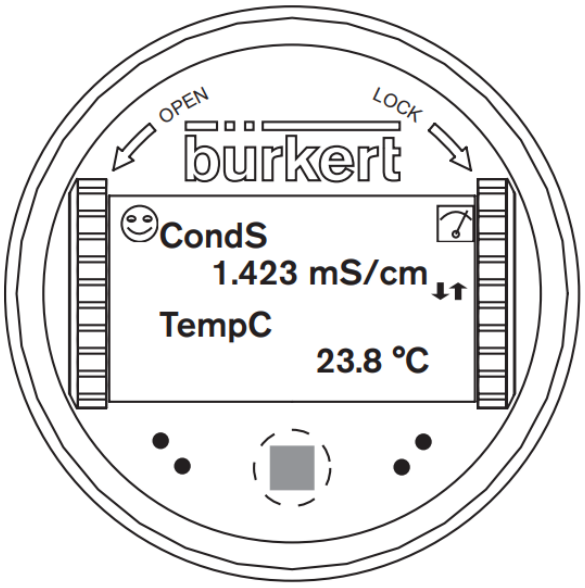


Image 45: Display of the conductivity and temperature of the recirculation water.

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No field intervention is required to put the system in operation.

WARNING

This mechanism does not replace the water treatment, which should be guided by a specialized company.

WARNING

Changing the pre-established factory parameters characterizes in the loss of warranty of the product.

WARNING

12.3.1 Purge System Operating Mode

After equipment startup, with the condenser enabled and the emergency released, the system starts checking the conductivity parameters through the conductivity sensor. When the water reaches parameters above Value A $\mu S/cm^2$ (Setpoint [SP]), the purge valve is activated. The valve is then activated

when the conductivity is above Value B μS/cm2 (Setpoint - Hysteresis [SP-Hyst]). If the value remains over and the time elapsed since the start of the purge is equal to Time A s, the purge process is interrupted for Time B s and the purge cycle is restarted. The deconcentration process is only interrupted when the conductivity meter reading is below Value B μS/cm^2. The cycle is repeated indefinitely while the condenser is enabled. In image 46 below it is possible to verify the operating flowchart.

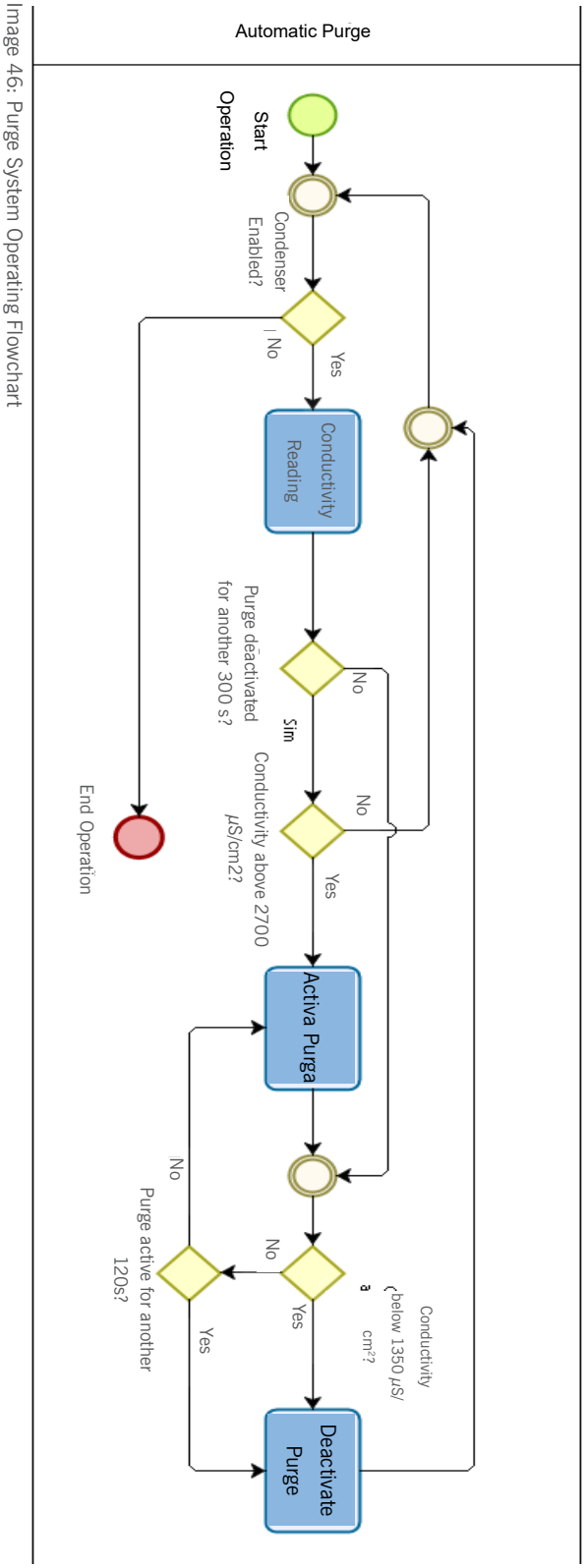

Image 46: Purge System Operating Flowchart

Your After-Sales Service Contact

Our After-Sales department has a specialized committed to answer any question, technical support, support and/or problems with a quick and efficient response time. The range of services includes, from start-up to commissioning and weekend emergency repairs. When necessary, a member of our team will quickly go on site to take care of the problems and/or interests of our customers.
Our after-sales professionals are not only cooling and heat transfer engineering specialists, but also qualified in other specific fields, such as pipe welder qualification for different thicknesses and materials, as well as welding experts with advanced qualifications.

In case of need do not hesitate to contact us

Technical Support, Quality and Services
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Fax: + 55 (54) 3220 8114
E-mail: quality.br@guentner.com
Web: www.guentner.com.br/contato/

Warranty term

Dear Customer,

Güntner Brazil offers warranty against manufacturing defects for its equipment for a period of 24 months, counting from the date of issue of the invoice.
The customer must immediately notify Güntner Brazil in writing about the defects that have occurred and submit the product for analysis for the period necessary to identify the cause of the deviation, check the warranty coverage and for due repair. Damages possibly caused as a result of transportation should be reported on the back of the bill of lading and recorded with photographs at the time of receiving the equipment.
In order to be entitled to a warranty, the customer must comply with the technical document specifications of Güntner Brazil, which must comply with the Transport, Assembly, Operation and Maintenance Manual for the equipment, as well as the effective installation, operation, maintenance and storage standards and regulations in each state or country.
The following defects are not covered by the warranty: defects resulting from inadequate or inappropriate use, operation, handling and installation of the equipment; non-compliance with the specifications established in the operating manual; violation of seals; changes, change of product serial number or identification plate of the equipment; exposure to inappropriate cleaning products; electrical overload; existence of non-qualified devices connected to the equipment; lack of preventive maintenance; as well as defects resulting from external factors. Damages caused to the equipments during displacement to the installation site is not covered in the warranty when the transport is not the responsibility of Güntner Brazil.
The warranty is not applicable if the customer, by their own initiative, opens, repairs or modifies the equipment without prior written consent from Güntner Brazil.
The warranty does not cover defects or problems resulting from negligence or other causes that cannot be attributed to the manufacturer, but are not limited to: wrong or incomplete specifications or data by the customer, transport, storage, handling, installation, operation and maintenance in disagreement with the instructions provided, accidents, civil work deficiencies, use on applications or environmental conditions that were not previously known by Güntner Brazil.
The warranty does not include disassembly services at the customer's facilities, removal, loading, and transport costs of the product when requested by the customer.
The warranty services are provided by the Technical Support of Güntner on the field or at their own factory. These warranty services will not extend the warranty periods of the equipment or of the replaced or repaired parts and pieces.
In case no manufacturing and/or component defect is confirmed, a technical report will be generated and if an advance warranty was sent, a proposal with all the costs of the occurrence will be sent for commercial settlement.
When the warranty is found to be justified, the items will be sent free of charge to the customer. Güntner reserves the right to request the return of the noncompliant item for analysis and/or sending of a technician for analysis in loco with prior scheduling and through approval of the customer and/or

final customer. When the return of the noncompliant material is requested, the customer is responsible for the costs of the operation. The civil liability of Güntner Brazil is limited to the product supplied, and it is not liable for indirect or emerging damages, such as lost profits, loss of revenue and the like that may arise from the agreement signed between the parties.
Complaints should be sent by email to: assistance.br@guentner.com, after receiving the report, the documentation will be sent to be filled out, and the occurrences will be attended to by submitting the respective documents.

Best regards,

Technical Support
Güntner do Brasil

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Air Condensers

Evaporative Condensers / Fluid Cooler

Drycoolers

Evaporators / Air Coolers

Ice Machines

Plate Heat Exchangers

Pressure Vessels

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