Frick®
INDUSTRIAL REFRIGERATION

Form 140.010-IOM (APR 2018)
INSTALLATION - OPERATION - MAINTENANCE
File: SERVICE MANUAL - Section 140
Replaces: 140.010-IOM (OCT 2017)
Dist: 3, 3a, 3b, 3c

IDSC / ECOSS™

Stainless Steel Evaporative Condenser

THIS MANUAL CONTAINS RIGGING, ASSEMBLY, START-UP, AND MAINTENANCE INSTRUCTIONS. READ THOROUGHLY BEFORE BEGINNING INSTALLATION. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH, DAMAGE TO THE UNIT, OR IMPROPER OPERATION.

IMPORTANT! READ BEFORE PROCEEDING!

This manual provides the information needed for safe installation, operation, and maintenance for IDSC/ECOSS™ Evaporative Condensers. Close attention to the instructions provided in this manual will ensure proper installation and operation, and a long satisfactory unit life.

It is strongly recommended that one becomes fully familiar with this manual prior to operating or working on an IDSC/ECOSS™ Evaporative Condenser.

After installation the unit must be properly connected to an appropriately designed and installed refrigeration system. The engineering plans, piping layouts, etc., must be detailed in accordance with local codes and applicable industry standards and practices.

Units should be rigged and installed as outlined in this manual. These procedures should be reviewed in detail prior to the actual rigging operation to acquaint all personnel with the procedures to be followed.

If any questions or comments arise regarding this manual, we encourage you to call your sales representative.

CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls policy for continuous product improvement, the information contained in this document is subject to change without notice. While Johnson Controls-Frick makes no commitment to update or provide current information automatically to the manual owner, that information, if applicable, can be obtained by contacting the nearest Frick Factor or the nearest Frick Sales office.

It is the responsibility of operating/service personnel to verify the applicability of these documents to the equipment in question. If there is any question in the mind of operating / service personnel as to the applicability of these documents, then prior to working on the equipment, they should verify with the owner whether the equipment has been modified and if current literature is available.

⚠ WARNING

External wiring is NOT to be connected inside an IDSC/ECOSS™ factory mounted electrical panel unless specifically indicated as required field wiring on the JCI - Frick electrical drawings provided. Devices such as relays, switches, transducers and controls may NOT be installed inside the Frick IDSC/ECOSS™ electrical panel. NO external wiring is allowed to be run through the Frick IDSC/ECOSS™ electrical panel. All wiring must be in accordance with Johnson Controls-Frick published specifications and must be performed ONLY by qualified Johnson Controls-Frick personnel. Johnson Controls-Frick will not be responsible for damages/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this will void the manufacturer's warranty and may cause serious damage to property or injury to persons.

NOTICE

This manual, in combination with the applicable cooling coil data, unit G&A drawing, unit electrical drawing, and structural support drawing, provides the information necessary to safely install and start up a Frick IDSC/ECOSS™ unit. Due to the possibility of customization associated with the IDSC/ECOSS™ product line, there may be areas beyond the scope of this manual. If there are any questions about a special application lacking the required information, please contact the installing contractor or your local Frick Sales Office.

SAFETY PRECAUTION DEFINITIONS

⚠ DANGER	**Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**
⚠ WARNING	**Indicates a potentially hazardous situation or practice which, if not avoided, will result in death or serious injury.**
⚠ CAUTION	**Indicates a potentially hazardous situation or practice which, if not avoided, will result in damage to equipment and/or minor injury.**
NOTICE	**Indicates an operating procedure, practice, etc., or portion thereof which is essential to highlight.**

Contents

GENERAL INFORMATION

INSTALLATION

OPERATION

MAINTENANCE

APPENDIX I

GENERAL INFORMATION

This manual has been written for professionals in the refrigeration field. Basic knowledge of handling evaporative condensers is presupposed.

- Always keep the operating instructions including Appendix I: Safety Installation Operation & Maintenance in the unit's immediate vicinity at all times.
- Ensure that the operating instructions including Appendix I: Safety Installation Operation & Maintenance are accessible to all people that have anything at all to do with the unit at all times.
- Ensure that the operating instructions including Appendix I: Safety Installation Operation & Maintenance are read and understood by all people that have anything at all to do with the unit.

SAFETY

For safety information please refer to Appendix I, 2 Safety.

INFORMATION ON COMPONENT PARTS

For safety information see Appendix I, 3 Information on component parts.

CASING/COIL/BASIN/WATER SYSTEM

All Frick IDSC/ECOSS™ evaporative cooling products are fully constructed with 304/304L materials which are self-passivating. The ASME certified and constructed condenser coils are fabricated with ANSI rated materials. All coils are supplied standard as ASME "U" Stamp Compliant. When ASME is required, only the "U" stamp tag needs to be applied.

Figure 1 - Stainless Steel Coil

All coils are CRN-certified and possess a less than 1" tube diameter leading to a reduced refrigerant charge. The coils have an extended operating pressure range (maximum operating pressure is 380 psig). They are generously pitched to ensure complete drainage of the condensed refrigerant.

There is NO bowing of the tubes which often creates liquid traps in the coil, that leads to incomplete drainage.

The 2 box sections allow for precision alignment during assembly. The frame profile and panels fit tightly together with a structural interlocking design to ensure the correct alignment to prevent any water leakage at the seams. Hinged fan panels open up to a service walkway located within the fan deck compartment giving open access to drift eliminators and spray nozzles.

Figure 2 - Hinged Fan Panels and Interior Walkway

The fully welded, leak-free basin affords generous access to the strainer and pump inlet. The fully welded step / funnel design, coupled with sloped panels in the basin, minimizes sediment accumulation and standing water.

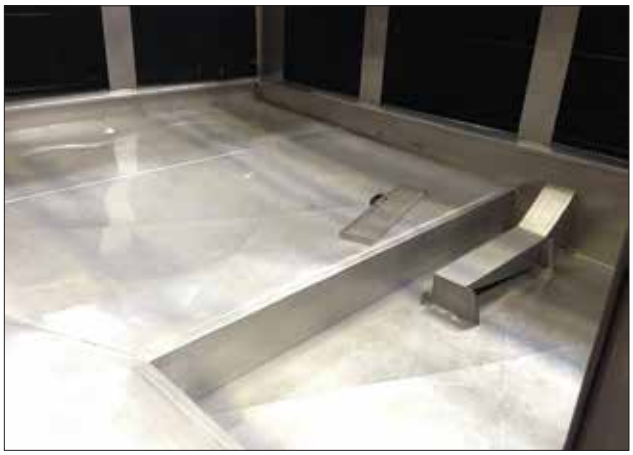

Figure 3 - Stainless Steel Basin

Figure 4 - Inlet Air Louvers

The inlet louvers are watertight, UV and corrosion resistant, with a robust, aerodynamically optimized construction. They have low pressure loss and zero line of sight to water in the basin – preventing any sunlight from entering the basin. This retards biological growth and contributes to maintenance-free operation.

The water spray distribution system consists of a stainless steel water distribution box; a low pressure, clog-resistant spray nozzle design with an increased nozzle diameter to prevent orifice blockage and to maintain continuous, uniform flow despite debris from airborne particulate; optimized water distribution over the entire coil surface area; a riser pipe from the pump positioned within the casing to prevent breakage; and a stainless steel strainer.

Figure 5 - Water Spray Nozzle

EC FANS WITH AXITOP

Figure 6 - Direct Drive Fan Motor

All EC direct drive fan motors are wired (power and control) to a common junction box, eliminating associated field wiring and labor. They allow for variable motor speed with no efficiency losses and additional equipment requirements (VFD's, filters or inverter duty motors). Motor speed control is achieved without efficiency penalty.

Soft start keeps the start-up current below FLA, reducing the load on power supply components. Integrated phase failure protection, power factor correction, harmonics filters, locked rotor and over-temperature protection; real-time diagnostics (measured process value, motor speed, operating hours, power consumption, and motor temperatures); lower EC motor temperature rise at reduced speed resulting in longer motor bearing life; no resonant frequency harmonics or vibration to encounter; no location or lead length constraints; and no shielded cables.

The mounting arms are bolted to the flange on the fan orifice and allow for a quick and simple removal if required. The motors can be lifted and removed by one person – NO motor davits required.

MMC – Motor Management Controller – factory wired to all direct drive EC motors for controlling fan speed and control setpoint.

NOTICE

During longer storage or downtime periods, the fans must be operated for 2 to 4 hours each month.

NOTICE

In the case of fans with protection type IP55 or higher, any sealed condensate drain holes must be opened at least every six months.

NOTICE

The fan motors use a separate electronic power circuit that is controlled via Motor Management Control MMC. The motors can be powered at three-phase (3~, 380 - 480 V AC, 50/60 Hz) voltages. Please refer to the wiring diagrams or motor terminal box information for the electrical connection.

The AxiTop diffuser is designed to recover wasted energy by purposely and efficiently decelerating the flow and reducing swirl, boosting the pressure rise of the impeller. Aerodynamic efficiency is increased and acoustic noise is reduced.

AxiTop is currently available for ebm-papst axial fan sizes 800 mm and 910 mm. There are no moving parts and it can be retrofitted with ease onto existing systems that already use ebm-papst fans (allowing for space).

PUMPS

Figure 7 - Water Pump

The water pump is a close-coupled centrifugal unit with ductile iron housing, closed impeller, mechanical seal TEFC motor; vertical alignment reduces installation footprint; bleed line from riser pipe supplied complete with regulating valve; lower recirculating flow rate results in less energy consumption. Two types of pumps are available: 5 HP and 7.5 HP

OPTIONS AND ACCESSORIES

Electric Basin Heaters

For low temperature climates, immersion heater packages are provided – factory fitted – to maintain the water temperature in the basin at 40°F. The design temperature of 40°F, has been determined with the fans being off, and options are available for ambient temperatures of -20°F.

Factory installed electrical contactors and wiring are also an available option. Additional, available options include electrical immersion heater(s) furnished with built in thermostat, thermostat/low water protection probe and controller, and electronic water level/heater control device.

Remote Sump: an oversized, 12" nominal flange mount connection and includes the necessary gaskets and hardware to connect to the basin (12" flange not included).

Ladder and Platform: for easy access to the catwalk. See Figure 8.

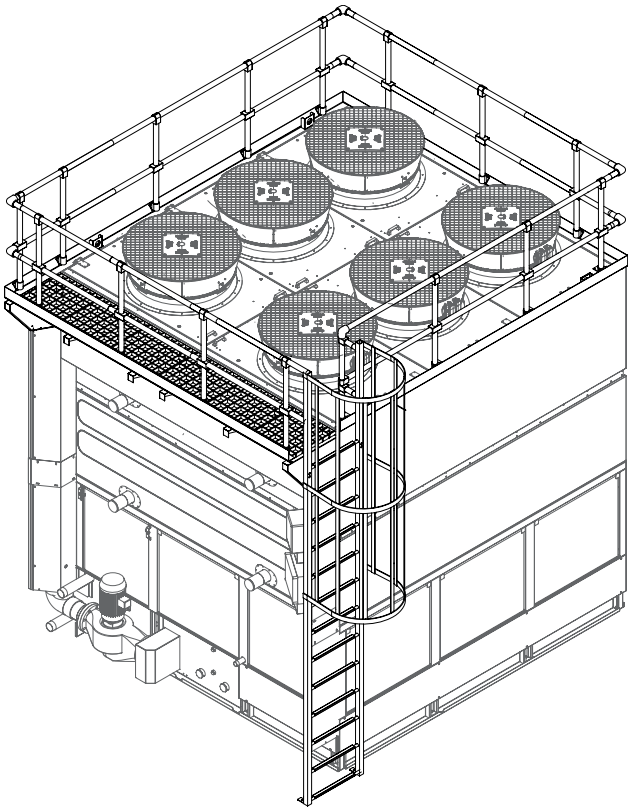

Figure 8 - Ladder and Platform

Electronic water level controller: includes alarm float switches indicating if water level is too low or too high (see Figure 9).

Figure 9 - Electronic Water Level Controller

INSTALLATION

TRANSPORTATION, STORAGE, UNPACKING AND MOUNTING

⚠ WARNING

Crushing danger with falling down! (see Appendix I, 4 Transportation, Storage, Unpacking & Mounting)

TRANSPORTATION

NOTICE

Read and observe all transport signs on the units' packaging! (see Appendix I, 4.1 Transportation)

STORAGE

NOTICE

Danger of corrosion and dirt build-up! (see Appendix I, 4.2 Storage)

See additional information in General Information section.

UNPACKING

The two parts of the unit are packed and shipped separately on their own substructure. See Figure 10.

After removing both sections of the unit from the truck:

- ✓ remove plastic wrapping
- ✓ loosen bolts connecting the unit to the substructure
- ✓ remove clamps, etc.
- ✓ remove any accessories shipped loose in the basin (boxed)
- ✓ ensure that delivery is complete and without damage. In case of damage or missing parts, contact the manufacturer immediately

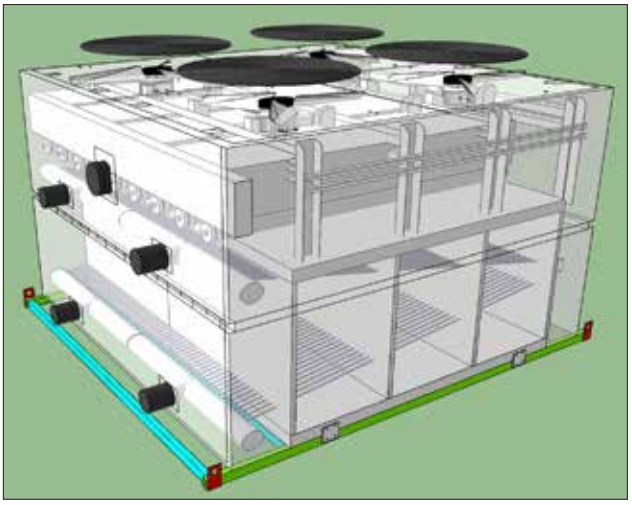

Figure 10 - Upper Section of Unit On Substructure

MOUNTING

Condensers will need to be structurally supported with two parallel I-beams traversing the entire length of the unit. (See Figure 11) I-beams must be level to within 1/8" over a 6' span. Shims cannot be used to level the unit as this will compromise the load bearing surface.

Mounting holes (13/16" diameter) are provided at the base of the basin section, in the side panel flanges, to enable securing each unit to the support structure utilizing ¾" diameter bolts. Refer to the Frick unit certified drawing for the bolt hole locations.

All support beams and anchoring bolts will be provided by others and must be selected in accordance with sound structural engineering standards. When selecting the support beams, each beam should be calculated with a uniform load equivalent to 2/3 (66%) of the unit's operating weight.

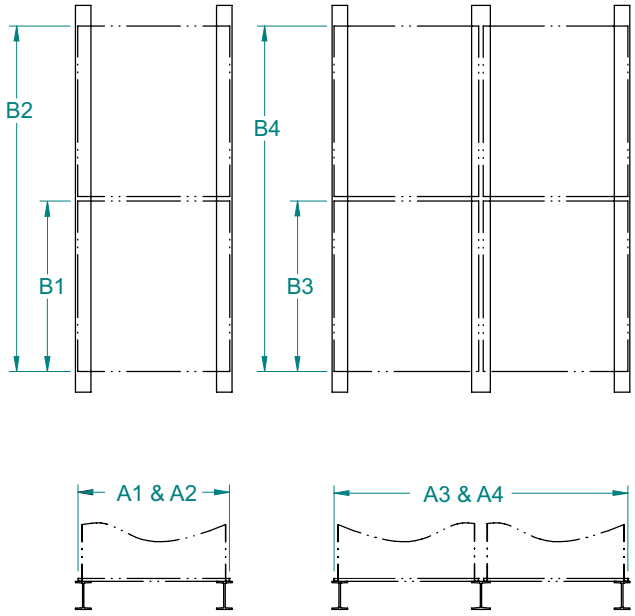

Figure 11 - IDSC/ECOSS™ Steel Support Dimensions (See Table for Dimensions)

IDSC/ECOSS™ Steel Support Dimensions		
10' Wide Models	**A1**	**B1**
IDSC 1012-06-10 to -12-30	9' 9¾"	11' 11¾"
IDSC 1018-06-15 to -12-30	9' 9¾"	18' 4"
	A2	**B2**
IDSC 1024-06-20 to -12-60	9' 9¾"	24' 1½"
IDSC 1036-06-20 to -12-80	9' 9¾"	36' 10"
12' Wide Models	**A1**	**B1**
IDSC 1212-08-15 to -12-40	11' 10"	11' 11¾"
IDSC 1218-08-20 to -12-50	11' 10"	18' 4"
	A2	**B2**
IDSC 1224-08-30 to -12-80	11' 10"	24' 1½"
IDSC 1236-06-60 to -12-100	11' 10"	36' 10"
24' Wide Models	**A3**	**B3**
IDSC 2412-08-30 to -12-80	23' 10"	11' 11¾"
IDSC 2418-06-60 to -12-100	23' 10"	18' 4"
	A4	**B4**
IDSC 2424-10-60 to -12-120	23' 10"	24' 1½"
IDSC 2436-08-80 to -12-200	23' 10"	36' 10"

⚠ WARNING

Danger of injury and damages to the property! (see Appendix I, 4.4 Mounting)

- ✓ Lift bottom section of unit from the substructure to intended place of use.
- ✓ Secure bottom section of unit to the support structure with ¾" diameter bolts (not provided).
  - o Use all of the bolt holes to fix the unit to the support structure (for bolt hole locations, see unit certified drawing).
  - o Make sure that all mounting bolts are tightened equally to achieve a load distribution on the connections that is as balanced as possible.
- ✓ Lift top section of unit from the substructure and position on top of the bottom structure (see Figure 12).

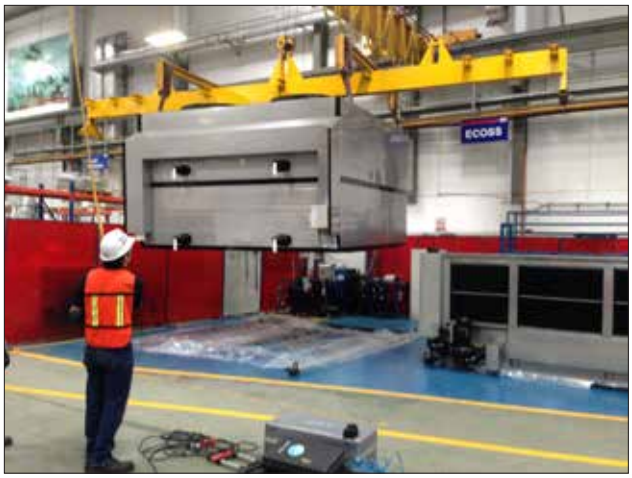

Figure 12 - Lifting Top Section of the Unit

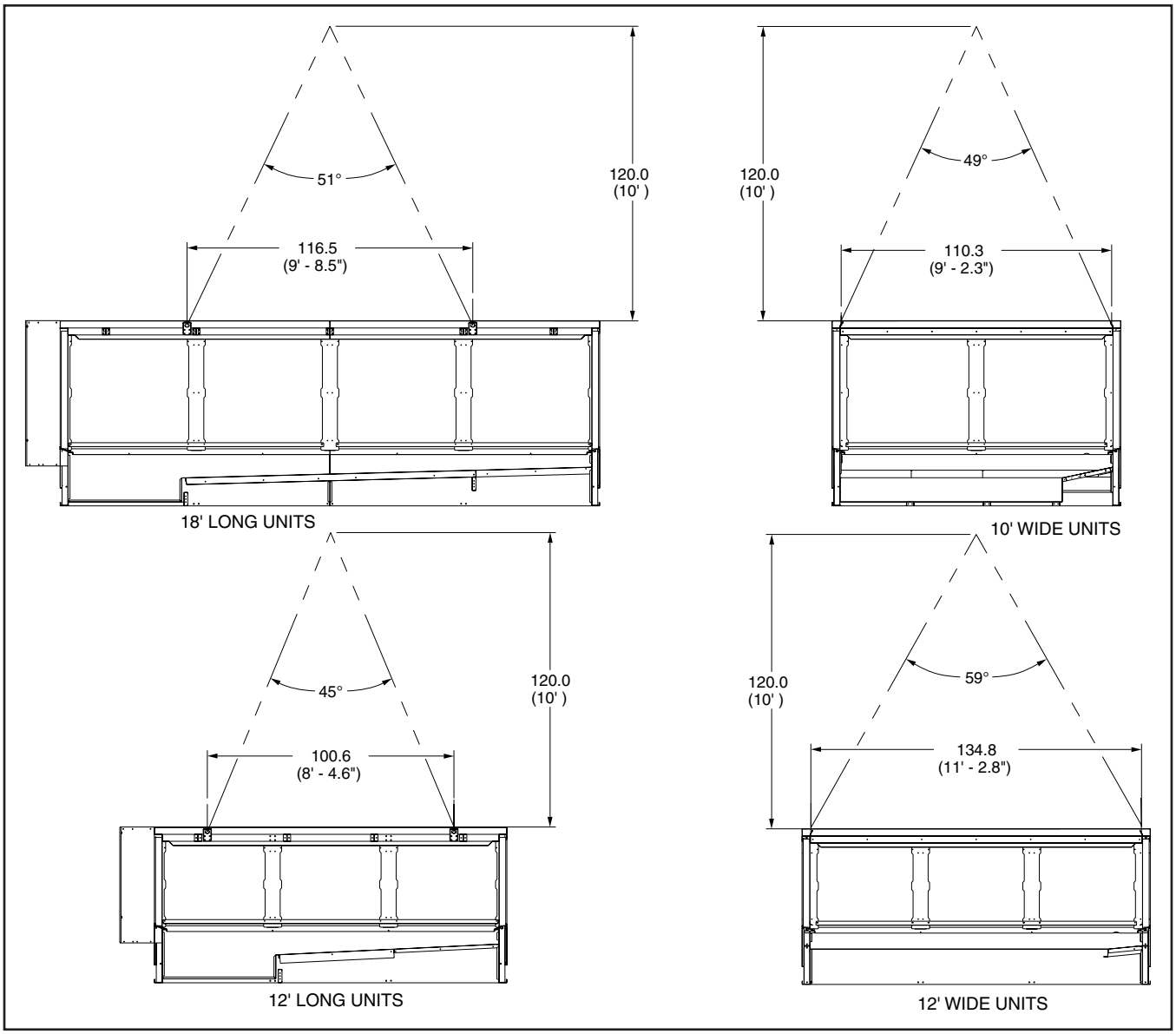

Figure 13 - Lower Section of the Unit - Lifting Guidelines

✓ Align the top section with the bottom section (see Figure 14).

Figure 14 - Aligning Top and Bottom Sections

✓ Appropriately guiding the top section safely above the section joint and free from pinch points (see Figure 15).

Figure 15 - Positioning the Top Section of the Unit

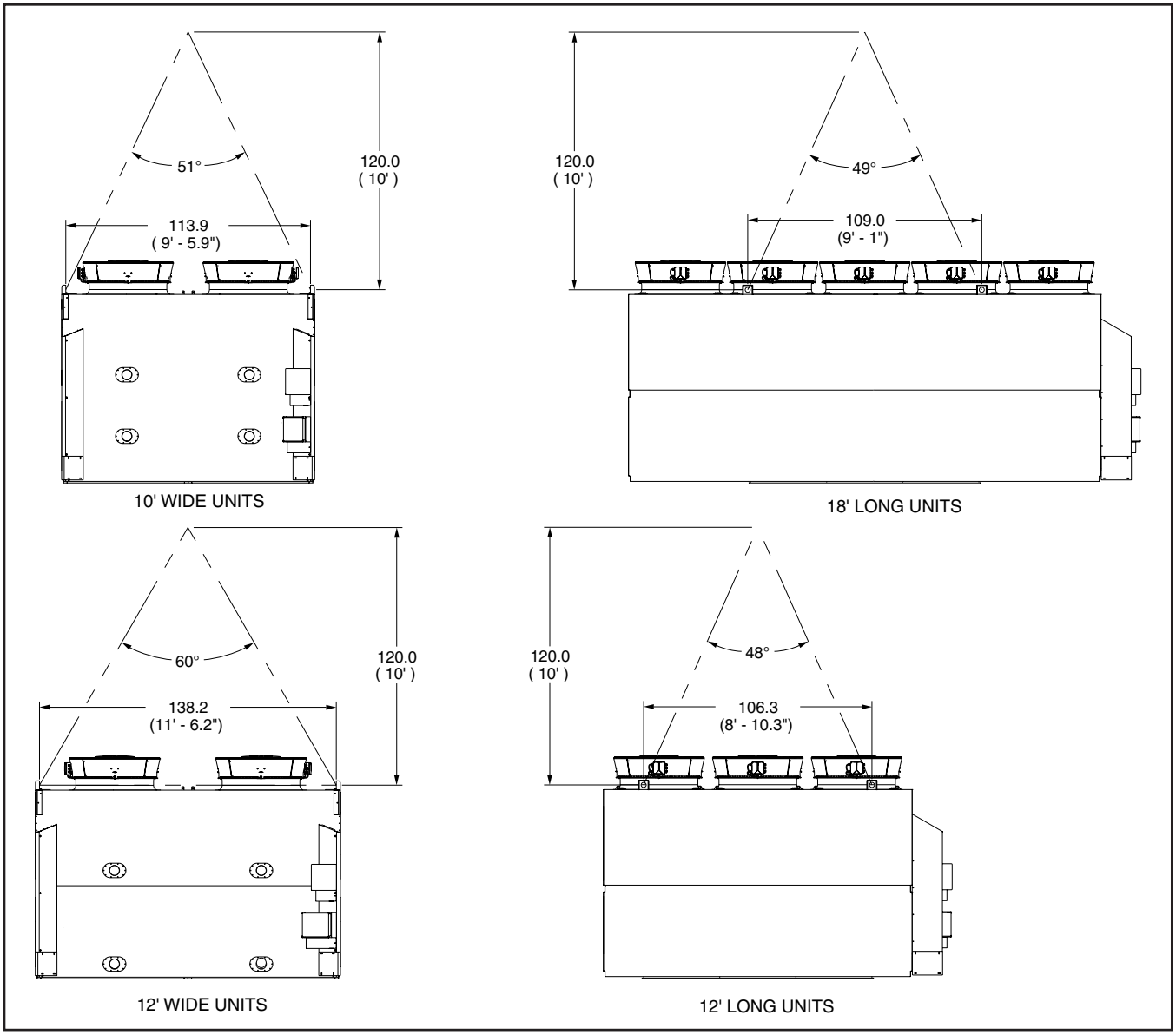

Figure 16 - Upper Section of the Unit - Lifting Guidelines

- ✓ Bolt the top section and the bottom section together from the inside.
- ✓ Close the gap between the lower and the upper riser pipe section with the pipe connector.
  - o Tip: liquid soap will help slide the pipe connector over the PVC pipe.
- ✓ Clamp pipes together.

Ladder And Platform

- ✓ See specific configuration installation instructions for the posts, railing, ladders, cages and gates included in the packaged materials. (Walkway, toe boards and post bases are pre-assembled.)

Adjustment Of Mechanical Float Assembly

The brass makeup water valve with armature and circular float for basin water level adjustment is delivered pre-assembled. Set circular float height to a maximum water level of 14¼ inches.

CONNECTING THE UNIT

SAFETY INSTRUCTIONS

Safety Instructions For Setup And Start-Up

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant! (see Appendix I, 5.1 Safety instructions Danger of injuries and damage to property with escaping refrigerant!)

NOTICE

Danger of damage to the system's cooling equipment! (see Appendix I, 5.1 Safety instructions Damage to the system's cooling equipment!)

NOTICE

Danger of corrosion and dirt build-up for units using ammonia as refrigerant! (see Appendix I, 5.1 Safety instructions, Danger of corrosion and dirt build-up for units using ammonia as refrigerant!)

⚠ WARNING

The electrical installation must only be performed by electricians in compliance with relevant rules (or applicable national and international regulations)!

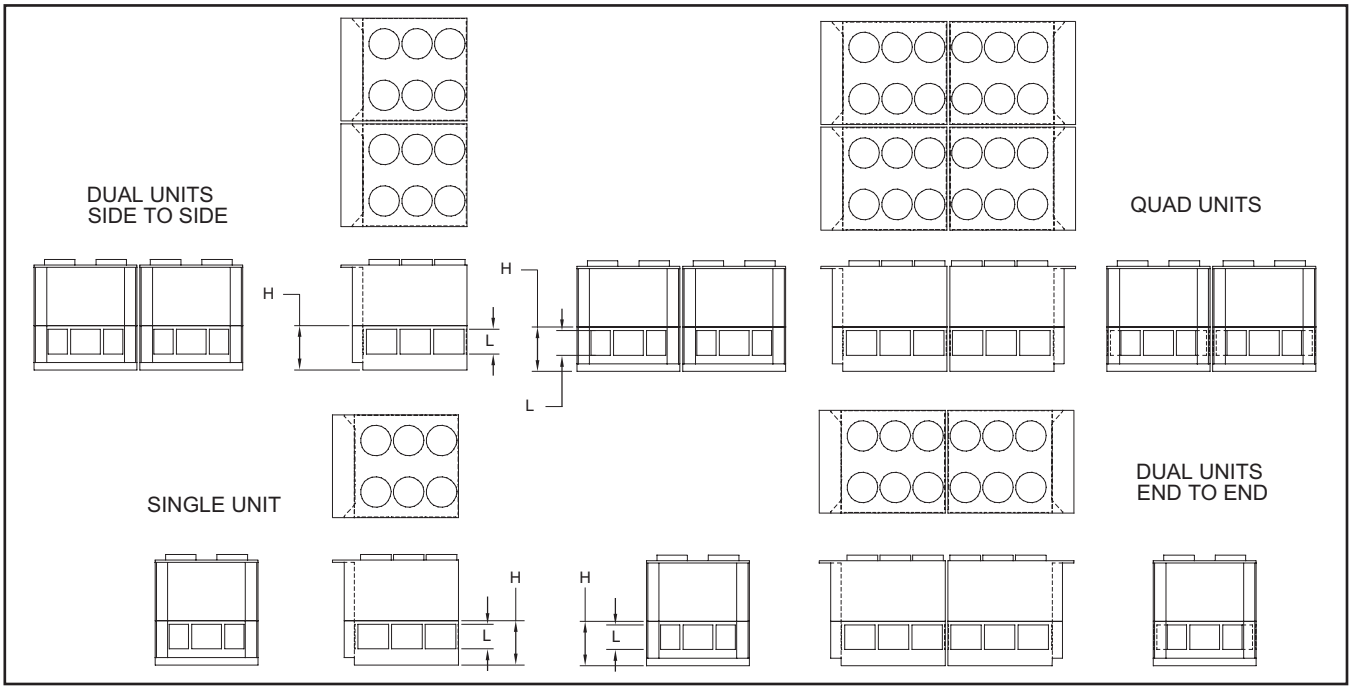

Figure 17 - IDSC/ECOSS Induced Draft Condenser Configurations - For Corresponding Air Inlet & Basin Heights, See Table.

IDSC/ECOSS CONFIGURATIONS AND AIR INLET & BASIN HEIGHTS (in.)								
Unit Size	Single Unit		Dual End to End		Dual Side by Side		Quad Unit	
	Inlet Louver Height (L)	Basin Height (H)	Inlet Louver Height (L)	Basin Height (H)	Inlet Louver Height (L)	Basin Height (H)	Inlet Louver Height (L)	Basin Height (H)
10′ x 12′	36	63.5	48	75.5	N/A	N/A	N/A	N/A
12′ x 12′	36	63.5	48	75.5	78	105.5	78	105.5
10′ x 18′	48	75.5	48	75.5	N/A	N/A	N/A	N/A
12′ x 18′	48	75.5	78	105.5	78	105.5	78	105.5

NOTE: Consult Factory for additional information. For reference only, use certified drawings for design purposes.

System-side safety requirements

For safety information, please refer to Appendix I, 5.1.2 System-side safety requirements.

Customer-side safety precautions

⚠ WARNING

Danger of injuries and damage to property! (see Appendix I, 5.1.3 Customer-side safety precautions)

⚠ WARNING

Ammonia: Danger of environmental pollution! (see Appendix I, 5.1.3 Customer-side safety precautions)

LOCATION REQUIREMENTS

You will find the dimensions and weights in the order-related documents.

In order to not compromise the performance of the evaporative condenser(s), it is imperative that the location allows for unrestricted airflow into each condenser and that there is no recirculation of the saturated discharge air. Locations on open rooftops or at ground level, with no obstructions such as walls or adjacent buildings, are preferred. However, in many instances this is not possible. Positioning in wells, next to high walls, adjacent buildings, occupied areas or specific enclosures all pose a risk of recirculating the saturated discharge air. This will increase the wet bulb temperature of the intake air and compromise the performance of the condenser, which typically results in higher condensing temperatures. Units that are located in a well, an enclosure or close to adjacent walls or buildings must be positioned such that the discharge of the condenser (at the top) is either level or higher than these adjacent obstacles.

If the unit/s is/are to be located in occupied areas or close to adjacent buildings, it is advisable that the discharge air is not in the direction of, or in close proximity to, any air intake location for the building's ventilation system.

If the units are intended to be put into a dual or quad position, the height of the louver section in the lower box sections is increased to almost the double that of the original model type in order to ensure sufficient air intake (See Figure 15).

- ✓ Ensure that the unit is set up so that it is not damaged by environment-conditional hazards (production, transportation and other sources at the installation site) and that its functioning is not disturbed by the interventions of unauthorized persons.
- ✓ Enable optimal unit control and accessibility:
  - o Place the unit so that it can be monitored and controlled from all sides at all times.
  - o Ensure that sufficient space is provided for maintenance.
  - o Ensure that all liquid-carrying components, connection lines, and all electrical connections and lines are easy to access.
  - o Ensure that the pipe connection points are visible.

NOTICE

Lightning protection rods beside the unit are recommended.

NOTES ON CONNECTING THE UNIT

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant! (see Appendix I, 5.3 Notes on connecting the unit)

CONNECTING THE WATER PIPES

RECIRCULATED WATER SYSTEM

Depending on the location, impurities within the air (chemicals in an industrial environment, or salt laden air when close to the ocean) are also absorbed by the water and can result in a corrosive solution. Therefore it is critical to the longevity of the condenser that these impurities are bled from the unit at a rate which is at least equal to that which is absorbed. This continual bleed and replacement with fresh source water will determine the concentration of dissolved solids within the system and must be maintained at an acceptable level.

All evaporative condensers supplied with a factory fitted pump are furnished with a clear water bleed line with flow regulating valve. Units supplied for remote sump applications must have a bleed line with flow regulating valve installed at the pump discharge.

⚠ WARNING

Danger of injury due to biological contamination! (see Appendix I, 5.4 Connecting the water pipes)

CONNECTING THE UNIT TO THE SYSTEM

Prevent stresses on the unit:

- ✓ Ensure that all mounting points have the same spacing to the fixing level.
- ✓ Ensure that all mounting points maintain the same spacing to the support structure under load and permanently.
- ✓ Set up units as follows: Airflow must not be impaired by obstructions.
- ✓ The units must be installed on mounting points that are appropriate for the unit's weight and then bolted with mounting bolts. The operator or installer of the equipment is responsible for ensuring that the bolted connections are of adequate strength. The following instructions must be observed when mounting the units:
  - o The diameter of the mounting holes has been determined by the manufacturer; the mounting bolts must be adapted accordingly. When calculating the transferring bearing strength it is imperative to take into account the total weight of the unit (= structural weight + all contents).
  - o The mounting bolts must be secured against loosening with an appropriate locking device.
  - o The mounting bolts must not be overtightened or stripped.
  - o All mounting bolts must be tightened equally.

- ✓ Fix the unit in its position and prevent the unit from shifting. Tighten and secure the mounting bolts.
- ✓ Only secure the unit at the intended mounting points.

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant! (see Appendix I, 5.5 Connecting the unit to the system).

Important considerations regarding installation

Condenser piping should be designed and installed in accordance with generally accepted condenser piping engineering practice as detailed in ANSI/IIAR-2 Piping Handbook

All field piping which is external to the IDSC/ECOSS™ evaporative condenser must be supported and anchored separately. External loads must not be placed on the condenser connections. Piping supports must not be anchored to any part of the panels or frame of the evaporative condenser.

When condensers are installed on vibration rails or springs, the field piping must incorporate compensators to prevent vibration transmission to the external piping.

⚠ CAUTION

The unit must only be put into operation, operated, maintained and repaired by trained, experienced and qualified personnel. (see Appendix I, 5.5.1 Important considerations regarding installation).

UNIT ELECTRICAL CONNECTION & PROTECTION

- ✓ Seal all electrical lines to the connection boxes in accordance with their protection class. The connection class is specified in the order-related documents.

⚠ CAUTION

Danger of injuries and damage to property! (see Appendix I, 5.6 Unit Electrical connection & protection).

PERFORM ACCEPTANCE TEST

⚠ WARNING

Danger of injuries and damage to property! (see Appendix I, 5.7 Perform acceptance test).

Acceptance Test:

- ✓ Ensure sufficient air flow.
- ✓ Ensure that the electrical supply feed is sufficient for the required energy. Compare the unit inside of the system with the plans of the system and the electrical wiring diagrams.
- ✓ Test the unit for excessive vibrations and movements that can be caused by the fans and operation of the system. Remove oscillations, vibrations and movements following consultation with the manufacturer or independently.
- ✓ Perform visual inspection of the structural design, the brackets and fixtures (materials, sequence, and connections), the arrangement of the fittings, and the ability to operate.
- ✓ Check and retighten all threaded connections, especially on the fans.
- ✓ Check installation of pipe connections.
- ✓ Check support of refrigerant-carrying connection pipes.
- ✓ Ensure that the unit is protected against mechanical damage.
- ✓ Ensure that the unit is protected against inadmissible heating up and cooling down.
- ✓ Check the fan blades protection.
- ✓ Ensure that the unit control is readily accessible.
  - o Is the unit placed so that it can be monitored and controlled from all sides at all times?
  - o Is there sufficient space for maintenance?
  - o Are all refrigerant-carrying components, connections and lines, and all electrical connections and lines easy to access?
  - o Are the pipes easy to identify?
- ✓ Check heat exchanger surfaces for dirt and clean where necessary (see section "CLEAN UNIT").
- ✓ Ensure that the water level does not exceed the fill level of 17" prior to energizing the recirculation water pump (measured from the inside of the depressed area of the basin).
- ✓ Ensure that the circular float for basin water level adjustment is set so that water level does not exceed 14¼" inches when in operation (measured from the inside of the depressed area of the basin).
- ✓ Perform function tests on the fans (rotation direction, power consumption, etc.).
- ✓ Check electrical connections of the fan motors for damage.
- ✓ Check the quality of the soldering connections, the electrical connections and the fixture connections.
- ✓ Perform pressure test with test gas and with a test pressure of 1.1-times the permissible operating pressure: check the connection seals and look for leaks, e.g. with foaming agent, or similar.
- ✓ Perform test run and check for:
  - o Smooth fan operation (bearing noises, contact noises, imbalances, etc.).
  - o Fan power consumption
  - o Leaks
- ✓ Report all defects to the manufacturer immediately and request instructions on how to proceed.
- ✓ Check the unit and the unit's interaction with the system again after 48 hours of operation, especially the connections and the fans. Document the test results.

TEST READINESS FOR OPERATION

- ✓ Ensure that all electrical protective measures are ready to function.
- ✓ Ensure that all refrigerant-carrying connections are securely in place.
- ✓ Ensure that all electrical connections (fans) are effected securely.
- ✓ Ensure that all threaded connections on the fans, the unit mounting bolts, and all other threaded connections are firmly tightened.

OPERATION

PUTTING THE UNIT INTO OPERATION FOR THE FIRST TIME

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant! (see Appendix I, 5.9 Putting the unit into operation for the first time).

Only put the unit into operation, when:

- ✓ The unit has been properly mounted and connected (see sections "TRANSPORTATION, STORAGE, UNPACKING AND MOUNTING" and "CONNECTING THE UNIT").
- ✓ You have performed a complete acceptance test (see section "Perform Acceptance Test").
- ✓ You have performed a test for ensuring the system's readiness for operation (see section "Test Readiness For Operation")
- ✓ All safety precautions (see Appendix I, 5 Connecting the unit) have been taken.
- ✓ Contact the manufacturer immediately if you want to operate the unit under different operating conditions from those defined in the order-related documents.

Putting the unit into operation:

- ✓ Switch on the system including the electrical system.
- ✓ Activate the unit:
  - o Open the valves on the inlet and outlet side of the system
  - o Energize fans
- ✓ Wait until the operating point is reached. After the operating point is reached, the unit is ready to operate (see system).

Parameters for setting the operating setpoint, see order-related documents. The operating point is defined by:

- Condensation temperature
- Operating fan kW
- Air inlet temperature

Ensure that the operating setpoint is secure from unauthorized access.

TAKING A UNIT OUT OF OPERATION

A unit is taken out of operation by switching off the refrigerating system in accordance with the refrigerating system's IOM.

- ✓ Switch fans off
- ✓ Switch electrical system off
- ✓ Close refrigerant-carrying lines

NOTICE

For unit shutdown, take precautions so that the maximum operating pressure is not exceeded.

NOTICE

With shutdown times of a month or longer put the fans into operation for approximately 2-4 hours a month to maintain their functionality.

SHUTTING THE UNIT DOWN

⚠ WARNING

Danger of injuries and damage to property! (see Appendix I, 5.11 Shutting the unit down).

NOTICE

Danger of dirt build-up! (see Appendix I, 5.11 Shutting the unit down).

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant (see Appendix I, 2.7 Residual hazards with refrigerant).

- ✓ Take the unit out of operation (see Appendix I, 5.10 Taking the unit out of operation).
- ✓ Secure the unit:
  - o Secure the fan motor drives and ensure that they are disconnected, locked out, and tagged out.
  - o Secure refrigerant-carrying lines by pressurizing with refrigerant.
  - o Secure the unit at the installation or storage location to protect from external sources damaging the unit (see Appendix I, 5 Connecting the unit 5.1 Safety instructions 5.1.1 Safety instructions for setup and start-up).
  - o Evacuate the unit: Completely capture all of the refrigerant (must not release any refrigerant into the atmosphere) and, if applicable, the refrigerant oil (see Appendix I, 2.9 Combined Residual hazards, Residual hazards with disposal)

PUTTING THE UNIT INTO OPERATION AFTER A SHUTDOWN

The unit must be put back into operation after a shutdown in accordance with the operating instructions manual as follows:

- ✓ Test the unit's readiness for operation (see 5.8 Test readiness for operation).
- ✓ Perform pressure test and visual inspection for corrosion.

NOTICE

The pressure test with recommissioning must only be carried out with appropriate media and at the appropriate test pressure.

- ✓ Put the unit into operation (see section 5.9 Putting the unit into operation for the first time).

MAINTENANCE

⚠ CAUTION

Danger of slipping and falling (see Appendix I, 6 Maintenance)!

BEFORE STARTING ANY MAINTENANCE

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant (see Appendix I, 6.1 Before starting all maintenance)!

WITH ALL MAINTENANCE WORK

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant (see Appendix I, 6.2 With all maintenance work)!

NOTICE

Danger of damage to property (see Appendix I, 6.2 With all maintenance work Danger of damage to property!)!

AFTER ALL MAINTENANCE WORK

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant (see Appendix I, 6.3 After all maintenance work)!

INSPECTION AND MAINTENANCE PLAN

(See Table)

Maintenance Plan for Evaporative Condenser IDSC/ECOSS

Type of action	Action step	Start-up	Action to be taken after each period of days				
			1	15	30	90	180
Checks and adjustments	Read the IDSC/ECOSS™ IOM & Appendix I (Safety IOM)	X					X
	Check the water distribution in the upper module	X		X			
	Check the rotation direction of the water pump	X		X			
	Check the basin water level	X	X	X			
	Adjusting water displacer	X					X
	Check the direction of axial fans	X		X			
	Check installation of additional accessories	X					
	Adjustment of the operating parameters of the GMM (when applicable)	X			X		
Maintenance and Cleaning	Cleaning and sanitizing the water distribution system (sprinkler)	X				X	
	Basin cleaning and sanitizing	X		X			
	Cleaning and sanitizing the side, top and bottom panel enclosures (fairings)	X		X			X
	Cleaning and sanitizing drift eliminators	X				X	
	Cleaning and sanitizing the closed loop water system	X		X			
	Lubrication of water pumps motors (according to the water pump manufacturer's manual)	X		X			
	Fans maintenance (according to the fan manufacturer's manual)	X		X			
Inspections	Inspection of safety recommendations of motorized fans (according to the fan manufacturer's manual)	X		X			
	Inspection of the level of founding from the water basin	X		X			
	Inspection of water infiltration into the switchboard and fans	X		X			
	Check tightness of electrical box, fan and bolts in general	X		X			
Control and Monitoring	Control the water level of the reservoir water loop (when applicable)	X	X				
	Monitoring by MMC (when applicable)	X		X			
	Chemical treatment control in accordance with the water quality minimum analytical parameters required	X			X		
	Control the water purge	X					
	Control the level of fouling from the coils	X		X			
	Control of the electric motor amperage of the pump water recirculation	X		X			
	Control of motorized fans amperage	X		X			
	Monitoring the links of thermal relays (according to the fan manufacturer's manual)	X		X			
	Monitoring of the adjustment of circuit breakers (according to the fan manufacturer's manual)	X		X			
	Monitoring the temperature of the water basin	X		X			
	Monitoring the input and output temperature of the working fluid	X		X			
	Control and register the maintenance and monitoring program recommended	X					

MAINTENANCE WORK

Remove leaks:

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant (see Appendix I, 6.5 Maintenance work)

Strainer And Basin

Clean per maintenance schedule.

Level Of Water

- ✓ Fill level prior to energizing the recirculation water pump is 17" (measured from the inside of the depressed area of the basin).
- ✓ The operating water level in the basin is 14¼" (measured from the inside of the depressed area of the basin).

Fans

Maintenance Required every 6 months

- ✓ Check the fans for dirt build-up and clean as required.
- ✓ Check that fan drive runs smoothly.
  - o If vibrating, remove imbalances; Tighten and correct blade fixtures and blade settings where required.
- ✓ Check and replace fan bearing if running sound and smoothness changes.
- ✓ Check and replace fan motor bearing if required; clean and repair motor.
- ✓ Check bolts on fan wheels with threaded blades. If corrosion present, replace bolts.
- ✓ Check fan blades for corrosion and replace if necessary.

Pumps

- ✓ Check for leaks while the pump is running.
- ✓ Listen for unusual sounds or vibrations.
- ✓ Note any strange odors.
- ✓ Perform lockout/tagout.

NOTICE

Proper isolation is not just the electrical, but hydraulic energy (valves) as well.

Mechanical Inspection:

- ✓ Check that mounting points are secure
- ✓ Inspect the mechanical seal and packing
- ✓ Inspect the pump flanges for leaks
- ✓ Inspect coupling

Lubrication:

- ✓ Lubricate the motor and pump bearing per manufacturer's guidelines. Do not over-lubricate! More bearing damage occurs as a result of over-greasing than under-greasing. If the bearing has a vent cap, remove the cap and run pump for 30 minutes before reinstalling cap. This allows excess grease to work its way out of the bearing.

Electrical/motor:

- ✓ Check that all terminations are tight.
- ✓ Inspect motor vents and windings for dust/dirt build-up. Clean as necessary.
- ✓ Inspect starter/contactor for arcing, overheating, etc.
- ✓ Put a megohmmeter on the windings to check for insulation failure.

Elimination Of Water Drops

Clean and remove debris from drift eliminators.

Water Distribution System And Nozzles

Inspect and clean threaded nozzles if necessary.

CLEAN UNIT

General

For easy cleaning it is possible to open the fan panels at the top of the unit (see Figure 18).

Figure 18 - Open Fan Panels on Top of the Unit

If cleaning agents are used they must be compatible with 304/304L and must be environmentally friendly. Any substances which are harmful to the environment are prohibited. When cleaning agents are used, the corrosion resistance of the unit's materials to the applied cleaning agent has to be observed and properly evaluated! Warranty is null and void in case of non-compliance.

NOTICE

If during maintenance or cleaning any corrosion is detected, please contact the manufacturer directly. (see Appendix 1, 6.6.1 General)

Cleaning Of Coil, Casing And Basin

- ✓ Clean coil, casing, and basin by rinsing with warm water (approximately +80°F) and/or with environmentally friendly cleaning agents.
- ✓ If cleaning agents are used, rinse thoroughly with water.

NOTICE

Danger of damage to property!

Water or steam jets can damage fans, electrical lines or other components.

- ✓ Ensure that electrical connections and motors, as well as components and stored goods at the setup point are not touched by water or steam jets. Cover these if required.

- ✓ Heavier moisture or greasy dirt must be removed with a high-pressure water jet (max. 725 psi pressure), steam pressure jet (max. 725 psig pressure), minimum 8 inches away with a flat jet nozzle, or using a neutral cleaning agent where applicable. **NOTE:**
  - o With oily and greasy dirt it helps to add a cleaning agent to the water.
  - o Cleaning should be done from inside to the outside (always opposing the dirt onset) and from top to bottom.
  - o Continue cleaning until all dirt has been removed.

WATER TREATMENT

WATER TREATMENT AND MINIMUM WATER QUALITY REQUIREMENTS

Biological Control

With the inlet louvers structure of the side coverings, which effectively shut out the sunlight and the double inclination of the basin for complete drainage, it is ensured that there will be minimal biological growth in the basin.

Chemical treatment

For necessary measures to maintain the prescribed limit values (see Table "Recirculated Water Quality Guidelines), please contact your local water treatment specialist.

Recirculated Water Quality Guidelines

Property	Recommended Value	
	304L SST	316L SST (Std. Tube Material)
Total Bacteria (cfu/ml)	< 1,000	
pH (90°F)	6.0 - 9.0	
Chlorides as Cl	< 250 ppm	< 400 ppm
Sulfates as SO_4^{2-}	< 250 ppm	
Silica	< 150 ppm	
Hardness	< 500 ppm (as $CaCO_3$)	
Alkalinity	< 600 ppm (as $CaCO_3$)	
Total Dissolved Solids	< 1,500 ppm	
Total Suspended Solids	< 40 ppm	
Conductivity	< 3,000 (micromhos)	
Free Chlorine	< 1.0 ppm	< 2.0 ppm

NOTES:

1. The water quality guidelines listed above are for clean surfaces. Proper and periodic equipment maintenance is required to prevent tube fouling, surface deposit(s), scale, microbial deposit(s), etc. which in turn can reduce the range of the guidelines provided above.

2. Water distribution nozzles are to be kept clean at all times to ensure complete wetting of the coil. Failure to do so will result in warranty being voided.

3. Only Non-Chlorinated Biocides should be used for biological control.

4. Anaerobic dip slide: Sessile bacteria sampling must be conducted along with bulk water (planktonic) sampling.

Water Treatment Guidelines:

Water related problems that typically occur in an evaporative condenser can be broadly classified as:

- Scale Deposits
- Corrosion
- Microbiological Fouling

Scale deposits are a serious concern in evaporative heat transfer products. When dissolved solids become overly concentrated, an adherent deposit termed "scale" will form on the tubes of the heat exchanger, severely impacting the thermal performance of the heat exchanger. Evaporative cooled deposits may also include dust scrubbed from the air, corrosion byproducts and microbiological contaminants (slime). Regardless of the source, the end result is reduced thermal performance, increased operating costs and eventually, equipment failure.

Corrosion in water is usually an electrochemical reaction initiated by the presence of naturally occurring impurities in water or microbiological growth. Corrosion is the destructive reaction of a metal with its immediate environment, resulting in metal loss and ultimately equipment failure.

Metal corrosion occurs as a result of galvanic action at a negatively charged pole, or site on the metal surface. Both anodes and cathodes can be created on metal surfaces due to impurities in the metal, localized stress, metal grain size or composition differences. The difference in charges between anodes and cathodes creates an electrical potential between them which results in an electrical charge flowing from anodes to cathodes, using the surrounding water was a conductor. General corrosion is wide spread and normally caused by impurities in the metal or characteristics of the metal or its environment that results in an overall fouling of the metal surface. Localized corrosion results from stress or localized environment.

Having a consistent maintenance program in place and maintaining the equipment in a clean state all ascribe to the longevity of IDSC/ECOSS units.

Microbiological fouling results from bacteria, fungi, zooplankton and algae introduced into the system through makeup water or filtered from the air. Fouling results when these microorganisms grow in open systems rich in oxygen and form slime on the surfaces of the equipment. Slime is an aggregate of both biological and non-biological materials.

The best method of controlling biological fouling in evaporative units is to keep them clean. At least twice during the cooling season, the unit should be drained, scrubbed clean and allowed to dry fully before refilling. Thereafter, a chemical treatment will complete the process.

Uncontrolled microbiological fouling can cause major corrosion and deposit problems in evaporative units. Microbials in condenser water systems can become resistant to a single method of treatment, therefore it is recommended that both

oxidizing and non-oxidizing types of chemical treatment be used, either blended together or in alternating treatment patterns, as indicated by periodic water test results. The key to a successful biological treatment program is maintaining adequate chemical treatment levels at all times via continuous feed of antimicrobials in the water distribution system.

In order to maintain a continuous natural passivation of the stainless steel surface and maximize the unit life, it is essential to keep the stainless steel surface clean and free of foreign materials. Otherwise, the corrosion resistance that natural passivation provides can be interrupted or stopped resulting in premature material failure.

Legionella thrives in water temperatures between 68°F (20°C) and 122°F (50°C), with optimum growth occurring between 95°F (35°C) and 115°F (46°C). Low pH and high levels of aquatic growth enhance bacteria growth. Water temperatures above 140°F (60°C) will kill the bacteria.

The typical operating temperature(s) of evaporative units range from 85 -100°F, which makes the equipment an ideal habitat for Legionella. The major mechanism for infection by Legionella is via the inhalation of aerosolized water droplets or particles containing the bacteria. The spray nozzles introduce aerosolized water droplets and therefore represent prime mechanisms for infecting humans. Drinking water with the bacteria in it will not cause disease, nor can the disease be passed by human-to-human contact.

Evaporative units should be tested for Legionella within the water distribution system. This testing must be specific for Legionella. "Total bacteria" testing, promoted by some water treatment companies is inadequate since there is no correlation between total bacteria and Legionella concentrations. It is recommended that these tests are done once a year as a minimum, however, twice a year is recommended.

A water treatment program, undertaken by a water treatment service company with full service capabilities, is a mandatory requirement for all IDSC/ECOSS units, and must be included in the maintenance schedule. The water treatment program must be compatible with the unit's construction materials. In systems with mixed metallurgy, the water treatment expert must devise a program to ensure adequate protection for all components within the recirculated water loop. A system with a remote sump and carbon steel interconnecting piping coupled to the stainless steel heat exchanger is an example of mixed metallurgy.

It is recommended that the water treatment service company has sufficient expertise and experience to completely address all aspects of water related issues. The proposed approach to water treatment should incorporate proven technology. This does not exclude new technologies, products or methods, but does mean that the company should be able to demonstrate that their proposed technology has been successfully applied at other locations with similar water treatment conditions and requirements.

It is also recommended, at least twice a year, to send water samples from the units to an independent laboratory for analysis and compare the results with the most recent monthly reports provided by the water treatment company.

An effective water treatment program for IDSC/ECOSS units is integral to water and energy efficiency, and will help ensure the longevity of the units.

NOTICE

Failure to comply with the water guidelines as laid out above will void all warranties.

The water quality guidelines recommended in this manual are for stainless steel surfaces which are kept clean and free of debris and coverage. If a stainless steel surface is covered with foreign materials, the guidelines could change (i.e. the max. level of choride). The information is intended as a guideline only and does not imply or expressly state a guarantee.

TROUBLESHOOTING

⚠ WARNING

Danger of injuries and damage to property (see Appendix I, 8 Troubleshooting)!

SERVICE

Contact your nearest Frick Factor.

TROUBLESHOOTING TABLE

Fault	Possible cause(s)	Remedy
Fan motor not running	Power supply interrupted	Restore power supply
	Fan blade stuck	Enable fan to rotate freely
Bearing noises	Defective fan motor	Renew bearing or fan motor
Excessive vibration of the unit	Defective fan blades	Change fan blades
	Loose fan fixture	Tighten fixtures
Refrigerant leak	Unit refrigerant-carrying components leaking	Switch off refrigerant feed and fans, close leak

APPENDIX I

1 GENERAL INFORMATION

This equipment is relatively complicated and the installation, operation, maintenance and servicing should only be carried out by suitable individuals who are qualified to carry out these functions. These individuals shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to the function/s.

- ✓ Always keep the operating instructions including Appendix I "Safety-Related Information" in the unit's immediate vicinity at all times.
- ✓ Ensure that the operating instructions including Appendix I "Safety-Related Information" are accessible to all people that have anything at all to do with the unit at all times.
- ✓ Ensure that the operating instructions including Appendix I "Safety-Related Information" are read and understood by all people that have anything at all to do with the unit.

1.1 RESPONSIBILITIES

1.1.1 Manufacturer's responsibilities

The notes provided in these operating instructions on maintaining the unit's functional safety, preventing possible hazards when transporting, setting up and installing, start-up and operation, and with maintenance activities (cleaning, servicing and repairing) refer exclusively to the unit.

The construction, soldering and welding materials are configured so that they withstand the foreseeable mechanical, thermal and chemical stresses, and are resistant to the refrigerant and the refrigerant/refrigerator oil mixture used.

The refrigerant-carrying parts of the unit (coil and header outlet) are configured so that they remain tight with the foreseeable mechanical, thermal and chemical stresses, and withstand the maximum operating pressure.

Material, wall thickness, tensile strength, corrosive resistance, shaping process and testing are suitable for the refrigerant used and withstand the possible pressures and stresses that might occur.

All responsibilities, regarding the equipment into which the unit is integrated, are the exclusive responsibility of the people involved in the individual workflows.

1.1.2 Responsibilities of the system's installer

The responsibilities of the system installer are documented in the system's version (design, manufacture and testing – cooling equipment and refrigeration system) in accordance with IIAR standards.

Component supplier-system installer interfaces:

- Inform Johnson Controls immediately if faults occur during the setup, installation, start-up and operation.

The responsibilities of the system installer in particular include:

- Planning and preparing emergency measures:

To avoid consequential damage caused by operational disruptions, a warning system which immediately signals all faults must be provided on-site. Prepare emergency measures that prevent consequential damage for people and property should faults occur.

- ✓ Install emergency STOP switches that can be actuated without danger.
- ✓ Specify checking and maintenance intervals.

The complete system must be configured and equipped with all required equipment for maintenance and sufficient servicing and testing in accordance with IIAR standards.

With the integration of the unit into the refrigeration system, the refrigerant and unit model must not deviate from the order-related information specified in the order-related documents.

The installer of the system must refer to the requirement for sufficient instruction of the operating and supervision staff when operating and maintaining the equipment.

It is recommended that the future customer staff be present during setup and installation, tightness test and cleaning, filling with refrigerant, and setting of the equipment.

1.1.3 Owner or operator responsibilities

The owner or operator responsibilities are documented in accordance with IIAR standards.

The owner or operator must ensure that the proper people have sufficient knowledge and experience and are sufficiently trained and qualified for operating, monitoring, and servicing the system.

Before the system start-up the owner or operator must ensure that the operating personnel are sufficiently instructed with the system's documentation on the setup, monitoring, mode of operation and servicing of the system and the safety measures to be observed, and with regard to the properties and handling of the refrigerant to be used.

The owner or operator must ensure that when operating, monitoring and maintaining the system the refrigerant and unit model must not deviate from the details specified in the order-related documents.

Planning and preparing emergency measures: To avoid consequential damage caused by operational disruptions, a warning system must be installed on the customer's premises. Prepare emergency measures that prevent consequential damage for people and property should faults occur.

Responsibility remains with the owner or operator of the system, if the system is used by somebody else, unless there is an agreement on sharing responsibility.

1.2 LEGAL NOTES

Warranty claim expires as follows:

- With faults and damages that can be attributed to non-compliance with the specifications of these operating instructions.
- With complications that can be attributed to the use of spare parts other than the original spare parts specified in the order-related documents.
- With changes to the unit (refrigerant, unit model, function, operating parameters) deviating from the order-related information specified in the order-related documents without the manufacturer's prior consent.

1.3 OPERATING INSTRUCTIONS

1.3.1 Scope

These operating instructions apply for all IDSC/ECOSS™ evaporative condensers.

NOTICE

You will find the precise type of your unit in the attached order-related documents.

1.4 CONVENTIONS FOR SAFETY SIGNS AND NOTICES

1.4.1 General safety signs and their meaning in these operating instructions

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially hazardous situation or practice which, if not avoided, will result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation or practice which, if not avoided, will result in damage to equipment and/or minor injury.

NOTICE

Refers you to possible damage to property or indicates an operating procedure, practice, etc., or portion thereof which is essential to highlight.

1.4.2 Warning signs and their meaning in these operating instructions

	**Warns against hand injuries!** Hands or fingers can be crushed, pulled in or otherwise injured with non-compliance.
	**Warns against hot surfaces!** The temperature is over 110°F (protein clotting) and can cause burns.
	**Warns against dangerous electrical voltage!** Danger of an electric shock if voltage-carrying parts are touched.
	**Warns against fire-risk substances at setup point.** Use of ignition sources can cause fire at setup point.
	**Warns against harmful to health or irritant substances at setup point.** Contact with or inhaling harmful to heal or irritant substances can cause injuries or damage the health.
	**Warns against potentially explosive substances at setup point.** Use of ignition sources can cause explosions at setup point.

1.4.3 Prohibitory signs and their meaning in these operating instructions

	**Fire, open flame and smoking are prohibited!** Ignition sources must be kept away and ignition sources must not develop!
	**No smoking!** Smoking is prohibited.

1.4.4 Mandatory signs and their meaning in these operating instructions

	**Use eye protection!** Eye protection: Use protective cover, protective glasses or face protection.
	**Use hand protection!** Protective gloves must protect against mechanical and chemical dangers.
	**Use repiratory protection!** Breathing apparatus must be suitable for the working fluid used. Breathing apparatus must consist of at least two independent breathing devices (self-contained breathing apparatus)
	**Use protective clothing!** Personal protective clothing must be suitable for the working fluid used and for low temperatures, and must have good heat insulation properties.

Deactivate before work!
Deactivate the electrical system and ensure all electrical switchgear for the fans are disconnected, locked out and tagged out before starting installation, maintenance and repair work.

2 SAFETY

2.1 LABELING ON THE UNIT

2.1.1 Safety signs on the unit.

⚠ DANGER

Direct and indirect contact with voltage-carrying parts of motors and electrical lines can cause serious injuries or death.

⚠ WARNING

Disconnect 30 AMP switch before doing any maintenance. Ensure all electrical switchgear have been disconnected, locked out and tagged out.

2.2 BASIC SAFETY NOTICES

2.2.1 How to act in an emergency with halocarbons

⚠ WARNING

Danger of injuries!

The halocarbon refrigerants that are used (R134a, R404A, R407C, R507 ...) are Group L1/A1 refrigerants in compliance with classification according to flammability (L) and toxicity (A):

- Refrigerants that, when gaseous, are nonflammable irrelevant of their concentration in air.
- Refrigerants with a time-weighted, averaged concentration that have no adverse effects on the majority of staff who are exposed every day during a normal 8 hour working day and a 40 hour working week to this concentration, which is greater than or equal to 400 ml/m³ ppm (V/V).

There is no imminent danger for the staff. However, refrigerants of the Group L1/A1 are generally heavier than air and may flow off to rooms on a lower level. In still air there may be an increase of the ground level concentration. With high concentrations there is a danger of suffering from disordered cardiac rhythm and suffocation due to a reduced oxygen concentration, especially at ground level.

Unauthorized people must not have access to the unit. Please ensure that the halocarbon refrigerant leaking from the unit cannot penetrate the interior of the building or put people at risk in any other way.

Safety measures and procedure:

- With unexpected serious refrigerant escapes, leave the setup space immediately and activate the emergency STOP switch set up in a safe place, e.g. with:
  - o Visibly leaking refrigerant liquid or vapor from the heat exchanger or pipe components.
  - o Sudden large release (release and evaporation of the greater part of the entire refrigerant filling in a short time, e.g. in less than 5 minutes).
  - o Activation of the refrigerant detector:
- Have experienced, trained personnel with prescribed protective clothing perform all necessary protective and other measures:
  - o Use respiratory protection.
  - o Use a room air-independent breathing apparatus with maintenance work in high refrigerant concentrations in the room air.
  - o Ensure the setup space is well ventilated.
  - o Divert leaking refrigerant vapor and leaking refrigerant liquid safely.
  - o Ensure that no refrigerant enters water systems or sewage.

2.2.2 How to act in an emergency with Ammonia

⚠ WARNING

Danger of injuries and damage to property!

If the unit contains ammonia as a refrigerant (NH_3). Ammonia is a potentially explosive and fire-risk substance. Unintentionally carried in oil residues and unintentionally carried in refrigerant can ignite. An explosion can cause the most serious injuries and loss of limb.

Ammonia is a corrosive, toxic irritant gas. From ammonia concentration of 0.2 vol % in the ambient air or with a long stay in the ammonia-containing ambient air ammonia can be life-threatening or fatal.

Safety measures and procedure:

- With unexpected serious refrigerant leaks, leave the setup space immediately and activate the emergency STOP switch set up in a safe place, e.g. with:
  - o Visibly leaking ammonia liquid or vapor from the heat exchanger or pipe components.
  - o Sudden large release (release and evaporation of the greater part of the entire refrigerant filling in a short time, e.g. in less than 5 minutes).
  - o Sudden strong smell; very irritating; immediate irritation of the eyes, nose and air passages.
  - o Activate NH_3 alarm device (NH_3 concentration > 200 ppm):
- Have experienced, trained personnel with prescribed protective clothing perform all necessary protective and other measures:
  - o Use respiratory protection.
  - o Use a room air-independent breathing apparatus with maintenance work in high ammonia concentrations in the room air.
  - o Ensure the setup space is well ventilated.
  - o Divert escaped refrigerant vapor and escaped refrigerant liquid safely.
- Instructions for dealing with injuries:

- o Call an emergency doctor immediately!
- o Liquid ammonia can cause frostbite or corrosive injuries to the skin or eyes. The injured person must keep breathing apparatus on until further notice to prevent inhalation of vapors from ammonia contaminated clothing.
- o Shower the injured person for five to fifteen minutes with water. Be careful when removing the clothing during the shower. If ammonia-contaminated clothing is removed without wetting with water first, the injury can worsen, as firmly frozen skin may be torn away. Showering should be with warm water as much as possible to prevent a temperature shock. If available, use an emergency shower; otherwise use a water hose.

2.2.3 Personnel, care requirements

⚠ CAUTION

The unit must only be put into operation, operated, maintained and repaired by trained, experienced and qualified personnel. People that are responsible for the operation, maintenance, repair and evaluation of systems and their components must have the required training and specialist knowledge. Qualified or expert means the ability to satisfactorily perform the activities required for the operation, maintenance, repair and evaluation of refrigeration systems and their components.

The unit may be operated by personnel that have no specific knowledge of refrigeration engineering, but have sufficient knowledge and experience with regard to the mode of operation, operation and daily monitoring of this system. These operating personnel may not make any interventions or settings on the system.

Changes to the unit, which the manufacturer has first to agree to in writing, may only be made by instructed and qualified personnel.

Electrical installation:

Work on the electrical equipment may only be performed by personnel that have the required expertise (ex: an electrician or an electro-technically instructed person), and who are authorized by the operator, in compliance with the respective regulations and the TCCs of the EPCs.

2.3 PROPER INTENDED USE

Proper intended use:

IDSC/ECOSS™ evaporative condensers are intended for installation in a refrigeration system and for outdoor installations. The condensers condense the refrigerant by rejecting heat to the ambient air that is moved by fans over the wet heat exchanger surface.

The unit is delivered for operation with a specific operating point:

- Condensation temperature
- Fan kW
- Air inlet bulb temperature

The specified operating point is provided in the order-related documents.

Operating Conditions:

The unit is a component of a cooling system including its refrigerant circuit. The purpose of these operating instructions is to restrict the dangers to people and property and the environment from the unit and the refrigerant used in it to a minimum. These dangers are essentially connected with the physical and chemical properties of the refrigerant and with the pressures and temperatures that occur in the refrigerant-carrying components of the unit (see Appendix I, 2.7 Residual hazards with refrigerant halocarbons: and Ammonia:).

⚠ WARNING

Danger of injuries and damage to property!

The unit must only be used in accordance with the proper intended use. The operator must ensure that when operating, monitoring and maintaining the unit, the refrigerant and model type do not deviate from the order-related information specified in the order-specific documents.

The operator must ensure that maintenance measures are performed in compliance with the system's operating instructions manual.

Improper use:

⚠ WARNING

Danger of injuries and damage to property!

Refrigerants and their combinations with water or other substances in the refrigerant-carrying components have chemical and physical effects from the inside on the materials surrounding them. The unit must only be pressurized with a specified refrigerant. Pressurizing the unit with another refrigerant results in:

- material, wall thickness, tensile strength, corrosive resistance, shaping process, and testing are not suitable for the refrigerant used and do not withstand the possible pressures and stresses that might occur
- the unit not being resistant to the other refrigerant and the other refrigerant mixture
- the unit not remaining tight during operation and when shut down
- a possible sudden escaping of refrigerants could directly endanger people and/or property and the environment

The maximum permissible operating pressure specified on the name plate must not be exceeded! If the operating pressure is exceeded:

- the structural and welding materials will not withstand the foreseeable mechanical, thermal and chemical stresses and the pressure that can occur during operation and when shut down
- the unit will not remain tight during operation and when shut down
- there may be a possible sudden escaping of refrigerants after a break or leakage on refrigerant-carrying components, which would result in the following dangers:
  - o Danger of escaping materials
  - o Dangers caused by oxygen displacement

- o Fire hazard (caused by refrigerator oil parts)
- o Frostbite hazard (caused by liquid coolant squirting/ splashing)
- o Suffocation hazard
- o Hazards caused by panic reactions,
- o Environmental pollution

⚠ WARNING

Danger of injuries and damage to property!

IDSC/ECOSS™ Evaporative condensers may not be used:

- where it is possible that short or prolonged effect caused by contact, inhalation or ingestion of the refrigerant might result in harmful hazards
- where the possibility exists of a sudden large release (release and evaporation) of the greater part of the entire refrigerant filling in a short time (ex. in less than 5 minutes)

The unit must not be changed without prior written consent by Johnson Controls. Changes to the unit are:

- changing the operating point (see chapter Unit)
- changing the fan capacity (air volume)
- changing the refrigerant flow-through volume
- changing over to another refrigerant

The unit must not be operated if safety devices recommended by the manufacturer are not available, not properly installed or not fully functional.

The unit must not be operated if it is damaged or demonstrates faults. All damages and faults must be reported to Johnson Controls immediately and must be removed immediately.

Work on the unit must not be performed without the personal protective equipment specified in these operating instructions.

2.4 MECHANICAL RESIDUAL HAZARDS

⚠ WARNING

Danger of cutting off, pulling in!

There is a danger of cutting off fingers on the rotating fan blades, injury hazard for the hands and pulling in danger for lose elements such as hair, necklaces, or clothing parts.

Do not operate fans without guard grille. Pinch/trap point hazard!

With automatic fan start during maintenance work there is a danger of pinching/ trapping for the hands and fingers.

Power off the unit before you begin maintenance work with which you must remove the guard grille. Ensure that all electrical switchgear for the fans must be disconnected, locked out and tagged out!

2.5 ELECTRICAL RESIDUAL HAZARDS

⚠ WARNING

Warns against dangerous electrical voltage!

Direct and indirect contact with voltage-carrying parts of motors and electrical lines can cause serious injuries or death.

Power off the unit before you begin maintenance work. See the refrigeration system documentation for this. Ensure all electrical switchgear have been disconnected, locked out and tagged out.

Please note that the main cables may also be carrying voltage, even if the unit is powered off.

Work on electrical equipment must only be performed by people that have the required expertise (ex: an electrician or an electro-technically instructed person) and who are authorized to do so by the facility operator.

2.6 THERMAL RESIDUAL HAZARDS

⚠ WARNING

Danger of burns - Warning against hot surfaces!

During operation, the coil of the unit and heater elements (option) have temperatures of over +110°F. Contact can cause burns.

With refrigerant temperatures of above +110°F there is hazard of burns on pipe components and header inlets.

Use appropriate hand protection!

⚠ WARNING

Danger of frostbite - Warning against cold!

When doing maintenance work consider that residual refrigerant still under defervescence has a temperature of 32°F. Contact with refrigerant under defervescence caused by spraying causes frostbite.

- Use appropriate eye protection!
- Use appropriate hand protection!

⚠ CAUTION

Danger of damage to the property in the event of the unit freezing!

When not in operation the water in the basin may freeze in the event of very low temperatures. Make sure the basin is drained whenever the unit is not in operation or use the heating elements to ensure the water in the basin does not freeze. Warranty is void in case of non-compliance with these instructions.

2.7 RESIDUAL HAZARDS WITH REFRIGERANT

⚠ WARNING

Danger of injuries!

Halocarbons:

The halocarbon refrigerants that are used (R134a, R404A, R407C, R507 ...) are Group L1/A1 refrigerants in compliance with classification according to flammability (L) and toxicity (A):

- Refrigerants that, when gaseous, are non-flammable irrelevant of their concentration in air.
- Refrigerants with a time-weighted, averaged concentration that have no adverse effects on the majority of staff that are exposed every day during a normal 8 hour working day and a 40 hour working week to this concentration, which is greater than or equal to 400 ml/m³ (400 ppm (V/V)).

There is no imminent danger for the staff. With good air ventilation and removal by suction, it will fall easily and clearly below the allowed limit values.

⚠ WARNING

Danger of harm to health and environmental damage!

Refrigerants of the Group L1/A1 are generally heavier than air and may flow off to rooms on a lower level. In still air there may be an increase of the ground level concentration. With high concentrations there is a danger of suffering from disordered cardiac rhythm and suffocation due to a reduced oxygen concentration, especially at ground level.

Unauthorized people must not have access to the unit.

Ensure working rooms are well-ventilated in order to prevent inhalation of high vapor concentrations.

Please ensure that the halocarbon refrigerant leaking from the unit cannot penetrate the interior of the building or put people at risk in any other way. Halocarbon refrigerant vapor or gas must be kept from penetrating neighboring rooms, staircases, yards, passages or drainage systems and must be discharged without risk.

Monitor the halocarbon refrigerant concentration in the ambient air to ensure constant compliance with limit values.

Test the tightness of the unit regularly, as specified in these operating instructions (see Appendix I, 6.4 Inspection and maintenance plan).

Ignition and fire hazard!

- With work involving fire or sparks, ex. grinding, welding, etc. ensure suitable firefighting equipment is on-site.
- In particular be aware of the danger of ignition of residues or halocarbon refrigerant unintentionally carried in oil.
- Ensure that firefighting equipment is provided in sufficient quantities, that it functions properly and that the extinguishing agent does not react with the halocarbon refrigerant.
- Smoking during work is prohibited!

Frostbite hazard

Splashing halocarbon refrigerant under boiling retardation can cause frostbit on the eyes and skin.

- When removing faults after halocarbon refrigerant spills, you must be vigilant for remaining halocarbon refrigerant still under boiling retardation.

Danger of poisoning!

Halocarbon refrigerant contact with fire can form toxic combustion products.

- Prevent halocarbon refrigerant contact with open fire.
- Welding and soldering must therefore only take place after completely draining the relevant section of the system of the halocarbon refrigerant. Ensure good ventilation!
- With emergency work in high refrigerant concentrations in the room air, wear a room air-independent breathing apparatus.

Ammonia:

⚠ WARNING

Danger of injuries and damage to property with Ammonia as refrigerant!

Ammonia can cause the following hazard situations and injuries:

Explosion hazard! Fire hazard!

Ammonia is a flammable, explosive gas. The fire and explosion hazard is low because of the high ignition temperature, small ignition range, low explosiveness potential and high affinity with air humidity. Leaks in the unit can cause the NH_3 refrigerant to escape into the installed area. Direct and indirect ignition sources can cause the NH_3 refrigerant to burn and/or explode.

- Do not store potentially explosive and fire-risk substances in the installed area!
- Test for leaks of the unit regularly, as specified in these operating instructions.

Provide firefighting equipment in sufficient numbers in the unit's installed area. Observe the details for firefighting in the NH_3 refrigerant safety data sheet.

Chemical burn hazard!

Leaks in the unit can cause the NH_3 refrigerant to escape into the installed area. NH_3 refrigerant is corrosive in combination with moisture. Contact with the skin, mucous membranes and the eyes with the NH_3 refrigerant causes chemical burns on the skin, mucous membranes and the eyes. If the NH_3 refrigerant gets into the eyes, the eyes can no longer be kept open because of the strong burning, and thus orientation is lost.

Danger of poisoning!

Leaks in the unit can cause the NH_3 refrigerant to escape into the installed area. Ammonia is a toxic irritant gas. Inhaled NH_3 refrigerant causes agitation, dizziness, vomiting and cramps; with heavy concentrations suffocation and life-threatening pulmonary edema. Panic sets in. From an ammonia concentration of

0.2 vol % in the ambient air or with a long stay in the ammonia-containing ambient air ammonia can be life-threatening or fatal.

- Ensure that the maximum permissible limit values in the setup room are not exceeded.
- Monitor the ammonia concentration in the ambient air with detectors and alarm devices.

Frostbite hazard!

Leaks in the unit can cause the NH_3 refrigerant to escape into the setup area. Liquid NH_3 refrigerant has a temperature of -28°F. Contact with the skin and eyes will cause frostbite.

- Test the tightness of the unit regularly, as specified in these operating instructions.

Ammonia is considered toxic at low concentration levels of 35-50 ppm. Large quantities of ammonia should not be vented to enclosed areas near open flames or heavy sparks. Ammonia at 16 – 25% by volume burns and can explode in air in the presence of an open flame.

⚠ WARNING

Danger of injury, damage to property or the environment with ammonia-water combinations!

If water gets in contact with hydrous ammonia, this can result in strong gas development and liquid ammonia splashing.

- Never sprinkle water on liquid ammonia!
- Do not use water in the machine room to bind vaporous ammonia!
- Ensure that ammonia-water (ammonia solution) never enters water systems or sewage!

2.8 RESIDUAL HAZARDS CAUSED BY VIBRATIONS

⚠ WARNING

Danger of injuries and damage to property caused by escaping materials!

If fans are damaged during fan operation, flying parts of the fan blades can injure people or cause damage to property close to the fan.

Fans, components, and cables in the system must be designed, constructed, and integrated so that dangers caused by vibrations are reduced to an absolute minimum.

NOTICE

Damage to property caused by vibrations!

Vibrations that are increased by imbalances, due to dirt or fan blade damage can cause further damage to the unit, the unit mounting, or refrigeration system components connected to the unit.

Check the fan blades and guard grille regularly for dirt and ensure that the fans operate smoothly (see Appendix I, 6.5.3 Fans and pumps).

2.9 COMBINED RESIDUAL HAZARDS

Residual hazards caused by pressurized parts:

⚠ WARNING

Injury and damage to property caused by pressurized parts that contain CFC/HFC or ammonia refrigerant!

Breaks in pressurized pipes or pressurized components of the unit can cause injuries or damage to property caused by leaking materials. A sudden large release of the refrigerant with its hazardous properties after a break or leak on pressurized components of the unit can cause the following hazards:

Halocarbons	Ammonia
Oxygen displacement	Flammability
Flammability caused by refrigerant oil % present	Explosion hazard
Frostbite (caused by liquid refrigerant squirting/ splashing)	Frostbite (caused by liquid refrigerant squirting/ splashing)
Suffocation	Suffocation
Panic	Panic
Environmental pollution	Environmental pollution
	Chemical burns

✓ Ensure that the unit in question is pressure-free before maintenance work begins or remove the refrigerant from the unit in question.

Only perform maintenance work – especially soldering work – on the unit in question after completely removing the refrigerant from the unit.

Residual hazards caused by defective installation:

⚠ WARNING

Injuries and damage to property caused by defective installation! Defective installation results in hazards caused by:

- break or leak on refrigerant-carrying unit components and pipes
- absence of release devices to prevent liquid escape: Liquid that can heat up during a refrigeration system shutdown state and cause pipes or connection flanges to break when it expands must not be locked in
- uneven load distribution on the fixtures with the danger of stresses within the unit or unit displacement (breaks or leaks on refrigerant-carrying components of the unit and pipes; danger of breaking off)
- insufficient securing of refrigerant-carrying lines against mechanical damage! On-site connections: loaded installation; effect of forces on the distribution and header pipes with the danger of breaks or leaks on refrigerant-carrying components of the unit and pipes; danger of breaking off!
- break-off and fall danger of the unit with hazard of escaping refrigerant and exposed electrical cables
- danger of damage caused by environment-conditional hazard sources (production, transport, and other processes at the setup point)
- unit functional faults caused by air inlet/outlet obstructions
- obstruction of all-side inspection, checks and maintenance, i.e. no unobstructed accessibility to the refrigerant-carrying and electrical components, connections and cables, no recognizable identifiers on the pipes and insufficient space for tests

With ammonia units, defective installation may also result in hazards caused by:

- under-cooled liquid in system sections: If system sections are opened with repairs and the pressure is balanced with the atmosphere, there is a danger that liquid, under-cooled ammonia will still be in the opened area. Ammonia has a very high evaporation heat, so that the heat penetration in the pipes, for example, which are laid with a "fluid sack", is not sufficient to evaporate the liquid ammonia quickly – especially if this is an insulated line.

Ensure that:

- The units are to be installed on the mounting points corresponding with their weights and tightened with mounting bolts. The operator or installer is responsible for ensuring that the bolted connections are of adequate strength.
- The diameters of the mounting holes have been statically determined by the manufacturer and the mounting bolts are adapted accordingly.
- The mounting bolts are secured against loosening by means of an appropriate locking device.
- The mounting bolts are not over-tightened or stripped.
- All mounting bolts are tightened equally to achieve a load distribution on the connections that is as balanced as possible.
- All mounting points maintain the same spacing to the support structure permanently and under load, so that no mechanical stress occurs in the unit structure. The units are anchored in their position in order to prevent the equipment from moving.
- The functional safety of the mounting bolts is tested as part of the maintenance periods.
- The unit is fixed and set up so that it is not damaged by environment-conditional hazard sources (production, transport and other processes at the setup point) or its functioning is not disturbed by the interventions of unauthorized persons.
- The units are fixed and set up so that unobstructed air inlet/outlet is constantly available without any air short circuiting.
- The units are fixed so that they can be inspected, checked and maintained from all sides at all times, i.e. there must be unobstructed access to the refrigerant-carrying and electrical components, connections and lines, the pipeline labeling must be identifiable and adequate space must be available for testing.
- The refrigerant-carrying lines are protected against mechanical damage. On-site connections: when installing keep the unit free of load; force must not be exerted on the distribution and header pipes.
- The following must be observed without fail when installing the unit:
  - o Imperative adherence to spacing from objects that could be endangered by an effect of the halocarbon refrigerant.
  - o Imperative adherence to spacing from objects that

could be endangered by an explosion or the toxic effect of NH_3.
- o Provision of measures to safeguard protective objects from an NH_3 concentration of more than 200 ppm.
- o Easily flammable materials must not be placed below the unit.
- o Release devices to prevent liquid escapes must be provided and available.
- o In units using ammonia as the refrigerant, the subcooled liquid must only be present in the lowest possible amount in system sections in shutdown state – minimized number of "fluid traps".

Residual hazards with break during operation

⚠ WARNING

Injuries and damage to property caused by break during operation!

The following may result in ruptures during operation and maintenance:

- Residual hazards with break during operation (see Appendix I, 2.9 Combined Residual hazards, Residual hazards caused by defective installation:).
- Non-compliance with maximum permissible operating pressure (see Appendix I, 2.3 Proper intended use, Operating Conditions:),
- Disregarding pressurized line sections with maintenance (see Appendix I, 2.9 Combined Residual hazards, Residual hazards caused by pressurized parts:).
- Disregarding residual hazards caused by vibration (see Appendix I, 2.8 Residual hazards caused by vibrations).

This results in dangers caused by:

- leaking materials (see Appendix I, 2.9 Combined Residual hazards, Residual hazards caused by pressurized parts:).
- released refrigerant (see Appendix I, 2.7 Residual hazards with refrigerant halocarbons: and Ammonia:).

Ensure that:

- The installation is fault-free.
- The maximum permissible operating pressure is always adhered to.
- Pressurized line sections are depressurized before all maintenance and repair work.
- Vibrations from the refrigeration system (vibrations caused by the complete system's compressors, components and lines,) and from the fans (imbalances caused by frosting, icing or dirt build-up or damages) are reduced with all available means and brought down to an absolute minimum.
- Release devices to prevent liquid escapes are provided and available.
- Under-cooled liquid is only present in the lowest possible amount in system sections in shutdown state – minimized number of "fluid sacks".

Residual hazards with disposal

⚠ WARNING

Danger of injuries and damage to property caused by refrigerant!

The following notes are recommendations for the proper professional disposal of the unit. Applicable waste disposal laws are binding for the country of operation:

- Disposal must only be carried out by experts.
- All unit components, ex: refrigerants, refrigerant oil, heat exchangers, fans must be disposed of properly as specified.
- Used refrigerant that is not determined for reuse, must be treated as waste and safely disposed of. There must be no emissions into the environment.
- The refrigerant must be filled into a special refrigerant container in compliance with the respective safety measures. This special refrigerant container must be suitable for the refrigerant. It must be easy to identify and labeled for the refrigerant.
- A disposable single-use container must not be used, as refrigerant vapor residues in the container escape during disposal.
- The refrigerant container must not be overfilled. The maximum permissible pressure of the refrigerant container must not be exceeded during the work process.
- The refrigerant must not be filled in a liquid container that contains another or an unknown refrigerant. This other or unknown refrigerant must not be released into the atmosphere, but rather identified, treated again, or properly disposed of as specified.
- An officially authorized facility can be used for destroying the refrigerant.
- Used refrigerant oil that has been recovered from the unit and cannot be treated again, must be kept in a separate, suitable container, treated as waste and safely disposed.
- It must be ensured that all unit components containing refrigerants and refrigerant oil, are disposed of properly as specified.
- The unit consists predominantly of the basic materials stainless steel, polyamide (motors and water spray nozzles). These materials can be handled by the waste industry, including in paint-treated state, to recycling via mechanical and thermal separation.
- Before scrapping the refrigerant-carrying unit components, they must be drained, whereby the pressure must be reduced to at least 8.7 psia for a unit pipe volume up to and including 200 l, and to 4.3 psia for a unit pipe volume over 200 l. The pressure reduction process is then ended when the pressure no longer increases and remains constant, and the unit is at ambient temperature.

⚠ WARNING

Danger of environmental pollution!

The facility for recovering or disposing of the refrigerant must be operated so that the danger of a refrigerant or refrigerant oil emission into the environment is kept as low as possible.

The ammonia (NH_3) refrigerant is classified in accordance with the "Catalogue of Substances Hazardous to Waters" as water hazard class 2.

Escaping ammonia can enter the environment wind-born. Ammonia is lighter than air and rises quickly. It is diluted with the air to harmless concentrations. But even if the concentration is harmless, the ammonia smell is still irritating. Ammonia's classification as "toxic" means that people in the area will be concerned.

- Ensure that no refrigerant enters water systems or sewage.

- Operate the facility for recovering or disposing of refrigerants so that the danger of a refrigerant or refrigerant oil emission into the environment is kept as low as possible.

3 INFORMATION ON COMPONENT PARTS

No specific dangers at this point in service life.

4 TRANSPORTATION, STORAGE, UNPACKING & MOUNTING

⚠ WARNING

Crushing danger with falling down!

The unit can slip and fall off the means of transport, causing serious injuries or death. Heavy impacts or vibrations can damage the unit.

Observe the instructions on the transport labels on the packed units. Ensure that the assigned staff is trained for proper unloading.

Use a transporting device appropriate for the unit's weight (1.5 x the weight of the unit). You will find the weight of the packed unit in the order-related documents. Ensure that nobody is under the unit or near the loaded area during the transport.

Observe even distribution of unit weight for transport. Observe the instructions on the transport labels on the packed units (see Appendix I, 2.1.2 Other signs and notes on the unit) No specific dangers at this point in service life.

Secure the unit against slipping and mechanical damage.

When lifting by crane: The hooks and lifting gear of the load lifting equipment must be only attached at the points specified by the manufacturer. Ensure that the unit enclosure is not crushed by slings.

Use auxiliary lifting equipment where required. Do not use connection pieces and header pipes as hooking points for lifting, pulling, fixing or mounting. This can cause damage and subsequent leaks.

Lift the unit carefully. Avoid setting the unit down hard in particular.

4.1 TRANSPORTATION

NOTICE

Read and observe all transport signs on the unit packaging!

Prolonged mechanical stresses caused by uneven road surfaces and potholes cause transportation damage.

Transporting the unit at the installation point

- Unloading the unit
- Transport and unload the packed unit with suitable transport equipment (ex: crane) at the setup point.

Do NOT use a fork lift.

4.2 LONG TERM STORAGE

NOTICE

Danger of corrosion and dirt build-up! (see Appendix I, 5 Connecting the unit, 5.1 Safety instructions, 5.1.1 Safety instructions for setup and start-up).

The unit is intended for outdoor use only. To protect the unit from damage due to the elements, the unit should be stored in a clean, dry location and away from areas with excessive traffic. The unit should be well ventilated at all times during storage.

Do not store the unit(s) for longer than necessary, and make sure the original packaging is kept intact. Do not remove the basin and / or the coil sections from their respective shipping support until basin section is mounted on support structure and upper casing is properly positioned and fastened to the basin section already mounted and fastened properly to the support structure.

During extended storage or downtime periods, the fans must be operated for at least 2 - 4 hours each month. At an absolute minimum the motors should be rotated a minimum of ten (10) revolutions per month.

Moisture and dirt must be prevented from entering the unit.

- ✓ Protect the unit against dust, dirt, moisture and wetness, damage and other harmful effects.
- ✓ Harmful effects: see Appendix I, 5 Connecting the unit, 5.1 Safety instructions, Safety instructions for setup and start-up).
- ✓ Do not store the unit for longer than necessary. Only store the units in their original packaging until installation.
- ✓ Store the unit at a protected place free of dust, dirt, and moisture and damage-free until it is set up (well-ventilated halls or roofed storage site).
- ✓ If the unit setup is delayed with regard to the planned installation time: protect the unit against weather and other harmful effects and dirt and other contaminants with an appropriate cover. The unit must also be well-ventilated.

4.3 UNPACKING

No specific dangers at this point in service life.

4.4 MOUNTING

⚠ WARNING

Danger of injury and damages to the property!

There is already a “gap” designed between the PVC riser pipe in the basin and casing sections. Care should be taken when lifting the casing section such that it is lifted level (with little or no tilt) to ensure the PVC riser pipe does not come in contact with the ground, any objects, or the basin section to prevent damage.

If instructions are not followed, warranty will be void.

5 CONNECTING THE UNIT

5.1 SAFETY INSTRUCTIONS

5.1.1 Safety instructions for setup and start-up

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant!

Incorrect installation causes the danger of refrigerant escaping when the unit is operated and injuries or damage to property (see Appendix I, 2.7 Residual hazards with refrigerant).

Follow the setup instructions in this chapter precisely and exercise extreme caution!

NOTICE

Damage to the system's cooling equipment!

Foreign materials and contaminants in the refrigerant circuit can impair the effectiveness or damage components. Particularly harmful contaminants are:

- Moisture
- Atmospheric air
- Soldering/welding residues
- Rust
- Soot/ash/cinders
- Metal cuttings
- Unstable oils
- Dust and dirt of all kinds

Moisture in the refrigerant-carrying components of the unit can have the following consequences:

- Water separation and ice formation cause faults in the switching and control fittings of the refrigeration system
- Acidification
- Aging and refrigerant oil decay
- Corrosion

Atmospheric air and other non-condensable gases can have the following consequences:

- Refrigerant oil oxidation
- Chemical reactions between refrigerant and refrigerant oil
- Increased condensing pressure in the system

Chemical reactions between refrigerant and refrigerant oil with the absence of moisture or atmospheric air with aging and refrigerant and refrigerant oil decay can have the following consequences:

- Formation of organic and inorganic acids
- Increased compressed gas temperature in the system
- Corrosion
- Bad lubrication, increased wear and tear through to system or failure

Other contaminants can cause:

- Accelerated chemical processes (decomposition)
- Mechanical and electrical faults in the refrigeration system

Ensure with installation (connecting the refrigerant-carrying components of the unit to the refrigerant-carrying system of the installation) that internal contamination is strictly avoided.

Perform the installation with extreme cleanliness.

Finish all on-site pipe installation work before releasing the transport pressure!

Only release the transport pressure on the Schrader valve immediately before installation.

Only remove the sealing caps on the distribution and header pipe immediately before installation.

NOTICE

Danger of corrosion and dirt build-up for units using ammonia as refrigerant!

The refrigerant ammonia is highly hygroscopic, i.e. it attracts humidity. Humidity and dirt may not get into the unit's interior. If humidity or dirt gets into the unit's interior, fittings and other components of the refrigeration installation can be damaged.

Protect the unit against dust, contamination, moisture and wetness, damage and other harmful influences. Harmful influences are, for example:

- Mechanical: Damages caused by impacts, objects falling on or against, collisions with transport equipment, etc.
- Physical: Damages caused by close by concentrated flammable gases
- Chemical: Damages caused by contaminated atmospheres (salt, acid, chlorine, sulfur-containing, or similar)
- Thermal: Damages caused by close-by heat sources

Start as soon as possible with installation.

⚠ WARNING

The electrical installation must only be performed by electricians in compliance with relevant rules (or applicable national and international regulations).

5.1.2 System-side safety requirements

The unit is a component of an installation and can only be operated in conjunction with the installation:

- All equipment required for operating the unit must be integrated into the switching and activation equipment:
  - o Electrics: Fans
  - o Working fluids: valves and fittings
- An emergency STOP switch that can be actuated without danger must be installed.
- The refrigerant-side and electrical connections must be available on the system. The connections must be specified in the order-related documents.
- The power supply of the fans must be provided in accordance with the specifications on the name plate on the fan motors.
- A switch-off device for preventing unexpected start-up (repairs switch), which separates all active conductors from the power supply (all-pole switch-off), must be provided for the fans.
- The fans' switch-on/off device must be secured (ex: with a padlock) to prevent uncontrolled fan start-up.
- The electrical motor, repairs switch, terminal box and switching cabinet connections must be provided in accordance with the respective connection diagrams.
- It must be possible to shut off the unit if a leak occurs.
- People wearing ambient air-independent breathing apparatus in full protective clothing must also be able to activate all safety-relevant shutoff fittings.
- It must be possible to activate all devices meant for diverting escaping working fluids from a safe location.

5.1.3 Customer-side safety precautions

Halocarbons:

⚠ WARNING

Danger of environmental pollution!

- Ensure that no refrigerant enters water systems or sewage.
- Operate the facility for recovering or disposing of refrigerant so that the danger of a refrigerant or refrigerant oil emission into the environment is kept as low as possible

Ammonia:

⚠ WARNING

Danger of environmental pollution!

The ammonia (NH_3) refrigerant is classified in accordance with the "Catalogue of Substances Hazardous to Waters" as water hazard class 2. Refrigerant must never enter water systems or sewage.

Escaping ammonia can enter the environment wind-born. Ammonia is lighter than air and rises quickly. It is diluted with the air to harmless concentrations. But even if the concentration is harmless, the ammonia smell is still irritating. Ammonia's classification as "toxic" means that people in the area will be concerned.

- Set up the unit so that liquid ammonia, which can escape from the unit in the event of a fault, cannot enter water systems or sewage.
- With serious ammonia escapes into the waste water system, for example when ammonia vapor is broken down by water: immediately report the incident to the responsible office for the local waste water system.
- If an ammonia puddle has formed on the floor under the unit, covering with a film (PE, for example) or synthetic medium expansion foam (fire department) can cut off almost all the heat dissipation to this liquid and therefore the vapor formation, so that there is enough time for disposal measures.

5.2 LOCATION REQUIREMENTS

No specific dangers at this point.

5.3 NOTES ON CONNECTING THE UNIT

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant! (see Appendix I, 2.7 Residual hazards with refrigerant).

In case of improper installation, leak of refrigerant can occur during operation of the installation, this can lead to injuries or damage to property.

Prevent refrigerant from escaping from the unit into the environment.

- Secure all refrigerant-carrying lines against mechanical damage.
- In areas that are used for internal traffic, only lay the pipelines to and from the unit with connections and fittings that cannot be removed.

Ensure that the on-site connections do not exercise any forces upon the distribution and header points. This can cause leaks on the refrigerant connection points of the unit and on connection points of the on-site pipe-laying.

Ensure that:

- Release devices to prevent liquid escapes are provided and available.
- With refrigeration system shutdown state, under-cooled liquid is only present in the lowest possible amount in system components – minimized number of "fluid sacks".

5.4 CONNECTING THE WATER PIPES

Recirculated water system

⚠ WARNING

Danger of injury due to biological contamination! (see Appendix I, 5.4 Connecting the water pipes)

Biological contamination of the water must be regularly monitored and treated accordingly when detected. Untreated, this biological contamination can lead to sludge, slime, continuous algae growth and other possible harmful microorganisms such as Legionella. Because of this, all internal surfaces, such as the coil, inlet louvers and drift eliminators must be kept clean at all times.

It is therefore essential that there is an ongoing water treatment program in place to monitor, analyze and maintain the water quality being recirculated through the unit. This should only be carried out by a suitably qualified water treatment company who can devise a program specific to the location, quality water source (could be multiple) and the construction materials of the unit.

5.5 CONNECTING THE UNIT TO THE SYSTEM

⚠ WARNING

In case of improper installation, leakage of refrigerant can occur during installation. This can lead to injuries or damage to property (see Appendix I, 2.7 Residual hazards with refrigerant).

- Only mount the unit to the mounting points intended.

Prevent refrigerant from escaping from the unit into the environment.

- Secure all refrigerant-carrying lines against mechanical damage.
- In areas that are used for internal traffic, only lay the pipelines to and from the unit with connections and fittings that cannot be removed.

✓ Ensure that the on-site connections do not apply any forces on the distribution and header points. This can cause leaks on the refrigerant connection points of the unit and on connection points of the on-site pipe-laying.

Ensure that:

- Release devices to prevent liquid escapes are provided and available.
- With refrigeration system shutdown state, under-cooled liquid is only present in the lowest possible amount in system components – minimized number of "fluid sacks".

5.5.1 Important considerations regarding installation

⚠ CAUTION

The unit must only be put into operation, operated, maintained and repaired by trained, experienced and qualified personnel. (see Appendix I, 2.2.1 Personnel, care requirements).

Any work done to connect the unit to the system must be done carefully, ex: welding the connecting pieces.

Warranty for damages caused by careless handling is excluded.

5.6 UNIT ELECTRICAL CONNECTION & PROTECTION

⚠ WARNING

Danger of injuries and damage to property!

If the fusing is too high there is the danger of injuries to people and damage to property.

Make sure that the supply lines are always fused in accordance with the smallest wire cross-section.

5.7 PERFORM ACCEPTANCE TEST

⚠ WARNING

Danger of injuries and damage to property!

Escaping refrigerant can cause injuries or even death (see Appendix I, 2.7 Residual hazards with refrigerant).

Perform the following acceptance test with an expert before starting up the unit after making important changes and after a unit swap-out.

5.8 TEST READINESS FOR OPERATION

No specific dangers at this point.

5.9 PUTTING THE UNIT INTO OPERATION FOR THE FIRST TIME

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant!

Escaping refrigerant can cause injuries or even death! (see Appendix I, 2.7 Residual hazards with refrigerant).

5.10 TAKING THE UNIT OUT OF OPERATION

NOTICE

For unit shutdown, consider the maximum operating pressure!

If necessary, take precautions so that it cannot be exceeded.

NOTICE

With shutdown times of a month or longer energize the fans for approximately 2-4 hours a month to maintain their functionality.

5.11 SHUTTING THE UNIT DOWN

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant!

Escaping refrigerant can cause injuries (see Appendix I, 2.7 Residual hazards with refrigerant and Appendix I, 2.9 Combined Residual hazards, Residual hazards caused by pressurized parts:).

Ensure that the maximum operating pressure is not exceeded after shutdown!

NOTICE

Danger of dirt build-up!

Moisture and dirt must be prevented from entering the condensing coil.

Protect the unit against dust, dirt, moisture, wet conditions, damaging and other detrimental influences (see Appendix I, 5 Connecting the unit, 5.1 Safety instructions, 5.1.1 Safety instructions for setup and start-up). With shutdown times of a month or longer energize the fans for approximately 2-4 hours a month to maintain their functionality.

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant (see Appendix I, 2.7 Residual hazards with refrigerant).

5.12 PUTTING THE UNIT INTO OPERATION AFTER A SHUTDOWN

NOTICE

The pressure test with recommissioning must only be carried out with appropriate media at appropriate test pressure by trained personnel.

6 MAINTENANCE

⚠ CAUTION

Danger of slipping and falling!!

Only step onto the unit with firm, tough and safe footwear and only when required.

If the units do not have any railings, always only walk on them with a safety device that prevents falling.

6.1 BEFORE STARTING ALL MAINTENANCE

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant (see Appendix I, 2.7 Residual hazards with refrigerant).

Only perform maintenance work – especially welding work – on the leaking unit after completely removing the refrigerant from the leaking unit!

Perform the following safety measures before beginning all maintenance work:

- drain the unit's heat exchanger
- clean and blow out the unit's heat exchanger

6.2 WITH ALL MAINTENANCE WORK

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant (see Appendix I, 2.7 Residual hazards with refrigerant).

Escaping refrigerant with leaks can cause the following hazard situations and injuries:

 	Warning against explosion-risk and fire-risk substances in the setup space! Unintentionally carried in oil residues can ignite.
	Ensure that there is no unintentionally carried-in oil in the setup space.
	Keep the risk area free of direct and indirect ignition sources.
	Before releasing for maintenance, obtain the required approvals for work for the unit that can involve ignition sources (ex: grinding, welding, soldering, etc.).
	With all work involving ignition sources (ex: grinding, welding, soldering, etc.) in the work area, keep suitable fire extinguishing equipment at hand.
	Do NOT bring any open flames or hot gases (ex: candles, matches, welding beads, sparks, glowing cinders or tobacco) into the setup space.
	Ensure that there are no warmed up or hot surfaces (ex: heaters, hotplates, bulbs, motor housings) in the setup space.

	Warns against corrosive substances in the setup space!
	NH_3 refrigerant still present is corrosive. Contact with the skin, mucous membranes and the eyes with NH_3 refrigerant under effervescence causes chemical burns on the skin, mucous membranes and the eyes.
	Use eye protection!
	Use hand protection!

	Warns against toxic and health-endangering irritants in the setup space!
	Still present NH_3 refrigerant under retardation of boiling can evaporate. Inhalation of refrigerant vapor is poisonous.
	Escaping refrigerant vapor and escaping refrigerant liquid must not reach adjacent rooms, staircases, yards, passages or drainage systems.
	Use respiratory protection.
	Use a room air-independent breathing apparatus with maintenance work in high ammonia concentrations in the room air.
	Ensure the setup space is well ventilated.
	Divert escaped refrigerant vapor and escaped refrigerant liquid safely.

	**Warns against health-endangering irritants in the setup space!**
	Residual refrigerant still under effervescence can evaporate. Inhalation of refrigerant vapor causes harmful-to-health irritations and lack of oxygen.
	Escaping refrigerant vapor and escaping refrigerant liquid must not reach adjacent rooms, staircases, yards, passages or drainage systems.
	Use respiratory protection.
	Use a room air-independent breathing apparatus with maintenance work in high halocarbon refrigerant concentrations in the room air.
	Ensure the setup space is well ventilated.
	Divert escaped refrigerant vapor and escaped refrigerant liquid safely.

	**Warns against cold!**
	Residual refrigerant still under effervescence has a temperature of -28°F. Contact with refrigerant under effervescence caused by spraying causes frostbite.
	Use eye protection!
	Use hand protection!

- Ensure that the unit in question is pressure-free before maintenance work begins or the refrigerant is bled from the unit in question.
- Power off the electrical system and ensure that all electrical switchgear are disconnected, locked out and tagged out.
- Separate the unit to be managed from the refrigeration system and secure it.

NOTICE
Danger of damage to property!

	**With work in the inlet and outlet feeds of the fans and heat exchanger, objects can get into the fans and therefore cause faults and damage to the components.**
	Power off the fans before beginning maintenance work ensure all are disconnected, locked out and tagged out.
	After the work has finished, do not allow any objects to get back into the inlet and outlet feeds of the fans or the installed space.

6.3 AFTER ALL MAINTENANCE WORK

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant (see Appendix I, 2.7 Residual hazards with refrigerant).

Perform the following safety measures after finishing all maintenance work:

- ✓ Ensure the switching and activation devices, the measuring and display devices and the safety devices function properly.
- ✓ Ensure the refrigerant fittings are functioning properly.
- ✓ Ensure that the hinged fan panels and the side covers are fixed in their original position and secured against unintentional or unauthorized opening.
- ✓ Check the identification of the pipelines and ensure labels are visible and legible.
- ✓ Check the mounting of the components in question.
- ✓ Ensure the electrical connections (fans) are functioning properly.
- ✓ Perform a pressure test and a leak check
- ✓ Perform an acceptance test (See INSTALLATION section: PERFORM ACCEPTANCE TEST).

6.4 INSPECTION AND MAINTENANCE PLAN

No specific dangers at this point in service life.

6.5 MAINTENANCE WORK

⚠ WARNING

Danger of injuries and damage to property with escaping refrigerant (see Appendix I, 2.7 Residual hazards with refrigerant).

- Have leaks repaired as quickly as possible by an expert.
- Do not fill with a refrigerant other than that specified in accordance with the order-related documents!
- Only put the unit back into operation when all leaks have been repaired.
- ✓ Perform all required work including pressure, acceptance and functional test.

6.5.1 Strainer and basin

No specific dangers at this point in service life.

6.5.2 Water level

No specific dangers at this point in service life.

6.5.3 Fans and pumps

No specific dangers at this point in service life.

6.5.4 Elimination of water drops/water carry-over

No specific dangers at this point in service life.

6.5.5 Water distribution system and nozzles

No specific dangers at this point in service life.

6.6 CLEAN UNIT

6.6.1 General

NOTICE

If during maintenance or cleaning any corrosion is being detected please contact the manufacturer directly.

6.6.2 Cleaning coil, casing and basin

No specific dangers at this point in service life.

6.6.3 Cleaning fans and water pump(s)

No specific dangers at this point in service life.

7 WATER TREATMENT

7.1 WATER TREATMENT AND MINIMUM WATER QUALITY REQUIREMENTS

No specific dangers at this point in service life.

7.1.1 Biological control

No specific dangers at this point in service life.

7.1.2 Chemical treatment

No specific dangers at this point in service life.

NOTICE

Consulting with a water treatment service company with full service capabilities before installation is strongly recommended.

7.2 BLEED OR BLOW DOWN RATE:

The thermodynamics behind evaporative cooling is such that a portion of the recirculated water passing over the heat exchange surface evaporates as it absorbs the heat from the fluid being cooled. This process provides the primary cooling effect. The heat is rejected into the atmosphere as relatively warm, saturated air discharged through the fan section.

However, only pure water will evaporate which means that any impurities within the makeup water will remain within the recirculated water system. Depending on the location it is also possible that airborne impurities could be absorbed into the recirculating water system.

The impurities and any airborne contaminants (dissolved solids) therefore remain in the water system. If not effectively controlled, they can lead to sludge accumulations, biological growth, scale, fouling and corrosion as their concentration increases within the water distribution system.

To prevent these dissolved solids from overconcentrating, a portion of the recirculating water system must be drained from the system as a bleed or blow down. The concentration level of these dissolved solids is referred to as the cycles of concentration within the water distribution system.

$$\text{Cycles of Concentration} = \frac{\text{Water Conductivity (in the evaporative unit)}}{\text{Makeup Water Conductivity}}$$

This cycles of concentration equation reflects the degree to which the dissolved solids in the makeup water are allowed to concentrate in the recirculating water system.

The higher this ratio, the more the dissolved solids in the makeup water are allowed to concentrate in the water system, and the lower the bleed rate. To reduce the cycles of concentration, makeup water must be added to the re-circulated water system.

However, in order to add water to the system, an equal amount must be removed from the system. This is what is referred to as the bleed or blow down. Regulating the bleed rate will therefore maintain a specific cycle of concentration. A regulating valve is located on the discharge side of the water pump on all IDSC/ECOSS units. An automatic conductivity controller is recommended to reduce water waste and maximize water usage efficiency.

The cycles of concentration equation above can be expressed in terms of water flow by the following equation:

$$\text{Cycles of Concentration} = MU / BD$$

MU = Total makeup water [sum of evaporation + bleed (gpm)]

BD = Bleed flow rate (gpm)

MU in this equation can be replaced with the value (E + BD), where E is the evaporation rate and can therefore be rearranged to yield the following relationship:

The evaporation rate will always be dependent on the location (wet bulb temperature) and the heat load.

There are two methods to control the blow down / bleed rate:

1. Constant Blow Down - manually setting the bleed regulating valve at the pump discharge, based on periodic analysis of the concentration of dissolved solids (water hardness), at peak loads. This a simple method, but due to the blow down being constant, the loss of water and water treatment chemicals is high, expensive and certainly not efficient.
2. Controlled Blow Down - dependent on an automated monitoring of the dissolved solids (water hardness) as indicated by its conductivity. Automated control minimizes water and chemical waste, and is the preferred method. The solenoid valve and conductivity controller must be supplied by others. The set point for the conductivity controller will maintain the desired cycles of concentration and should be determined by a suitably qualified water treatment specialist.

8 TROUBLESHOOTING

⚠ WARNING

Danger of injuries and damage to property!

Faults that are not described in these operating instructions must only be removed by Johnson Controls.

Faults that are described in these operating instructions must only be removed by appropriately trained personnel (see 2.2.1 Personnel, care requirements).

With faults that occur during the operation, monitoring and maintenance of the complete system, inform Johnson Controls immediately.

8.1 SERVICE

No specific dangers at this point in service life.

8.2 TROUBLESHOOTING TABLE

No specific dangers at this point in service life.

Index

R

S

T

U

V

W

April 2018 Form Revisions

p.27 – Added Long Term Storage details

Form 140.010-IOM (2018-04)
Supersedes: **140.010-IOM (2017-10)**
Subject to change without notice
Published in USA • 04/18 • PDF

JOHNSON CONTROLS
100 Cumberland Valley Avenue
Waynesboro, PA 17268-1206 USA
Phone: 717-762-2121 • FAX: 717-762-8624
www.johnsoncontrols.com/frick