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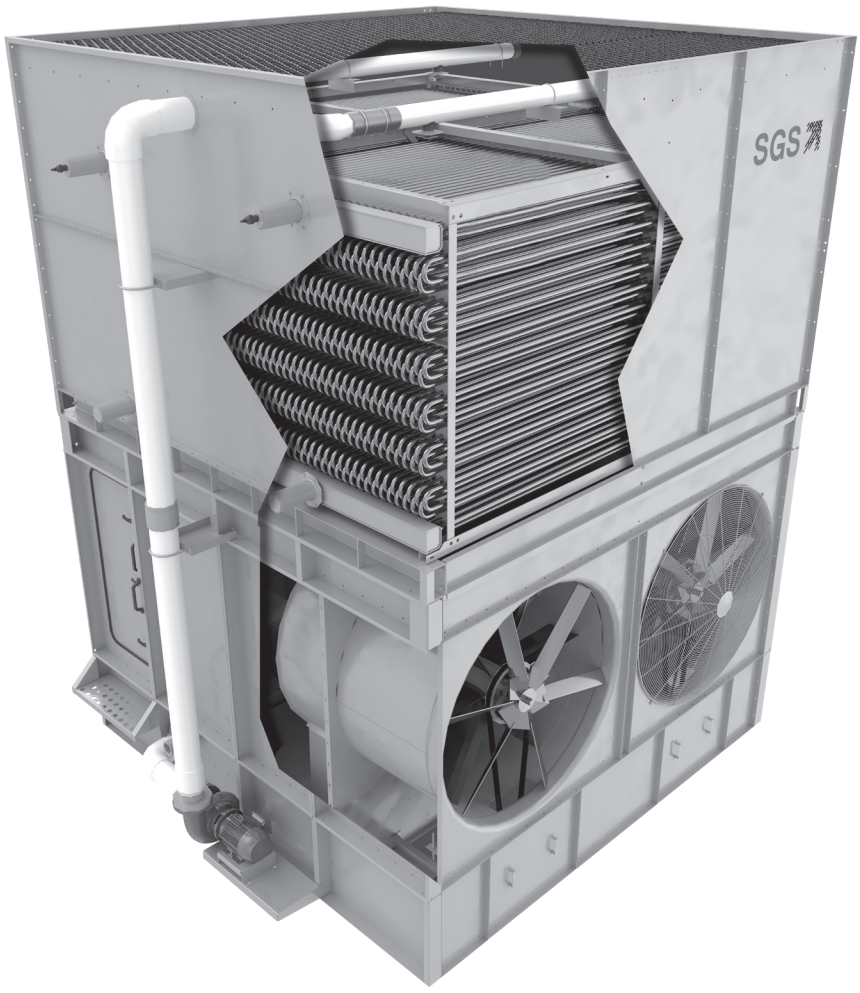
user manual

IEC-B series evaporative condenser

INSTALLATION - OPERATION - MAINTENANCE

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READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING OR SERVICING THIS PRODUCT.



contents

Note

This manual contains vital information for the proper installation and operation of your evaporative condenser. Carefully read the manual before installation or operation of the evaporative condenser and follow all instructions. Save this manual for future reference.

Overview 3
Location 4
Shipment 4
Receiving 5
Hoisting 5
Installation 5
Motor Wiring 7
Mechanical Equipment 10
Startup 11
Operation 12
Dry Operation 13
Freezing Weather Operation 14
Water Quality and Blowdown 15
Evaporative Condenser Inspection and Maintenance 17
Water Collection Basin Access 18
Drive System Access 18
Belt Tensioning 19
Sheave Alignment 20
Drift Eliminator Removal and Replacement 21
Distribution System Maintenance 22
Routine Maintenance 22
Seasonal Shutdown Instructions 24
Troubleshooting 28
Maintenance Schedule 30

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning the life of the product. Also, please observe all Caution and Warning labels on the evaporative condenser.

⚠ Warning

Indicates presence of a hazard which can cause severe personal injury, death or substantial property damage if ignored.

⚠ Caution

Indicates presence of a hazard which will or can cause personal injury or property damage if ignored.

Note

Indicates special instructions on installation, operation or maintenance which are important but not related to personal injury hazards.

overview

This User Manual as well as those offered separately on motors, fans, couplings, drive shafts, float valves, pumps, etc., is intended to assure that this evaporative condenser serves you properly for the maximum possible time. Since product warrantability may well depend upon your actions, please read this User Manual thoroughly prior to operation.

This User Manual provides information regarding general equipment installation and operation. Any deviation from, change or modification to, the User Manual, the original design conditions or the original in-tended use of the equipment may result in improper installation and/or operation.

Any such deviation, change or modification shall be the responsibility of the party or parties making such deviation, change or modification. SPX Cooling Tech, LLC expressly disclaims all liability for any such deviation, change or modification. The equipment shall be warranted in accordance with the applicable SPX Cooling Certification of Limited Warranty.

If you have questions about the operation and/or maintenance of this evaporative condenser, and you don't find the answers in this manual, please contact your sales representative. When writing for information, or when ordering parts, please include the serial number shown on the equipment nameplate.

Safety First

The location and orientation of the evaporative condenser can affect the safety of those responsible for installation, operation or maintenance. However, since SPX Cooling does not determine the evaporative condenser location or orientation, we cannot be responsible for addressing those safety issues that are affected by condenser location or orientation.

⚠ Warning

The following safety issues should be considered by those responsible for designing the evaporative condenser installation.

- ***Access to and from the collection basin***
- ***Access to and from mechanical access doors***
- ***The possible need for external access platforms***
- ***The possible need for ladders (either portable or permanent)***
- ***The possible need for safety cages around ladders***
- ***Access issues due to obstructions surrounding the evaporative condenser***
- ***Lockout of mechanical equipment***
- ***The need to avoid exposing maintenance personnel to the potentially unsafe environment inside the equipment***

overview

Those are only some of the safety issues that may arise in the design process. SPX strongly recommends that you consult a safety engineer to be sure that all safety considerations have been addressed.

Several options are available that may assist you in addressing some of these personnel safety concerns, including:

- access platform(s) and ladder(s)
- ladder extensions (used where the base of the evaporative condenser is elevated)
- safety cages for ladders
- safety gates for platforms

Location

Space available around the evaporative condenser should be as generous as possible to promote ease of maintenance—and to permit freedom of airflow into and through the evaporative condenser. If you have questions about the adequacy of the available space or the intended configuration of the equipment, please contact your SGS sales representative for guidance.

Prepare a stable, level support foundation for the evaporative condenser, utilizing weight, wind load, and dimensional information appearing on appropriate SGS submittal drawings. Supports must be level to insure proper operation of the evaporative condenser.

⚠ Warning

The evaporative condenser must be located at such distance and direction to avoid the possibility of contaminated discharge air being drawn into building fresh air intake ducts. The purchaser should obtain the services of a Licensed Professional Engineer or Registered Architect to certify that the location of the equipment is in compliance with applicable air pollution, fire and clean air codes.

Shipment

Unless otherwise specified, evaporative condensers ship by truck (on trailer(s)), which lets you receive, hoist, and install in one continuous operation. Single cell IEC-B evaporative condensers generally ship on one truck. Multicell IEC-B evaporative condensers, and condensers with access options (i.e. platforms) may require more than one truck.

Responsibility for the condition of the evaporative condenser upon its arrival belongs to the trucker—as does the coordination of multiple shipments, if required.

receiving and hoisting

Receiving

Prior to unloading the evaporative condenser from the delivering carrier, inspect the shipment for evidence of damage in transit. If damage is apparent, note the freight bill accordingly. This will support your future recovery claim.

Find and remove the installation instruction drawings and bills of material located in a plastic tub in the crate accompanying the evaporative condenser. This information should be kept for future reference and maintenance purposes.

Hoisting

All IEC-B evaporative condenser models must use hoist clips and overhead lifting for handling assembled evaporative condenser modules. **Fork lifting from base of evaporative condenser modules is not permitted.** Hoisting clips are located at the top of the basin/fan (lower) module and at the top of the coil (upper) module. A **Hoisting-Installation** label which has hoisting dimensional information is located on the side casing of the equipment, and a hoisting drawing is located in the installation instruction drawings accompanying the equipment. Remove evaporative condenser modules from the trailer and hoist into place according to the instructions on the label.

⚠ Warning

Modules must be hoisted and set according to instructions. Do not preassemble modules prior to hoisting.

Hoisting clips are provided for ease of unloading and positioning the evaporative condenser. For overhead lifts or where additional safety is required, safety slings should also be placed under the evaporative condenser modules. Under no circumstances should you combine the top and bottom modules and attempt to hoist them at the same time by utilizing the hoisting clips alone!

Installation

Note

These installation instructions are intended to help you prepare before your evaporative condenser arrives. If discrepancies exist between these instructions and those shipped with the evaporative condenser, the instructions shipped with the evaporative condenser will govern

installation

1. Prior to placement of the evaporative condenser, confirm that the supporting platform is level, and that the anchor bolt holes are correctly located in accordance with SGS drawings. If your installation uses vibration isolators to dampen vibration, they must be mounted below the supporting steel. See support drawings for further information.
2. Place basin (bottom) module on your prepared supports, aligning anchor bolt holes with those in your supporting steel. Make sure that the orientation agrees with your intended piping arrangement. Attach to supporting steel with bolts and flat washers (by others) – see support drawing for size, location and quantity. Position flat washers between the bolt head and the evaporative condenser basin flange.
3. Before setting coil module in place on the basin module, clean any debris from the underside of the coil module and the top of the basin module. Apply sealing gasket tape to the top of the basin module per the installation instructions shipped with the evaporative condenser. Note, the gasket tape and both the top and bottom modules need to be completely dry before installation. Make sure that the orientation of the modules agrees with your intended piping arrangement. Pay close attention to face designations on sales orientation drawings e.g. Face A, Face B, etc. Place coil module on the top peripheral bearing surface of basin module, aligning mating holes with drift pins as it is set in place. Use care when setting the modules as lifting and resetting will compromise the sealing gasket between the two sections, possibly resulting in a leaking joint. If the modules must be reset, it may be necessary to remove the sealing gasket tape and replace. Attach the modules together with fasteners provided according to drawings shipped with your evaporative condenser.

Note

Sealing details must be followed correctly or leaks may occur that will not be covered under warranty.

4. Connect the recirculation piping with rubber coupling shipped with the bottom module piping according to drawings shipped with the evaporative condenser.
5. Attach makeup water supply piping to appropriately sized float valve connection located in collection water basin side wall. Install the drain and overflow according to drawings shipped with your evaporative condenser. If you wish to pipe overflow and drain water to a remote discharge point, make those connections at this time also.

Note

Fasteners and components provided by others that are to be attached to the evaporative condenser must be compatible with the evaporative condenser materials–i.e. fasteners in a stainless steel cold water basin must be stainless steel.

6. Attach the refrigerant supply and return piping to the condenser coil connections. Coils are charged with nitrogen to approximately 20 psig at the factory. Upon installation, coil connections require cutting and beveling. Protect adjacent areas from excessive heat and sparks or damage may occur. It is recommended that weld areas be protected against corrosion. Cold galvanizing is suggested for weld areas on galvanized coils, applied according to the manufacturer's instructions.

⚠ Caution

Except for the horizontal components of piping, do not support your piping from the evaporative condenser inlet / outlet connections – support it externally.

⚠ Caution

Protect adjacent areas from excessive heat and sparks during welding or damage may occur.

7. Wire fan motor(s) and recirculation pump motor(s) in accordance with wiring diagram.

⚠ Warning

For maintenance/safety purposes, a lockout type disconnect switch is recommended for all mechanical equipment. In addition to a disconnect switch, the motor should be wired to main power supply through short circuit protection, and a magnetic starter with overload protection.

Motor Wiring

Wire motor leads as shown on the motor nameplate matching the supply voltage. Do not deviate from the motor nameplate wiring.

Internal space heaters may be present, depending upon the motor manufacturer. For space heater operation and wiring refer to the **"Fan Motor"** User Manual Z0239042.

Either of following symbols may be shown on the motor nameplate – Δ, Δ Δ, Y, or YY. These symbols represent how the motor is constructed on the inside and in no way have anything to do with a Delta or Wye electrical distribution system serving the motor.

When using a starter:

- Set motor overload protection to 110% of motor nameplate amps. This setting allows the fan motor to operate during cooler weather. During cooler weather it is common for the motor to draw 6 to 10% higher than nameplate amps. High amps are common during evaporative condenser commissioning when the evaporative condenser is dry and the ambient air temperature is cool.

Note

Do not start the motor more than four to five times per hour. Short cycling the motor(s) will cause fuses, breakers or OLs to operate and will decrease motor life.

When using a *two-speed* starter:

- Motor rotation must be the same at slow speed and high speed.
- Single winding motor requires a starter with a shorting contactor.
- Two-winding motor requires a starter with out a shorting contactor.
- All two-speed starters must have a 20 second time delay relay when switching from high speed to low speed.

Note

Do not start the motor more than four to five times per hour (each low speed start and each high speed start count as one start).

When using a VFD:

Note

Before beginning, ensure that the motor is rated for "Inverter Duty" per NEMA MG-1, part 31.

- Set the VFD solid state overload protection to 119% of motor nameplate amps and set "maximum current parameter" in the VFD to motor nameplate amps. "Maximum current parameter" will reduce fan speed and limit amp draw to nameplate amps during cold weather operation. If furnished with a mechanical O.L. set this at 110% over motor nameplate amps.
- Motor rotation must be the same in both VFD mode and By-pass mode.
- If cable distance between the VFD and motor is greater than 100 feet a DV/DT output filter is recommended to avoid damage to the motor. 100 feet distance is based on our field experience, the VFD manufacture may state different distances and distance does vary depending on the VFD manufacture.

- Program the VFD for variable torque output.
- Do not start and stop the motor using the safety switch at the motor. If the drive is being commanded to run and the load side is cycled ON and OFF with the safety switch this may damage the VFD.

Using a VFD in cooling applications has advantages over traditional single or two speed motor control. A VFD can reduce the cost of electrical energy being used and provide better temperature control. In addition, it reduces the mechanical and electrical stress on the motor and mechanical equipment. Electrical savings can be large during periods of low ambient temperature when the cooling requirement can be satisfied at reduced speeds. To benefit from these advantages, it is important that the drive be installed correctly.

⚠ Warning

Improper use of a VFD may cause damage to equipment or personal injury. Failure to correctly install the VFD drive will automatically void all warranties associated with the motor and any equipment that is either electrically or mechanically (directly) attached to the VFD drive system. The length of this warranty avoidance will be contingent on properly installing the VFD system and repairing any damage that may have occurred during its operation. SPX Cooling does not assume responsibility for any technical support or damages for problems associated with VFD systems.

The evaporative condenser is designed to operate at full speed and half speed. Warranty is void if the evaporative condenser is operated at speeds which cause damaging vibrations to the evaporative condenser and associated equipment. When utilizing a variable frequency drive, the evaporative condenser must be tested across the full range of speeds and checked for excessive vibration. Speed ranges not meeting these guidelines must be locked out in the VFD.

Mechanical Equipment

⚠ Warning

Always shut off electrical power to the evaporative condenser fan motor prior to performing any maintenance on the evaporative condenser. Any electrical switches should be locked out and tagged out to prevent others from turning the power back on.

1. Spin the fans manually to assure that all fan blades properly clear the inside of the fan cylinder. Observe the action of the sheaves and belts to be sure that the motor is properly aligned with the fan sheave. See **Belt Tensioning** and **Sheave Alignment** on pages 18 and 20.

⚠ Warning

The access door should NOT be opened while the fan(s) are operating. Fan operation causes a positive pressure inside the evaporative condenser and can abruptly move the door should access be attempted. Only open the access door when the fan is off and locked out.

2. Momentarily bump (energize) the motor(s) and observe rotation of the fans. If rotation is backwards, shut off the fan and reverse two of the three primary leads supplying power to the motor.

⚠ Caution

If evaporative condenser is equipped with a two-speed motor, check for proper rotation at both speeds. Check also to see that starter is equipped with a 20 second time delay which prevents direct switching from high speed to low speed. This delays will prevent abnormal stress from being applied to the mechanical equipment and the electrical circuit components.

3. Run the motor(s) and observe the operation of the mechanical equipment.
4. Check belt tension and torque on the fan and motor sheave after 10 to 60 hours of operation. See **Bushing Fastener Torque Values** on page 21.

Note

If the water supply system is not being operated, motor amps read at this time may indicate an apparent overload of as much as 10–20%. This is because of the reduced static pressure of the system without recirculating water. Determination of an accurate motor load should await the application of the recirculating water system.

operation

Startup

⚠ **Warning**

Microorganisms including Legionella bacteria can exist in premise plumbing including evaporative condensers. The development of an effective water management plan (WMP) and implementation of maintenance procedures are essential to prevent the presence, dissemination and amplification of Legionella bacteria and other waterborne contaminants throughout premise plumbing. Before operating the evaporative condensers, the water management plan and maintenance procedures must be in place and regularly practiced.

Water System:

1. Consult a knowledgeable water treatment professional to clean and treat your condenser prior to startup. Evaporative condensers must be cleaned and disinfected regularly in accordance with ASHRAE Standard 188 and Guideline 12.

   The water conditions during the initial operation are crucial in preventing premature corrosion of galvanized steel (white rust). For at least the first eight weeks of operation, pH should be controlled between 6.5 and 8.0 with hardness and alkalinity levels between 100 and 300 ppm (expressed as $CaCO_3$).

2. Do NOT attempt any service unless the fan motor is locked out.
3. Remove any and all accumulated debris from evaporative condenser. Pay particular attention to inside areas of collection water basin, distribution water system and drift eliminators. Make sure that recirculating water suction screens are clear and properly installed.
4. Fill the water system to the recommended operating water level. Shown on the outlet piping drawing accompanying the evaporative condenser, the recommended operating water level is typically a depth of 7” - 8" in the depressed area of the collection water basin. Adjust the float valve so that it is 75% open at that level. Continue filling the system until the water reaches a level approximately 1⁄8" below the lip of the overflow.
5. Start your pump(s) and check for proper rotation as indicated by the arrow on the pump cover, observe system operation. A certain amount of “pump-down” of the basin water level will occur before water completes the circuit and begins to fall from the coil(s). The amount of initial pump-down may be insufficient to cause the float valve to open. However, you can check its operation by pressing down on the operating lever to which the stem of the float valve is attached.

Some trial and error adjustment of the float valve may be required to balance the makeup water with evaporative condenser operation. Ideally, the float valve setting will be such that no water is wasted through the overflow at pump shutdown. However, the water level after pump start-up must be deep enough to assure positive pump suction.

6. Open the valve on the evaporative condenser bleed line and adjust bleed to the recommended rate. See **Water Quality and Blowdown** section.
7. Continue pump operation for about 15 minutes, after which it is recommended that the water system be drained, flushed and refilled.
8. While operating the recirculating water pump(s) and prior to operating the evaporative condenser fan(s), execute one of the two alternative biocidal treatment programs described in the following:
   - Resume treatment with the biocide which had been used prior to shutdown. Utilize the services of the water treatment supplier. Maintain the maximum recommended biocide residual (for the specific biocide) for a sufficient period of time (residual and time will vary with the biocide) to bring the system under good biological control ***or***
   - Treat the system with sodium hypochlorite to a level of 4 to 5 ppm free chlorine residual at a pH of 7.0 to 7.6. The chlorine residual must be held at 4 to 5 ppm for six hours, measurable with standard commercial water test kits.

   If the evaporative condenser has been in operation and then shut down for a duration of time and not drained, perform one of the two previous biocidal treatment programs directly to the recirculating water storage vessel (collection basin, drain down tank, etc.) without circulating stagnant water over the coil(s) or operating the fan(s).

   After biocidal pretreatment has been successfully completed, cooling water may be circulated over the coil(s) with the fan off.

   When biocidal treatment has been maintained at a satisfactory level for at least six hours, the fan may be turned on and the system returned to service. Resume the standard water treatment program, including biocidal treatment.

Operation

General:

The refrigerant condensing temperature obtained from an operating evaporative condenser will vary with the following influences:

1. **Heat Load** With the fan in full operation, if the heat load increases, the condensing temperature will rise. If the heat load reduces, the condensing temperature will reduce.

   The evaporative condenser establishes only the condensing temperature attainable under any operating circumstance.

2. **Air Wet-bulb Temperature** Condensing temperature will also vary with the wet-bulb temperature of the air entering the condenser. Reduced wet-bulb temperatures will result in lower condensing temperatures. However, the condensing temperature will not vary linearly with the wet-bulb. For example, a 20°F reduction in wet-bulb may result in only a 15°F reduction in condensing temperature.

3. **Air-flow Rate** Reducing air flow through the condenser causes the condensing temperature to rise. This is the recommended method by which to control condensing temperature.

   If your condenser is equipped with a single-speed motor, the motor may be shut off when the condensing temperature becomes too low. This will cause the condensing temperature to rise. When the condensing temperature then becomes too warm for your process, the motor can be restarted.

Fan Cycling Limits:

Note

Considering the normal fan and motor sizes utilized on IEC-B evaporative condensers, anticipate that approximately 4 to 5 starts per hour are allowable.

If your evaporative condenser is equipped with a two-speed motor(s), you will have an opportunity for process temperature control. When the process fluid temperature becomes too cold, switching the fan to half-speed will cause the condensing temperature to rise—stabilizing at a temperature a few degrees higher than before. With a further reduction in condensing, the fan may be cycled alternately from half-speed to off.

operation

⚠ **Caution**

Do not start the motor(s) more than four to five times per hour (each low speed start and each high speed start count as one start).

Pump Cycling Limits Cycling the recirculating water pump(s) to control condensing temperature is not typically recommended. If the recirculating water pumps(s) are cycled as part of normal system operation, care must be exercised – frequent wet/dry cycles may lead to premature scaling of the coil surface. Motor cycling limits apply.

Dry Operation

Note

Also refer to the Freezing Weather Operation section.

IEC-B evaporative condenser models may be operated dry without recirculating water during colder weather as heat load and ambient conditions permit. Dry operation is the best way to minimize the potential for ice buildup in freezing weather operation.

If dry operation is intended and the recirculating water is at risk of freezing, the recirculating pump should be turned off, and the water in the collection basin, pump and make-up supply piping should be drained. Care must be exercised when cycling the recirculating water pump(s)– frequent wet/dry cycles may lead to premature scaling of the coil surface.

Freezing Weather Operation

In freezing ambient conditions, forced draft evaporative condensers may be prone to ice buildup on the fan drive equipment, particularly when the fans are off. Without sufficient airflow through the condenser, falling water may cause moist air to migrate to the fan drive area where it can condense and build ice on drive components. Severe damage may occur if the condenser fan drive(s) are operated with ice accumulated on the drive components. Dry operation, with the recirculating pump off and basin drained, is the best way to minimize the potential for ice buildup. In situations where the condenser must be operated with the recirculating water pump on in order to satisfy load requirements, an operational strategy that keeps fans running at reduced speed during freezing conditions to keep positive air flow through the condenser, or limits the amount of time that individual fans are off to very short periods, should be employed to limit the potential for destructive ice build-up.

⚠ **Caution**

Do not start the motor(s) more than five times per hour (each low speed start and each high speed start count as one start).
VFD control systems are recommended for applications operating in extreme cold ambient temperatures with variable load requirements. Reversal of fans, common in induced draft evaporative heat rejection equipment for the purpose of thawing ice accumulated in air inlet areas, is NOT recommended for IEC-B forced draft evaporative condensers.

Intermittent Freezing Weather Operation:

If periods of shutdown (nights, weekends, etc.) occur during freezing weather, measures must be taken to prevent the water in the cold water basin–and all exposed pipework–from freezing. Several methods are used to combat this, including automatic basin heater systems and pump freeze protection systems.

⚠ **Caution**

Unless some means of freeze prevention is incorporated into your system, the evaporative condenser basin and exposed pipework should be drained at the beginning of each wintertime shutdown period.
If evaporative condenser basin is drained, verify that all basin heaters have been shut off either by automatic cutoff or disconnect switch.

Water Quality and Blowdown

Maintaining Water Quality:

The steel used in IEC-B evaporative condensers has been galvanized with a heavy zinc coating averaging 2.0 mils in thickness. Other materials used (PVC drift eliminators, aluminum fans, etc.) are selected to offer maximum service life in a "normal" evaporative condenser environment, defined as follows:

Circulating water with a pH between 6.5 and 8; a chloride content (as NaCl) below 500 ppm; a sulfate content (SO_4) below 250 ppm; total alkalinity (as $CaCO_3$) below 500 ppm; calcium hardness (as $CaCO_3$) above 50 ppm; a maximum inlet water temperature not to exceed 125°F (52°C); no significant contamination with unusual chemicals or foreign substances; and adequate water treatment to minimize scaling.

- Startup Conditions: The water conditions during the initial operation are crucial in preventing premature corrosion of galvanized steel (white rust).

For at least the first eight weeks of operation, pH should be controlled between 6.5 and 8.0 with hardness and alkalinity levels between 100 and 300 ppm (expressed as $CaCO_3$).

- Chlorine (if used) shall be added intermittently, with a free residual not to exceed 1 ppm–maintained for short periods. Excessive chlorine levels may deteriorate sealants and other materials of construction.
- An atmosphere surrounding the condenser no worse than "moderate industrial", where rainfall and fog are no more than slightly acid, and they do not contain significant chlorides or hydrogen sulfide (H_2S).
- Many proprietary chemicals exist for control of scale, corrosion, and biological growth and should be used prudently. Also, combinations of chemicals may cause reactions which reduce treatment effectiveness, and certain chemicals such as surfactants, biodispersants and antifoams may increase drift rate.

Note

The structure and coil of your evaporative condenser consists primarily of galvanized steel, therefore your water treatment program must be compatible with zinc. In working with your water treatment supplier, it is important that you recognize the potential effects on zinc of the specific treatment program you choose.

Blowdown:

Evaporative heat exchange equipment functions by continuously causing a portion of the water circulated over the heat transfer media to evaporate. Although the water lost by evaporation is replenished by the makeup system, it exits the evaporative condenser as pure water–leaving behind its burden of dissolved solids to concentrate in the remaining water. Given no means of control, this increasing concentration of contaminants can reach a very high level.

In order to achieve water quality which is acceptable to the condenser, the selected water treatment company must work from a relatively constant level of concentrations. This stabilization of contaminant concentrations is usually accomplished by blowdown, which is the discharge of a portion of the circulating water to waste. As a rule, acceptable levels on which to base a treatment schedule will be in the range of 2-4 concentrations. If the condenser is operated at 4 concentrations, circulating water will contain four times as much dissolved solid as the makeup water, assuming none of the solids form scale or are otherwise removed from the system.

Note

When water treatment chemicals are added, they should not be introduced into the circulating water system via the cold water basin of the evaporative condenser. Water velocities are lowest at that point, which results in inadequate mixing.

Evaporative Condenser Inspection and Maintenance

⚠ Warning

Microorganisms including Legionella bacteria can exist in premise plumbing including evaporative condensers. The development of an effective water management plan (WMP) and implementation of maintenance procedures are essential to prevent the presence, dissemination and amplification of Legionella bacteria and other waterborne contaminants throughout premise plumbing. Before operating the evaporative condenser, the water management plan and maintenance procedures must be in place and regularly practiced.

In addition, the following steps are recommended:

Do NOT attempt any service unless the fan motor is locked out.

- Consult a knowledgeable water treatment professional to clean and treat your evaporative condensers. See **Startup** section of this manual.
- Evaporative condensers must be cleaned and disinfected regularly in accordance with ASHRAE Standard 188 and Guideline 12.
- Workers performing decontamination procedures must wear personal protective equipment (PPE) as directed by their facility safety officer.
- Evaporative condensers must be visually inspected regularly to assess signs of bacterial growth, appearance of debris and scale on drift eliminators and general operating conditions. Refer to ASHRAE Standard 188 and Guideline 12 for specific frequency recommendations.
- Replace worn or damaged components.

To minimize the presence of waterborne microorganisms, including Legionella, follow the water management plan for your facility, perform regularly scheduled Evaporative condensers inspections and maintenance, and enlist the services of water treatment professionals.

For additional technical support, contact your SGS sales representative.

References: ashrae.org. Search “ASHRAE Standard 188” and “ASHRAE Guideline 12.” cdc.gov. Search “Water Management Program.”

maintenance

Water Collection Basin Access:

Some maintenance procedures require access to components located in the water collection basin. To access the basin, inward-swinging exterior access doors are provided on each endwall of the condenser. Interior fan partitions are also equipped with doors, allowing access to each basin section from either exterior door.

⚠ Caution

Collection basin floor has uneven surfaces and has the potential to be slippery. Care should be taken if entering the basin.

⚠ Warning

Always shut off electrical power to the fan motor prior to performing any inspections that may involve physical contact with the mechanical or electrical equipment in or on the evaporative condenser. Lock out and tag out any electrical switches to prevent others from turning the power back on. Service personnel must wear proper personal protective clothing and equipment.

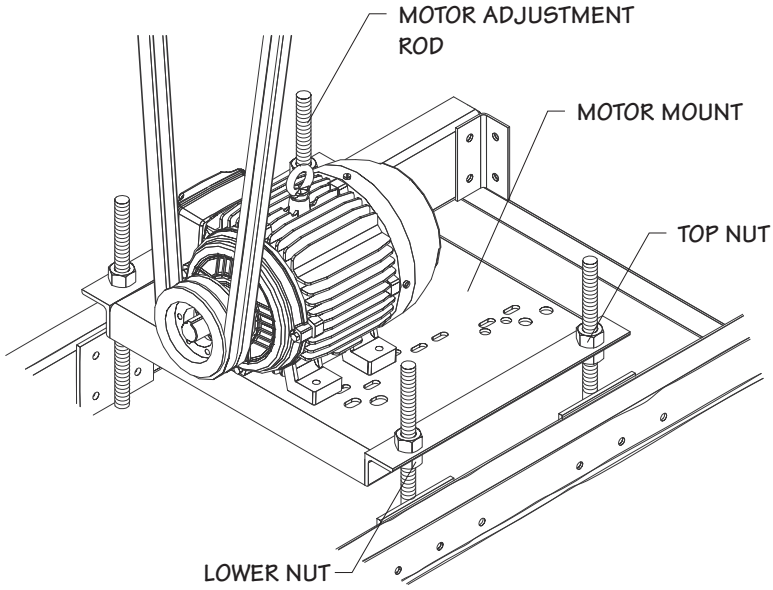
Drive System Access:

Mechanical equipment (sheaves, belts, fans, etc.) can be accessed by removing motor access cover and fan guard. Fan guards are attached to the condenser with tap screws, motor access covers are attached with bolts. Always replace guards and covers before operating the condenser drive system(s).

Belt Tensioning:

⚠ **Warning**

Always shut off electrical power to the fan motor(s) prior to performing any inspections that may involve physical contact with the mechanical or electrical equipment in or on the condenser. Lock out and tag out any electrical switches to prevent others from turning the power back on. Service personnel must wear proper personal protective clothing and equipment.



Belt tension is adjusted by first loosening top nuts on the motor adjustment rods. After loosening the top nuts raise or lower motor mount as needed using the lower nuts, turning each one equally. After adjusting the belt tension tighten the top nuts and check belt alignment. If the lower nuts are not adjusted equally, the motor may become misaligned with fan shaft.

Ideal tension is the lowest tension at which the belt will not slip under peak load conditions. Check tension frequently during the first 24-48 hours of run-in operation. Over-tensioning shortens belt and bearing life. Keep belts free from foreign material which may cause slipping. Never apply belt dressing as this will damage the belt and cause early failure. Specific tools are made to measure the tension of a V-belt drive system. A Dodge® V-Belt Tension Tester, Browning® Belt Tension Checker or equivalent an alternative should be used for tensioning V-belts. Check with your local belt supplier.

Belt tension is measured by applying a force perpendicular to the belt at the center point between motor and fan sheaves. The belt should deflect 1⁄64" of

the entire span, (measured sheave centerline to sheave centerline) when the pressure shown in the table below is applied. Because belt tension is a function of the motor sheave diameter, it is necessary to inspect the motor sheave to determine the diameter. If diameter markings are unreadable, measure the sheave diameter at the bottom of the sheave grooves.

Belt Tension		
Motor Sheave diameter	**Used V-Belt** minimum	**New V-Belt** maximum
3.4" - 4.2"	4.9 lb	7.2 lb
4.4" - 5.6"	7.1 lb	10.5 lb
5.8" - 8.6"	8.5 lb	12.6 lb

New belts (operating less than 8 hours) should be tensioned to the maximum value. Tension after this period should use no less than the minimum value. If the belt span was measured in inches, then use the pounds of force values. If the belt span was measured in centimeters, then use the kilograms of force values. If specific tensioning instructions are provided with your tensioning tool, those instructions should be used instead.

Sheave Alignment:

⚠ **Warning**

Always shut off electrical power to the fan motor(s) prior to performing any inspections that may involve physical contact with the mechanical or electrical equipment in or on the condenser. Lock out and tag out any electrical switches to prevent others from turning the power back on. Service personnel must wear proper personal protective clothing and equipment.

- The motor sheave is to be positioned as close as possible to the motor in order to minimize torque on the motor bushings.
- The motor and/or fan sheave(s) may have grooves that are not used.
- Sheaves must be aligned within 1⁄8" of each other in order to not adversely affect drive system life. Alignment can be achieved by placing a straight edge flush across the faces of the sheaves and ensuring four points of contact.
- The number of grooves on the motor and fan sheaves may not match each other, or the number of grooves on the belt. Install the belt(s) on the groove(s) closest to the fan or motor- doing so will reduce the force on bearings, thus increasing their life.

Bushing Fastener Torque Values

Bushing	Fastener	Torque N·m
SH	¼ - 20	8
SDS	¼ - 20	8
SD	¼ - 20	8
SK	5/16 - 18	18
SF	⅜ - 16	30
E	½ - 13	47
F	9/16 - 12	88

Drift Eliminator Removal and Replacement:

The drift eliminators, located at the top discharge of the evaporative condenser, may be removed for cleaning, replacement or access to the distribution system. The eliminators are held in place by nylon straps and are formed so that they nest with each other and form a monolithic barrier. Individual packs of eliminator are formed into two-foot wide sections that span from the casing end wall to eliminator supports.

⚠ Caution

Ensure provisions for safe access are in place before performing any work above grade level.
Eliminator edges can be very sharp and can cut skin if proper protection is not used. Always wear gloves and sleeves when handling eliminator packs.

To remove the eliminator, lift with two hands on an eliminator section, this will indicate where one section stops and another starts. Lift the eliminators at that intersection, removing two packs at one time. Once the first two packs are removed, the remaining packs should be easily removed. Pay close attention to the orientation and placement, they are not symmetrical. Each pack should be replaced at the location which it was removed.

Note

Proper eliminator pack replacement is essential to evaporative condenser operation. Incorrect installation may result in excessive drift rates and fan inefficiency! To ensure packs are reinstalled in the correct orientation, it is recommended that one pack is left in its original location as a reminder of pack orientation. Place packs in the evaporative condenser in the order they were removed. Packs should nest tightly with each other, leaving a level surface with no gaps. The last two packs should be installed at the same time.

maintenance

Distribution System Maintenance:

To keep your IEC-B evaporative condenser operating at peak performance, it may be necessary to clear the spray system of debris or sediment. To access the spray system, remove the drift eliminators as explained in the previous section. Observe the spray system with full flow on the unit. Each nozzle should produce a rectangular pattern spray which over-laps the adjacent nozzle patterns.

⚠ Warning

Ensure provisions for safe access are in place before performing any work above grade level.

If a nozzle appears clogged or is not producing a proper pattern, remove the nozzle and clean all surfaces. To remove the nozzle unscrew it from the adaptor. Inspect the nozzle for cleanliness or broken pieces. If the nozzle appears broken or damaged, consult your SGS representative for replacement parts. Insert the nozzles by screwing it back into the adaptor.

It may also be necessary to remove an entire branch arm from the spray system. Each arm is held in place with threaded U-bolt, rubber hose and hose clamps. Loosen hose clamps and slide hose off of branch arm and remove U-bolts. The branch arm can now be removed. It may be necessary to the remove the center eliminator supports to remove the branch arms. When reinstalling the branch arms ensure that all nozzles are aligned to the bottom of the branch arm.

Routine Maintenance:

Some procedures may require maintenance personnel to enter the evaporative condenser. Each cell has an access door for entry into the evaporative condenser.

⚠ Warning

The purchaser or owner is responsible for providing a safe method for entering or exiting the access door.

Included with the instruction packet are separate User Manuals on each major operating component of the evaporative condenser, and it is recommended that you read them thoroughly. Where discrepancies may exist, the separate User Manuals will take precedence. The following is recommended as a minimum routine of scheduled maintenance:

maintenance

⚠ Caution

Always shut off electrical power to the fan motor prior to performing any inspections that may involve physical contact with the mechanical or electrical equipment in or on the evaporative condenser. Lock out and tag out any electrical switches to prevent others from turning the power back on. Service personnel must wear proper personal protective clothing and equipment.

Weekly Visually inspect the evaporative condenser to assess general operating conditions and for signs of microbial growth and appearance of debris, scale and corrosion. Refer to ASHRAE Standard 188 and Guideline 12 for specific frequency recommendations. Consult a knowledgeable water treatment professional to maintain evaporative condenser hygiene.

Monthly (Weekly at start up) Observe, touch, and listen to the evaporative condenser. Become accustomed to its normal appearance, sound, and level of vibration. Abnormal aspects relating to the rotating equipment should be considered reason to shut down the evaporative condenser until the problem can be located and corrected. Observe operation of the motor, belt and sheaves and fan. Become familiar with the normal operating temperature of the motor(s), as well as the sight and sound of all components as a whole.

Inspect drift eliminators and basin trash screens and remove any debris or scale which may have accumulated. Replace any damaged or worn out components. Use of high-pressure water may damage the eliminator material.

Observe operation of the float valve. Depress the operating lever to make sure that the valve is operating freely. Inspect the suction screen for plugging. Remove any debris that may have accumulated.

Check for any buildup of silt on the floor of the collection basin. Mentally make note of the amount, if any, so future inspections will enable you to determine the rate at which it is forming.

View the water pattern as it exits the coil section. Consistent coverage indicates that all nozzles are flowing properly. If there are dry spot in the coil or inconsistent coverage, this may be evidence of a clogged nozzle. Inspect nozzles for blockage.

Every 3 months Lubricate fan shaft bearings. While rotating equipment by hand, grease the bearings until a bead forms around the seals–a maximum charge of 0.75 ounces is recommended. Chevron SRI-2 grease (or equivalent lithium-based grease) is recommended.

Semi-Annually Check the belt tension and condition. Adjust tension as necessary.

Annually Inspect the evaporative condenser thoroughly, making maximum use of instructions given in the separate User Manuals. Check structural bolted connections and tighten as required. Make preventive maintenance repairs as necessary.

Lubricate motor(s) according to the manufacturer's instructions. Fan motors with sealed bearings do not require lubrication maintenance. Check to see that all bolts are tight in the fan and mechanical equipment region, including the fan cylinder and air inlet screens. Refer to Component User Manuals for torque values.

Seasonal Shutdown Instructions

When the system is to be shut down for an extended period of time, it is recommended that the recirculating water system be drained. Leave the basin drains open.

During shutdown, follow recommendations in the **Evaporative Condenser Inspection and Maintenance** section of this manual before attempting repairs. Eliminators can be removed to gain access to the coil. Pay particular attention to mechanical equipment supports and sheaves.

Following each year's shutdown and cleaning, inspect the evaporative condenser's metal surfaces for evidence of the need to apply a protective coating. Do not misinterpret grime as a need to have the evaporative condenser painted. If relatively bright metal can be exposed by cleaning, consider that the galvanizing has remained effective. Unless there is evidence of a generalized failure of the galvanizing, localized touch-up should be all that is required.

Note

To the extent that the galvanizing (zinc coating) still exists, paint will not adhere to it readily. Contact the manufacturer of the coating you intend to use for instructions.

Evaporative Condenser Framework Check structural bolted connections and tighten as required.

Fans Check fan assembly bolting and tighten as required. Use torque values prescribed in the **Fan User Manual**.

Fans Shaft Bearings Lubricate fan shaft bearings at close of each operating season–see page 24.

Fan motors Clean and lubricate motor (if required) at close of each operating season (refer to motor manufacturer's recommendations). Does not apply to motors with sealed bearings. Check motor anchor bolts and tighten as required.

maintenance

⚠ **Caution**

Do not start motor before determining that there will be no interference with free rotation of the fan drive.

The motor should be operated for three hours at least once a month. This serves to dry out windings and lubricate bearing surfaces. Refer to the **"Fan Motor"** User Manual Z0239042 for additional information.

At start of new operating season, make sure bearings are adequately lubricated before returning motor to service. Does not apply to motors with sealed bearings.

Long Term Storage Procedures:

Instructions for protection of non-operating equipment for more than 3 months.

After installation of the IEC-B evaporative condenser and completion of the pre-startup instructions, the operational availability of equipment will last for a maximum period of three months. Ensure that the condenser is completely drained of all water and the drain is open. Coils should remain charged with nitrogen until put in service.

After this initial period of 3 months, until the unit is employed into continuous operation, the fan shaft should be turned by hand for a few minutes every month after: Inject a small amount of grease into ball /roller bearings of fan shaft and drive components as per the manufacturer's recommendation attached.

Internal Protection of Coil: All of the coil inlet and outlet connections should be sealed off and the coils should be charged with nitrogen gas to prevent corrosion. Condenser coils from the factory are charged with nitrogen to approximately 20 psig. No external protection of the coil is required for long-term storage.

Mechanical Components:

Electric Motors All drive motors should be taken down and stored indoors. Then, every month, turn motor shafts to evenly distribute lubricant to the bearing parts.

Recirculation Pumps All pumps and pump motors should be taken down and stored indoors (pumps and motors may be stored fully assembled). Then, every month, turn pump impeller shaft to evenly distribute lubricant to the bearing parts.

maintenance

Belts Properly stored belts will retain their properties unchanged for several years. Under unfavorable storage conditions and with improper handling, deterioration of their physical properties will result. These changes can be caused by, for example, oxidation, ozone, extreme temperatures, light, damp or sol-vents. It should be ensured that belts are stored stress free, which is to say without tension, pressure or other causes of deformation, as strain causes permanent deformation and failure due to fatigue, as well as cracking. If, for reasons of space, they are stored suspended, the diameter of the bar from which they are suspended must be equal to at least 10 times the height of the belt

The belts may not be stored for longer than 3 month in an open, uncontrolled environment. The storage area must be dry and dust-free. Belts may not be kept together with chemicals, solvents, fuels, lubricants, acids, etc.

Belts should be shielded from Radiators and their pipes. The distance between radiators and stored equipment must be at least 10 feet.

Belts should be protected from light, particularly from direct sunlight and strong artificial light with high ultraviolet content (formation of ozone), such as for example fluorescent tubes installed in open fixtures. Ideally, room lighting should be normal incandescent bulbs.

To counteract the damaging effect of ozone, the storage areas may not contain any form of ozone generating equipment, such as for example fluorescent light sources, mercury vapor lamps or electrical high voltage devices. Combustion gases and vapors, which may lead to ozone formation due to chemical processes, must be avoided or removed.

Damp storage areas are quite unsuitable. It should be ensured that no condensation occurs. The relative humidity should be below 65 %.

Cleaning of dirty belts can be carried out with a mixture of glycerin and spirit in a ratio of 1:10.

⚠ Caution

Benzene, benzol, turpentine and similar substances may not be used. Furthermore, sharp objects, wire brushes, emery paper etc., may not be used, as they will cause mechanical damage to the belts.

Bearings Every month, turn the fan shaft and rotate by hand to distribute grease evenly over the bearing parts. Then, every three months, inject grease to prevent any blocking of the lubrication lines possibly due to grease hardening. Whenever the fan shaft has been turned, it is a must to secure them at a standstill.

Fans See **Fan User Manual** for instructions.

Additional Services

Our interest in your IEC-B evaporative condenser does not end with the sale. Having designed and manufactured one of the most reliable and longest-lasting evaporative condensers in its class, we want to make sure that you gain the maximum possible benefit from its purchase.

Therefore, the following services are available which are intended to: assure the maximum possible service life under your operating conditions; tailor the operating characteristics to your specific needs–and maintain consistently optimum thermal performance capability. They are available by contacting your SGS sales representative.

Replacement Parts For complete parts and service assistance, contact the SGS sales representative in your area. If you need help locating your representative, please check the internet at spxcooling.com/sgs-refrigeration.

Be sure to mention your evaporative condenser serial number (from the evaporative condenser nameplate) when ordering parts.

Increased Load Requirements IEC-B evaporative condensers are designed so that cells of either equal or unequal capacity can be added in the future. This allows you to compensate for the load increases that normally occur with the replacement or addition of production equipment–and still retain continuity with respect to your evaporative condenser system.

Evaporative Condenser Rebuilding SPX routinely rebuilds and upgrades evaporative condensers, fluid coolers and cooling towers of all materials and manufacture. If your product ever reaches the limit of its service life, we recommend that you investigate the cost of rebuilding before you routinely order a new replacement evaporative condenser.

Each IEC-B evaporative condenser includes a document package containing general orientation drawings, assembly instructions and evaporative condenser component manuals. **These documents contain important information relating to safe installation and operation of the evaporative condenser**. Some optional accessories, such as access platforms, ladders and safety cages may also require field installation. A separate installation drawing or manual for each purchased option is included in the document package along with bills of material. If you have purchased an option and can't find the appropriate installation drawing, contact your local sales representative before proceeding.

troubleshooting

Trouble	Cause	Remedy
Motor will not start	Power not available at motor terminals	Check power at starter. Correct any bad connections between the control apparatus and the motor.
		Check starter contacts and control circuit. Reset overloads, close contacts, reset tripped switches or replace failed control switches.
		If power is not on all leads at starter, make sure overload and short circuit devices are in proper condition
	Wrong connections	Check motor and control connections against wiring diagrams.
	Low voltage	Check nameplate voltage against power supply. Check voltage at motor terminals.
	Open circuit in motor winding	Check stator windings for open circuits.
	Motor or fan drive stuck	Disconnect motor from load and check motor and fan drive for cause of problem.
	Rotor defective	Look for broken bars or rings.
Unusual motor noise	Motor running single-phase	Check motor and attempt to start it. Motor will not start if single-phased. Check wiring, controls and motor.
	Motor leads connected incorrectly	Check motor connections against wiring diagram on motor.
	Bad bearings	Check lubrication. Replace bad bearings.
	Electrical unbalance	Check voltages and currents of all three lines. Correct if required.
	Air gap not uniform	Check and correct bracket fits or bearing.
	Rotor unbalance	Rebalance
	Cooling fan hitting end belt guard	Reinstall or replace fan.
Motor runs hot	Wrong voltage or unbalanced voltage	Check voltage and current of all three lines against nameplate values.
	Overload	Check fan blade pitch. See “Fan User Manual.” Check for drag in fan drivetrain as from damaged bearings.
	Wrong motor RPM	Check nameplate against power supply. Check RPM of motor and drive ratio.
	Bearing overgreased	Remove bearing reliefs. Run motor up to speed to purge excessive grease. Does not apply to motors with sealed bearings.
	Wrong lubricant in bearings	Change to proper lubricant. See motor manufacturer's instructions.
	One phase open	Stop motor and attempt to start it. Motor will not stat if single-phased. Check wiring, controls and motor.
	Poor ventilation	Clean motor and check ventilation openings. Allow ample ventilation around motor.
	Winding fault	Check with ohmmeter.
	Bent motor shaft	Straighten or replace shaft.
	Insufficient grease	Remove plugs and regrease bearings. Does not apply to motors with sealed bearings.
	Too frequent starting or speed changes	Limit cumulative accelerations time to a total of 30 seconds/hour. Set on/off or speed change set points farther apart. Consider installing a VFD drive for fine temperature control.
	Deterioration of grease or foreign material in grease	Flush bearings and relubricate. Does not apply to motors with sealed bearings.
	Bearings damaged	Replace bearings.

troubleshooting

Trouble	Cause	Remedy
Motor does not come up to speed	Voltage too low at motor terminals because of line drop	Check transformer and setting of taps. Use higher voltage on transformer terminals or reduce loads. Increase wire size or reduce inertia.
	Broken rotor bars	Look for cracks near the rings. A new rotor may be required. Have motor service person check motor.
Wrong motor rotation	Wrong sequence of phases	Switch any two of the three motor leads.
Unusual fan drive vibration	Loose bolts and cap screws	Tighten all bolts and cap screws on all mechanical equipment and supports.
	Fan	Make certain all blades are as far from center of fan as safety devices permit. All blades must be pitched the same. See “Fan User Manual.” Clean off deposit build-up on blades
	Worn fan shaft bearings.	Check fan shaft endplay. Replace bearings as necessary.
	Unbalanced motor	Disconnect load and operate motor. If motor still vibrates, rebalance rotor.
Fan noise	Blade rubbing inside of fan cylinder	Adjust cylinder to provide blade tip clearance
	Loose bolts in blade clamps	Check and tighten if necessary.
	Fan shaft bearing	Grease bearings.
Scale or foreign substance in circulating water system	Insufficient blowdown	See “Water Treatment” section of this manual.
	Water treatment deficiency	Consult competent water treating specialist. See “Water Treatment” section of this manual
Condensing temperature too warm. See “Evaporative Condenser Operation.”	Entering wet bulb temperature is above design	Check to see if local heat sources are affecting evaporative condenser. See if surrounding structures are causing recirculation of evaporative condenser discharge air. Discuss remedy with SGS representative.
	Design wet bulb temperature was too low.	May have to increase evaporative condenser size. Discuss remedy with SGS representative
	Actual process load greater than design	May have to increase evaporative condenser size. Discuss remedy with SGS representative
	Overpumping	Reduce water flow rate over evaporative condenser to design conditions.
	Fluid cooler starved for air	Check motor current and voltage to be sure of correct contract horsepower. Repitch fan blades if necessary. Clean eliminators. Check to see if nearby structures or enclosing walls are obstructing normal airflow to evaporative condenser. Discuss remedy with SGS representative.
Excessive drift exiting evaporative condenser	Spray system malfunction	Inspect spray system for proper operation. Correct as necessary.
	Faulty drift elimination	Check to see that the eliminators are clean, free of debris and installed correctly. Clean if necessary. Replace damaged or worn out components.

maintenance schedule

Maintenance Service	Monthly	Semi-annually	Seasonal Startup or Annually
Inspect General Condition and Operation	x		x
Observe Operation of:			
Mechanical–motor, fan and drive mechanism	x		x
Makeup valve (if equipped)	x		x
Inspect for unusual noise or vibration	x		x
Inspect and Clean:			
Air inlet	x		x
PVC drift eliminators	x		x
Nozzles	x		x
Collection Basin	x		x
Fan and pump motor exterior	x		x
Coil surface		x	
Check:			
Collection water basin level	x		x
Blowdown–adjust as required	x		x
Belt drive:			
Fan shaft bearing lubrication (every 3 mo.)		every 3 months	every 3 months
Check and tighten support fasteners			x
Check shaft, sheave and belt alignment			x
Check belt tension and condition		x	x
Check sheave bushing fastener torque			x
Fan:			
Check and tighten blade and hub fasteners			x
Check fan blade pitch and tip clearance			x
Check fan cylinder for loose fasteners			x
Motor:			
Lubricate (as required)			R
Check mounting bolts for tightness			x
Operate at least	3 hours a month	3 hours a month	3 hours a month
Basin Heater (if equipped):			
Check for proper operation of temp/low water level sensor			x
Inspect/clean buildup of contaminant from sensor		x	x
Structure:			
Inspect/tighten all fasteners		x	x
Inspect and touch up all metal surfaces			x

R – Refer to Component User Manual

Note: It is recommended at least weekly, that the general operation and condition be observed. Pay attention to any changes in sound or vibration that may signify a need for closer inspection.

IEC-B evaporative condenser

USER MANUAL

SPX COOLING TECH, LLC
827 WEST PROGRESS DRIVE
DIXON, IL 61021 USA
815 284 2700 | spxcooling@spx.com
spxcooling.com

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