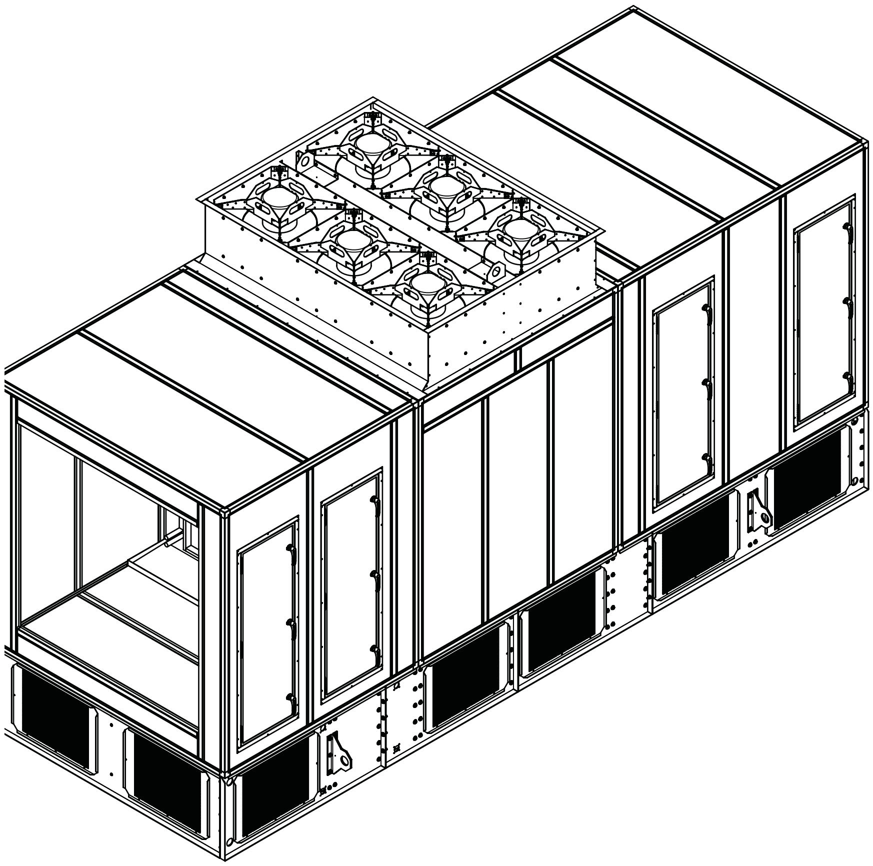


IeCE

Air Handling Unit

Model ASM-080-I

Installation, Operation and Maintenance Manual

STULZ IeCE - Air Handling Unit

Model Nomenclature		
ASM-XXX-X		
ASM	**Cabinet Size**	**Primary Cooling Method**
STULZ Modular Air Handling System	080 =	F = Direct Air-Side Economizer (outside air) I = Indirect Air-side Economizer (air-to-air heat exchanger)

STULZ Air Technology Systems, Inc.
1572 Tilco Drive
Frederick, MD 21704
USA

Table of Contents

Figures

Tables

1.0 INTRODUCTION

1.1 General

The STULZ IeCE modular air handling system is designed and manufactured by STULZ Air Technology Systems, Inc. (STULZ) and uses the latest, state-of-the-art control technology. The unit will provide years of trouble-free service if installed and maintained in accordance with this manual. Damage to the unit from improper installation, operation or maintenance is not covered by the warranty.

Spare parts are available from STULZ to ensure continuous operation. Using substitute parts or bypassing electrical or safety components in order to continue operation is not recommended and will void the warranty. Due to technological advancements, components are subject to change without notice.

Your STULZ IeCE system is designed to be installed on a pad and ducted to the space to be conditioned.

NOTE

STULZ IeCE systems are strictly for non-residential applications.

1.2 Safety

STULZ manuals contain notes, cautions, and warnings to draw your attention to important operational and safety information.

- A bold text **NOTE** marks an important detail.
- A bold text **CAUTION** alerts you to information important to protecting your equipment and its performance. Be especially careful to read and follow all cautions that apply to your application.
- A bold text **WARNING** alerts you to information important to protecting you from harm. Pay very close attention to all warnings that apply to your application.

A general safety alert symbol — ⚠ — precedes a general **WARNING** or **CAUTION** safety statement.

An electrical safety alert symbol — ⚡ — precedes an electrical shock hazard **WARNING** safety statement.

1.2.1 Safety Summary

The following warnings and cautions appear in this manual. Before you start performing the installation, operation, maintenance and troubleshooting procedures in the manual, read and follow these cautions and warnings

Note that the IeCE system should be serviced and repaired only by a journeyman refrigeration mechanic or air conditioning technician.

CAUTION ⚠

When moving the unit it must be kept in its normal installed position. If the unit is not kept level and vertical, damage may result.

CAUTION ⚠

The return air intake, scavenger (outside) air intakes and discharge (supply) air outlet must be free of obstructions.

CAUTION ⚠

Do not use chloride based water conditioning additives in condensate drain pans. This will cause corrosion to occur on the coil fins.

WARNING ⚠

Never lift any component in excess of 35 pounds without help. If a lifting device is used to move a unit, ensure it is capable of supporting the unit.

WARNING ⚠

Do not allow the unit to swing while suspended from a lifting device. Failure to observe this warning may result in injury to personnel and damage to the equipment.

WARNING ⚠

Do not allow anyone under the unit or any part of the unit while it is suspended from a lifting device.

WARNING ⚡

All personnel working on or near the equipment should be familiar with hazards associated with electrical maintenance. Safety placards/stickers have been placed on the unit to call attention to personal and equipment damage hazard areas.

WARNING ⚡

Never work on electrical equipment unless another person who is familiar with the operation and hazards of the equipment and competent in administering first aid is nearby.

WARNING

Never operate the unit with any cover, guard, screen panel, etc., removed unless the instructions specifically state otherwise, and then do so with extreme caution to avoid personal injury.

WARNING

When working on electrical equipment, remove all jewelry, watches, rings, etc.

WARNING

This unit employs high voltage equipment with rotating components. Exercise extreme care to avoid accidents and ensure proper operation.

WARNING

Hazardous voltage will still be present inside the control box(es) at the motor starter protectors and circuit breakers, even with the unit turned off at the microprocessor controller. To isolate the unit for maintenance, turn off power at the main power disconnect switch(es). Always disconnect main power prior to performing any service or repairs.

WARNING

A lock-out tag-out procedure should be followed to ensure that power is not inadvertently reconnected.

WARNING

To prevent personal injury, stay clear of rotating components as automatic controls may start them unexpectedly. Turn off power to the unit unless you are performing tests that require power. With power and controls energized, the unit could begin operating at any time.

WARNING

Cooling coils and associated piping circuits are pressurized up to 100 psi and sealed when they leave the factory. Before installing the interconnecting piping, observe appropriate safety precautions and release the pressure via an available stem valve or Schrader valve prior to uncapping the pipes

WARNING

Refrigerant is used in units equipped with a DX cooling system. Death or serious injury may result if personnel fail to observe proper safety precautions when servicing the DX system. Do not contact liquid refrigerant or refrigerant gas (discharged under pressure) with any part of the body. The extremely low temperature resulting from the rapid expansion of liquid refrigerant or pressurized gas can cause sudden and irreversible tissue damage.

At a minimum, all personnel should wear thermal protective gloves and face-shield/goggles when working with refrigerant. Application of excessive heat to any component will cause extreme pressure and may result in a rupture.

Exposing R410A refrigerant to an open flame or very hot surface can cause a highly toxic gas, FLUOROPHOSGENE, to form. In its natural state, refrigerant is a colorless, odorless vapor with no toxic characteristics. It is heavier than air and will disperse rapidly in a well-ventilated area. In an unventilated area it presents a danger as a suffocant.

WARNING

Do not use cleaning solvents near open flame or excessive heat. Wear eye protection when blowing solvent from parts. The pressure-wash should not exceed 30 psig. Dispose of solvent solutions in accordance with local and state regulatory statutes.

WARNING

Certain maintenance or cleaning procedures may call for the use and handling of chemicals, solvents, or cleansers. Always refer to the manufacturer's Safety Data Sheet (SDS) prior to using these materials. Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvents. Wash exposed skin thoroughly after contact with solvents.

WARNING

When performing soldering or desoldering operations, make certain the refrigeration system is fully recovered and purged and dry nitrogen is flowing through the system at the rate of not less than 1–2 CFM (.03–.06 m^3/minute).

1.3 Product Description

NOTE

Customer-specified, non-standard features or design variations may not be described in this manual. Refer to the installation and/or electrical drawings supplied with your unit for details on additional feature(s). In some cases, an addendum to this manual may be provided to further describe the feature(s).

STULZ IeCE systems comprise pre-designed modules integrated on a single steel mounting base (skid). Modular composition allows STULZ to rapidly incorporate custom features using a standardized approach to system design and manufacture.

IeCE units can be configured to operate in either of two primary cooling modes:

- Indirect air-side economizer mode, called “dry mode”
- Indirect evaporative mode, called “wet mode”

The two modes are briefly described below. See section “2.1 Cooling Control” on page 9 for a more detailed discussion of the modes.

Available air patterns include:

- Supply and Return on opposite ends
- Supply and Return on top
- Supply and Return on bottom
- Supply and Return on rear

1.3.1 Microprocessor Controller

IeCE systems employ the STULZ E^2 series microprocessor controllers running software customized for the options in your IeCE system. This controller provides these general features:

- Full alarm system
- Input/output status monitoring
- Full integrated control of cooling
- Multi-system control and remote communication with building management systems

The E^2 controller is mounted inside the Unit Control Box. If the unit includes the DX cooling option, a second E^2 controller is included in the Compressor Control Box to manage the DX system components.

The user interface to the E^2 controller is a graphic terminal that is typically mounted inside the Unit Control Box (see Figure 1 on page 4), but may be shipped loose for customer mounting. It has a backlit liquid-crystal alphanumeric display and a set of function keys to navigate through the controller menus and adjust operating parameters.

A customer-provided BMS may be used to directly interface to the E^2 controller. Operating instructions for the E^2 controller are provided in the *STULZ E² Series Microprocessor Controller for IeCE Systems IOM* shipped in the data package with your unit. Refer to that manual for detailed instructions on operating the system controller.

1.3.2 Indirect Air-Side Economizer (Dry Mode) Cooling

The base configuration of all IeCE units is an indirect air-to-air heat exchanger module comprising an array of aluminum plate air-to-air heat exchangers. The air-to-air heat exchangers are composed of a series of narrowly-separated plates that form perpendicular channels for process air and scavenger (outside or ambient) air to flow through without interacting with each other.

The system is equipped with EC (electronically commutated) fans. Fan speed is continuously adjustable via a signal from the system controller without the use of VFDs.

Dry mode cooling capacity is modulated via an array of scavenger EC fans, where scavenger fan speed is increased as cooling demand increases. Scavenger fans are also staged in order to reduce scavenger airflow enough to prevent condensation/ freezing when ambient (outside) air temperature is well below freezing.

An array of supply air fans moves data center return air through a set of air filters into the process air channels. The cooler scavenger air blows through the scavenger air channels and cools the heat exchanger plates, which in turn cools the process air that passes across the other side of the plates.

Other available (optional) cooling modes are:

- Indirect evaporative cooling – Water sprayed into scavenger side of air-to-air heat exchangers
- Direct Expansion (DX) refrigerant-based cooling
- Chilled Water (CW) cooling

Refer to “2.1.1.1 Indirect Air-Side Economizer (Dry Mode Cooling)” on page 10 for more information on this cooling mode.

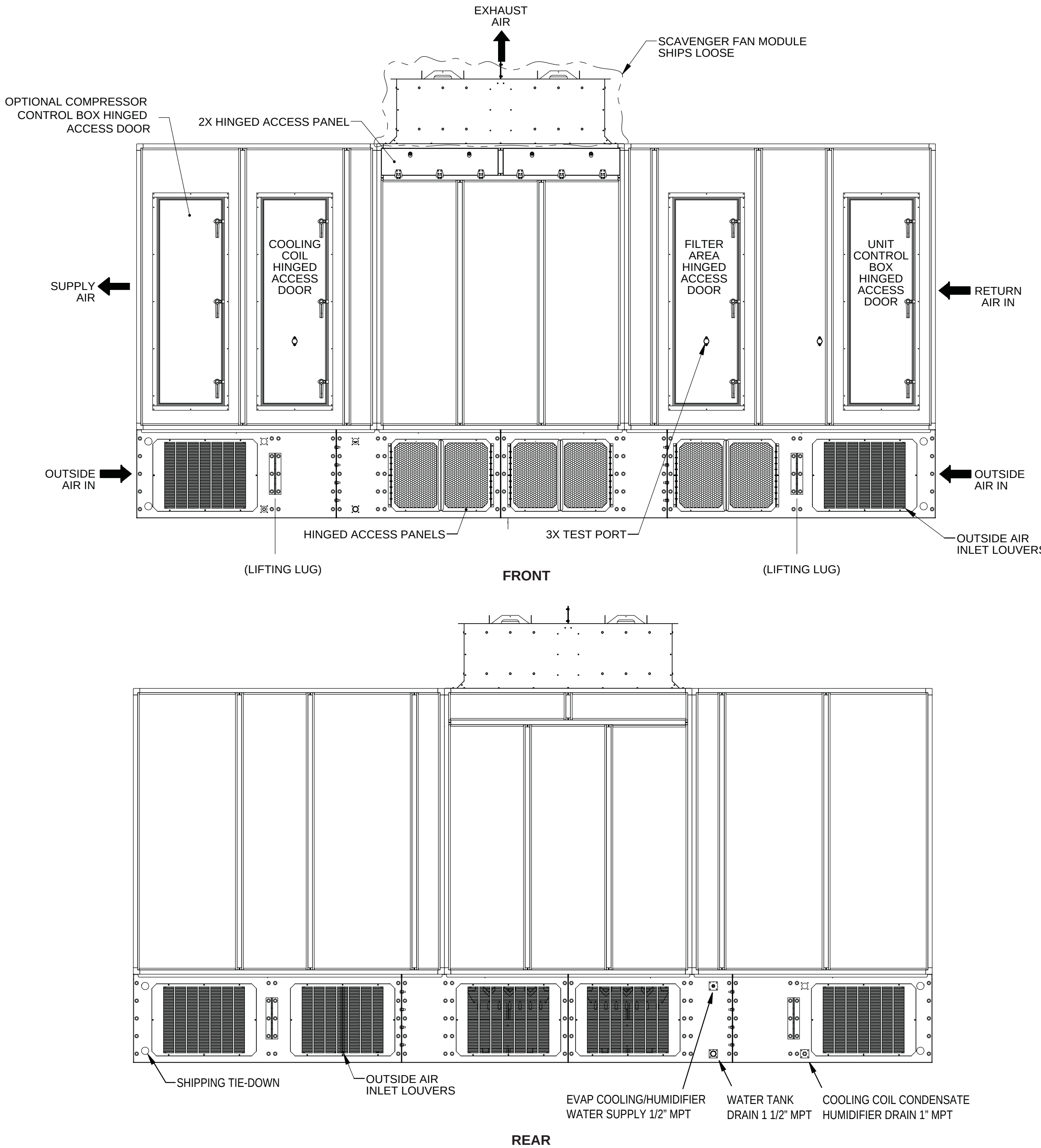


Figure 1. IeCE (left-hand unit) Supply and Return on Opposite Ends

1.3.3 Indirect Evaporative Economizer (Wet Mode) Cooling

The indirect evaporative cooling option ("wet-mode" cooling) adds a water distribution system that sprays water into the scavenger side of the heat exchanger channels. Adding evaporative cooling to the scavenger side of the heat exchanger extends the operating range for indirect economization. For example, dry mode may be able to provide all required cooling for ambient (outside) air temperatures up to 68 °F (20 °C), without the need for any DX or CW cooling. Wet mode could extend economizer-only operation as high as 95 °F (35 °C) ambient air temperature.

The following configurations are available for the evaporative water spray system. Refer to section "2.1.1.2 Indirect Evaporative Economizer (Wet Mode Cooling)" on page 10 for a more detailed discussion of the evaporative cooling option.

Available configurations include:

- Recirculating water system. The main water supply fills a set of water tanks. Pumps move the water from the tanks to a series of spray bars and into the heat exchangers. Excess water is buffered in the storage tanks and only drains when accumulated mineral content (water conductivity) is high. Refer to "1.5.1.2 Recirculating Water System" on page 7, and "2.2.1 Recirculating Water System Sequences" on page 11 for more information.
- Once-through water system. The main water supply feeds the spray bars directly and the water is used once (no pumps, no water storage/buffering) and any excess water drains out of system. Refer to "1.5.1.1 Once-Through Water System" on page 7, for more information.

NOTE

The water supply requirements are the same for either configuration. Clean, filtered (i.e., potable) water is required. The use of Deionized (DI) or Reverse Osmosis (RO) water is discouraged. Filtration and a service valve are to be supplied by others. Refer to the indirect evaporative cooling piping diagram provided with your unit for more information, including the required water supply pressure and flow rate.

Refer to "2.1.1.2 Indirect Evaporative Economizer (Wet Mode Cooling)" on page 10 for more information on this cooling mode. Refer to "1.5.1 Indirect Evaporative Water System" on page 7 for a more detailed discussion of the water system options.

1.3.4 DX or CW Cooling

IeCE units may be optionally equipped with a DX or CW cooling subsystem to either assist indirect economizer cooling or to provide full cooling capacity backup. Up to eight additional cooling stages are available. Note: Dehumidification is only available in systems equipped with a DX or CW subsystem. Refer to "1.5.2 Additional Cooling Modes" on page 7 for more information

1.3.5 Environment Sensors

Various system environment sensors provide data for system control and/or monitoring. Refer to "1.4.3 Temperature/Humidity Sensors" on page 6 and "3.9.2 Wiring Optional Devices" on page 22 for more information about environment sensors.

1.4 General Design

STULZ IeCE air handling units are constructed of double-wall insulated cabinet modules mounted on a hot-dipped galvanized steel skid. The interior and exterior cabinet skins are aluminum to reduce weight and the potential for corrosion. Lifting lugs that bolt onto the skid base are provided to facilitate rigging, moving and positioning the unit. The system is designed to mount on steel dunnage above the space to be conditioned or on a slab adjacent to the space to be conditioned.

Hinged access doors are provided for easy maintenance/service access to all major components. The access doors are fully gasketed to prevent moisture infiltration into the cabinet. Refer to the installation drawing provided with your unit for the cabinet layout, unit dimensions, unit weight, location of access doors and utility interfaces.

1.4.1 Control Box

Electrical components for the base unit are located in the Unit Control Box, as shown in Figure 1 on page 4. If the unit is configured with DX cooling, additional electrical control components for the DX subsystem are located in the Compressor Control Box.

WARNING

This unit employs high voltage equipment with rotating components. Exercise extreme care to avoid accidents. Always keep hands, clothing and tools clear of the fan blades when power is On.

WARNING

With power and controls energized, the unit could begin operating at any time. To prevent personal injury, stay clear of rotating components as automatic controls may start them unexpectedly.

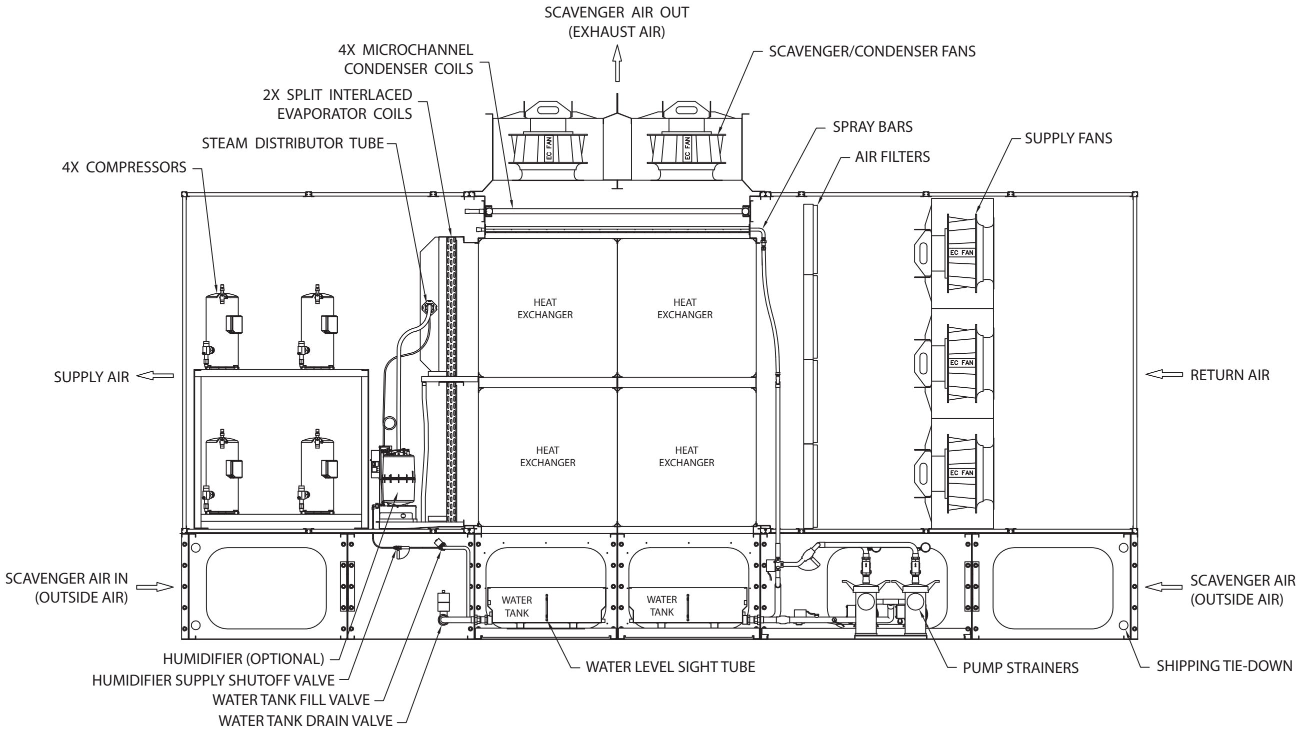


Figure 2. IeCE Cut-Away Front View, Left-Hand Unit with Indirect Evap and DX Cooling

The control box door is safety-interlocked by the main power service disconnect switch mounted in the door, preventing the door from being opened when the switch is in the ON position. The main power service disconnect switch must be OFF to gain access to the components within the electrical enclosure. The handle of the switch can be locked in the OFF position to prevent unintended operation.

Turn the unit off for maintenance using the BMS system first (if possible), then disconnect power using the main power service disconnect switch.

1.4.1.1 Circuit Breakers / Motor Starter Protectors

Individual overload protection is provided by circuit breaker(s) and motor starter protectors. These devices must be manually reset once an overload condition is cleared.

1.4.2 Fans

The IeCE system is equipped with high efficiency EC fans. EC fans have a brushless motor equipped with permanent magnets and permanently lubricated ball bearings. The fan impellers are backward curved and attached to the rotor casing. The fans are balanced and aerodynamically optimized to minimize vibration.

The fans do not use drive belts. Fan speed is varied by the system controller via Modbus. The fan motors are equipped with integral electronics and do not require the addition of secondary electronics, such as thermal protection, inverters or filters. The fans will not produce AC inverter whine.

EC fans feature an integrated monitoring function to protect the motor and electronics against damage from jamming, phase loss or overheating. If any of the following failure conditions occur, the motor automatically stops and an alarm is signaled:

- Locked rotor
- Loss of a phase
- Low main supply voltage
- Overheating of electronics
- Overheating of motor

If communication with the fans is lost, the fans continue to run at their last received output command until a new command is received. If a power cycle occurs, for example after a power outage, the fans will restart at their last received command when power is restored. Once the controller reboot cycle completes (and the Modbus network is online), fan speed is once again managed by the system controller.

1.4.3 Temperature/Humidity Sensors

Temperature/humidity (T/H) sensors are provided at a variety of places in the unit and may be factory- or field-installed. T/H sensors include:

- Return air
- Supply air
- Cold aisle

- Scavenger air inlet
- Scavenger air exhaust
- Cooling coil inlet (optional) – Factory installed in units with DX or CW cooling option

The system controller uses information from these sensors to determine when to turn on fans, evaporative cooling water, DX circuits, humidifier, and so on in order to maintain temperature, and optionally, relative humidity or dewpoint. Refer to your unit-specific documentation and the unit electrical drawing for the types and locations of sensors.

1.4.4 Filtration

High efficiency cartridge air filters are located downstream of the return air inlet (see Figure 2 on page 6).

NOTE

Operating the unit with dirty filters will reduce performance, but operating the unit with dirty filters is better than operating with no filters at all.

1.4.4.1 Air Proving/Filter Pressure Drop Sensor

A differential pressure transducer is provided to measure pressure drop across the air filters. This sensor is used to prove airflow (safety interlock) and determine when the air filters are dirty.

Increased pressure drop across the filters indicates that the air filters need to be replaced. At that point, an alarm is triggered and displayed at the graphic terminal. The pressure differential that triggers the alarm is set in the E^2 controller Airflow Setup screen.

1.5 Optional Equipment

1.5.1 Indirect Evaporative Water System

The evaporative water spray system provides water for cooling the scavenger air side of the heat exchanger plates.

Water for the evaporative spray can either be a "once-through" or recirculating. Potable or other clean water source, such as filtered rain water, is required for use by the water system.

1.5.1.1 Once-Through Water System

This option uses supplied water once, then drains any excess away. This system includes valves, spray bars, water catch pans and a detergent injection system. The detergent system is required on a once-through system in order to remove the minerals that accumulate on the scavenger side of the heat exchanger plates. The water catch pans drain directly (no drain valve). The water spray system is organized into several zones that are independently controlled (staged) based on required cooling capacity, with the goal being to minimize excess water that drains out of the system.

1.5.1.2 Recirculating Water System

This option uses supplied water to fill water tanks. That water is sprayed into the heat exchangers and the excess water is recirculated back through the heat exchanger multiple times (see below for more details). The system includes pumps, water tanks, tank level switches, strainers (water filters), valves, spray bars and a water conductivity sensor.

Water is collected/stored in two tanks positioned under the heat exchangers. Floatation switches are used to monitor water level in the tanks and determine when more water is required.

Pumps recirculate water from the tanks up to a series of spray bars that distribute the water into the scavenger side of the heat exchangers. Water strainers are included to catch debris that may be drawn in with the outside air.

NOTE

Water strainers should be inspected for debris daily. See "5.2.1.1 Pump Strainers" on page 28 for more information.

Water is recirculated until it is no longer considered "potable." Minerals left behind by evaporation accumulate in the recirculated water, gradually raising water conductivity. A sensor monitors water conductivity and when it exceeds an adjustable threshold, the system controller initiates a flush cycle. The flush cycle drains some of the water from the tanks (by opening the tank drain valve) while replenishing with fresh water (by opening the water supply/fill valve). The flush cycle may run multiple consecutive times in order to reduce water conductivity below another threshold, which is lower than the flush cycle initiation threshold.

The recirculation water system is organized into four independent spray zones that can be staged to minimize water use (when the unit is configured for water conservation as opposed to power conservation).

Because dirt and some of the leftover minerals may deposit in the heat exchangers over time, a control sequence is included to periodically flush the heat exchangers.

The system controller also includes logic to protect water system components from potential freeze damage by draining the system when ambient (outside) air temperature approaches freezing.

1.5.2 Additional Cooling Modes

If the unit was configured with DX or CW cooling, two or more coils are located downstream of the air-to-air heat exchangers and, when active, provide additional cooling of the supply airstream after it exits the heat exchangers. DX or CW cooling may also be sized for capacity backup if the indirect economizer is offline for any reason. Up to eight additional cooling stages are available, some of which may be used for dehumidification.

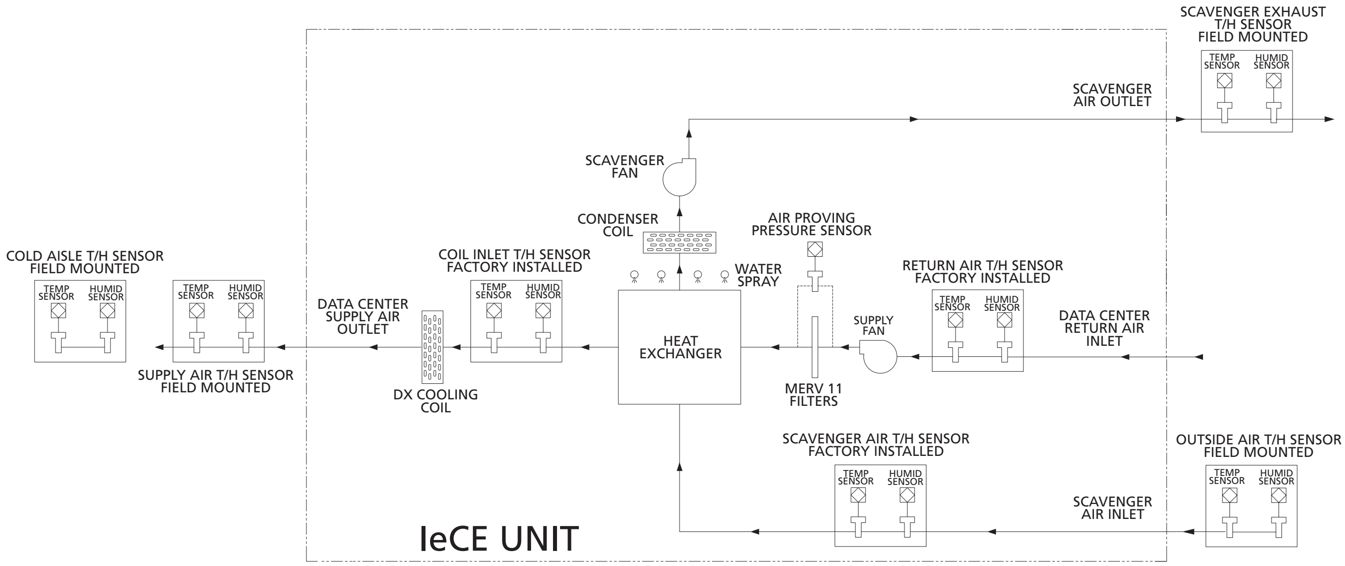


Figure 3. System Airflow Diagram with IeCE Options

1.5.2.1 CW Cooling

When equipped with CW cooling, proportional CW valves control the flow of chilled water through the CW coils. Multiple valves and coils allow for cooling staging and dehumidification.

1.5.2.2 DX Cooling

When equipped with DX cooling, each DX circuit includes one compressor, one evaporator coil/circuit, one condenser coil and one expansion valve. DX coils may be single circuit or split interlaced (dual circuit). R-410A refrigerant is used in the DX circuits.

The compressor controller turns each DX stage on and off based on cooling demand, as calculated by a PI control loop. Compressor activation rotates based on which compressor previously came on first, second, and so on. When a DX stage needs to be activated, the compressor that was stopped first (that is, the one that has been off the longest) is started. When a DX cooling stage needs to be deactivated, the compressor that was started first (the one that has been on the longest) is stopped.

Available options for DX condenser heat rejection include:

- Condenser coils are integrated into the AHU and exhaust (scavenger) air passes through the coils to take advantage of the evaporatively cooled air exiting the system.
- Some or all of the condenser coils or condensing units are located remotely, typically only when space or other factors don't allow integration into the AHU.

Refer to the refrigeration drawing provided with the unit for more detailed information about each cooling circuit.

1.5.2.2.1 Cooling Coil(s)

DX and CW cooling coils have aluminum fins mechanically bonded to seamless drawn copper tubes. The coils are leak tested and cleaned before installation in the unit.

1.5.2.3 Condensate Drainage

Stainless steel pans are provided to collect and drain condensate created by DX or CW cooling coils. The condensate pans drain to a 1" MPT connector located on the rear of the unit, as shown in Figure 1 on page 4. Refer to section 3.8.2 on page 20 for more information about condensate drainage requirements.

1.5.3 Humidification/Dehumidification

The unit may be equipped with a supply air humidifier. The humidifier includes an automatic fill and drain valve and all associated piping. In units with DX or CW cooling, the humidifier drains into the cooling coil condensate pan. Operation of the humidifier's fill and drain cycles is based on water conductivity, which is monitored by the humidifier's on-board controller. An operating manual for the humidifier is provided under separate cover. Refer to that manual for detailed information on the operation and maintenance of the humidifier.

In high return air temperature applications, dehumidification may not be achievable using indirect economizer cooling alone. Dehumidification is supported by IeCE systems but typically requires the DX or CW cooling option to function.

1.5.4 Smoke Detector

Optionally mounted at the return air inlet, a photo-electric smoke detector is used to sense the presence of smoke and signal the controller when a smoke alarm condition exists. The controller shuts down the unit until the alarm condition is cleared.

1.5.5 Firestat

Optionally mounted at the return air inlet, a firestat senses high return air temperature and signals the controller when a fire alarm condition exists. The system controller is programmed to shut down the entire system, including fans, when a fire alarm condition is detected. A manual restart is required.

NOTE

The smoke detector and firestat are not designed to operate as room smoke/fire detection systems that may be required by local or national codes.

2.0 THEORY OF OPERATION

This section provides sequence of operation information for the IeCE unit.

2.1 Cooling Control

As previously described, IeCE units can include any of several different cooling sources, with indirect air-side economizer (cooling via an air-to-air heat exchanger) being the only mode that is standard on all IeCE units. The number of stages available for each cooling source are:

- Indirect air-side economizer (dry mode cooling)—up to six stages available
- Indirect evaporative economizer (Wet mode cooling)—up to four stages available
- DX or CW (full backup or assisted cooling and/or dehumidification)—up to eight stages available

Whether DX or CW cooling is sized to assist or fully back up the indirect economizer, the cooling control sequence is the same — a cooling output (based on one or more PI control loops) adds stages, as necessary, to provide the required cooling.

When indirect evaporative cooling (wet mode) is available, a configuration parameter allows cooling staging to be configured to either conserve power or conserve water. When the unit is configured for power conservation operation, wet mode becomes the primary cooling source and dry mode is effectively disabled—dry mode is only enabled when wet mode is disabled (refer to section 2.1.1.2 on page 10 for the conditions that disable wet mode).

If a cooling mode (for example, wet mode) is offline for any reason, cooling control will reapportion the cooling output based on the available cooling stages, thus avoiding a potentially large temperature swing while the PI output counts up to automatically pull in the next available cooling mode. If control is configured based on a defined envelope (for example, "ASHRAE recommended"), cooling output will be based on the maximum output of several different PI loops, which are based on the defined operating envelope. Also, if operation is based on a defined envelope, adjustable offsets will be enabled (offsets from the defined dry bulb temperature, RH and dew point temperature limits) to help prevent excursions outside the defined limits.

2.1.1 Modes of Operation

As described in the section above, the primary cooling source (mode) depends on which cooling sources were ordered with the unit, as well as which conservation mode (power conservation or water conservation) was requested, where applicable. If water conservation was requested or the unit doesn't include the evaporative cooling option, indirect air-side economizer (dry mode) is the default primary cooling mode. If evaporative cooling (wet mode) was ordered and power conservation was requested, wet mode is the default primary cooling mode.

2.1.1.1 Indirect Air-Side Economizer (Dry Mode Cooling)

If the unit is configured for water conservation mode (power conservation mode is the factory default) water usage is reduced by making dry mode the primary cooling mode and staging water delivery to the heat exchangers. Pumps and water spray zones may be enabled based on cooling demand, but the predominant method for modulating dry mode cooling capacity is via scavenger (exhaust) EC fan speed—scavenger fan speed is increased as cooling demand increases. Scavenger fans may also be staged in order to reduce scavenger airflow enough to prevent condensation/freezing when ambient (outside) air temperature is well below freezing.

Whenever the supply/space/cold aisle dry bulb temperature set point cannot be reached, cooling output will continue to rise, eventually initiating the second stage of cooling (typically wet mode).

NOTE

Dry mode becomes ineffective as ambient dry bulb temperature approaches return air temperature so dry mode may be disabled, based on an adjustable differential between ambient air temperature and return air temperature, on systems without wet mode. If that situation arises, cooling output is reapportioned for the backup cooling mode(s).

Until cooling output dictates the need for other cooling modes, the features/components specific to the other cooling modes are locked out.

2.1.1.2 Indirect Evaporative Economizer (Wet Mode Cooling)

If evaporative cooling is present, water is sprayed into the scavenger side of the air-to-air-heat exchangers, taking advantage of evaporative cooling without adding humidity to the conditioned space. Wet mode operation is initiated based on either of the following conditions:

- Wet mode is the primary cooling mode – Unit is configured for power conservation as opposed to water conservation
- Dry mode is the primary cooling mode but the supply air temperature set point cannot be met using dry mode cooling alone. Cooling demand keeps rising with the scavenger fans at full capacity

NOTE

The unit can be configured not to run the scavenger fans up to 100% before enabling wet mode (when dry mode is the primary cooling mode).

The following conditions must also be met or wet mode operation is disabled:

- Ambient (outside) air dry bulb temperature is greater than an adjustable set point (default is 40 °F). This limit applies whether the water system is recirculating or once-through.
- At least one water tank high level float switch is closed (indicating the tank is full). This condition only applies to recirculating water systems when wet mode is first initialized. The system waits until the water fills the tank(s) before pumping any water. Otherwise, the water level can drop enough to trip a low level switch and disable wet mode.
- Water conductivity is below the adjustable limit (default is 1000 µS/cm). This condition only applies to recirculating water systems. Note: If the tank is full and water conductivity is high, a flush sequence runs in order to remove some of the dirty water. Refer to “2.2.1 Recirculating Water System Sequences” on page 11, for more details.

To conserve power, scavenger fan speed is typically modulated to control supply air temperature (cooling capacity), while the pumps run at full capacity the entire time wet mode is active. If water conservation is paramount, the unit can be configured to stage the pumps and spray zones in addition to modulating scavenger fan speed.

Wet mode capacity can be divided into four stages, where the pumps and zone valves are staged in response to cooling demand. The scavenger fans ramp up and down within the individual stages. This reduces water consumption at the expense of higher fan power. The unit needs to be configured for water conservation mode to enable pump/zone water staging.

2.1.2 Cooling Output

As mentioned previously, cooling staging and the enabling of additional cooling modes is a function of cooling output. The method used to calculate cooling output mainly depends on how unit control is configured. Typical control configurations include:

- Space / cold aisle temperature control
- Supply air temperature control
- Return air / hot aisle temperature control.
- ASHRAE recommended envelope control (space)
- ASHRAE allowable envelope control (space)
- Custom defined envelope control

The various envelope configurations already encompass relative humidity (RH) and dewpoint temperature control but either of those can be added in addition to the corresponding temperature control configurations. In addition to the various control configurations, multiple PI control loops are defined and can be enabled based on the desired control method. The basic PI control loops include:

- Space / cold aisle temperature PI loop
- Supply air temperature PI loop
- Return air / hot aisle temperature PI loop
- Space / cold aisle relative humidity PI loop
- Supply air relative humidity PI loop
- Return air / hot aisle relative humidity PI loop
- Space / cold aisle dewpoint temperature PI loop
- Supply air dewpoint temperature PI loop
- Return air / hot aisle dewpoint temperature PI loop

In the simplest control configuration, where the unit is only configured for space temperature control, cooling output is generally just the output of the space/cold aisle temperature PI loop. If the unit was also configured to control space relative humidity (and the unit included DX or CW cooling), the control output would be the maximum of the space/cold aisle PI loop and the space/cold aisle RH PI loop. In more complex control configurations, cooling output is based on several PI loop outputs. For example, when operating within a defined ASHRAE envelope, the PI loops that factor into the cooling output are, at a minimum:

- Space / cold aisle temperature PI loop
- Space / cold aisle relative humidity PI loop
- Space / cold aisle dewpoint temperature PI loop

All the above PI loops would be "enabled" and cooling output would typically be the maximum of the independent PI loops.

2.1.2.1 Custom Control Configuration

There are situations where a minimum output may be required from a group of related PI loops, as well as situations where additional PI loops may need to be enabled to improve control. For instance, if space temperature control is difficult due to the lag from averaging several sensors, the supply air control loops are enabled to help limit the integral from prematurely driving the cooling output to 100%. In this case, the temperature PI output that feeds into the overall cooling output calculation (that's used to enable cooling stages and modes) would be the minimum of the space and supply temperature PI loops.

NOTE

Due to the complexities involved, please contact STULZ for assistance whenever control issues arise that may require custom control configurations.

2.2 Water Control

When indirect evaporative cooling is included in an IeCE unit, which it typically is, several sequences are required to prevent the potential for freeze damage, to ensure proper water delivery to the heat exchangers and to reduce heat exchanger fouling. The standard IeCE unit includes a recirculating water system which uses pumps and zone control valves to stage water delivery to the heat exchangers.

A relatively large amount of water has to flow across the heat exchanger plates to maximize evaporation from the surface of the plates. The estimated water flow rate is 50 to 300 times the actual water evaporation rate so large water storage tanks are required. The recirculated water also tends to filter dirt from the scavenger airstream, requiring a water filter/strainer that needs to be cleaned frequently. Also, the dirt and mineral buildup in the water needs to be monitored (via water conductivity measurements) so the system can be flushed before they become excessive.

NOTE

Softened or low mineral (RO, DI) water shouldn't be used because it will interact with the protective coating on the heat exchanger plates, eventually removing all the coating. Normal potable (tap) water is recommended.

2.2.1 Recirculating Water System Sequences

The recirculating water system includes two pumps, at least one large water storage tank (with low and high level switches) and at least two 3-way zone control valves. Refer to STULZ drawing RNA0283 for the standard recirculating system piping schematic that shows the valve designators referenced below.

Because water conservation is a requirement for some customers but not others, evaporative cooling (wet mode) can be configured for power conservation, which uses evaporative cooling and full water flow whenever evaporative cooling is feasible, or water conservation, which stages pumps and spray zones only as required by cooling demand.

Power conservation is the standard factory configuration and basically flips the cooling staging priority around, making wet mode the primary cooling mode. Dry mode only acts as primary when wet mode is disabled (for example, when ambient temperature is low). See "2.1.1.2 Indirect Evaporative Economizer (Wet Mode Cooling)" on page 10 for more details.

The following basic recirculating water system control sequences are independent of how wet mode is configured:

- Water tank level control – Water needs to be stored to buffer the pump(s) so they don't run dry.
- Startup flush – Flushes the water lines before feeding any water to the heat exchangers.
- High conductivity water flush – Drains some of the recirculated water and replaces with clean water to remove dirt and reduce mineral concentration.
- Heat exchanger clean cycle – Flushes out the heat exchangers to remove possible dirt and mineral buildup.
- Manual and automatic system drain – To prevent freeze damage and bacterial growth, the system should be drained when ambient (outside) air temperature is low and/or the system is inactive.

NOTE

The use of variable speed pumps is not recommended because the spray bars require relatively high flow (stable water pressure) to ensure even water distribution.

2.2.1.1 Startup Flush

Because there may be scale in dormant water supply lines or debris may accumulate in the water storage tank(s), the entire water system should be flushed when wet mode has been idle/inactive for an extended period of time (this is an adjustable parameter with a default of 24 hours). Water will not be sprayed into the heat exchangers until the water tanks and lines have been properly flushed.

2.2.1.2 High Conductivity Flush

In recirculating water systems, dirt from the scavenger airstream will be filtered by the water and the dirt and minerals left behind by the evaporated water will become more and more concentrated in the water. Monitoring water conductivity and flushing some of the water, when necessary, during wet mode operation is required to limit fouling the heat exchangers. The sequence for flushing during operation is as follows:

When water conductivity exceeds 1000 μS/cm (adjustable) the normally closed water supply valve (V3) is opened until at least one high water level switch opens, indicating the tank is full. Next, the tank drain valve (V2) is opened for an adjustable time period (the default is 30 seconds). The tank drain valve (V2) closes after the timer expires.

If water conductivity is below an adjustable value (the default is 600 μS/cm), the sequence is complete and normal operation can resume. If water conductivity is above the adjustable value, the sequence is rerun. If the sequence runs more than 10 times (adjustable) consecutively, a non-fatal alarm is logged to indicate a potential water quality or system cleanliness issue (maintenance recommended).

2.2.1.3 Heat Exchanger Clean Cycle

Because some of the concentrated dirt and minerals may deposit inside the heat exchanger, the heat exchangers themselves are periodically flushed to help remove dirt and mineral buildup. A screen is included in the controller software that allows a user to initiate a heat exchanger clean cycle. If configured to do so automatically, the heat exchanger cleaning cycle runs at the completion of wet mode, as follows:

1. Scavenger fan speed is reduced to an adjustable fixed value (the default is 30%).
2. All the zone valves are energized and water pumps started for an adjustable time period (the default is two minutes).
3. After the time delay expires, the zone valves are closed and pumps de-energized.

NOTE

Operating modes and/or sequences are displayed on the graphic terminal while active.

2.2.1.4 Water Storage Tank Level Control

Sufficient water is required to prevent the pump(s) from running dry. The location of the low level switches is intended to ensure there is enough water in the tank to operate wet mode at full capacity for approximately two minutes before the pump runs dry.

Note that a water flow switch, located in the common pump suction line, is used to interlock the pump(s) to help prevent operating the pumps dry.

2.2.1.5 Manual and Auto System Drain

Water tank capacity is large in recirculating systems, so the water should only be drained when necessary. High water conductivity has already been identified as a reason to partially drain (flush) the tanks during operation (wet mode). The following criteria necessitate completely draining the water tanks:

- When requested by the operator. A prompt may appear on the graphic terminal to verify manual drain of the tanks for maintenance purposes.
- When ambient temperature is continuously below an adjustable value, as set in the Evap Freeze controller screen. The default temperature is 40 °F for an adjustable time period set in the Auto Drain screen. The default time period is 2 hours.
- When wet mode has been inactive for an adjustable time period, as set in the Auto Drain Idle controller screen. The default period is 24 hours.

NOTE

The system can be configured to automatically drain or not drain the water storage tanks when turned off by remote start/stop.

When a complete water system drain is required, the tank drain valve (V2) is opened. (Note that the valve is a non-spring return On/Off valve. The valve position doesn't change if power is lost (doesn't automatically drain the tanks.) The following controller command sequence implements the drain process:

1. The normally open manifold drain valves (V9) are de-energized.
2. The normally closed pump priming valves (V10) are energized (opened).
3. After both water tank low water level switches open, indicating low water level in the tanks, the pumps are energized for an adjustable time period (the default is 20 seconds).
4. The pumps and pump priming valves (V10) are de-energized after the time delay expires but the drain valve (V2) is kept open.

2.2.2 Recirculating Water System Operating Modes and Capacity Control

Wet mode may be configured for water conservation or power conservation. Power conservation is the factory default and the unit operates as described in "2.2.1 Recirculating Water System Sequences" on page 11. When power conservation is selected, both pumps operate and all four zone valves (V1) are energized for full water flow to the spray bars. Scavenger fan speed is modulated to control indirect cooling capacity. When water conservation is selected, the pumps and zone valves are staged as described in "2.2.2.2 Capacity Control – Wet Mode with Water Conservation" on page 13.

2.2.2.1 Capacity Control – Wet Mode with Power Conservation

In this configuration, wet mode becomes the primary cooling stage. Dry mode is essentially locked out unless wet mode is disabled. Refer to the section "2.2.1.2 High Conductivity Flush" on page 12 for the conditions that disable wet mode. When wet mode is initiated and power conservation is selected:

1. The startup flush sequence runs.
2. After the startup flush sequence is complete, both pumps are energized.
3. The normally-open manifold drain valves (V9) are closed.
4. All the zone valves (V1) are energized.
5. The tank drain valve (V2) and flush valves (V9) remain closed, at least until a flush or drain sequence is required.
6. Maximum scavenger fan speed is limited at an adjustable value (the factory default is 100%). Scavenger fans start at their minimal output (all scavenger fans operating) and ramp up as needed.
7. Scavenger fan speed ramps up or down in concert with cooling demand (cooling output). If scavenger fan speed reaches its maximum and cooling demand continues to increase, DX or CW cooling is required (if available) — See section "2.1 Cooling Control" on page 9, for more details.

NOTE

Scavenger fan speed limiting is disabled when DX cooling is enabled – Scavenger fans operate at 100%.

2.2.2.2 Capacity Control – Wet Mode with Water Conservation

In this configuration, dry mode becomes the primary cooling stage. Wet mode is initiated when dry mode capacity is insufficient to handle the load and cooling demand pulls in wet mode. When wet mode is initiated and water conservation is selected:

1. The startup flush sequence runs.
2. After the startup flush sequence is complete, one of the pumps is energized.
3. All the normally open manifold drain valves (V9) are energized (closed)
4. One of the zone valves (V1) assigned to the operating pump is energized
5. The tank drain valve (V2) and flush valves (V9) re- main closed, at least until a flush or drain sequence is required.
6. Scavenger fan speed is limited at an adjustable maximum value (the factory default is100%). Scavenger fans are started at their minimal output (all scavenger fans operating) and ramped up as needed.
7. Scavenger fan speed is ramped up or down in concert with cooling demand (cooling output). If scavenger fan speed reaches its maximum and cooling demand continues to increase, another zone is staged. The other zone valve (V1) assigned to the operating pump is energized.
8. Scavenger fan speed is ramped up or down in concert with cooling demand. If scavenger fan speed reaches its maximum and cooling demand continues to increase, the second pump is energized (if available) and one of the zone valves (V1) assigned to that pump is energized.
9. Scavenger fan speed ramps up or down in concert with cooling demand. If scavenger fan speed reaches its maximum and cooling demand continues to increase,

pull in another zone (that is, energize the other zone valve (V1) assigned to that pump).

10. If cooling demand continues to increase, DX or CW cooling is required (if available).

NOTE

Scavenger fan speed limiting is disabled when DX cooling is enabled, meaning scavenger fans operate at 100%.

2.2.3 Valve Types and Operation

This section documents the types of valves used in the recirculating water system and when they are energized or de-energized.

1. Zone control valves (V1-x) – These are 3-way valves that are only energized in wet mode and only when the associated pump is operating. If a zone valve is de-energized when its assigned pump is operating, water is simply diverted back into the water tank. Zone valves V1-1 and V1-2 are assigned to Pump A. Zone valves V1-3 and V1-4 are assigned to Pump B.
2. Tank drain valve (V2) – This is a 2-way On/Off non- spring return valve that has to be driven open or closed via the controller. The valve only needs to be driven closed when the control sequences demand it, which is typically only when wet mode is active. The valve can be manually overridden, allowing the tanks to be drained manually when the system is shut down.
3. Water supply (fill) valve (V3) – This is a 2-way, normally-closed solenoid valve that is energized (opened) when the water tank(s) need fresh (clean) water.
4. Manifold drain/flush valves (V9-x) – These are normally-open 2-way valves that are only energized (closed) when a pump is operating. All V9 valves should be energized (closed) whenever any pump is operating. Otherwise, they open (when de-energized) to drain water out of the spray lines to avoid freeze damage.
5. Pump priming valves (V10-x) – These are 2-way normally-closed valves that are only energized (opened) briefly before starting their associated pump, following a complete system drain (typically any time wet mode is initiated). Valve V10-1 is assigned to pump A and valve V10-2 is assigned to pump B.

2.2.4 Recirculating Water System Balancing

The recirculating water system is an open system that was balanced at the factory but may need to be rebalanced during Startup. Refer to “4.2.1 Recirculating Water System Balancing” on page 26 for detailed instructions on how to balance the recirculating water system.

3.0 INSTALLATION

3.1 Receiving the Equipment

Your STULZ IeCE system has been tested and inspected prior to shipment. To ensure the equipment is received in factory condition, perform a visual inspection immediately upon receipt. Carefully remove all protective packaging. Open the access doors and thoroughly inspect the unit interior for any signs of transit-incurred damage. If there is shipping damage, it must be noted on the freight carrier’s delivery forms before signing for the equipment. Any freight claims must be done through the freight carrier. STULZ ships all equipment FOB. STULZ can assist with providing information to support a claim. Should any damage be present, contact STULZ Product Support prior to attempting any repairs. Refer to Section “6.0 Product Support” on page 39 of this manual for instructions.

A data package has been sent with your unit. It contains this manual, an ***E²*** controller manual, system drawings, applicable safety data sheets, other component manuals, warranty registration and other applicable instructions based on the configuration and options of your unit. The data package has been placed in your unit in a clear plastic zip lock bag. These documents need to be retained with the unit for future reference.

NOTE

Items that have been shipped loose, such as temperature/humidity sensors, are shipped inside the air handler unless specified otherwise by the customer. Unpack and store these items in a safe place unless you are installing them immediately.

3.2 Site Preparation

STULZ IeCE air handling systems are designed with easy service access in mind. Hinged doors are located on the front of the unit. Electric control components, including the system controller, are located in an internal compartment with a hinged door accessed from the front of the unit. When determining the installation location, consider how to route the ductwork to and from the unit and how to route wiring into the electric compartment.

Install the system in a secure location safe from tampering and where the main power switch cannot be inadvertently turned off. Locate the unit where outside air inlets are not likely to draw dirt and debris into the unit. Allow unobstructed access around the unit to perform routine inspection and maintenance.

In order to allow access to serviceable components via the front doors, no permanent obstructions should be placed within 24 inches of the front of the unit. To judge the clearance requirements in front of the unit, consider that the air filters are housed inside the cabinet and need to be removed and replaced regularly through the front.

NOTE

Working clearance requirements need to be established prior to mounting the unit. Refer to local and national electrical codes.

3.2.1 Conditioned Space

To minimize adverse effects of the environment surrounding the conditioned space, certain precautions must be taken. This is especially true in data center applications, where the goal is to minimize the energy required to cool/dehumidify the data center. The conditioned space should be well insulated and include a vapor barrier. The installer should ensure that the proper rated insulation is used based on the design of the space, which was the basis for the system selected.

The following table is the minimum recommended R-value (thermal resistance) to reduce heat infiltration.

Table 1. Minimum Recommended R-Values

Structure	R-Value
Ceiling	R-38
Wall	R-31
Floor	R-19
Door	R-5

The vapor barrier is an important requirement for maintaining environmental control in the conditioned space. The vapor barrier in the ceiling and walls can be a polyethylene film. Concrete walls and floors should be painted with a rubber or plastic-based paint. Doors and windows should be properly sealed and a door sweep used to minimize leakage. While complying with relevant IAQ standards, minimize outside (fresh) air to limit added cooling, heating, humidification or dehumidification loads associated with fresh air. Ignoring these measures can cause erratic operation, unstable room control and higher maintenance costs.

3.3 Rigging

The system is designed to be kept horizontal. Its steel mounting skid base provides rigidity and protects it from damage during installation. When moving the unit, use a suitable device, such as a crane. The unit may be lifted using cables, chains or slings attached to overhead lifting bars. Removable lifting lugs were provided and need to be installed at multiple points on the mounting skid for attaching lifting slings to facilitate lifting. After placing the unit, the lifting lugs may be removed.

If an overhead lifting device is used, ensure it can safely handle the weight of the unit. The approximate weight of the unit is provided on the installation drawing. If an overhead lifting device is employed, use spreader bars that exceed the cabinet width (see Figure 4) in order to avoid crushing the sides of the unit and/or damaging components mounted to the sides.

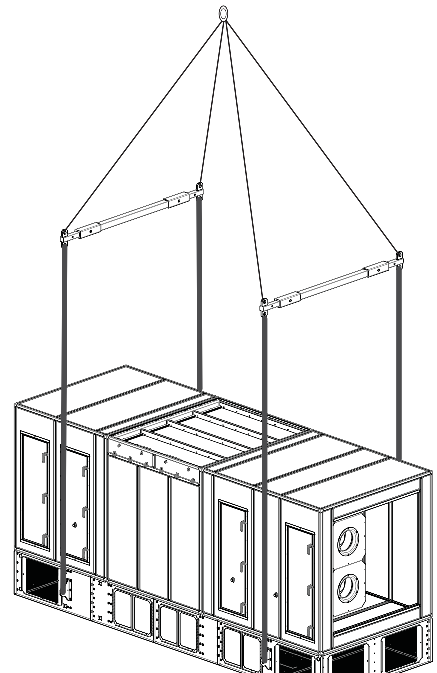


Figure 4. Rigging

CAUTION ⚠

The unit must be kept level and horizontal when lifting to prevent damage to interior components.

3.4 Location and Clearances

STULZ IeCE systems use a steel base for unit rigidity. The system is designed to be installed on a pad or steel dunnage and ducted to and from the space to be conditioned.

Holes are provided in the bottom rails to secure the unit to the pad or steel dunnage when the system is in its final position.

CAUTION ⚠

Ensure the mounting surface is capable of supporting the weight of the equipment.

3.5 Unit Assembly

Due to shipping restrictions (typically height and width), some IeCE modules or major components may need to be disassembled for shipment and reassembled on site. A bag or box of the hardware that was used to assemble the modules at the factory should have shipped with the unit. Locate that hardware prior to reassembly.

3.5.1 Scavenger Fan Module Assembly

The scavenger fan module (see Figure 5) typically ships loose for field assembly. The unit lifting lugs were designed to handle the combined weight of all IeCE modules and components, so the fan module can be installed before or after unit placement.

The scavenger fan module includes two junction boxes for fan cabling that must be installed as the module is being lowered onto the IeCE unit (that is, before the module is fully lowered onto the IeCE unit).

Installation involves certain high-level steps, including:

1. Hoisting the scavenger fan module to within a foot of the top of the IeCE unit. See section 3.5.1.2, "Hoist the Scavenger Fan Module over the IeCE unit" for more details.
2. Routing fan cabling from two junction boxes through cutouts provided in the IeCE unit. See section 3.5.1.3, "Route and Connect Scavenger Fan Cabling" for more details.
3. Securing the scavenger fan module and sealing the interface between the module and the IeCE unit. See section 3.5.1.4, "Secure and Seal Fan Module" for more details.
4. Securing and sealing the scavenger fan cable junction boxes. See section 3.5.1.5, "Secure and Seal Cable Junction Boxes" for more details.
5. Connecting the scavenger fan power and communication plugs to the appropriate receptacles.

Due to the critical nature of the scavenger fan module installation, it's important to read and fully understand the entire module assembly procedure before attempting installation. Then, follow the step-by-step instructions (detailed in Sections 3.5.1.2 through 3.5.1.5) to ensure no steps are missed during the assembly process.

Assembly steps 1 through 3 above are illustrated in Figure 7 and Figure 8. Detailed step-by-step instructions for the complete scavenger fan module installation are provided below.

3.5.1.1 Required Assembly Materials

- Phillips screw driver
- 7/16" hex nut driver or socket wrench
- 16 count #10×1" machine screws (for cable junction box attachment)
- 30 count 1/4-20×1" hex-head screws, with 7/16" hex head
- 2 count 10 ounce tubes of silicone RTV sealant
- Caulk gun

All screws should be included in the hardware kit that shipped with the unit.

3.5.1.2 Hoist the Scavenger Fan Module over the IeCE unit

Using the lifting eyes on the scavenger module (see Figure 5), hoist the module over the IeCE unit and position it over the scavenger fan opening in the roof of the IeCE unit.

NOTE

The scavenger fan module should be oriented such that the two cable junction boxes taped to the fan module are located at the front of the IeCE unit. Lower the fan module approximately one foot above the IeCE unit.

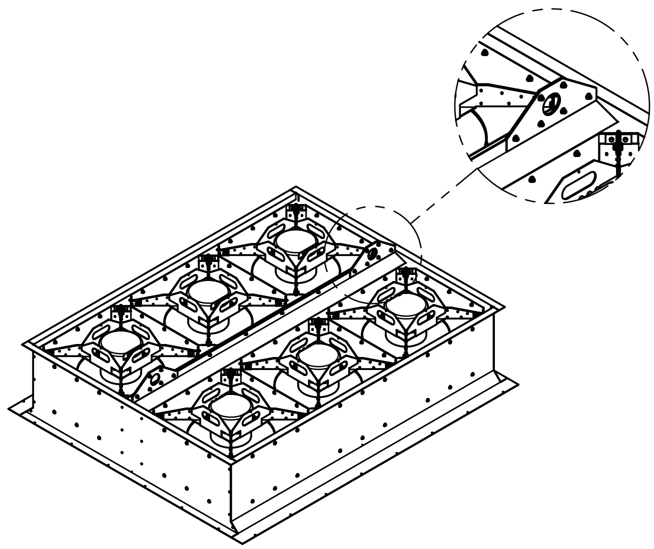
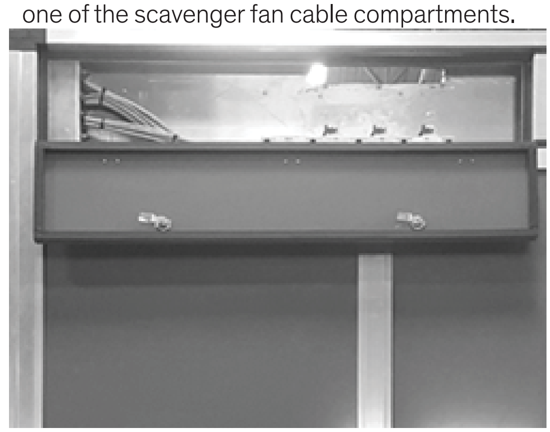


Figure 5. Scavenger Fan Module Lifting Eyes

3.5.1.3 Route and Connect Scavenger Fan Cabling

The following procedure is performed by a workman on a ladder positioned in front of the IeCE unit, near the center of the heat exchanger module where the two small rectangular hinged drop-down doors are located.

1. From a position in front of one of the hinged drop-down doors, turn the two latches to open the door and access one of the scavenger fan cable compartments.



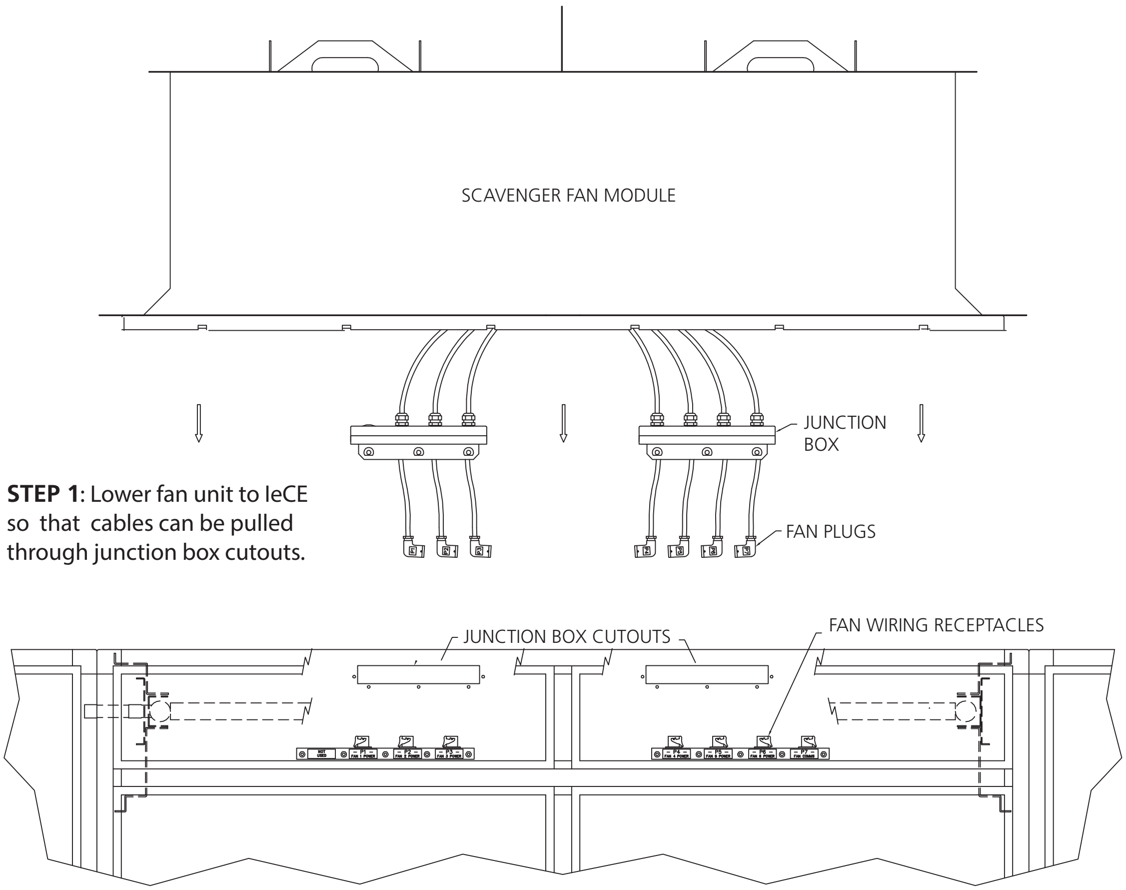
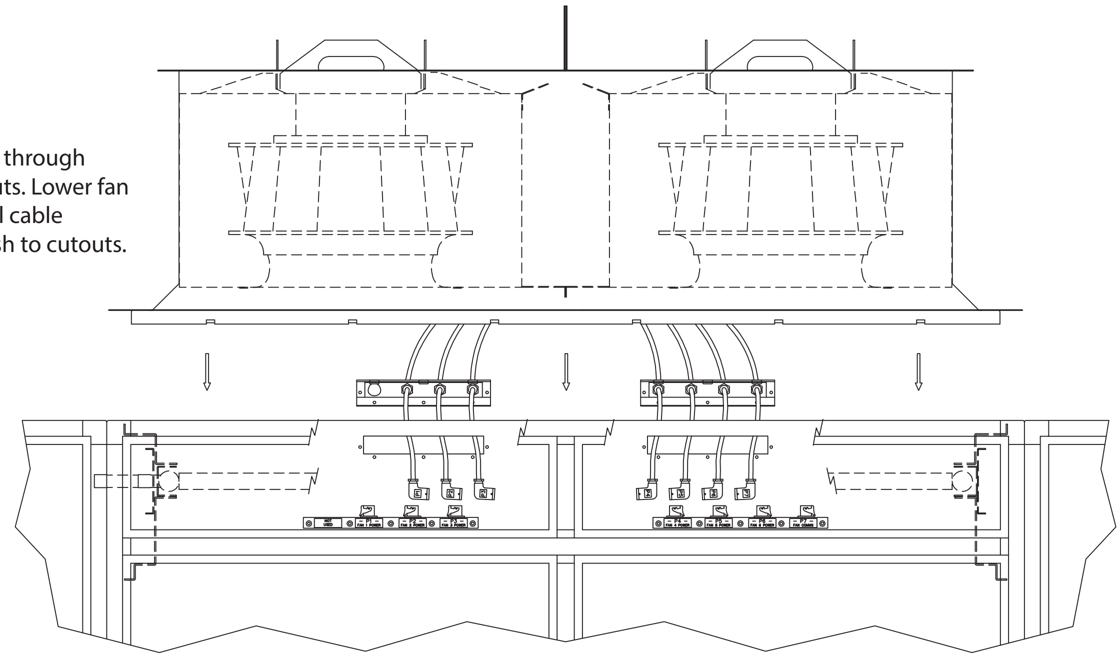


Figure 6. Scavenger Fan Installation 1 of 2

STEP 2: Pull cable through junction box cutouts. Lower fan unit as req'd to pull cable junction boxes flush to cutouts.



STEP 3: Attach cable junction boxes to IeCE and plug in cables.

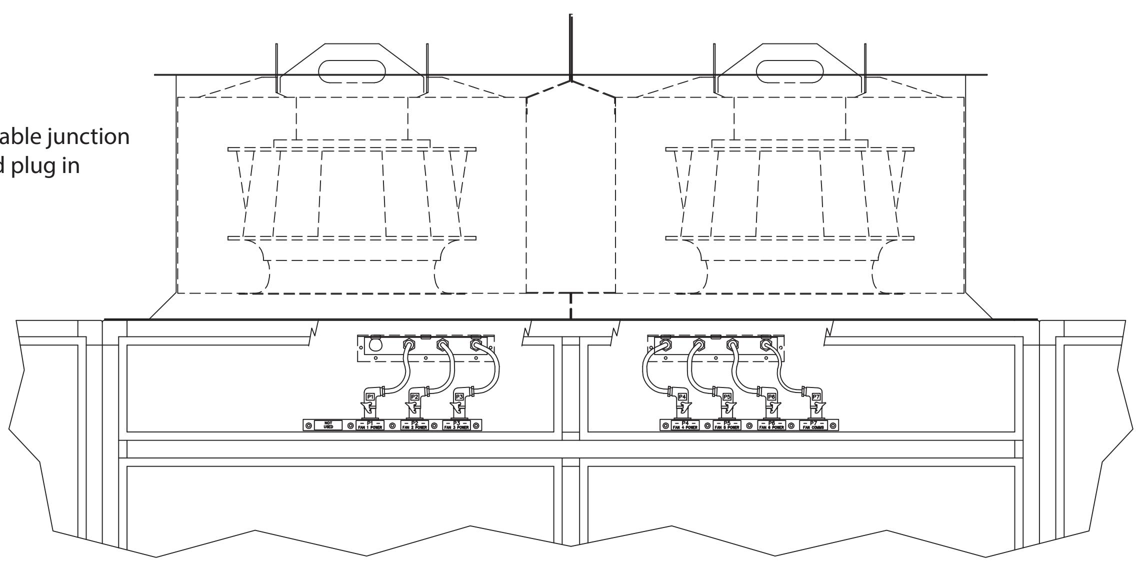


Figure 7. Scavenger Fan Installation 2 of 2

2. Detach the cable junction box taped to the fan module and feed the box and cables into the gap between the fan module and IeCE unit. The junction box and cables should now be hanging behind the cutout. Verify the junction box is correct for the compartment you are working on by comparing the numbers on the plugs to the numbers on the receptacles in the fan compartment.
3. Reach through the cutout in the fan cable compartment and feed the cables/plugs through the cutout. Ensure all the plugs/cables are hanging freely on the front-side of the cutout but don't connect any the plugs into any receptacles at this point.
4. Reposition the ladder in front of the other scavenger fan cable compartment and repeat Steps 1 through 3 for the other cable junction box.

3.5.1.4 Secure and Seal Fan Module

1. Moving to the top of the IeCE unit, place protection (e.g., plywood) in walking areas to avoid damaging the aluminum skinned panels.
2. Use isopropyl alcohol on a clean cloth to wipe the mating surfaces of the scavenger fan cutout on the IeCE unit and the flange near the bottom of the scavenger fan module (the outer flange that isn't gasketed).
3. Inspect the factory-applied gasket on the inner, bottommost flange of the fan module, ensuring the gasket is complete and still adhered.
4. Apply a continuous bead of silicone RTV sealant to the fan module mating flange location on the top of the IeCE unit, encircling all screw holes.

NOTE

The aluminum extrusion framing with the holes in them constitute the mating surface where the fan module flange screws down to the IeCE unit.

5. Lower the scavenger module onto the IeCE unit so the mounting holes on the flange of the scavenger fan unit align with the mounting holes on the IeCE unit.
6. Install 30 1/4-20×1" hex-head screws (one for each hole in the fan unit mounting flange) and tighten in a criss-cross pattern to distribute pressure evenly.
7. Smooth any excess sealant that squeezes out of the joints.
8. If necessary, apply additional silicone RTV sealant to any joints, holes or gaps that aren't visibly sealed, including the outer edge of the fan module mating flange.

3.5.1.5 Secure and Seal Cable Junction Boxes

9. Now that the fan module is fully lowered and secured atop the IeCE unit, the junction boxes can be secured.
10. Moving back to the ladder located at the front of the IeCE unit, use the cables to pull the junction box up to the cutout. The top flange on the junction box comes through the cutout while the gasketed face comes up against the back of the cutout.
11. Inspect the gasket on the top and face of the cable junction box. Ensure the notches in the three grommets in the top flange are oriented as shown in Figure 8.

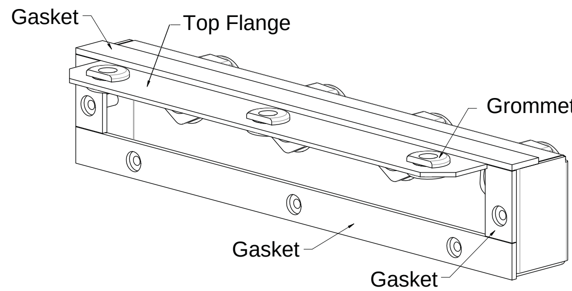


Figure 8. Junction Box

12. Align the grommeted holes in the top flange with the holes in the framing above. Insert three of the #10×1" machine screws (from the parts kit) and partially tighten using a Phillips screwdriver – Do not fully tighten the screws at this time.
13. Align the mounting holes in the face of the junction box with the mounting holes around the cable cutout.
14. Insert five #10×1" machine screws through the screw holes around the cable cutout but do not fully tighten the screws.
15. Alternate tightening the screws in the face and the screws in the top flange, while ensuring the gasket in the face is evenly compressed.
16. If any gaps are apparent in the gasket around the face of the junction box, apply silicone RTV to seal.
17. The cables and receptacles are labeled with unique cable P<num> identifiers to match the plugs to the correct receptacles. Plug each cable into its matching receptacle.
18. Close the cable connector compartment door.
19. Repeat these steps in this section for the other cable junction box.

3.6 Ductwork

Return air is drawn into one end of the cabinet. Conditioned supply air discharges out the other end. Allow adequate clearance on both ends of the unit for the required duct connections.

The air inlet and outlet are rectangular and include a mounting flange for attaching mating ductwork. Ducting should be sized for the appropriate air quantity and pressure drop. Refer to the installation drawing to ensure the ductwork to and from the conditioned space matches the dimensions of the supply and return air openings in the cabinet.

All ductwork must be airtight or the system will not perform to its maximum capability. Even small leaks can have a dramatic effect on system performance.

3.6.1 Optionally Ducting Scavenger Fan Exhaust for Wet Mode Operation

If the scavenger exhaust needs to be ducted for any reason and the unit includes evaporative cooling (wet mode), special conditions apply to the design of that ductwork. While in wet mode, scavenger exhaust air contains a lot of humidity, even potentially including water droplets that carry over at higher scavenger fan speeds. This moisture can condense and collect above the scavenger fans and in the ductwork. Since the ductwork will eventually get wet, all inner surfaces need to be sealed and protected against corrosion. Provisions to control the condensed/collected water may be required. The ductwork should be pitched to prevent water from pooling. If necessary, the ductwork can be pitched to force the water to run back into the unit.

Also, access must be provided to allow periodic scavenger fan inspection and cleaning, as well as potential fan replacement. This means ducting should be designed to facilitate replacing fans, which includes positioning a hoist or rigging above the scavenger fan module for lifting fans in and out of the module. The individual fans are 18" deep, so a minimum of that distance plus the space for the hoist mechanism is required.

3.7 Field Installed Devices

3.7.1 Temperature/Humidity Sensors

Field-installed remote temperature/humidity (T/H) sensors may be provided for a variety of purposes/locations. See the unit-specific documentation for your IeCE unit for a list of the field-installed sensors. For wiring instructions, refer to the electrical drawing and "3.9.2 Wiring Optional Devices" on page 22.

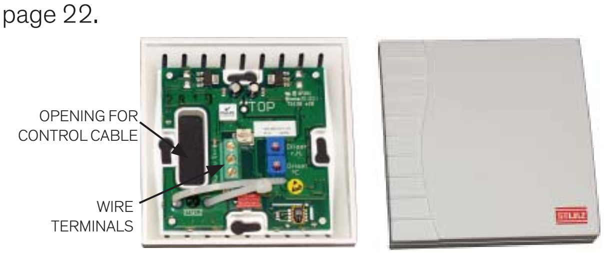


Figure 9. Temperature/Humidity Sensor

A T/H sensor should not be mounted near a doorway or an area where it will be exposed to direct sunlight. When locating the sensors, consider the length of wire to be used. As an option, a 75 foot long cable may be provided by STULZ. Follow the steps below to mount the sensor.

1. Remove the cover from the base of the sensor by squeezing it at the top and bottom.

CAUTION ⚠

Take care not to damage the exposed temperature/humidity sensors on the PC board when the cover is removed. The sensors can be damaged if handled improperly.

2. Place the base temporarily against the mounting surface.
3. Level the base. Mark and drill mounting holes through at least two of the available slotted holes. Also, mark through the large opening in the base and drill a hole into the mounting surface for a control cable to pass through the back of the base.
4. Run a three-conductor shielded control cable through the opening in the base, then secure the base with screws, ensuring the word TOP on the PC board is oriented upward.
5. Run the sensor control cable into the system control box.
6. Replace the cover plate on the base after terminating the control wires. Refer to the unit electrical drawing and Section"3.9.2 Wiring Optional Devices" on page 22.

3.7.2 Optional Static Pressure Transmitter

If the option to control space pressure was ordered, a static pressure transmitter was shipped loose for field installation in the designated space. Refer to the manufacturer's installation instructions included with the static pressure transmitter. Install the transmitter in the conditioned space where it can measure the static pressure of the room. For wiring instructions, refer to the electrical drawing and Section"3.9.2 Wiring Optional Devices" on page 22.

3.8 System Piping

3.8.1 Self-Contained Systems with DX Cooling

No refrigeration connections are required for self-contained systems (systems where the compressors and condensers are pre-installed). All refrigerant piping was factory installed and the system was pre-charged with refrigerant.

3.8.2 Condensate Drain

A 1" MPT connection is provided for condensate drainage. The drain connection is located in the skid base at the rear of the unit. Connect a drain line to direct the condensate away from the unit and away from equipment that may be damaged by water. A condensate trap is built into the unit and does not need to be provided by the installer. The drain line added to the unit must have no back pressure and must be located so it will not be exposed to freezing temperatures. The diameter of the drain line should be the full size of the connection.

NOTE

Pour some water into the drain pan prior to start-up. This prevents air from being drawn up the drain line when the unit is first turned on. If installing a drain "trunk line," ensure the trunk line assembly is mechanically supported to prevent its weight from being applied to the drain fitting on the air handler.

WARNING ⚠

Do not use chloride-based water conditioning additives in condensate drain pans. They will cause corrosion to occur on the coil fins.

3.8.3 Humidifier

STULZ IeCE systems may be equipped with an optional electrode steam humidifier. If the unit includes evaporative cooling, the humidifier shares the evaporative water supply fitting located in the skid base at the rear of the unit. Refer to the installation drawing provided with your unit for the size and location of the connection.

The humidifier requires normal tap water for the water supply. If the supply water is high in particulates, an external filter may be needed.

CAUTION ⚠

Do not use de-mineralized water in the humidifier.

Refer to the humidifier operator's manual supplied with the IeCE unit for complete manufacturer's information on the humidifier and the supply water recommendations.

The humidifier empties into the cooling coil condensate pan during the flush/drain cycle. The condensate pan drains to a fitting located in the skid base at the rear of the unit. Refer to the installation drawing provided with your unit for the size and location of the connection.

3.9 Utility Connections

3.9.1 Main Power

Depending on your unit configuration, the unit may require multiple power feeds and one or more control enclosures. Units with DX cooling typically have a separate control enclosure with its own power feed and nameplate. Refer to the nameplate(s) to confirm the operating voltage, frequency and phase requirements of the system (see Figure 10). It is important to verify that the main power supply coincides with the voltage, phase and frequency information specified on the unit nameplate. The supply voltage measured at the unit must be within 10% of the specified voltage.

The nameplate also provides the full load amperage (FLA) the unit will draw under full design load, the minimum circuit ampacity (MCA) for wire sizing, and the maximum fuse or HACR (Heating, Air Conditioning, Refrigeration) breaker size (MAX FUSE/CKT BKR) for circuit protection. The unit nameplate is located inside the electrical enclosure(s).

NOTE

If the nameplate states MAX FUSE/CKT BKR, fuses or an HACR type circuit breaker is required to protect the system. Using other protection devices may violate the product certification listing.

WARNING ⚡

Verify power to all control boxes is turned off before making connections to the equipment.

NOTE

All wiring must conform to local and national electrical code requirements. Only use copper conductors. Wiring terminations may loosen during transport; verify that all wiring terminations are secure prior to start-up.

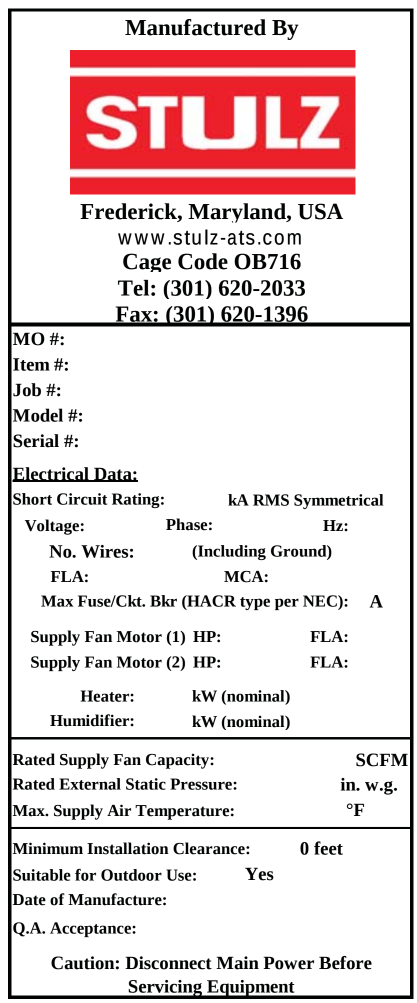


Figure 10. Sample Nameplate

After the wiring is installed, seal the gaps between the wires and the entrance holes so air won't leak around the wires.

A fused disconnect switch or HACR-type circuit breaker must be installed per local and national electrical codes. Do not mount a customer-supplied fused disconnect switch or HACR-type circuit breaker to the surface of the cabinet.

Control boxes are equipped with terminals for all required field wiring. Refer to the electrical schematic supplied with the unit for all power and control field wiring. It is important to identify the options that were purchased with the unit in order to confirm which field connections are required.

Wire penetration holes may be drilled into the wall of the cabinet for main power and control wiring. For each control box present in the unit, terminate the main power wires at the line side of the main power disconnect switch located in the control box (See Figure 1 on page 4). A separate equipment ground lug is located next to the switch for termination of an earth ground wire. Prior to operation, an adequate unit-to-earth ground must be connected in each control box.

3.9.2 Wiring Optional Devices

NOTE

All wiring must be provided in accordance with local and national electrical code requirements.

CAUTION ⚠

The control transformer(s) supplied with the equipment are sized and selected based upon the expected loads for the system. Do not connect any additional loads to the system control transformers. Connecting additional loads to the factory-supplied control transformer may overload the transformer.

3.9.2.1 Remote On/Off Control

Terminals are provided on the control terminal block inside the Unit Control Box where a remotely operated, on/off control device (switch or contacts) may be connected. This will allow the unit to be remotely started and stopped. When the circuit is closed, the unit operates; when the circuit is opened, the unit stops. Refer to the electrical drawing for wiring details.

WARNING

Main power is still present inside the cabinet when a remote On/Off feature is installed.

3.9.2.2 Static Pressure Transmitter (optional)

The optional field-installed static pressure transmitter requires a shielded cable with the shield terminated in the control box in the same manner as the T/H sensors. Refer to the electrical drawing supplied with your unit for the proper wire terminations.

3.9.2.3 Remote Temperature/Humidity Sensors

Remotely-mounted temperature/humidity (T/H) sensors require a shielded cable with the shield terminated in the Unit Control Box. Route the wires from the T/H sensors into the STULZ IeCE cabinet and into the Unit Control Box. Both the Unit Control Box and the sensor include a control terminal strip with box-type lugs for wire connections. Terminate the wires to the correct control terminal positions inside the Unit Control Box. Refer to the electrical drawing supplied with your unit for the proper wire terminations.

3.9.2.4 BMS Interface

A BMS may interface to the system controller via the control terminal strip inside the Unit Control Box. Refer to the electrical drawing supplied with your unit for the designated terminal positions to connect BMS interface wiring.

3.10 Control Box Layouts

The IeCE system has a Unit Control Box housing the ***E²*** controller and electrical controls and components for the unit. If the unit is equipped with optional DX cooling, a second control box called the Compressor Control Box is present in the unit. The latter contains an ***E²*** controller and electrical controls and components for the DX subsystem.

Figure 11 on page 23 shows the IeCE Unit Control Box layout and identifies its major components. Figure 12 on page 24 shows the Compressor Control Box layout and identifies its major components.

Control box components are labeled with reference designators that are defined in the unit electrical drawing. Refer to that drawing to identify the motor starters and circuit breakers assigned to specific devices. Note that the position of the pictured components may vary between units.

3.11 System Charging

Units with a DX cooling system are provided pre-charged with R-410A refrigerant and do not require refrigerant charging during start-up.

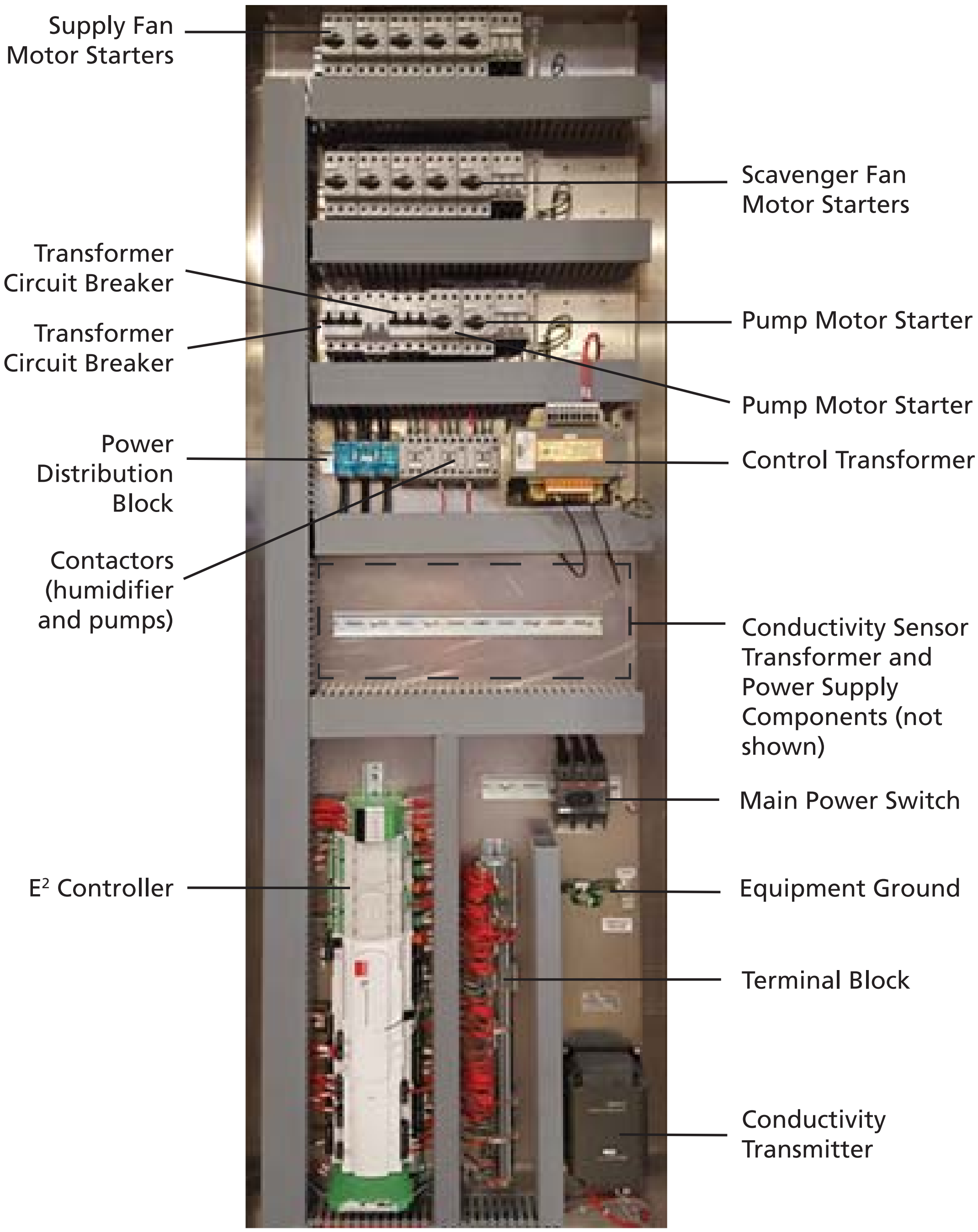


Figure 11. Unit Control Box Components

NOTE

Identify the device controlled by a given motor starter by matching the reference designator on the component to the same in the unit electrical drawing.

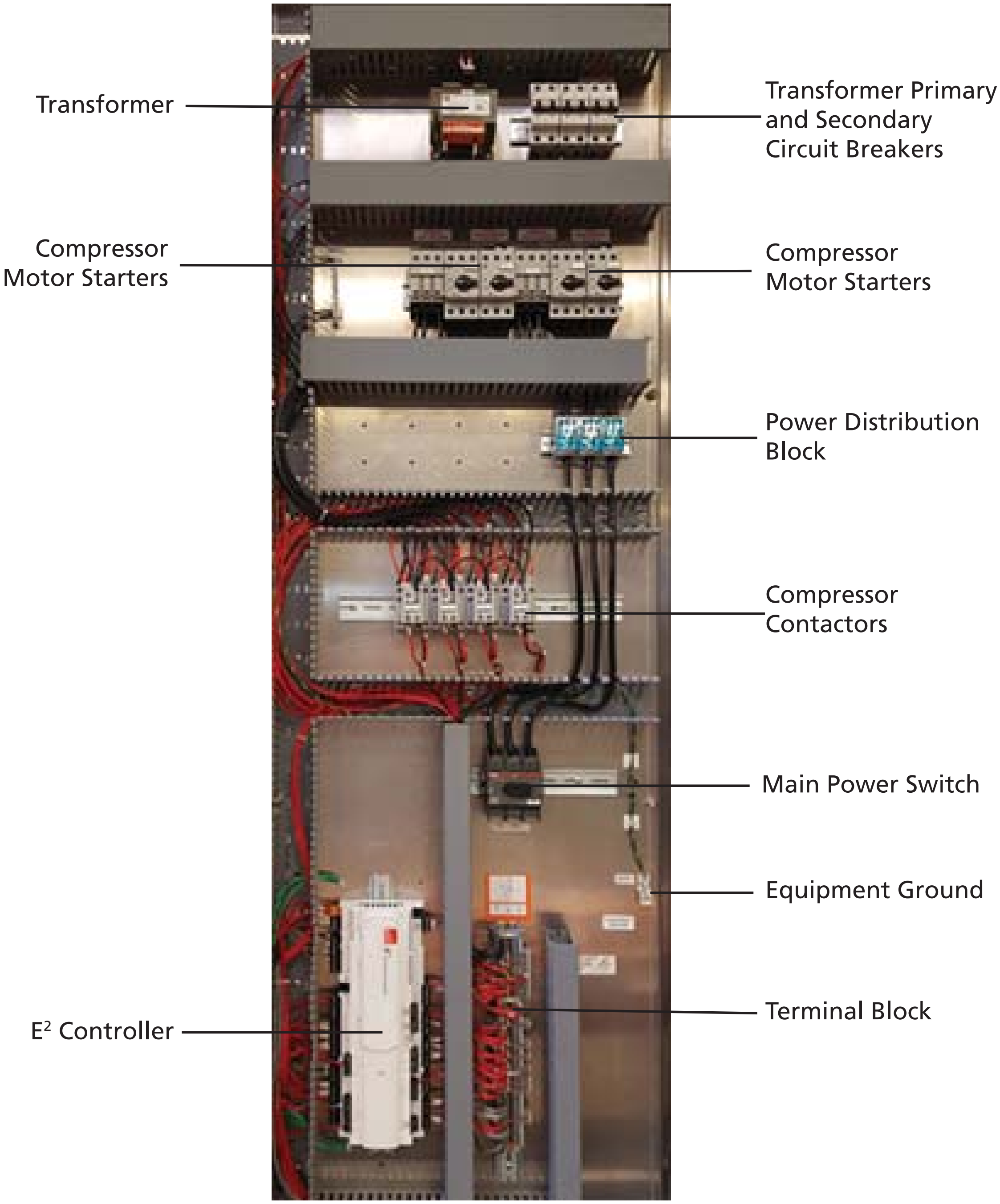


Figure 12. Compressor Control Box Components

NOTE

Identify the device controlled by a given motor starter by matching the reference designator on the component to the same in the unit electrical drawing.

4.0 START-UP/COMMISSIONING

For new installations, prior to start-up ensure the unit is ready to operate by completing the Start Up Checklist included in the unit data package delivered with the unit.

NOTE

Complete the Warranty Registration and Start Up Checklist during start-up and send it to STULZ. Use the checklist as a guideline for items that need to be confirmed during start-up.

Because IeCE systems typically include more than one cooling mode, start-up can vary depending on unit configuration. Start-up methodology for IeCE units involves checking individual cooling mode operation by disabling other available cooling modes. The basic start-up sequence for a typical IeCE unit is:

1. Check indirect air-side economizer (dry mode cooling) operation.
2. Check operation of each individual DX circuit, where applicable.
3. Check indirect evaporative (wet mode cooling) operation.

NOTE

When DX cooling is included in the IeCE unit, start-up should be performed only by a journeyman refrigeration mechanic or air conditioning technician.

4.1 Step-by-Step Start-Up Instructions

1. Close all cabinet doors and replace all access panels removed prior to performing start-up checks.
2. Apply power to the unit at the main power disconnect switch located on the Unit Control Box door.

   NOTE

   The Unit Control Box is typically located on the return air inlet end of the unit.

3. If the unit includes DX cooling:
   a. Disconnect compressor power using the through-door disconnect switch located on the Compressor Control Box door.

      NOTE

      The Compressor Control Box is typically located on the supply air outlet end of the unit.

   b. Open the Compressor Control Box door and turn off all the compressor motor starter protectors (also called "manual motor starters"). Refer to "Figure 12. Compressor Control Box Components" on page 24, for the location of the compressor motor starters).
   c. Close the door and apply power to the DX system using the through-door disconnect switch.
4. After the controller initialization period, the supply fans are enabled and a fan symbol appears on the ***E²*** controller graphic terminal display, indicating the fans are operating. Refer to the start-up instructions in the *STULZ IeCE E² Microprocessor Controller Operator Manual* sent in the data package with your unit for additional information.

   If the current conditions in the conditioned space are not within the range of the selected operating envelope, the system begins operating in the modes needed to reach the control setpoints. Symbols appear in the controller graphic terminal display to indicate the active operating modes.
5. Ensure that all fans are rotating correctly and freely without any unusual noise. Record individual supply (evaporator) fan current draws as per the Start Up Checklist.

   WARNING

   This unit employs high voltage equipment with rotating components. Keep hands, clothing and tools clear of the fan blades when power is On.

6. Test dry mode cooling operation by setting the temperature setpoint below actual room temperature using the ***E²*** controller graphic terminal.
7. Close the main water supply isolation valve (supplied by others) in order to disable evaporative cooling.

   NOTE

   If ambient (outside) air temperature is greater than return air temperature, dry mode operation cannot be checked, so skip steps 8 through 10.

8. Verify that scavenger fan output ramps up and supply air temperature drops.
9. Allow the system to stabilize. If indirect economizer cooling is insufficient to handle the heat load, stable operation will occur when the scavenger fans reach maximum output. When the scavenger fans reach maximum output, record individual fan current draw per the Start Up Checklist.
10. Calculate and record dry mode efficiency. See section "5.1.1 Determining Dry Mode Efficiency" on page 27 for the details.
11. Check DX operation. If DX cooling is included, it is typically integrated into the IeCE unit so the scavenger fans double as condenser fans and dry mode cannot be disabled. Therefore, lowering the space temperature setpoint using the ***E²*** controller graphic terminal may be required in order to enable DX cooling. That is, you

may have to increase cooling demand beyond what dry mode cooling can handle on its own.

NOTE

If DX cooling isn't included as part of the IeCE unit configuration, skip steps 12 and 13.

WARNING

Only personnel familiar with the hazards of high voltage equipment should handle control box components.

12. Once cooling demand (cooling output) is high enough to enable DX cooling (wet mode cooling is bypassed because it was disabled in Step 7), one of the DX circuits can be started by turning on the corresponding compressor motor starter. The compressor should start and the supply air temperature should drop. Record compressor current draw and circuit pressures / temperatures per the Start Up Checklist.
13. Test the remaining DX circuits by turning off the current compressor motor starter and turning on the next compressor motor starter. Repeat Step 12 for the remaining DX circuits.

NOTE

All refrigeration circuits must be tested at start-up.

14. To test evaporative (wet mode) cooling operation, open the main water supply isolation valve that was closed in Step 7.

NOTE

Lowering the space temperature setpoint using the ***E²*** controller graphic terminal may be required in order to enable wet mode cooling—you have to increase cooling demand beyond the level dry mode cooling can handle on its own.

15. Allow the water supply line to flush and the water tanks to fill. The pumps won't start until at least one water tank fills up to the high level switch.
16. Where applicable, turn off all compressor motor starters to completely disable DX cooling.
17. Once the pumps start, water system balance needs to be checked. The water system was balanced at the factory but adjustments may be required. Refer to Section "4.2.1 Recirculating Water System Balancing" on page 26, for balancing instructions. After balancing is complete, record individual pump current draws per the Start Up Checklist.
18. Supply air temperature should start to drop. Allow the supply air temperature to stabilize, as indicated by only small up and down variations in the temperature over a period of at least 30 minutes.
19. Calculate and record overall wet mode system efficiency. Refer to "5.1.2 Determining Wet Mode Efficiency" on page 27, for details.
20. Test humidifier operation by creating a demand for humidification via the ***E²*** controller graphic terminal. Adjust the space humidity setpoint 10% higher than actual room conditions. Visually check for vapor leaving the steam distributor tube or feel if the cylinder is warm to verify the humidifier is operational. Record humidifier current draw per the Start Up Checklist.
21. Test dehumidification operation, if it is being used, by creating a demand for dehumidification via the ***E²*** controller graphic terminal. Adjust the space humidity setpoint 10% lower than actual room conditions (the setpoint may already be below actual room conditions, especially at start-up).
22. Turn on all the compressor motor starters. One or more compressors should energize to begin the dehumidification process.

    While dehumidifying, room temperature may decrease. As conditions in the room change, you may have to readjust the space humidity setpoint as you check operation.

In all cases, several hours may be required to reach the desired temperature and humidity in the conditioned space. Once room conditions have been programmed or set, a repeat visit to the site may be required to ensure the system is meeting the requirements of the space to be conditioned.

4.2 Recirculating Water System

The recirculating water system is an open system with a set of water tanks on one end and a set of spray bars on the other end. Refer to drawing RNA0283 for component designations and an overall system schematic.

The recirculating water system is divided into two identical circuits, each including a basket strainer, a self-priming centrifugal pump, two automatic zone valves (V1), two automatic spray circuit drain valves (V9), two manual balancing valves (V6) and eight spray bars. The pumps (circuits) can operate independently or simultaneously. The V1 automatic zone valves can be used to stage water flow to the heat exchangers (if the unit is configured for Water Conservation Mode – refer to "2.2.2.2 Capacity Control – Wet Mode with Water Conservation" on page 13 for modes of operation).

4.2.1 Recirculating Water System Balancing

For proper operation, the recirculating water system needs to be balanced. Each circuit includes a pressure gauge which provides a rough correlation to water flow rate. The V6 manual ball valves are provided to set the water flow rate and balance the flow for each circuit. The system is designed to operate at 20 to 30 GPM per pump (40 to 60 GPM total).

Manually adjust the V6 valves until the corresponding pressure gauge reading is 24 to 27 psig, which correlates to 20 to 30 GPM per pump.

Note that closing the V6 valves increases gauge pressure, while opening the V6 valves decreases gauge pressure. The settings for all V6 ball valves should be similar (none should be mostly open while the corresponding valve is mostly closed) but may differ slightly between the set of valves on Pump A (V6-1 and 2) and the set of valves on Pump B (V6-3 and 4). Also note that partially closing the tank isolation valve (V8 on drawing RNA0283) may help balance the system by improving the resolution of the V6 valve adjustments, but closing the V8 valve too much will result in turbulence and air bubbles in the water strainers. If the water level in the strainers drops below half and/or there is a lot of turbulence and bubbles in the strainers, open the V8 valve more.

The main purpose of the V8 valve is to isolate the water tanks for maintenance or repair functions. The V6 valves can also be used for spray zone isolation, but always rebalance the system afterward.

4.3 Microprocessor Controller Programming

The ***E²*** microprocessor controller is factory programmed based on the features selected with the system. A user-provided BMS may be used to directly interface to the ***E²*** controller. The operator may view all the available menu loops through a BMS, however, changes may be made only to basic parameters such as adjusting setpoints and setting and acknowledging alarms. More advanced parameter adjustments are made through the graphic terminal. Operating instructions for the ***E²*** controller are provided separately.

5.0 MAINTENANCE AND REPAIR

This section provides procedures for periodic maintenance and field service. It starts with methods for taking indirect economizer wet and dry mode performance measurements, which can indicate basic system health.

5.1 Indirect Economizer Performance Measurements

Overall system efficiency is a good measure of indirect air-side economizer (dry mode) and indirect evaporative economizer (wet mode) cooling performance. Tracking system efficiency is a good way to determine if indirect economizer performance has degraded over time, which can indicate that maintenance is required. Reduced airflow (i.e., dirty air filters) or fouled air-to-air heat exchangers and/or spray bars can reduce heat exchanger efficiency and subsequent cooling capacity.

Certain factors may affect maximum attainable heat exchanger efficiency. Therefore, system efficiency comparisons should be based on similar operating conditions (scavenger and return air temperature/ humidity, supply and scavenger airflow, water delivery rate).

5.1.1 Determining Dry Mode Efficiency

A good measure of overall dry mode system efficiency, when there is no other supplemental cooling (including wet mode), is how closely supply air temperature approaches ambient (outside) air dry bulb temperature. The equation is:

$$\text{Dry Efficiency} = \frac{\text{Return Air Temp. - Supply Air Temp.}}{\text{Return Air Temp. - Ambient Dry Bulb Temp.}}$$

5.1.2 Determining Wet Mode Efficiency

When evaporative cooling is added to the indirect air-side economizer (Wet Mode), a good measure of overall system efficiency, without any supplemental cooling, is how closely supply air temperature approaches ambient (outside) air wet bulb temperature. The equation is:

$$\text{Wet Efficiency} = \frac{\text{Return Air Temp. - Supply Air Temp.}}{\text{Return Air Temp. - Ambient Wet Bulb Temp.}}$$

5.2 Periodic General Maintenance

Periodic general maintenance of the unit is required for optimum performance. General maintenance should include the steps outlined in this section.

Use copies of the Periodic General Maintenance Checklist in this manual to record periodic general maintenance inspections. For assistance, contact STULZ Product Support. Ensure adherence to all safety statements while performing any type of maintenance.

WARNING

This equipment should be serviced and repaired only by a journeyman refrigeration mechanic or air conditioning technician.

WARNING

This unit employs high voltage equipment with rotating components. Exercise extreme care to avoid accidents and ensure proper operation.

Hazardous voltage will still be present inside the control box at the motor starter protectors and circuit breakers, even with the unit turned off at the ***E²*** controller. To isolate the unit for maintenance, turn off power at the main power disconnect switch. Always disconnect main power prior to performing any service or repairs.

WARNING

Unless you are performing tests that require power, turn off power to the unit. With power and controls energized, the unit can begin operating at any time. To prevent personal injury, stay clear of rotating components as automatic controls may start them unexpectedly.

Table 2. Inspection Schedule

Item	Frequency	Procedure (section)
Pump strainers	Daily	5.2.1.1
Water tanks	Biweekly	5.2.1.2
Air filters	Monthly	5.2.2
Coil condensate pans	3 mos	5.2.6
Humidifier cylinder	3 mos (seasonal)	5.2.7
Water pumps	3 mos (seasonal)	5.2.1.3
Spray bars	3 mos (seasonal)	5.2.1.4
Refrigerant levels	6 mos	5.2.4
Coils	6 mos	5.2.5
EC fans	6 mos	5.2.3

5.2.1 Water System Maintenance

Various components of the water system require periodic maintenance in units equipped with indirect evaporative cooling.

5.2.1.1 Pump Strainers

Units equipped with wet mode (evaporative) cooling and recirculating water include water strainers, like the one shown in Figure 13, to remove debris from the water, protecting the pumps and valves. The strainers require frequent inspection and cleaning.

The strainer basket is enclosed in a clear plastic container to allow visual inspection of the basket. If a visual inspection shows debris, clean it using the steps below.

Figure 13. Pump Strainer

NOTE

If possible, perform strainer basket clean out when pumps are inactive.

1. Shut off wet mode operation. See the *STULZ E² Series Microprocessor Controller for IeCE Systems IOM* for instructions on using the controller to perform this step.
2. Open the hinged access panel in front of the pump strainers.
3. Unscrew the cover from the top of the strainer container.
4. Lift the basket from the strainer container and thoroughly clean.
5. Replace the basket.
6. Screw the cover back onto the container.
7. Close the hinged access panels.

5.2.1.2 Water Tank Maintenance

The water in the tanks should always be clean and clear. Periodically check the tanks for debris and algae, mold or mildew growth. Remove any debris, as it can clog the drain valve or water lines. Algae, mold or mildew removal requires draining the tanks and scrubbing with an appropriate cleanser (for example, bleach). Thoroughly rinse the tanks and drain lines after using any cleansers.

NOTE

The tank drain valve includes a manual override handle that can be used to open the drain valve if the unit was shut down with the valve closed. Always drain the tanks if the unit will be shut down for any extended period of time.

Inspect the water tank level switches to verify that the float is free to move and not coated with any substance which would change its weight or volume significantly. If this occurs, the float should be cleaned. This is easily accomplished without disturbing the installation. In addition, the stem may be wiped down to remove any build-up.

5.2.1.3 Water Pump Maintenance

NOTE

The water pumps do not require lubrication.

Routinely examine the areas around the pump motor(s) and inlets and outlets:

- Check piping for signs of leaks.
- Check water lines for vibration isolation and support as necessary.
- Use a vacuum cleaner with a soft bristle brush to clean dirt from components.

The following lists preventive maintenance checks and services that should be performed periodically:

- Clean the suction line strainer.
- Examine all wiring for signs of chafing, loose connections or other obvious damage (semi-annually).
- Examine brackets, motor mounts and hardware for loose or missing parts or other damage.
- Clean accumulations of dust and dirt from exterior surfaces (semi-annually).

5.2.1.4 Spray Bar Maintenance

A series of spray bars are located above the air-to-air heat exchangers. The spray bars stream water into the vertical channels in the heat exchangers through an array of 0.1" (2.5mm) diameter holes. (Note that there are no small orifice nozzles that would tend to clog.) Whether any cleaning intervals are required for the spray bars will depend on the mineral content and/or cleanliness of the water supplied to the IeCE unit. Initially, the spray bars need to be periodically inspected to determine if routine maintenance (cleaning) is required and to determine the necessary maintenance interval.

Inspecting the spray bar holes will require spray bar removal, or at least backing the spray bar out far enough to see some of the holes. Inspecting one or more spray bars every season should be sufficient to determine if a cleaning interval needs to be established. To free a spray bar so it can be backed out (or removed altogether), shut down wet mode cooling so no pumps are operating and perform the following procedure:

1. Disconnect the spray bar supply line at the union fitting near the spray bar.
2. Remove the six 10-32 × 5/8" hex head screws from the split cover plates on both ends of the spray bar.
3. Remove the split cover plates and gaskets from both ends.
4. Rotate the spray bar 90 degrees and pull back.

5.2.2 Air Filters

Air filters are usually the most neglected item in an air handling system. To maintain efficient operation, the filters should be checked at least monthly and replaced as required.

NOTE

Conditions of spaces vary and the frequency of checking air filters should be based on those conditions.

The air filters are accessed from inside the cabinet. To change the air filters, open the filter access door on the front of the cabinet. Carry a work light as there is no light source inside the filters compartment. Step inside the cabinet; the filters are on the left side of the entrance.

Release the old filters by pulling back the clips on the corners of each filter. Insert the new filter(s), ensuring the directional airflow arrows on the filters are correct. Push the retaining clips back to hold the filters in place. Close the filter access door after exiting the cabinet.

5.2.3 EC Fans

NOTE

The EC fans do not require lubrication.

Periodic checks of the fans should include checking the wiring, fan motor mounts and fan impeller. Ensure all electrical connections are tight and all mounts are secure. The fan impeller should be kept free of debris.

5.2.4 Refrigerant Levels

The DX circuits are factory charged and typically do not require any fine tuning of the charge. Bubbles in the sight glass are common on R-410A systems and do not necessarily indicate a problem.

Check superheat and sub-cooling temperatures semi-annually. Superheat should be within the range of 5 °F to 15. Subcool should be at least 5 °F at the outlet of the condenser coil.

NOTE

Adding or removing refrigerant charge won't help adjust subcool on flooded systems. This is because extra refrigerant (stored in a receiver) floods the condenser coil (when head pressure starts to drop due to low due to low load or low ambient temperature) in order to maintain reasonable head pressure. IeCE systems typically lock condenser (scavenger) fan output at 100% (*E²* adjustable value) when DX cooling is enabled so subcool can vary greatly based on factors that are typically outside user control. If subcool is less than 5 °F at the outlet of the condenser coil, contact STULZ Product Support for assistance – Refer to "6.0 Product Support" on page 39 for contact information.

Superheat changes should not be required but can be made by adjusting the thermal expansion valve (TXV or TEV), located near the evaporator coil.

If the refrigerant level is low, check the system for leaks.

5.2.4.1 Refrigerant Pressure Variation

Target refrigerant pressures are specified on the Unit Nameplate but these pressures will vary depending on whether the unit is operating in DX assist or full DX backup. In full DX backup (that is, when wet mode cooling is not operating), when operating at full load and design ambient temperature, the refrigerant pressures should be around 440 psig high side (condensing) and 140 psig low side (evaporating). In DX assist, the condensing pressure will likely drop and the evaporating pressure will loosely follow (290 to 370 psig high side and 115 to 120 psig low side).

5.2.5 Coils

The coil(s) should be inspected semi-annually and cleaned as required following standard coil cleaning practices. Using a brush, clean coil fins of all debris that will inhibit airflow. This can also be done with low pressure compressed air or with a commercial coil cleaner. Check for bent or damaged coil fins and repair as necessary. Check all refrigerant lines and capillary tubes for vibration isolation, and support, where necessary. Check all piping for signs of leaks.

5.2.6 Coil Condensate Pans

If the unit is equipped with CW or DX cooling, inspect the condensate pans regularly while the system is in use. Ensure the condensate pan is not filling with water. Periodically clean the condensate pans. Ensure the pans don't leak and all drain openings are free of debris. Ensure the drain line is clear and water can pass through it freely.

5.2.7 Electrode Steam Humidifier

The electrode steam humidifier canister (cylinder) has a limited lifetime and must be replaced periodically. Because water conditions and humidifier usage rates vary greatly, it is difficult to establish intervals for changing the cylinder. Individual maintenance schedules must be determined for each specific installation, based upon periodic examination of the humidifier. A yellow LED on the humidifier cabinet will flash four times in a repeating pattern when the cylinder requires replacement.

NOTE

The yellow LED may illuminate during initial start- up but it doesn't necessarily mean the cylinder needs to be replaced.

See section "5.8.1 Electrode Steam Humidifier Cylinder Replacement" on page 38 and the humidifier operator's manual, supplied under separate cover, for detailed instructions on replacing the cylinder.

5.3 Troubleshooting Guide

The system is designed for continuous and dependable operation. The troubleshooting guidelines in Table 3 are included to assist in troubleshooting the system. In the event that a problem is encountered with the system, the system controller may be used to diagnose the cause. When the controller signals an alarm condition, an alarm text message provides a brief description of the cause. Often the remedy can be determined by reading the alarm message (i.e., a "Clogged Filter" alarm means you should replace the filters). If the problem cannot be resolved using the alarm screens and these guidelines, contact STULZ Product Support for assistance (See "6.0 Product Support" on page 39).

Unless the procedure specifically requires the system to operate, turn off all power to the unit before conducting any troubleshooting procedures. For troubleshooting purposes, the system may be operated with the control box open (by using a pair of channel lock pliers to turn the shaft of the main power disconnect switch to the "On" position). When the switch is turned on, high voltage will be present inside the cabinet. Exercise caution to prevent injury.

WARNING

To prevent injury, keep hands, clothing and tools clear of the electrical terminals and rotating components. Ensure that your footing is stable at all times.

Table 3. Troubleshooting Guide

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
Recirculating Pump(s) Not Starting	a. Wet mode not enabled.	1. Check controller graphic display for active modes of operation 2. Check graphic display for faults that would disable wet mode operation.
	b. Motor starter tripped.	Check for short circuit or other fault. Reset motor starter after correcting fault condition.
	c. Flow switch tripped.	Check controller for water flow alarm. See Water Flow Alarm troubleshooting below.
	d. Water tank level switch not closed.	Check water level in tanks and operation of level switches.
Recirculating Pump(s) Not Pumping Water (Running Dry)	a. Pump priming valves not opening during start-up.	Check pump priming valve solenoids - Only primes pumps at start of wet mode.
	b. Water system in drain sequence.	Check sequence on graphic display. Pumps continue to run after tanks empty to help drain water lines.
Water Flow Alarm	a. Flow switch trip due to obstruction in tank or line.	Check tank and common pump suction line for obstruction. Remove obstructions as needed.
	b. Strainer basket clogged.	Check strainer(s). Empty and wash strainer basket as needed.
Water Tank Levels Vary Significantly	a. Tank equalizer lines are obstructed	Check for obstructions in lines that connect water tanks. Remove obstruction or clean lines as needed.
	b. Water system unbalanced.	Check balance valve settings and pressure guages located at pump discharge. Adjust balance valves for correct and consistent pressure reading.
Water Droplets Spraying Out Humidifier Steam Distributor	a. Obstruction in condensate return line.	1. Check for kink in condesate return line. Replace as needed. 2. Check for plug in condensate return trap, Clean or replace as needed.
	b. Steam distributor tube not pitched properly.	Pitch tube so inlet (condensate return end) is lower than other end.
Suction Pressure Too Low	a. Loss of refrigerant (excessive bubbles in sight glass).	Locate leak and repair. Recharge system.
	b. Expansion valve stuck or obstructed (short cycle or continuous running).	Remove and clean or replace valve.
	c. Clogged drier/strainer (feels cold).	Replace with new drier/strainer.
	d. Dirty air filters.	Clean/replace filters.

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
Chilled Water Valve Fails to Open or Close	a. Temperature set point too high/low.	Adjust to correct temperature setting.
	b. No control power to the chilled water valve.	Thermostat wired incorrectly. Check wiring diagram and rewire if required.
	c. Actuator failed.	Replace actuator.
Evaporator Coil Ices	a. Low airflow.	1. Check filters. Replace as needed. 2. Check for and clear any obstructions across or in the (supply) discharge air-stream. 3. Check correct rotation of evaporator blower.
	b. Temperature setting too low.	Increase temperature setpoint (68 °F min.).
	c. Discharge air short cycling back to return.	Check discharge grille orientation.
	d. Low refrigerant charge.	Find leak, repair and recharge system.
Fans Fails to Start	a. Power failure.	Check main voltage power source input cable.
	b. Control transformer circuit breaker tripped.	Check for short circuit or ground fault; if none, reset circuit breaker.
	c. Defective contactor.	Repair or replace.
	d. Thermal overload tripped.	Reset overload and check amperage of motor. Compare to setting on overload and adjust to FLA. All direct-drive motors are internally protected and do not require overload.
Control is Erratic	Wiring improperly connected or broken.	Check wiring against electrical drawing.
Condenser Pressure Too High	a. Non-condensable gas or air in system.	Recover system and recharge. Replace drier/strainer. Evacuate to 50 microns and recharge.
	b. Condenser air intake is blocked.	Remove debris and clean condenser.
	c. Overcharge of refrigerant.	Reclaim excess refrigerant from system.
	d. Low water flow to water-cooled condenser.	Reset-determine cause and fix.
	e. Condenser fan not operating.	Check pressure/temperature operating switches and motor. Replace as needed.
	f. Water/glycol temperature too high.	Check flow and operation of drycooler.
	g. Condenser pressure regulating valve setting too high.	Adjust to obtain correct pressure.
	h. Flow of water/glycol too low.	1. Check glycol solution level and concentration. 2. Valves not open or partially open. Repair/replace as needed. 3. Air in system - bleed system. 4. Check all strainers and clean if needed.
	i. Water/glycol solution not mixed prior to adding to system.	Remove solution and premix. Refill system.

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
Condenser Pressure Too Low	a. Loss of refrigerant (indicated by bubbles in sight glass).	Locate and repair leak. Recharge system.
	b. Condenser fan controls not set Adjust or repair controls properly.	Adjust or repair controls.
	c. Water regulating valve adjusted too low.	R407C - Readjust to 320 psig. R410A - Readjust to 440 psig.
Noisy Compressor	a. Expansion valve stuck in open position (abnormally cold suction line).	Ensure feeder bulb is tight on suction line. Check operation and superheat.
	b. Worn or scarred compressor bearings.	Replace compressor.
	c. Liquid slugging.	System overcharged. Reclaim excess refrigerant.
	d. Scroll compressor not properly phased.	Phase correctly at main power source. Do not rewire compressor.
Compressor Fails to Start	a. Temperature setpoint too high.	Adjust to desired temperature.
	b. Compressor internal overload protector is open.	Check compressor for short circuit or ground.
	c. Complete loss of refrigerant charge (low pressure safety switch).	Locate and repair leak. Recharge system.
	d. Condenser pressure too high (highpressure safety switch).	Check condenser for obstructions.
	e. Condensate switch open.	1. Ensure unit is level. 2. Check that condensate pan is draining properly. Clear obstructions.
System Short of Capacity	a. Low refrigerant (indicated by bubbles in sight glass).	Check for leaks Repair and recharge system.
	b. Expansion valve stuck or obstructed (short cycling or continuous running).	Remove valve and clear obstruction or replace valve.
	c. Clogged drier/strainer (feels cold).	Replace with new drier/ strainer.
	d. Reduced airflow.	Check belt tension, filters and clear evaporator coil of debris.
Compressor Short Cycles	a. Low line voltage causing compressor to overheat.	Check power source for cause of low line voltage.
	b. Dirty or iced over evaporator coil.	Defrost and/or clean coil.
	c. Reduced airflow. (when applicable).	Check filter and belt tension.
	d. Lack of refrigerant.	Check for leak. Repair and recharge system.
	e. Short cycling of conditioned air.	1. Supply and/or return grilles are incorrectly oriented. Re-orient. 2. Supply and return grilles are too close together. Move further apart. 3. Insufficient heat load. Add temporary heat load to compensate.
	f. Thermostat is improperly located.	Check for supply registers that may be too close to thermostat. Relocate if necessary.

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
Heater Inoperative	a. Fuses blown/circuit breaker tripped.	Check for short circuit, replace fuses/reset circuit breaker.
	b. Thermostat set too low.	Increase temperature set point.
	c. Overheat switch open.	Insufficient airflow across heater elements. Check for dirty filters or obstructions that may reduce airflow. Correct or replace as needed.
	d. Fuse link blown.	Replace fuse link (See item immediately above).
	e. Heater element burned out.	Check continuity with an ohmmeter. Replace heater element.
Humidifier Inoperative *Note: See humidifier manual for additional help.*	a. Water supply has been turned off or not connected.	Connect and/or turn on water supply.
	b. Humidifier switch is in "Off" position.	Turn switch to "Auto/On" position.
	c. Electrical connections are loose.	Tighten electrical connections.
	d. Humidifier fuses are blown.	Check for over current by the humidifier electrodes. Drain water from tank and refill. Replace fuses.
	e. Relative humidity is above set point.	Adjust humidistat set point.
	f. Yellow status LED is flashing.	Consult humidifier manual.
	g. Water conductivity is too low.	Add a teaspoon of table salt to the water through the top of the cylinder. Typically only required on initial start-up.
EC Fan(s) Fail to Start	a. Power failure.	1. Check main power source voltage. 2. Check power Input cable.
	b. Motor starter protector (MSP) tripped.	Reset motor starter protector and check amperage of motor. Compare to setting on the motor starter protector and adjust the MSP to the correct FLA if necessary.
	c. Control transformer circuit breaker tripped.	Check for short circuit or ground fault. If none, reset circuit breaker.
	d. No Modbus control signal to fan(s).	Check for a Modbus control signal at each fan. Refer to the electric drawing to determine the correct terminals to check.
	e. EC fan's internal overheat protection interrupted fan motor operation.	Determine the cause of the interruption and correct. Possible causes are: 1. Blocked rotor. 2. Low supply voltage > 5 seconds. 3. Loss of phase > 5 seconds. After causes 1, 2, and 3 are corrected, the motor will automatically reset. 4. Over-temperature of electronics. 5. Over-temperature of motor. After causes 4 and 5 are corrected, the fan(s) must be manually reset by turning off power for 20 seconds
	f. Defective fan.	Repair or replace.

5.4 Recirculating Water System Service

The pumps are the heart of the recirculating water system. Pump troubleshooting steps are documented in the *AMT Operating Instructions & Maintenance Manual for Electric Motor-Driven Pumps*, part number 1808-634-00. At the time of writing, this document is available on the manufacturer's website at http://www.amtpump.com/products/pdfmanuals/1808-634-00.pdf

Visually inspect the pipe inlet/outlet fittings and observe the area around the pump and the base for signs of leaking coolant. If a leak is located in the piping, isolate that section of piping using appropriate shut-off valves. It may be necessary to drain some of the coolant. When repairs are complete, pressure check the system, checking for leaks prior to refilling the system. In 24 hours, observe the piping system for leaks.

NOTE

Repairs must be performed by a qualified technician

5.4.1 Water Pump Repair

Pump repair steps are documented in the ***AMT Specifications Information and Repair Parts Manual for Self-Priming Centrifugal Pumps***, document number 2851-252-00. At the time of writing, this document is available on the manufacturer's website at http://www. amtpump. com/products/pdfmanuals/2851-252-00.pdf.

The following repair procedures are documented in the above publication:

- Mechanical seal replacement
- Shim adjustment

5.5 EC Fan Service

Contact STULZ Product Support for troubleshooting fan problems. Refer to "6.0 Product Support" on page 39 for contact information.

5.5.1 EC Fan Removal

WARNING ⚠

An EC fan with mounting bracket weighs approximately 100 lbs. (45 kg). Fan replacement is a two-man job. To avoid injury, do not attempt to lift or carry the fan assembly by yourself. Replacing a scavenger EC fan will require a crane or hoist capable of reaching and lifting the fan from the top of the unit.

1. Turn the unit off, preferably in a manner that uses the controller, such as via BMS or external shutdown control.
2. Turn the main power disconnect handle(s) on the front door of the electric box to the OFF position.
3. Ensure that main power is not engaged while working on the EC fans by using the lockout tab on the main power disconnect switch.
4. Disconnect power and control wiring from the fan.
5. Cut the cable ties holding the wiring harness to the arm of the fan mounting bracket.
6. Temporarily tie the wire harness out of the way to protect it.

WARNING ⚠

Wear heavy duty work gloves to protect hands from sharp edges when handling the fan mounting bracket.

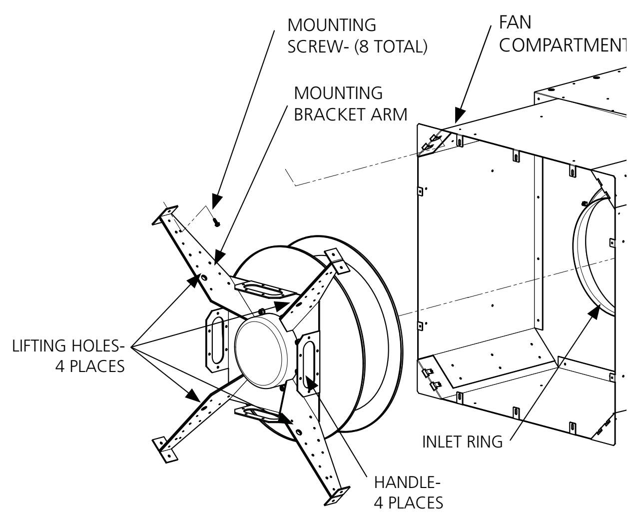


Figure 14. EC Fan Assembly

7. See Figure 14. Remove two screws from the end of each mounting bracket arm (eight screws total).
8. Grab the handles on each side of the fan and carefully slide the fan assembly out of the compartment in the bulkhead.
9. Pull the fan away from the cabinet and lower the fan to the floor.

5.5.2 EC Fan Replacement

1. Unscrew the fan mounting bracket from the back of the fan that was removed and install it on the replacement fan.
2. Raise the fan assembly up to the fan wall compartment and align it with the compartment.

3. Push the fan into the compartment aligning the two holes in the end of each mounting bracket arm with the holes in the corners of the fan compartment.
4. Adjust the depth of the fan assembly such that the overlap between the fixed fan inlet ring and the rotating fan impeller matches the other fans in the array (typical overlap is 1/4 to 3/8" (6 to 10mm)).
5. After the fan is secured, manually rotate the fan to ensure it spins freely.
6. Connect the power and control wiring to the fan referring to the electrical diagram for the correct wire terminations. Tie-wrap the wire harness to the holders in the mounting bracket arm.
7. Close the Filter Area access door.
8. Restart the IeCE unit.

5.6 DX System Service

NOTE

Do not attempt repairs without the proper tools.

It may be necessary to perform repairs on the A/C system. If field repairs are necessary, the following procedures apply:

WARNING ⚠

If refrigerant gas is released in an enclosed area it will displace oxygen and act as a suffocant. Always ensure adequate ventilation during refrigeration repairs.

CAUTION ⚠

Always recover all refrigerant prior to any system repairs, failure to do so may result in system over-pressurization and rupture.

5.6.1 Refrigerant Leaks

Several methods can be used to detect a leak in the refrigeration system. The best is to use an electronic leak detector. Follow the manufacturer's directions and any leak can be quickly located. A second method is to use soap bubbles. Apply a solution of soapy water with a brush or sponge to the joints and connections in the refrigerant lines. A leak in the lines will cause bubbles to form.

5.6.2 Refrigerant Leak Repair

When a leak is located, properly reclaim the remaining refrigerant charge before beginning repairs. Adjacent piping must be thoroughly cleaned by removing all paint, dirt and oily film. Use a wire brush, sandcloth or sandpaper and wipe the area with clean, dry cloths. Protect nearby parts from heat damage by wrapping with water-soaked cloths.

5.6.3 Refrigerant Piping Replacement

When replacing refrigeration components, the following consumable materials are recommended: Use Silfos alloy for copper-to-copper (piping discharge or suction line repairs). Silver solder (Stay-Silv #45) and flux are to be used on copper-to-brass or copper-to-steel repairs. Ensure that standard dry nitrogen purging practices are followed when making pipe repairs. For liquid line repairs at the Filter/drier, sight glass, or expansion valve, use a 95% tin to 5% antimony solder with flux.

When component replacement is complete, remove all traces of flux. After any repair, pressure check the system to ensure there are no leaks. Prior to recharging the system, evacuate to 50 microns and hold that vacuum for at least an hour to boil off any moisture.

5.6.4 Compressor Failure

The compressor is the heart of the DX circuit. Numerous safety devices are provided to protect the compressor from failing.

If a compressor failure occurs, determine whether it is an electrical or a mechanical failure. An electrical failure will be indicated by the distinct pungent odor once the system has been opened. If a burnout has occurred, the oil will be black and acidic. A mechanical failure will have no burned odor and the motor will attempt to run; an abnormal or excessive noise may be present.

Analysis of the oil is the only way to ensure the proper cleaning procedure for the refrigerant system. Acid test kits are available from several manufacturers for measuring the acid level in the oil. These are capable of making quite accurate acid measurements, but if they are not available, a check of the oil by sight and smell can give a quick indication of contamination.

All electrical connections should be checked to ensure they are tight and properly made. Check all fuses, contactors and wiring. The contactor should be examined and replaced if contacts are worn or pitted.

If there is acid in the oil, there has been an electrical failure which has caused the compressor motor to burn out. The acid diffuses throughout the refrigeration system and must be removed using a burnout filter kit before a new compressor is placed in service. Not only must the compressor be replaced, but the entire refrigeration circuit must be cleaned of the harmful contaminants left by the burnout. See Section "5.6.6 Burn-Out/Acidic Cleanup Procedure" on page 37 for the proper procedure.

If there is no acid in the oil, there has been a mechanical failure. See Section "5.6.5 Standard Clean Out Procedure" on page 37 for the proper cleaning procedure.

CAUTION ⚠

Damage to a replacement compressor caused by improper system cleaning constitutes abuse under the terms of the warranty. This will void the compressor warranty. Always consult the factory prior to replacing a compressor.

CAUTION ⚠

If a replacement compressor is provided, ensure that it is filled with POE oil before installing.

5.6.5 Standard Clean Out Procedure

WARNING ⚠

Avoid touching or contacting the gas and oil with exposed skin. Severe burns will result. Use long rubber gloves in handling contaminated parts.

NOTE

This procedure should be performed only by a journeyman refrigeration mechanic or air conditioning technician.

1. Turn the unit off, preferably in a manner that uses the controller, such as via BMS or external shutdown control.
2. Turn off power to unit at the main power disconnect switch.
3. Remove the old compressor and install the new compressor.
4. Remove the liquid line drier and install the appropriate liquid line filter-drier.
5. Evacuate the system according to standard procedures. Normally, this will include the use of a high-vacuum pump and a low-vacuum micron gauge for measuring the vacuum obtained.
6. Recharge the system.
7. Turn on the power at the main power disconnect switch and start the system.

5.6.6 Burn-Out/Acidic Cleanup Procedure

These systems should be cleaned using the suction line filter-drier method.

NOTE

This procedure should be performed only by a journeyman refrigeration mechanic or air conditioning technician.

1. Turn the unit off, preferably in a manner that uses the controller, such as via BMS or external shutdown control.
2. Turn off power to the unit at the main power disconnect switch.
3. Remove the burned-out compressor and install the new compressor.
4. Install a suction line filter-drier designed for acid removal.
5. Remove the liquid line drier and install the appropriate liquid line filter-drier.
6. Check the expansion valve, sight glass and other controls to see if cleaning or replacement is required.
7. Evacuate the system according to standard procedures. Normally, this will include the use of a high-vacuum pump and a low-vacuum micron gauge for measuring the vacuum obtained.
8. Recharge the system through the access valve on the suction line filter-drier.
9. Turn on power at the main power disconnect switch and start the system.
10. The suction line filter-drier permits small-system cleanup to be completed in one service call. The pressure drop across the suction line filter-drier should be measured during the first hour of operation. If the pressure drop becomes excessive, the suction line filter-drier should be replaced (See Sporlan Bulletin 40-10, for the maximum recommended pressure drop (PSI) for the suction line filter drier).
11. In 24 hours, take an oil sample. Observe the color and test for acidity. If the oil is dirty or acidic, replace the suction line filter-drier.
12. In two weeks, examine oil to determine if another suction line filter-drier change is necessary.

5.7 Chilled Water System Service

If the Chilled Water system isn't cooling or if cooling performance has degraded, check for clogs and leaks in the system. If filters or strainers are installed, check the condition and clean or replace if necessary.

5.7.1 CW Leaks

A leak in a chilled water cooling system will usually form an obvious puddle of fluid beneath the unit. Visually trace the leak up from the puddle to the area on the unit where fluid may be seen dripping.

5.7.2 CW Leak Repair

When a leak is detected, properly reclaim the remaining CW coolant before attempting repairs. Adjacent piping must be thoroughly cleaned by removing all paint, dirt and oily film. Use a wire brush, sandcloth or sandpaper and wipe the area with clean, dry cloths. Protect nearby parts from heat damage by wrapping with water-soaked cloths.

For copper-to-copper (piping) repairs use SILFOS Alloy. No flux is required with Silfos Alloy. Silver solder (Stay Silv #45) and flux should be used on copper-to-brass or copper-to-steel repairs.

When repairs are completed, remove all traces of flux. After any repair, check for leaks prior to recharging the system.

5.8 Electrode Steam Humidifier System Service

The electrode steam humidifier includes a fill valve, a drain valve, a steam cylinder and its own on-board controller. The steam cylinder is the main replacement item in the system. Refer to the *Nortec MES2 Installation and Operation Manual*, supplied with your IeCE unit, for maintenance, troubleshooting and service instructions specific to the humidifier.

5.8.1 Electrode Steam Humidifier Cylinder Replacement

After an extended period of operation, the yellow LED on the humidifier cabinet will repeatedly flash four times indicating that the cylinder is completely used and a replacement cylinder must be installed. The cylinder is disposable and cylinder life is dependent on water supply conditions and humidifier usage. Use the following procedure to replace the cylinder.

CAUTION ⚠

Failure to replace the cylinder at the end of cylinder life may result in humidifier damage.

NOTE

Decrease the humidity set point below actual conditioned space humidity to allow the cylinder to cool down prior to removal.

1. Turn the unit off, preferably in a manner that uses the controller, such as via BMS or external shutdown control.
2. Turn off the water supply to the humidifier using the small manual ball valve (in the unit skid, under the compartment where the humidifier is located) that tees off the main water supply.
3. Enter the cabinet section that houses the humidifier and drain the humidifier cylinder by toggling the ON/OFF/DRAIN switch on the humidifier to DRAIN.
4. Allow the cylinder to completely drain then turn the humidifier off by toggling the ON/OFF/DRAIN switch on the humidifier to OFF.
5. Exit the cabinet and turn off main power using the through-door disconnect switch on the door of the Unit Control Box.
6. Follow the steps of the cylinder removal, drain valve cleaning and cylinder installation procedures in the humidifier installation and operation manual, which was provided under separate cover with your unit.
7. Close up the cabinet and turn main power on using the through-door disconnect switch on the door of the Unit control box.
8. Open the manual ball valve that was closed in Step 2.
9. Turn the unit and readjust the humidity set point.

If the humidifier is to be shut down for an extended period, follow the steps of the Extended Shutdown procedure in the *Nortec MES2 Installation and Operation Manual.*

CAUTION ⚠

Failure to perform the recommended Extended Shutdown procedure before a prolonged shut- down period will drastically shorten cylinder life.

5.8.2 Humidifier Piping

A steam line runs from the top of the humidifier cylinder to the back end of a steam distributor tube. A smaller condensate return line runs from the bottom of the steam distributor tube back to the humidifier. Ensure there are no obstructions in the lines or areas that appear restricted or collapsed. If water droplets are spraying out of the steam distributor tube (should be steam only), the condensate return line is probably plugged and therefore not draining properly. If this is the case, the condensate return line needs to be replaced or at least removed for cleaning (plug is most likely in the trap).

6.0 PRODUCT SUPPORT

STULZ Product Support provides aftermarket technical and field support, warranty authorization and part sales to contractors and end users. Factory authorized services are available by request and include:

- Factory Authorized Start-up/Warranty Inspection
- Commissioning Assistance
- Break Fix Repair
- Preventive Maintenance Contracts
- Performance Evaluations
- Technician and Owner Training

6.1 Technical Support

The STULZ Technical Support Department is dedicated to the prompt reply and resolution of issues experienced with supplied equipment. Please contact (888) 529-1266 Monday through Friday from 8:00 a.m. to 5:00 p.m. EST. After hours support is also available. Please provide your name and contact information and a support technician will return your call.

When calling to obtain support, it is important to have the following information readily available, (information is found on the unit's nameplate):

- Unit Model Number
- STULZ Sales Order Number
- STULZ Item Number
- Unit Serial Number
- Description of Problem

6.2 Obtaining Warranty Parts

All Warranty Parts Authorizations are validated and processed through the Technical Support Department at (888) 529-1266 Monday through Friday from 8:00 a.m. to 5:00 p.m. EST. A support technician at STULZ will provide troubleshooting assistance over the telephone. If it can be determined that a part may be defective, a warranty authorization for a replacement part will be processed by STULZ Technical Support. The replacement part will then be shipped via UPS ground. If the customer requests that warranty part(s) be sent by any other method than UPS ground, the customer is responsible for the shipping charges. If you do not have established credit with STULZ you must provide a freight carrier account number.

A written (or faxed) purchase order is required on warranty parts and must be received prior to 12:00 p.m. for same day shipment. The purchase order must contain the following items:

- Purchase Order Number
- Date of Order
- STULZ Stated Part Price
- Customer Billing Address
- Shipping Address
- Customer's Telephone and Fax Numbers
- Contact Name
- Unit Model Number and Serial Number

The customer is responsible for the shipping cost incurred for returning the defective part(s) back to STULZ. Return of defective part(s) must be within 30 days, at which time an evaluation of the part(s) is conducted and if the part is found to have a manufacturing defect a credit will be issued.

When returning defective part(s), complete the Return Material Authorization Tag and the address label provided with the replacement part. For prompt processing, please affix the RMA in a prominent place on the external packaging of the returned part.

6.3 Obtaining Spare/Replacement Parts

Maintaining a recommended spare parts inventory is an industry best practice for critical facilities. On-site spares kits reduce downtime and can eliminate the cost of expedited freight charges. Recommended spares and replacement parts sales are available through Product Support at (888) 529-1266.

STULZ accepts Visa and MasterCard. STULZ may extend credit to its customers; a credit application must be prepared and approved (this process could take one week).

A 25% minimum restocking charge will be applied on returned stocked parts that were sold as spare/replacement parts. If the returned part is not a stocked item, a 50% restocking charge may be applied. Additionally a Return Material Authorization Number is required when returning parts. Repair/replacement parts may be returned for credit up to 30 days after purchase.

Date: ______________________ Prepared By: ______________________

Model Number: ______________________ Serial Number: ______________________

ISystem Number: ______________________

Daily

- ☐ Clean pump strainers

Bi-Weekly

- ☐ Inspect water tank water-level mechanism

Monthly

Filters:

- ☐ Inspect for cleanliness

Controls:

- ☐ Controls Operate Properly

3-Months

- ☐ Clean pump strainers
- ☐ Inspect humidifier cylinder
- ☐ Inspect spray bars (seasonal)
- ☐ Inspect coil condensate pan and drain
- ☐ Inspect water pumps (seasonal)

Semi-Annually

- ☐ Check refrigerant levels
- ☐ Check suction & discharge pressure
- ☐ Inspect and clean coils
- ☐ Check heater operation
- ☐ Tighten electrical connections
- ☐ Check contact pads on contactors for pitting
- ☐ Flush condensate drain
- ☐ Check EC fans

EC Fans:

- ☐ Fan(s) turn freely
- ☐ Wiring secure, no discoloration
- ☐ Fasteners tight

Annually

- ☐ Inspect System for Leaks and Corrosion
- ☐ Conduct a Complete Check of All Services Listed Above and Clean Unit's Interior

Notes: ____

____

____

____

____

____

Signature:__________________________________

*** If factory assistance is required for any reason, provide the model number, serial number and STULZ item number found on the unit nameplate. This will speed the process and ensure accuracy of information. ***

Appendix B - Glossary

Definition of Terms and Acronyms

STULZ	STULZ Air Technology Systems, Inc.
BMS	Building Management System
BTU/Hr	British Thermal Units Per Hour
CFM	Cubic Feet Per Minute
CNDCT	Conductor
EC	Electronically Commutated
ESD	Electrostatic Discharge
° F	Degrees Fahrenheit
FLA	Full Load Amps
FOB	Free on Board
HACR	Heating, Air Conditioning, Refrigeration
HP	Horse Power
Hz	Hertz
IAQ	Indoor Air Quality
in. w.g.	Inches of Water Gauge
kVA	Kilo Volt Amps
kW	Kilowatt
LEWT	Low Entering Water Temperature
LRA	Locked Rotor Amps
MAX CKT BKR	Maximum Circuit Breaker
MAX FUSE	Maximum Fuse
MCA	Minimum Circuit Ampacity
NEC	National Electric Code
NFPA	National Fire Protection Agency
PH	Phase
PI	Proportional–Integral
pLAN	Pico Local Area Network
PSI	Pounds Per Square Inch
psig	Pounds Per Square Inch Gauge
RLA	Run Load Amps
R-Value	Thermal Resistance
R-410A	Blended Refrigerant
SDS	Safety Data Sheet
SPDT	Single Pole, Double Throw
TXV	Thermostatic Expansion Valve
V	Volt
VAC	Volt, Alternating Current
VDC	Volt, Direct Current

Notes

Notes

STULZ North American Headquarters

STULZ AIR TECHNOLOGY SYSTEMS (STULZ USA), INC.
1572 Tilco Drive | Frederick, MD 21704
Tel: 301.620.2033 | Fax: 301.662.5487 | info@stulz-ats.com

STULZ Company Headquarters

STULZ GmbH
Holsteiner Chaussee 283
22457 Hamburg
products@stulz.de

STULZ Subsidiaries

STULZ Australia Pty. Ltd.
34 Bearing Road
Seven Hills NSW 2147

STULZ Austria GmbH
Industriezentrum NÖ – SÜD,
Straße 15, Objekt 77, Stg. 4, Top 7
2355 Wiener Neudorf

STULZ Belgium BVBA
Tervurenlaan 34
1040 Brussels

STULZ Brasil Ar Condicionado Ltda.
Rua Cancioneiro de Évora, 140
Bairro - Santo Amaro São
Paulo-SP, CEP 04708-010

STULZ España S.A.
Avenida de los Castillos 1034
28918 Leganés (Madrid)

STULZ France S. A. R. L.
107, Chemin de Ronde
78290 Croissy-sur-Seine
info@stulz.fr

STULZ S.p.A.
Via Torricelli, 3
37067 Valeggio sul Mincio (VR)

STULZ-CHSPL (India) Pvt. Ltd.
006, Jagruti Industrial Estate
Mogul Lane, Mahim
Mumbai - 400016

STULZ México S.A. de C.V.
Avda. Santa Fe No. 170
Oficina 2-2-08, German Centre
Delegación Alvaro Obregon
MX- 01210 México
Distrito Federal

STULZ GROEP B. V.
Postbus 75
180 AB Amstelveen

STULZ New Zealand Ltd.
Office 71, 300 Richmond Rd.
Grey Lynn, Auckland

STULZ Polska SP. Z O.O.
Budynek Mistral.
Al. Jerozolimskie 162
02 – 342 Warszawa

STULZ Singapore Pte Ltd.
33 Ubi Ave 3 #03-38 Vertex
Singapore 408868
andrew.peh@stulz.sg

STULZ Air Technology and Services Shanghai Co., Ltd.
Room 406, Building 5
457 North Shanxi Road
Shanghai 200040

STULZ South Africa Pty. Ltd.
Unit 3, Jan Smuts Business Park
Jet Park, Boksburg
Gauteng, South Africa

STULZ U. K. Ltd.
First Quarter,
Blenheim Rd. Epsom
Surrey KT 19 9 QN

www.stulz-usa.com