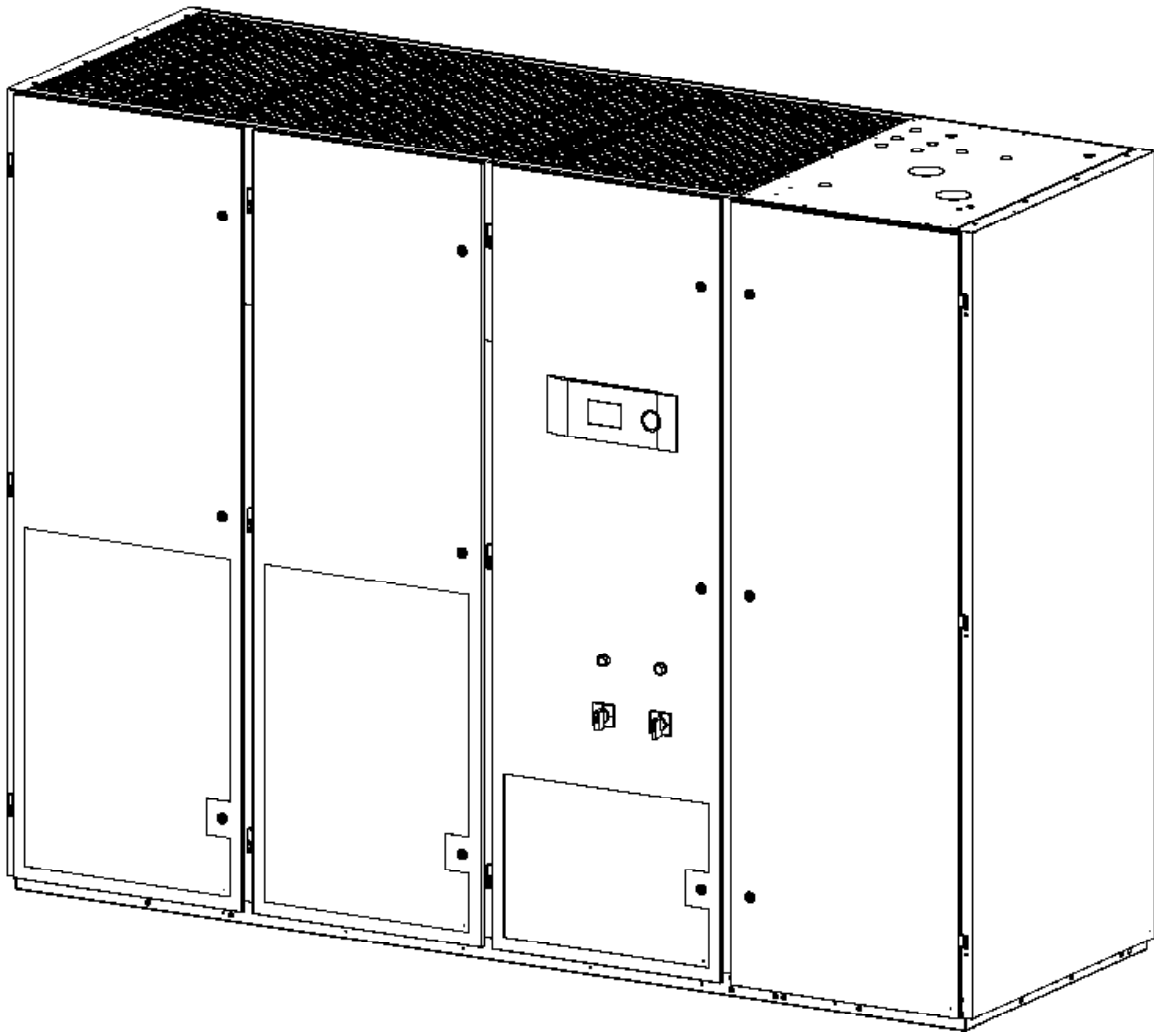


**STULZ**

CLIMATE. CUSTOMIZED.



# CyberAir<sup>®</sup> DX

**Installation, Operation and Maintenance Manual**

**Perimeter Mounted Precision Air Conditioners  
21 kW - 105 kW / 60 Hz**

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Nomenclature								
CFX-XXX-XXX-X-XX								
CF	Air Pattern	Capacity (kW)	Cooling Method	Number of Circuits	Heat Rejection	Secondary Cooling Options	Fan Location	Additional Special Options
CyberAir Floor Mounted Systems	D = Downflow U = Upflow	021, 028, 035, 053, 070, 088, 105	D = DX	2 = Dual Circuit	A = Air G = Glycol W = Water	0 = None = Water Side Economizer = Alternate Water Source	I = In Unit	0 = Standard T = Tandem Compressors S = Special*
CF	D	105	D	2	W	0	I	0

Call 888 520 1266 for additional information.

Example: 105 kW Capacity, Dual Circuit, Water Cooled, Direct Expansion, Down Flow, Floor Mounted System; with Internal EC Fans, and No Additional Options : CFD-105-D2W-0-I0

## 1.0 INTRODUCTION

### 1.1 General

The STULZ CyberAiR floor mounted, precision air conditioning system covered by this manual is designed and manufactured by STULZ Air Technology Systems, Inc. (STULZ) and uses the latest, state-of-the-art control technology. Recognized as a world leader, STULZ provides air conditioning systems with the highest quality craftsmanship using the finest materials available in the industry. 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.

STUDY the instructions contained in this manual. They must be followed to avoid difficulties. Spare parts are available from STULZ to ensure continuous operation. Using substitute parts or bypassing electrical or cooling 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.

STULZ CyberAir systems are designed to be installed indoors unless otherwise noted on the equipment.

### 1.2 Product Description

STULZ CyberAir systems are designed to be the most versatile and flexible floor mounted air conditioning systems in the industry. The unit is available in air-cooled, water-cooled or glycol-cooled configurations and have upflow or down flow air patterns utilizing highly efficient, electronically commutated (EC) fans. STULZ CyberAir systems are designed to supply air to only one room.

STULZ CyberAir systems incorporate two cooling circuits with highly reliable scroll compressors. They are designed to operate with R-410A refrigerant. The cooling capacity, in kW, will depend on the unit size which can range from 21 to 105 kW (1 kW = 3415 BTU/ Hr). Refer to the unit nameplate to identify the model number and cooling capacity of your unit.

#### **NOTE**

STULZ CyberAir systems are strictly for non- residential applications.

The functional modes of operation, in addition to cooling, are heating, humidification, dehumidification and filtration which provide complete environmental control of a conditioned space.

There are two air flow pattern configurations, upflow and downflow, and several cabinet sizes based on the type of system and capacity. Regardless of configuration, STULZ CyberAir systems are compact and versatile. See the Installation drawing provided with your unit for the layout and dimensions of the cabinet.

The STULZ CyberAir unit is provided with a factory mounted, main power disconnect switch with a lockable handle. The disconnect switch electrically isolates the unit during routine maintenance. The system incorporates state of the art component protection with the use of motor start protectors or circuit breakers.

The advanced **E<sup>2</sup>** microprocessor controller is provided as a standard for STULZ CyberAir systems. This controller provides superior features for more comprehensive control of the unit. These features include full alarm system; input/output monitoring status; full integrated control of heating, cooling, humidification, and dehumidification; multi-A/C unit control and remote communication with building management systems.

The controller user interface display panel is typically mounted on the front door of the A/C unit. It features a high resolution touch screen display offering enhanced graphical display capabilities and a round membrane type keypad to navigate through the controller menus and adjust operating parameters.

An easy to read, backlit liquid-crystal alphanumeric display panel is also available as an option.

An operating manual for the **E<sup>2</sup>** controller is provided under separate cover. Refer to that manual for detailed instructions on operating the system controller.



Touch Screen Display Panel



Liquid-Crystal Display Panel

## 1.3 Safety

### 1.3.1 General

STULZ uses **NOTES** along with **CAUTION** and **WARNING** symbols throughout this manual to draw your attention to important operational and safety information.

A bold text **NOTE** marks a short message in the information to alert you to an important detail.

A bold text **CAUTION** safety alert appears with information that is important for protecting your equipment and performance. Be especially careful to read and follow all cautions that apply to your application.

A bold text **WARNING** safety alert appears with information that is important for protecting you from harm and the equipment from damage. Pay very close attention to all warnings that apply to your application.

A safety alert symbol  accompanies a general **WARNING** or **CAUTION** safety statement.

A safety alert symbol  accompanies an electrical shock hazard **WARNING** or **CAUTION** safety statement.

### 1.3.2 Safety Summary

The following statements are general guidelines followed by warnings and cautions applicable throughout the manual.

Prior to performing any installation, operation, maintenance or troubleshooting procedure, read and understand all instructions, recommendations and guidelines contained within this manual.

Certain maintenance or cleaning procedures may call for the use and handling of chemicals, solvents, or cleansers. Always refer to the manufacturer's

Material Safety Data Sheet (MSDS) 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.

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

## CAUTION

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.

## CAUTION

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

## CAUTION

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.

## CAUTION

Do not allow anyone under the equipment while it's suspended from a lifting device.

## CAUTION

When the air conditioner is in the cooling mode, the return air-intake and discharge (supply) must be free of obstructions.

## CAUTION

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 all personal and equipment damage hazard areas.

## WARNING

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

## WARNING

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

## WARNING

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

**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** 

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

**CAUTION** 

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** 

Hazardous voltage will still be present inside the electric box at the motor start 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. Always disconnect main power prior to performing any service or repairs.

**CAUTION** 

Cooling coils and associated piping circuits are **pressurized (up to 100 psi)** and sealed when they leave the factory.

**WARNING** 

Refrigerant is used with this equipment. Death or serious injury may result if personnel fail to observe proper safety precautions. Great care must be exercised to prevent contact of 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.

As 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.

Exposure of refrigerant to an open flame or a very hot surface will cause a chemical reaction that will form carbonyl chloride (hydrochloric/hydrofluoric acid); a highly poisonous and corrosive gas commonly referred to as PHOSGENE. 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.

Always refer to the manufacturer's MSDS provided with the unit.

**CAUTION** 

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. Solvent solutions should be disposed of in accordance with local and state regulatory statutes.

**CAUTION** 

Certain maintenance or cleaning procedures may call for the use and handling of chemicals, solvents, or cleansers. Always refer to the manufacturer's Material Safety Data Sheet (MSDS) 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<sup>3</sup>/minute).

**WARNING** 

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



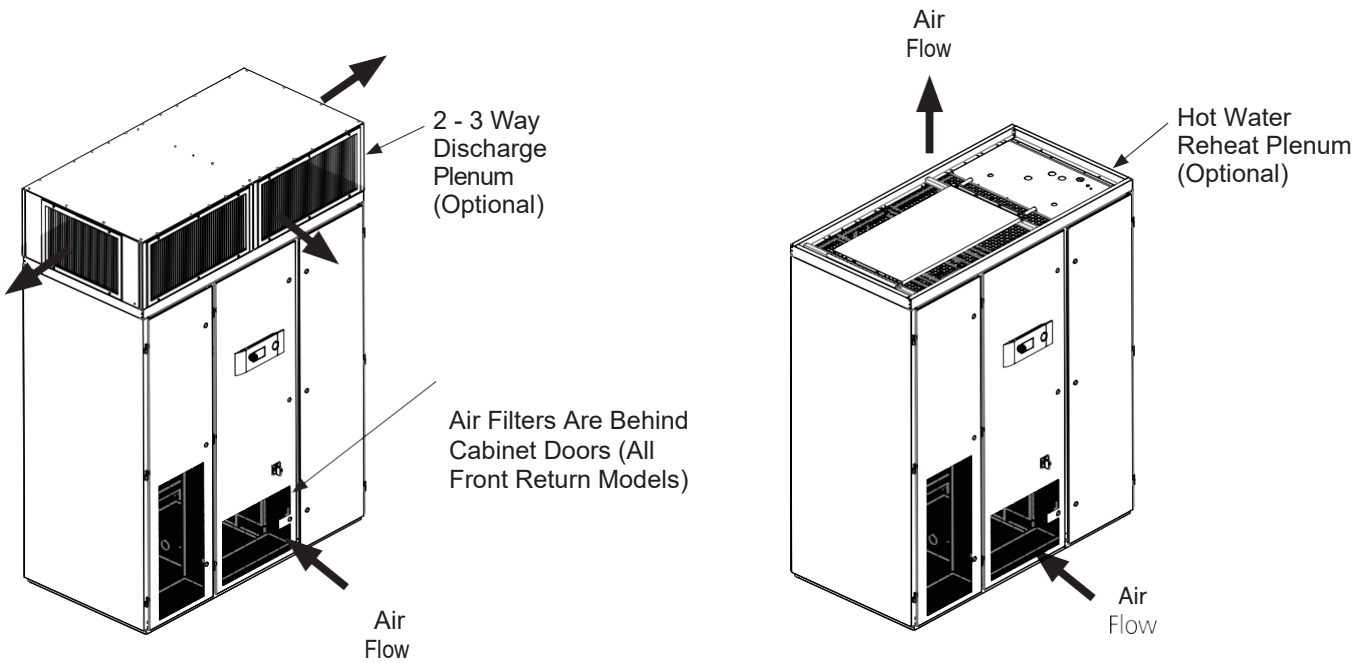
## 1.4 General Design

The STULZ CyberAir unit is housed in a steel frame type cabinet and is rated for indoor use. The cabinet is coated with a durable powder coat finish to protect against corrosion. Hinged doors are located on the front of the cabinet. The doors may be removed for easy access to all internal components. Operator controls are conveniently located on the front of the cabinet. STULZ CyberAir systems are available with upflow or downflow air discharge patterns. Cabinet sizes vary according to system capacity. Figures 1 and 2 depict the internal layouts of STULZ upflow and downflow CyberAir units and identifies the major components. Location of the major components may vary depending on model number and options purchased.

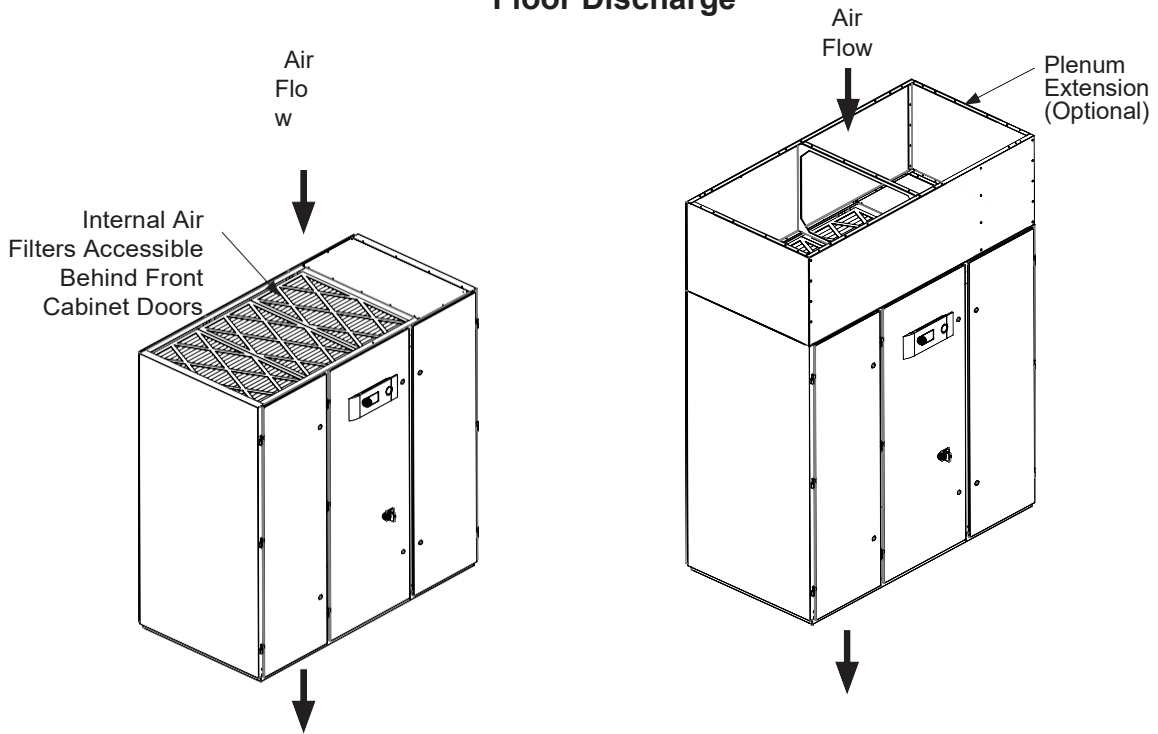
### NOTE

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 also be included to further describe the feature(s).

### Upflow Models Front Free Return

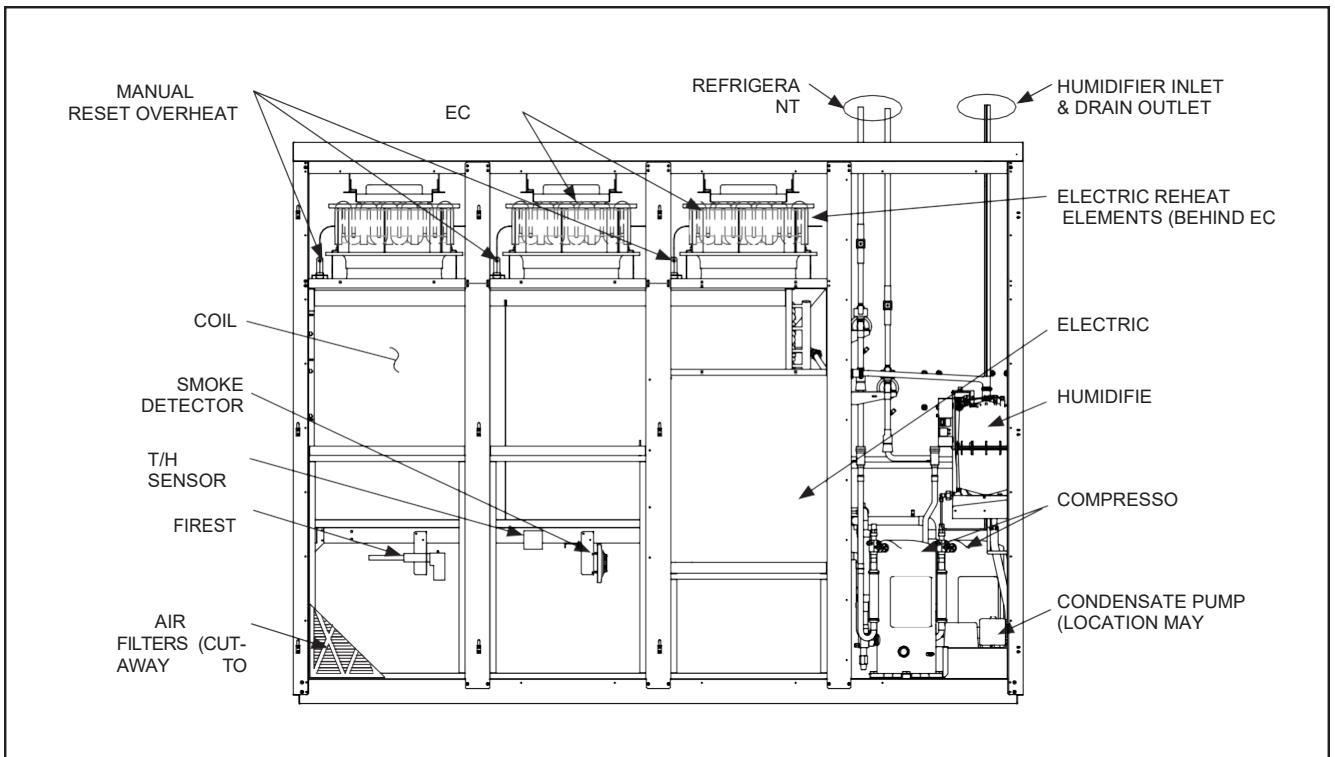


## Downflow Models Floor Discharge



### 1.4.1 Internal Layout - Upflow Model

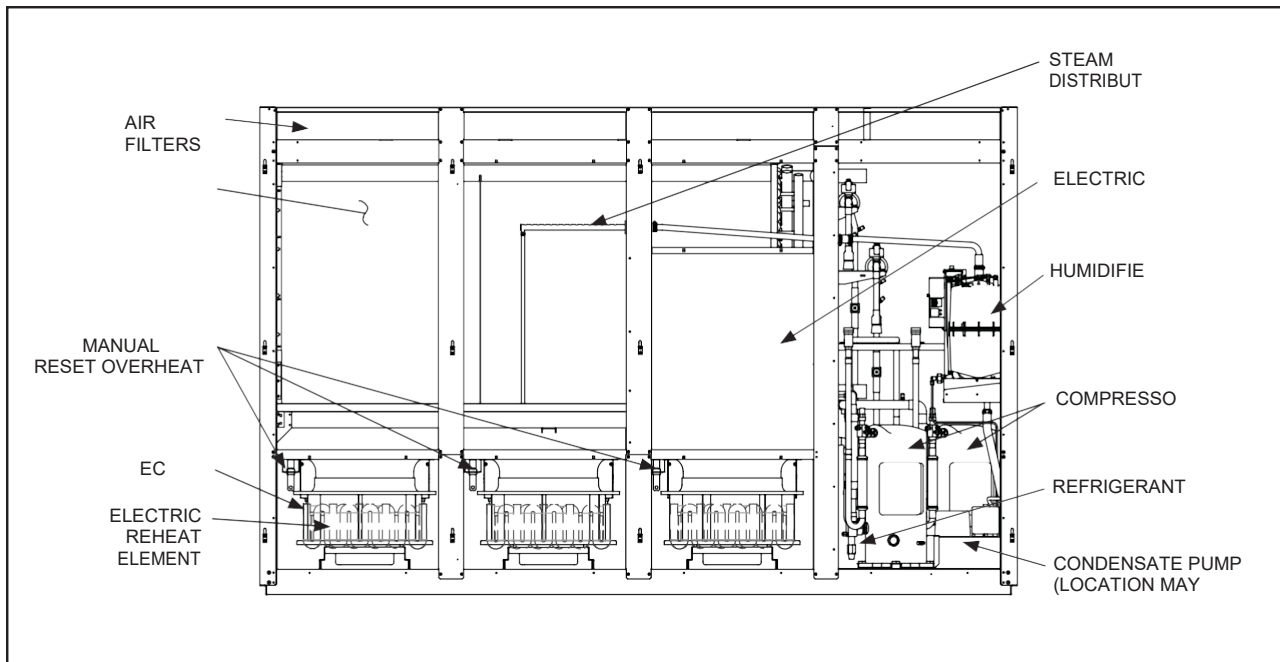
Figure 1 depicts a sample internal layout of a CFU (upflow) unit and identifies the major components.



**Figure 1- Typical Internal Layout- Upflow**  
(Front View - Door and Access Panels Removed)

### 1.4.2 Internal Layout - Downflow Model

Figure 2 depicts a sample internal layout of a CFD (downflow) unit and identifies the major components. The location of major components vary depending on model number and options purchased.



**Figure 2- Typical Internal Layout- Downflow**  
Front View - Door and Access Panels Removed

### 1.4.3 Electric Box Access

The electrical components are protected in an enclosure located inside the cabinet behind the hinged access door with the controller display panel. The front access door is safety interlocked with the main power service disconnect switch, preventing the door from being opened when the switch is in the On position. The main power service disconnect switch must be turned Off to gain access to the components within the electric box. The handle of the switch may be locked in the "Off" position to prevent unintended operation.

#### **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.

The main power service disconnect switch may be used to turn the unit off for performing routine maintenance. The handle of the switch can be locked in the "Off" position to prevent unintended operation.

#### **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.

### 1.4.4 Circuit Breakers/Motor Start Protectors

STULZ CyberAir units incorporate state of the art component protection with the use of motor start protectors and circuit breakers. If an overload occurs the switches must be manually re-set after the overload condition is cleared.

### 1.4.5 Compressors

Two scroll compressor circuits are utilized in DX based STULZ CyberAir systems. With fewer moving parts, scroll compressors have demonstrated superior durability. The scroll compressor is designed around two identical spirals or scrolls that, when inserted together, form crescent shaped pockets. During a compression cycle, one scroll remains stationary while the other scroll orbits around the first. As this motion

occurs, gas is drawn into the scrolls and moved in increasingly smaller pockets toward the center. At this point the gas, now compressed to a high pressure, is discharged from a port in the center of the fixed scroll. During each orbit, several pockets of gas are compressed simultaneously, creating smooth, nearly continuous compression.

#### 1.4.5.1 Electronic Expansion Valve

The *E<sup>2</sup>* system controller manages the operation of the electronic expansion valve (EEV) for each refrigeration circuit. The controller manages the EEV based on input signals from the suction pressure and temperature sensors. It regulates the amount of refrigerant entering the evaporator to maintain the correct superheat temperature.

#### 1.4.6 Coils

The evaporator coils are aluminum finned/copper tube construction. The coils are leak tested prior to installation by the factory. A condensate drain pan is provided to collect water condensed by the coils. The drain pan is emptied by gravity drain that directs the water away from the cabinet. A condensate pump may be provided as an option.

#### 1.4.7 EC Fan(s)

The unit is equipped with high efficiency, Electronically Commutated (EC) fan(s). EC Fans utilize a brushless motor equipped with permanent magnets and permanently lubricated ball bearing. The Fan impellers are backward curved and attached to the rotor casing. The fan is balanced and aerodynamically optimized to minimize vibration.

The fan does not utilize drive belts. The fan speed is variable via a 0 to 10 VDC signal from the system controller. The fan motor is equipped with integral electronics and does not require the addition of secondary electronics such as thermal protection, inverters or filters. The fan will not produce AC inverterwhine.

EC fans feature an integrated monitoring function to protect the motor and electronics against damage from jamming, phase loss or overheating. The *E<sup>2</sup>*

controller monitors each fan via the modbus and if any of the following failure conditions occur, the motor automatically stops and an alarm is signaled:

- a. Locked rotor
- b. Low main supply voltage
- c. Loss of a phase
- d. Over-heating of electronics
- e. Over-heating of motor

If a communication loss occurs, the fans will run at their last received output command until a new

command is received (Modbus comm is back online). If a power cycle occurs, (dual power changeover or power outage) the fans will begin to run immediately to their last received command once power is restored. Once the controller reboot cycle is completed (and the Modbus network is online), the fan speed will be managed by the system controller.

#### 1.4.8 Temperature/Humidity Sensor

As a standard, a temperature/humidity (T/H) sensor is factory mounted in the return air stream for room air control. The T/H sensor monitors the return air conditions and provides input signal(s) to the system controller to manage the operation of the A/C unit consistent with the set points entered in the controller. As an option, sensor(s) may be shipped loose for field installation. Refer to the electrical drawing supplied with your unit for details specific to your system. See Section 2.6.4.1 for descriptions of the types of T/H control methods that may be utilized.

#### 1.4.9 Heaters

The precision A/C unit incorporates heaters for reheating the supply air as required to offset the sensible cooling of the system during the dehumidification cycle and for the automatic heating mode. As a standard, electric resistance heating elements are factory installed in the supply airstream to heat the supply air.

As an option, hot water reheat may be selected. A hot water heating coil is factory installed in the supply air stream to heat the supply air. A control valve is provided to regulate the flow of hot water through the coil to maintain the reheat temperature to the control setpoint.

### 1.5 Optional Equipment

#### 1.5.1 Humidifier

STULZ CyberAir systems may be equipped with an optional electrode steam humidifier. For this option a humidifier is installed inside the air conditioner with automatic fill and drain valves and associated piping. Operation of the humidifier's fill and drain cycles is based on water conductivity and is maintained by the humidifier 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.

### 1.5.2 Condensate Pump

An optional condensate pump may be factory installed. The pump automatically eliminates condensate and humidifier flush water (if applicable) from the drain pan. An internal overflow safety switch is wired to the system controller to automatically signal an alarm should an overflow occur.

### 1.5.3 Water Detector

As an option, STULZ offers spot type or strip/cable type water detectors (see Section 2.6.5). Upon sensing a leak, the water detector control circuit will signal the system controller of the alarm condition.

### 1.5.4 Smoke Detector

Optionally mounted in the return air stream, a photo-electric smoke detector is used to sense the presence of smoke and signal the controller when a smoke alarm condition exists. The system controller is programmed to shut down the compressor and the fans when smoke is detected. When the alarm condition is cleared, a manual re-set is required by cycling the main power service disconnect switch off and on.

### 1.5.5 Firestat

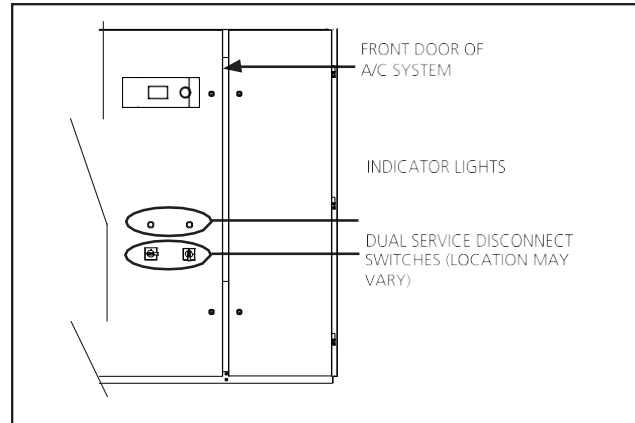
Optionally mounted in the return air stream, a fire detector senses high return air temperature and signals the controller when a fire alarm condition exists. The system controller is programmed to shut down the compressor and the fans when fire is detected. When the alarm condition is cleared, the reset button on the firestat must be manually pressed to resume operation.

#### **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.

### 1.5.6 Auto Power Transfer Switching

An automatic transfer, main power switching system is optionally available for critical operations. With this option, two main power service disconnect switches are provided on the door of the cabinet to connect two independent power sources (see Figure 3).



**Figure 3- Auto Transfer Disconnect Switches**

If the user selectable main power source is interrupted or, if a phase loss or imbalance occurs, the automatic transfer switching circuitry immediately transfers operation of the precision A/C system to a secondary power source. If power is transferred, the system controller provides an alarm signal and the alarm display indicates which power source failed. When the primary power source is functionally restored, the operation of the A/C system is automatically transferred back to the primary power source.

An indicator light is provided above each main power service disconnect switch (see Figure 3). A light illuminates above the switch that's selected to supply power to the A/C system, whether the unit is running or not, indicating that power is available at the switch.

A preferred power selector switch is included with the auto-transfer switching option. It is mounted inside the cabinet at the top of the electric box (see Figure 16). This switch may be used to manually transfer the power source and/or test the auto transfer switching function.

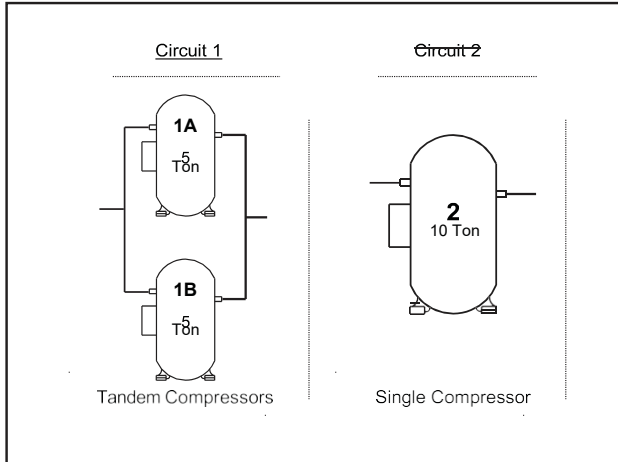
## 1.6 Dual Cooling Circuits

STULZ CyberAir DX systems are designed with two stages of cooling. The cooling circuits are typically comprised of one compressor per circuit. The circuits are staged to operate as needed, based on incremental cooling stage enable temperature set points as programmed in the system controller. Each stage is assigned an offset to the temperature set point for turning the compressors on. The controller turns each stage on and off as needed based on the temperature set point plus offset value (reference Section 4.5.1.2

in the *E<sup>2</sup>* Series Controller Manual). The compressor circuits rotate after each run cycle in an effort to promote equal run-times.

### 1.6.1 Tandem Compressor Option

An optional four stage cooling configuration is available which utilizes three compressors (two small tandem compressors and one large compressor). The two small tandem compressors operate as circuit 1 and the large compressor operates as circuit 2 (see Figure 4).



**Figure 4 - Tandem Compressor Configuration**

#### 1.6.1.1 Four Stage Operation

In the example of a CFU/D-070 (20 ton, 240,000 BTU) A/C system configured with three compressors, two small (5 ton) compressors are paired together as one, tandem circuit with a shared suction line and shared discharge line. The compressor suction and discharge ports are equipped with back pressure isolation valves so one compressor may operate independently or both may operate together as required by capacity staging demands. One large (10 ton) compressor is also provided as circuit two.

The controller manages operation of the three compressors with a unique method of staging which conserves energy by incrementally matching compressor capacity against the load. The three

compressors are turned on in various combinations to provide a total of 4 stages of cooling as shown in the table below:

Stage	Cut-in Offset	Compressor(s)	Capacity
1	+2° F	1A	5 tons
2	+3° F	2	10 tons
3	+4° F	1B+2	15 tons
4	+5° F	1A+1B+2	20 tons

#### 1.6.1.2 Four Stage Compressor Rotation

Compressors 1A and 1B rotate the lead role after each run cycle in the cooling mode. That is, after compressor 1A has completed an operating cycle as the primary compressor for stage 1, the next time cooling stage 1 is called for, the compressors switch roles and compressor 1B becomes the primary compressor for stage 1. When compressor 1B is the primary for stage 1 cooling, compressor 1A's role is switched to operate with compressor 2 for the third stage of cooling.

Compressor 2 is not involved in the cooling mode rotation so it will always be used for cooling stages 2, 3 and 4.

For the dehumidification mode, compressor circuits 1 and 2 (see Figure 4) rotate the lead role after each run cycle. The tandem compressors rotate as a single, dual compressor circuit because a single small compressor from the tandem set does not have enough capacity to satisfy the dehumidification load alone. In the dehumidification mode, after circuit 1 (compressors 1A and 1B) has completed an operating cycle as the lead, the next time dehumidification stage 1 is called for the compressor circuits switch roles and circuit 2 (compressor 2) becomes the primary compressor circuit for dehumidification.

## 1.7 Free-Cooling Operation

The free-cooling configuration is available to minimize the use of compressor operation during low ambient conditions for system energy savings. A FC (free-cooling) system utilizes a remote drycooler to provide water/glycol coolant to a free-cooling coil positioned within a DX refrigerant system. If outdoor air temperatures permit free-cooling operation (adjustable user set point), the free-cooling mode is enabled to take advantage of the low ambient conditions to provide cooling with partial use or without the use of the system compressor(s). Free-cooling provides an excellent opportunity for reduced operational cost by reducing the compressor operating hours.

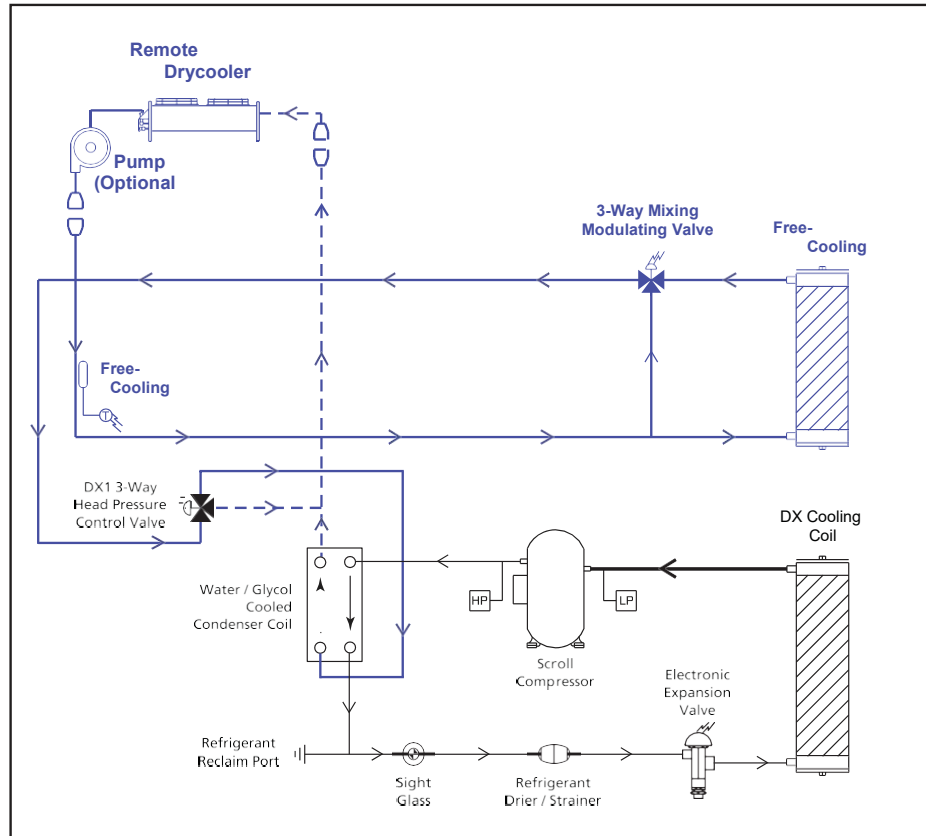
The free-cooling sequence is enabled if the entering fluid temperature is below the user adjustable free-cooling enable set point and the return air temperature rises to the free-cooling set point plus dead band.

The drycooler pump activates and the 3-way control valve directs chilled water/glycol coolant to the FC coil. The outdoor fluid cooler is controlled by first switching the leaving fluid control set point from typical DX heat rejection to free-cooling control (adjustable set point, ambient air) and by controlling the leaving fluid to its user adjustable set point. The free-cooling control valve opens proportionally to the demand for cooling based on the return air temperature's deviation from set point.

If the return air temperature continues to rise, the free-cooling valve position eventually reaches 100% open, maximizing the flow of coolant through the free-cooling coil. Continued operation in this position indicates the A/C unit is unable to lower the air temperature to the desired set point in the free-cooling mode.

The compressor activates if the DX cooling stage enable temperature set point has been reached or if the control valve position reaches 100% open for 20 seconds (default). The free-cooling circuit and the compressor operate in series to provide maximum cooling. The 3-way control valve continually modulates the flow of coolant in response to temperature with the compressor running.

The compressor cycles off based on the normal compressor temperature cut-out settings once the set point is maintained.



**Figure 5- Free-Cooling Diagram**

As the outside air temperature increases above the ambient air switch-over setting, the fluid cooler controls cycle back to typical DX heat rejection allowing the leaving fluid control set point to increase above the prevailing ambient conditions. The indoor unit's inlet fluid temperature sensor monitors the fluid temperature and deactivates the free-cooling mode once the fluid temperature increases above the user adjustable enable set point. The system compressors become the primary cooling source and will activate as the return air temperature increases above the set point.

## 1.8 Alternate Water Source Operation

An alternate water source (AWS) system utilizes an independent chilled water source to provide coolant to an AWS cooling coil in the A/C unit. If AWS cooling is unable to handle the load, the separate DX refrigeration circuit can be utilized to assist. Similar to FC operation, when return air temperature rises to the AWS cut-in temperature set point, AWS cooling activates (the AWS control valve opens) provided the chilled water inlet temperature is 55°F or cooler (adjustable).

If the return air temperature rises to the compressor cut-in set point or if the AWS control valve reaches 100% open for the compressor delay period (20 seconds, adjustable), the compressor turns on and operates in parallel with AWS cooling. The compressor runs until the cut-out set point temperature is reached provided the minimum run time expires.

AWS cooling will continue if the return air temperature is above the AWS cooling cut-in temperature set point and the chilled water inlet temperature is 55°F or cooler.

If the chilled water temperature is above 55°F, AWS cooling turns off (the control valve closes). If the compressor cut-in set point is reached, the compressor turns on and becomes the primary source of cooling.

In the event of loss of water flow during AWS operation, the AWS control valve is closed and compressor operation is activated.

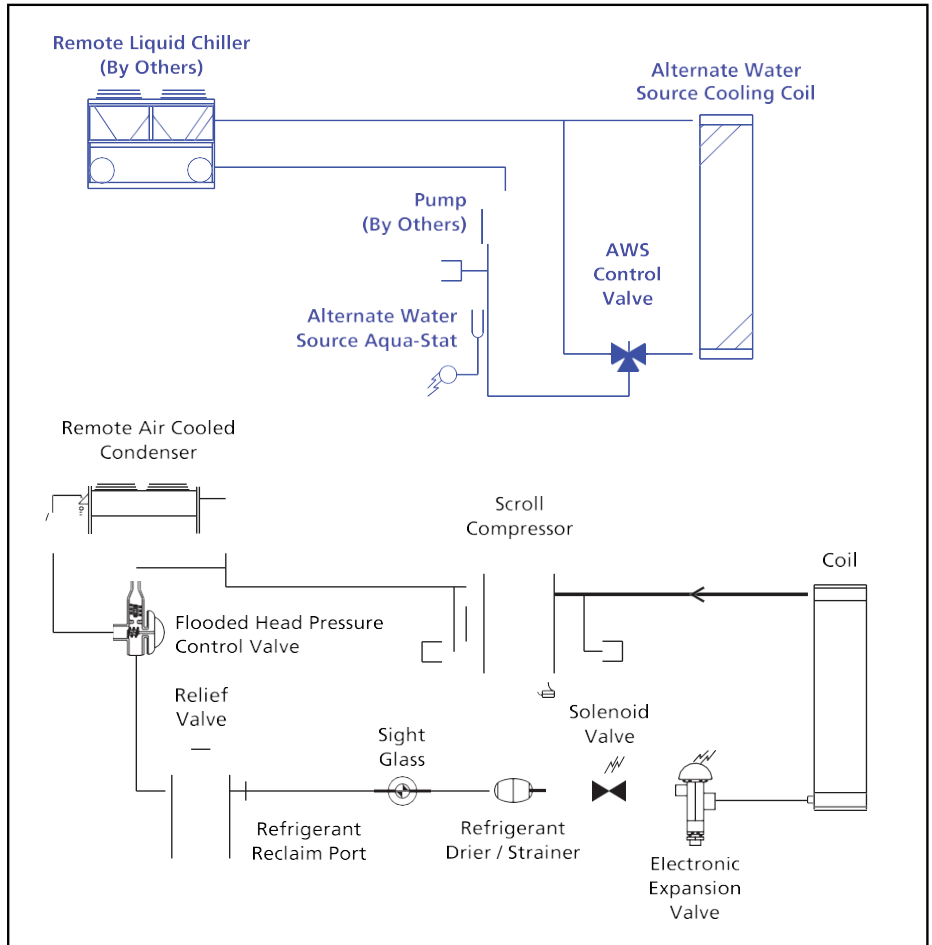


Figure 6- Alternate Water Source Diagram



## 20 INSTALLATION

### 21 Receiving the Equipment

Your STULZ CyberAir system has been inspected and tested prior to shipment. To ensure your equipment has been received in excellent condition, immediately inspect the unit for damage which may have occurred during shipment. If any is found, report it to the carrier immediately. Any obvious damage incurred during shipping must be noted on the freight carrier's delivery forms BEFORE signing for the equipment.

Freight claims must be done through the freight carrier. Generally, all equipment ships "FOB Factory". STULZ can assist in the claim filing process with the freight company. Refer to Section 5.0 of this manual for instructions.

Carefully remove the shipping cover. Open the front door, remove any loose parts, and check the equipment against the packing list to see if the shipment is complete. Report all discrepancies to the appropriate authority. Inspect the interior of the unit for any signs of transit-incurred damage. Should any damage be present, notify STULZ Product Support prior to attempting any repairs.

A Data Package has been sent with your unit. It contains this manual, a supplemental microprocessor controller manual, system drawings, applicable MSDS's, warranty registration form and other applicable component manuals and instructions based on the configuration and options included with your unit. The data package has been placed in your unit inside a clear plastic bag. These documents should be retained with the unit for future reference.

#### **NOTE**

Items that have been shipped loose, such as controllers, temperature/humidity sensors, water detectors, etc., are shipped inside the air conditioner unless specified otherwise by the customer. The plenum box (if applicable) is shipped separately. Unpack and store these items in a safe place unless you are using them immediately.

### 22 Site Preparation

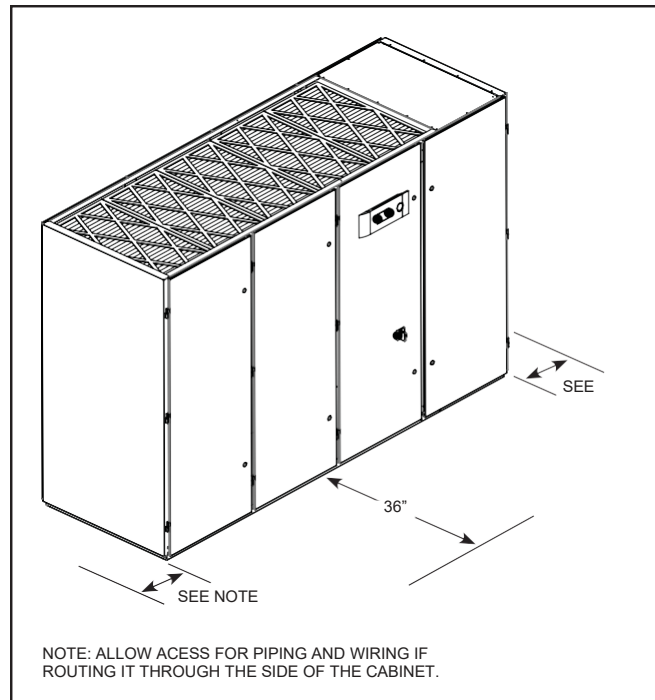
STULZ CyberAir systems are designed with easy service access in mind. Removable, hinged access doors are located on the front of the cabinet. The number of access doors vary depending on size and configuration of the unit. The electric box is located behind the front door with the controller user interface display. In order to have full service access through the front of the

unit, no permanent obstructions should be placed in front of the cabinet. See Figure 7 for the minimum recommended installation clearance in front of the unit.

#### **NOTE**

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

When determining the installation location consider how you'll route the piping and wiring into the cabinet (see Section 2.7). The installation drawing furnished with your unit shows the recommended entry locations. Ensure access is available for routing the piping and wiring if entering through the side of the cabinet. The cabinet may be positioned in a corner and if necessary a service opening may be cut into the wall for access to install the piping and wiring from an adjoining room.



**Figure 7- Recommended Installation Clearance**

#### **CAUTION**

The A/C unit must be installed in a space that will be air conditioned.

#### 2.2.1 Conditioned Space

Certain steps may be taken to minimize the effects of the environment surrounding the conditioned space. This is especially true in data center applications, where the goal is to minimize energy used 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 insulation rating is used based on the design of the space, which was the basis for the system selected. The following chart is the minimum recommended R-value (thermal resistance) to ensure optimum equipment operation.

STRUCTURE	R-VALUE
Ceiling	R-38
Wall	R-21
Floor	R-19
Door	R-5

The vapor barrier is the single most 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. Outside or fresh air should be kept to a minimum (as it adds to the cooling, heating, dehumidification and humidifying loads), while still maintaining the requirement of the Indoor Air Quality (IAQ) standard. Lack of attention to these factors can cause erratic operation, unstable room control and excessive maintenance costs.

### 2.3 Rigging

STULZ CyberAir systems are designed to be kept in a vertical position. Move the unit with a suitable device such as a forklift, pallet jack, or roller bar and dollies. A weight table is provided on the installation drawing.

The unit is shipped on a skid to facilitate moving prior to installation. The unit should always be stored indoors in a dry location prior to installation.

### CAUTION

When moving the unit, it must be kept level and in the vertical position when lifting to prevent damage.

### 2.4 Mounting/Placement

STULZ CyberAir systems use a frame and panel construction for unit rigidity. The cabinet design allows full service accessibility without moving the unit. STULZ CyberAir systems that are not ducted are designed to be located in the space to be conditioned. Ducted units may be located inside or outside the conditioned space but are designed to supply air to only one room. STULZ CyberAir systems are front accessible, which allows the

unit to be placed in a corner or between cabinetry. It is recommended that the unit is positioned to obtain optimum air circulation.

### NOTE

Placement of the floor or ceiling registers is important. If they are too close to the unit, the supply air will be recirculated back to the unit before it has circulated throughout the space.

See Figures 8 & 9. The STULZ CyberAir unit is designed to be located directly on top of the floor (typically upflow) or on a raised floor (typically downflow).

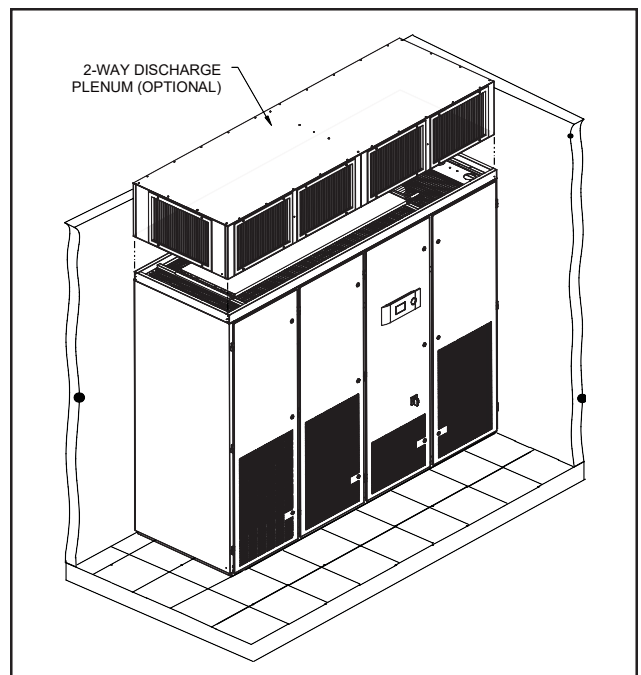


Figure 8- Typical CFU (Upflow)

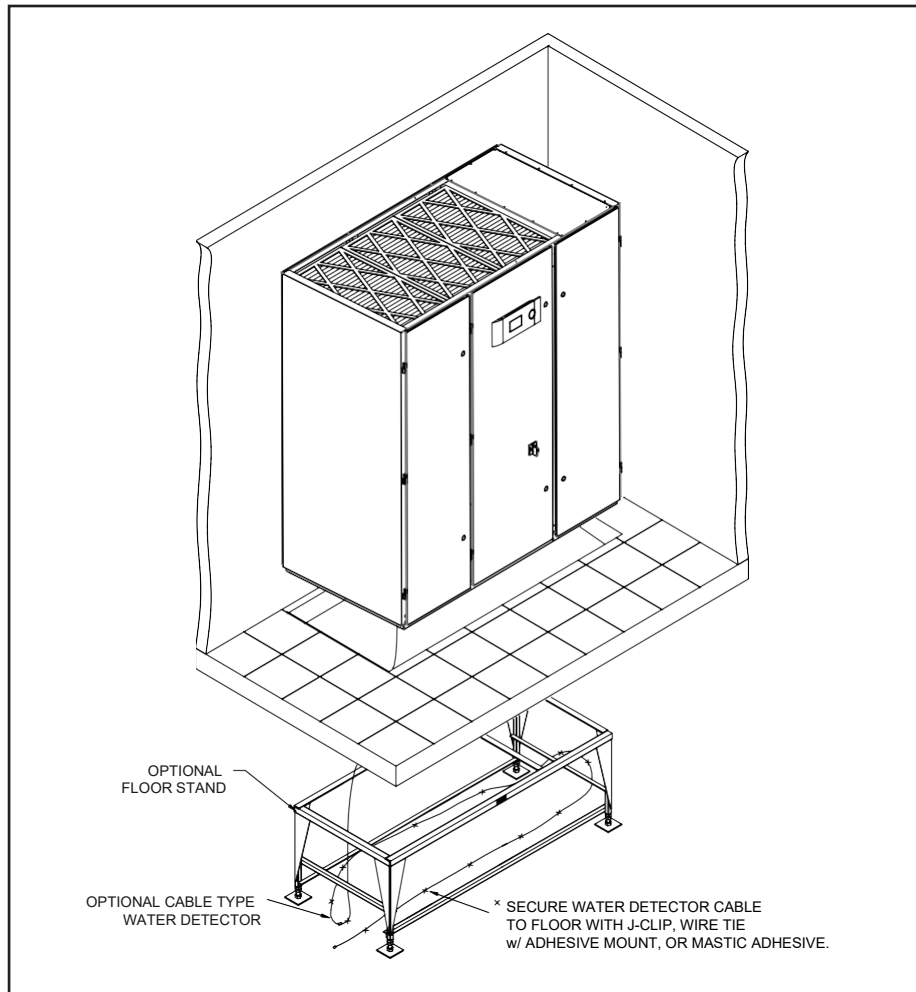
### Installation NOTE

The equipment must be level to operate properly.

### CAUTION

Ensure the mounting surface is capable of supporting the equipment. Before mounting the unit, refer to the weight table provided on the installation drawing. On some raised floor installations a floor stand may be required (see Figure 9) depending on the load capacity of the existing raised floor.

If a floor stand is selected (for downflow units), see Section 2.6.1 and refer to the installation drawing provided. Cut out an opening in the raised floor slightly larger than the cabinet's overall base dimension so the weight of the A/C unit is supported by the stand.



**Figure 9- Typical CFD (Downflow) Installation**

**NOTE:** These units use welded frame construction for unit rigidity. The system is designed to be installed on a roof curb, which is provided by others and ducted into a singular space to be conditioned. Ensure the curb is sealed to prevent air leakage. See the detail drawing provided with the unit for interface dimensions. These units are designed to be ducted to a space to be conditioned and are intended to condition only one room.

## 2.5 Air Distribution Connection

### 251 Upflow Configuration Air Patterns

In an upflow configured unit, the conditioned supply air has two methods of discharge: ducted or through a grilled, 2 or 3-way discharge air plenum box (see Figure 10). The return air pattern is front free return.

The supply air outlet is provided with a flange for connecting ductwork (refer to the installation drawing provided with the unit). The connection of ductwork to the unit may be made with either pop rivets or self-tapping screws. If ductwork is to be used, always consult your state and local codes when determining ducting requirements. The duct system should be designed to allow the air to move with as little resistance as possible.

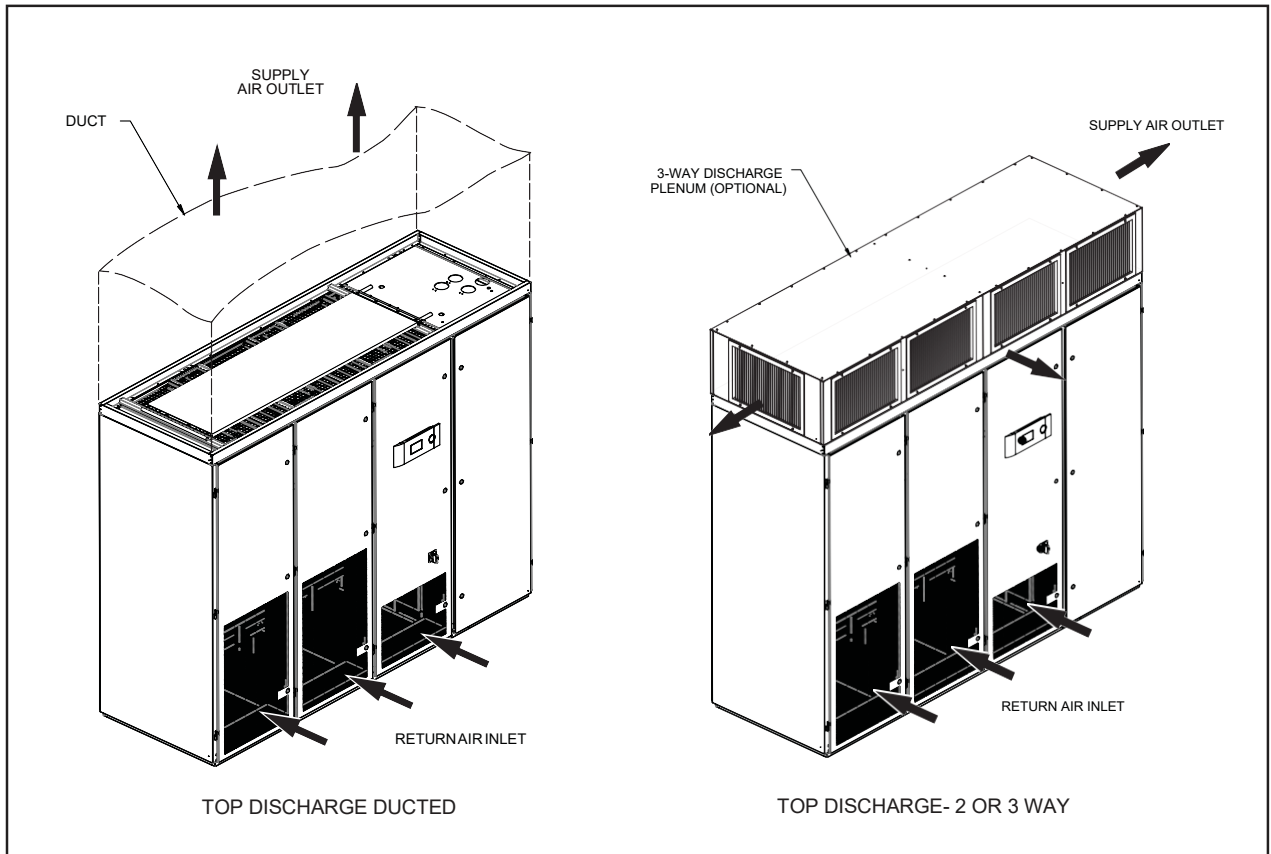


Figure 10- Upflow Configuration Air Patterns

## 252 Downflow Configuration Air Patterns

In a downflow configured unit, the conditioned supply air discharges through the bottom of the cabinet into a raised floor. There are two basic return air distribution methods: top free return and top ducted return (see Figure 11).

The return air inlet is provided with a turned in flange on top of the cabinet for connection of ductwork (refer to the installation drawing provided with the unit). The connection of ductwork to the unit may be made with either pop rivets or self-tapping screws.

If ductwork is to be installed, always consult your state and local codes when determining ducting requirements. The duct system should be designed to allow the air to move with as little resistance as possible.

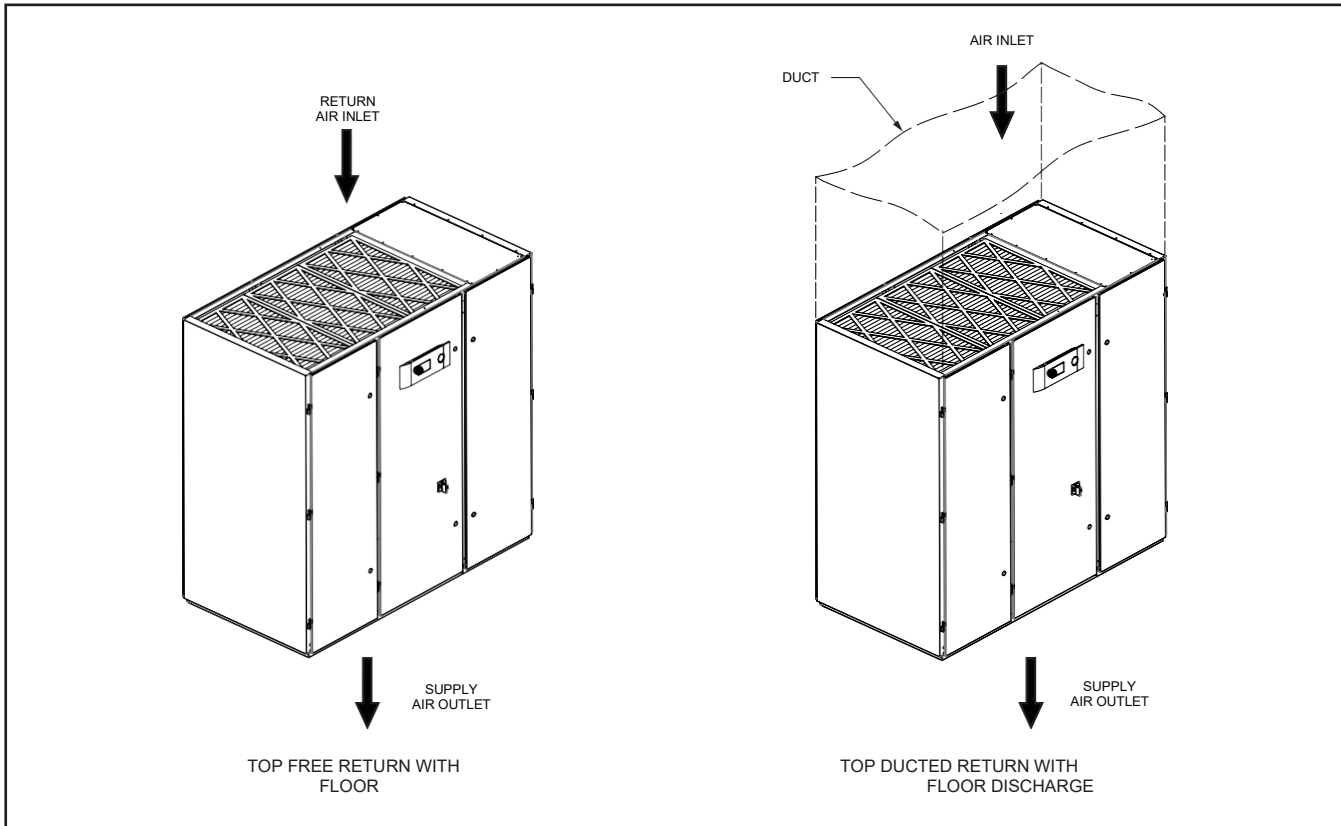


Figure 11- Downflow Configuration Air Patterns

## 2.6 Optional Equipment (Field Installed)

**NOTE:** Do not mount any optional equipment on the unit access doors.

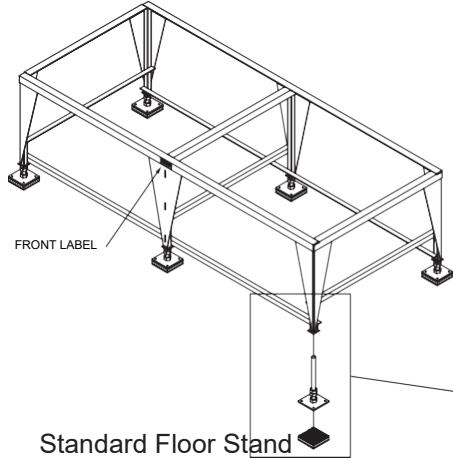
### 261 Floor Stands

Install the optional floor stand directly on the sub-floor, ensuring the side with the “FRONT” label is facing the same direction as the front of the precision A/C unit. Refer to the floor stand assembly drawing for the dimensions required to cut the raised floor. The floor stand is designed with adjustable legs, allowing for leveling and overall height adjustment. Refer to the floor stand assembly drawing for minimum and maximum height adjustments.

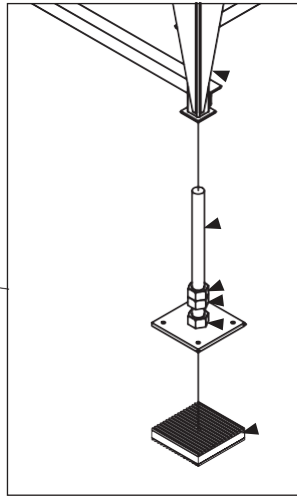
Adjust the height of the floor stand as described in the sections that follow. Once it is level and even with the raised floor, lock all the feet in place. Place the A/C unit on top of the stand.

2.6.1.1 Floor Stand Height Adjustment

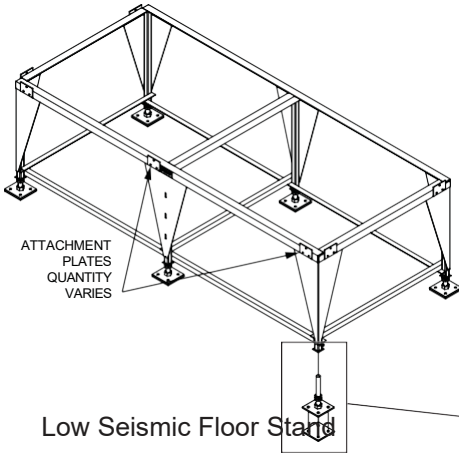
Standard and Low Seismic Floor Stands:



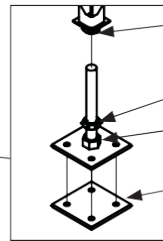
Standard Floor Stands- First loosen the middle hex nut (jam nut) on each leg. Turn the top hex nut to raise or lower the floor stand. Lock the height by tightening the middle hex nut up against the top hex nut.



- FLOOR STAND LEG
- THREADED ROD TOP HEX
- NUT
- MIDDLE HEX NUT (JAM NUT)
- BOTTOM HEX NUT (FIXED)
- ISOLATION PAD

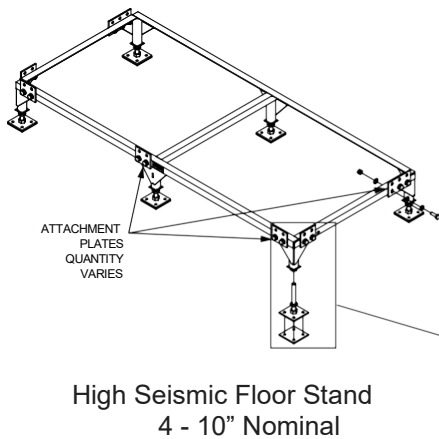


Low Seismic Floor Stands- First loosen the top hex nut (jam nut) on each leg. Turn the entire foot weldment to raise or lower the floor stand. Lock the height in place by tightening the top hex nut up against the fixed hex nut in the floor stand leg.

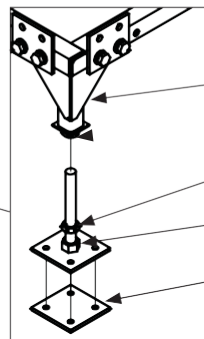


- FLOOR STAND HEX NUT
- (FIXED) TOP HEX NUT (JAM NUT)
- NUT
- BOTTOM HEX NUT (FIXED)
- ISOLATION PAD

High Seismic 4 - 10" Nominal Floor Stands:

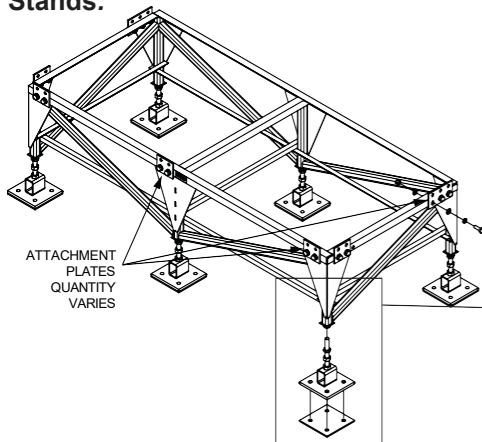


High Seismic Floor Stands- First loosen the top hex nut (jam nut) on each leg. Turn the entire foot weldment to raise or lower the floor stand. Lock the height in place by tightening the top hex nut up against the fixed hex nut in the floor stand leg.

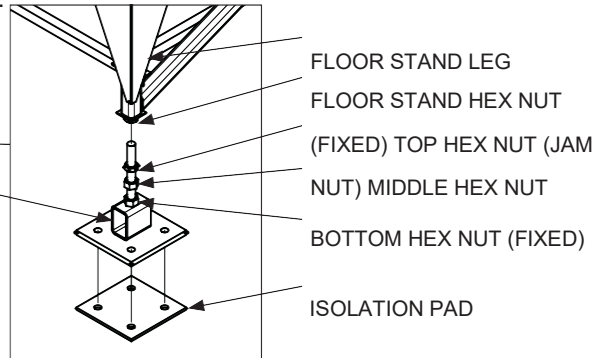


- FLOOR STAND LEG
- FLOOR STAND HEX NUT
- (FIXED) TOP HEX NUT (JAM NUT)
- NUT
- BOTTOM HEX NUT (FIXED) ISOLATION
- PAD

**High Seismic 12” and Taller Floor Stands:**



To adjust the height of a high seismic floor stand, first loosen the top hex nut and bottom hex nut on each leg. Next, turn the middle hex nut to raise or lower the floor stand. Lock the height in place by tightening the top hex nut up against fixed hex nut in the floor stand leg.



**High Seismic Floor Stand 12” and Taller**

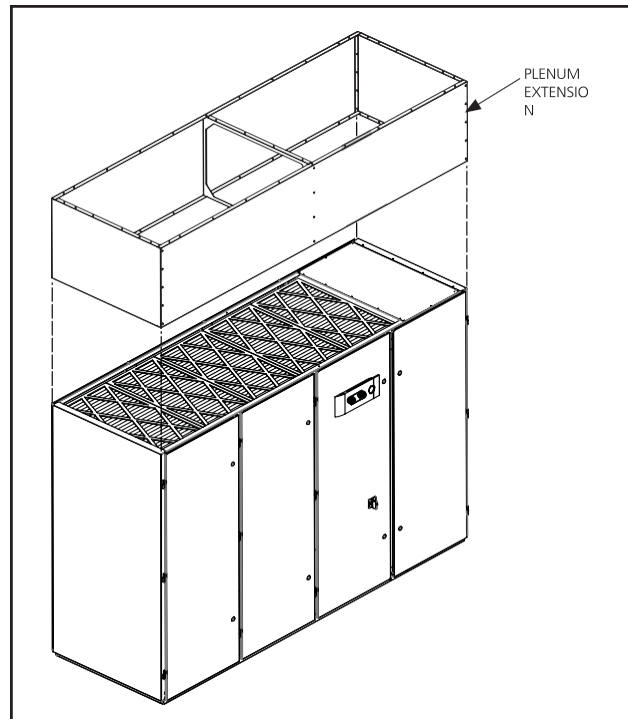
**2.6.1.2 Seismic Floor Stand Attachment Plates**

Attachment plates are provided with seismic floor stands to secure the A/C unit to the stand. Refer to the floor stand assembly drawing provided with your unit. Once the A/C unit is in place on top of the floor stand, mount the attachment plates to the stand. The plates for low seismic floor stands are to be attached with 1/4” sheet metal screws. Drill the sheet metal screws into the floor stand through the lower holes in the attachment plate and into the base of the A/C unit through the upper holes in the plate. Ensure all the screws are tightened. Take care not to strip the threads.

For high seismic stands, attach the plates to the stand with 1/2” bolts as shown in the floor stand assembly drawing. Drill holes for the fasteners into the base of the A/C cabinet through the upper holes in the plate. Secure the A/C unit to the floor stand (fasteners to be customer furnished). Ensure all the fasteners are tightened.

**262 Plenum Box**

If an optional plenum box (plenum extension box or 2 - 3 way air distribution plenum box) is selected it is typically shipped loose. To install a plenum box, first apply a strip of sealing foam gasketing around the top flange of the A/C unit or run a bead of silicone sealant. Place the plenum assembly on top of the unit (see Figure 12). Attach the plenum with the self-tapping screws provided. Holes are pre-drilled in the plenum box. If mounting a 2 - 3 way air discharge plenum box (shown in Figures 8 and 10), the front grilles may be removed for access to the mounting holes.



**Figure 12- Plenum Installation**

### 263 Condensate Pump

An optional, factory installed condensate pump may be provided for automatically eliminating condensate and humidifier flush water from the drain pan. The condensate pump is typically installed by the factory inside the A/C unit. If an optional, field installed condensate pump is selected, it should be located as near as possible to the air conditioning system. The pump should be positioned so the inlet hole in the pump is below the drain pan inside the A/C unit. Secure the pump in place with a mounting clamp or use an adhesive that's appropriate for the mounting surface. Ensure that the pump is level for proper operation.

See Section 2.7.3.2 for information on piping the condensate pump.

### 264 Types of Control

**Room Air Control (standard)**- The A/C unit is provided with a temperature and humidity (T/H) sensor, factory mounted in the return air stream of the A/C unit. The return air temperature and humidity are monitored by the system controller and compared to limit values set at the factory. Control outputs are based on set points entered into the system controller by the user.

As an alternative to locating the T/H sensor inside the A/C unit, it may be field installed under a raised floor for sensing supply air conditions or, on a wall in the conditioned space for sensing actual room conditions (see Figure 13).

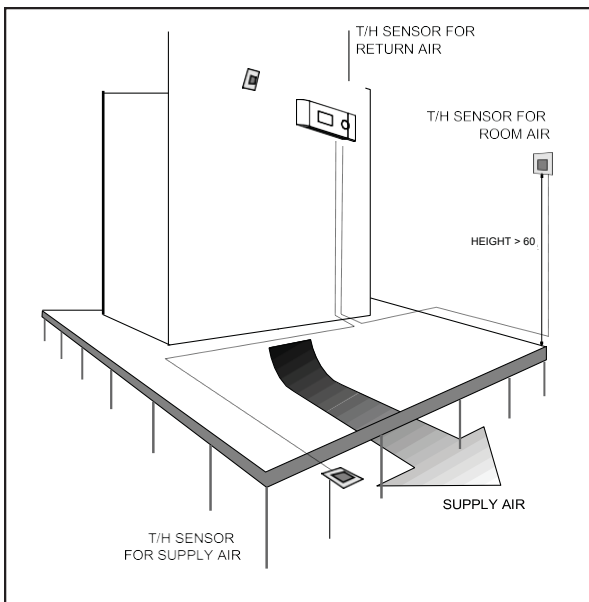
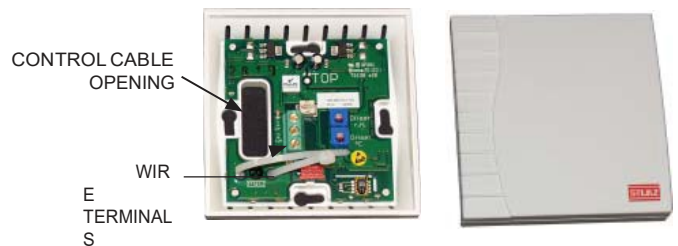


FIGURE 13- TEMPERATURE/HUMIDITY SENSOR LOCATION

**Supply Air Control**- As an option, a field installed T/H sensor may be used for supply air control. The sensor is equipped with a 20 foot long cable and is to be field installed in the supply air stream. Position the sensor at least 6 feet away from the supply air outlet. The supply air temperature and humidity are monitored by the system controller and compared to limit values set at the factory. Control outputs are based on set points entered into the system controller by the user.

#### 2.6.4.1 Remote Temperature/Humidity Sensor

A remote temperature/humidity (T/H) sensor must be located so that it will properly sense the temperature/humidity conditions to be controlled (room air or supply air). Depending on the type of control selected (see Section 2.6.4), the sensor may be factory mounted or shipped loose for field installation. The T/H sensor should not be mounted near a doorway or an area where it would be exposed to direct sunlight. When locating the sensor, consider the length of wire to be used. As an option, a 75 foot or 150 foot long cable may be provided by STULZ. Follow the steps below to mount the sensor.



#### Temperature /Humidity 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 3 conductor shielded 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. Make the wiring connections. Refer to Section 2.8,



Utility Connections and refer to the wiring diagram supplied with your unit.

6. Seal the hole in the wall behind the sensor.
7. Replace the cover plate on the base.

**CAUTION** 

The sensor can be damaged if handled improperly. Take care not to damage the exposed temperature/humidity sensor on the PC board. Do not touch the sensor as this will affect its accuracy.

**265 Remote Water Detector**

The remote water detector is normally placed on the sub-floor or in a field supplied auxiliary drain pan located beneath the unit. STULZ provides 2 types of water detectors:

**Spot type water detector-**

Remove the protective cover and connect two control wires to the terminals on the base. Run the control wires into the electric box and connect them to the control terminal block



as shown in the wiring diagram provided with your unit.

Replace the cover and place the water detector(s) on the floor with the

metal electrodes facing down. When water is present, current will flow between the electrodes. The base is provided with a mounting hole in the center which may be used to secure the water detector in place.

**NOTE**

Do not place the spot type water detector on an electrically conductive surface.

**Cable type water detector-**

Lay the cable water detector flat across the sub-floor where water could collect (see Figure 9). Secure

the cable every 12-18 inches with J-clips or cable ties with adhesive mounting



pads when installing it in the airstream. When routing it around obstructions, secure it at each turn of the cable. Do not tie the water detector cable to the metal floor stand or to metal pipes.

When a water leak on the floor reaches the cable, current will flow between the cable wires. A two conductor wire harness is provided with a quick connect fitting on the end. The harness mates to the fitting on the water detector and connects it to the

control terminal block inside the electric box (see Figure 16) as shown in the wiring diagram provided with your unit.

**2.7 Piping Connections**

Field piping connections for the system (refrigerant, water, water/glycol and optional hot water reheat piping) are sweat connections. CFD (downflow) units typically have pilot holes available for the routing piping and wiring through the floor of the cabinet. The piping connections are inside the cabinet. The STULZ installation drawing (furnished with your unit) shows the recommended entry location.

CFU (upflow) units are typically provided with pipe connections stubbed out at the top of the cabinet. When considering how to route the piping and wiring for CFU units furnished without top piping, entry holes may be drilled through either the floor of the cabinet or through a side panel. For special piping requirements contact STULZ for technical assistance.

If piping is brought into the side of the cabinet, ensure adequate working space is available on that side or if necessary cut a service opening into the adjacent wall if the unit is installed in a corner.

The piping should be isolated by the use of vibration isolating supports. Provide supports (clamps or hangers) as necessary every 5 to 10 feet along piping runs to minimize vibration and noise transmission. To reduce vibration transmission and prevent pipe damage, seal openings in walls using a soft flexible material to pack around the piping. After the piping is installed, seal the gaps between the pipes and the cabinet entrance holes so air won't leak around the pipes.

For pipe connection sizes, see the installation drawing provided with your unit. Field piping is not necessarily the same size as the unit's pipe connections.

**27.1 Refrigerant Piping**

**2.7.1.1 Self-Contained Systems**

No refrigeration connections are required for self-contained water or water/glycol cooled systems.

**2.7.1.2 Split Systems**

Split air-cooled systems with a remote condenser will require field installed refrigeration piping. All split systems are shipped with a dry nitrogen holding charge of 100 psig. Release the pressure via an available stem valve or Schrader valve prior to uncapping the pipes. Do not release the pressure until the field installed refrigerant piping is ready to connect.

Split system using a remote condenser will require a copper discharge and copper liquid line for each compressor circuit. The following instructions should be followed to ensure proper installation. A/C systems, utilizing R-410A refrigerant, have higher operating pressures than systems utilizing R-407C.

All refrigeration piping should be installed with high temperature brazed joints suitable for R-410A refrigerant. Use standard refrigeration practices for piping supports, leak testing, dehydration and charging of the refrigeration circuits. Oil traps must be included every 20 feet in the vertical risers and the refrigerant lines must be sloped ¼ inch for every 10 feet in the horizontal lines to ensure proper oil return to the compressor.

Wrap wet rags around the pipes between the areas to be soldered and any nearby refrigeration components to keep excessive heat from traveling through the pipe and causing damage. Clear all pipe connections of debris and prepare the connections for soldering. Use only “L” or “K” grade refrigerant copper piping. Be careful not to allow solder/piping debris to get inside refrigerant lines. Silver solder containing a minimum of 15% silver is recommended. Dry nitrogen should be flowing through the tubing while soldering at a rate of not less than 1-2 CFM (.03 - .06 M³/minute).

Refrigerant lines for split systems must be sized according to the piping distance between the evaporator and the condenser(s). Each valve, fitting and bend in the refrigerant line must be considered in this calculation.

Pipe sizes are given for “equivalent feet”, not linear feet. Do not confuse the terminologies. For example, a 7/8” standard 90° elbow has an equivalent length of 1.5 feet; a 7/8” branch Tee has an equivalent length of 3.5 feet. These corrections must be accounted for when sizing your piping. Refer to the following table for determining the standard equivalent lengths, in feet, of straight pipe.

Equivalent Length (ft) of Straight Pipe						
OD (In.) Line Size	Globe Valve	Angle Valve	90° Elbow	45° Elbow	Tee Line	Tee Branch
1/2	9.0	5.0	0.9	0.4	0.6	2.0
5/8	12	6.0	1.0	0.5	0.8	2.5
7/8	15	8.0	1.5	0.7	1.0	3.5
1-1/8	22	12	1.8	0.9	1.5	4.5
1-3/8	28	15	2.4	1.2	1.8	6.0
1-5/8	35	17	2.8	1.4	2.0	7.0
2-1/8	45	22	3.9	1.8	3.0	10
2-5/8	51	26	4.6	2.2	3.5	12
3-1/8	65	34	5.5	2.7	4.5	15
3-5/8	80	40	6.5	3.0	5.0	17

If the condenser is installed above the evaporator, the discharge line should include a p-trap at the lowest point in the piping. The highest point in the discharge line should be above the condenser coil and should include an inverted trap to help prevent oil and liquid from flooding back to the compressor during off cycles.

If the condenser is installed below the evaporator, an inverted trap the height of the evaporator coil is required on the liquid line to help prevent oil and liquid from flooding back to the compressor during off cycles.

**CAUTION** 

Liquid line length should not exceed 150 equivalent feet.

**NOTE**

Ensure proper condenser selection in order to maintain reasonable sub-cooling temperatures.

Refer to the remote condenser IOM manual, supplied with the equipment, for detailed installation instructions.

Refer to the following refrigerant line size tables for recommended line sizing.

**NOTE**

In the following tables, the line sizes are for individual refrigeration circuits. STULZ CyberAir- DX units must have two separate pairs of refrigeration lines. (One per compressor circuit.)

Recommended Liquid Line Sizes for R-410A Refrigerant			
CFS Model No./Total BTU Capacity	Receiver to Evaporator (Equivalent Ft.)*		
	50' or less	100' or less	150' or less
021 / 72,000	1/2	1/2	1/2
028 / 96,000	1/2	5/8	5/8
035 / 120,000	1/2	5/8	5/8
053 / 180,000	5/8	7/8	7/8
070 / 240,000	7/8	7/8	7/8
088 / 300,000	7/8	7/8	7/8
105 / 360,000	7/8	7/8	1 1/8

\*Equivalent Ft. accounts for the linear pipe length as well as equivalent length of Valves, Elbows & Tee's as shown in the previous table.

Recommended Discharge Line Sizes for R-410A Refrigerant			
CFS Model No. / Total BTU Capacity	Equivalent Length Ft.*		
	50' or less	100' or less	150' or less
021 / 72,000	5/8	5/8	5/8
028 / 96,000	7/8	7/8	7/8
035 / 120,000	7/8	7/8	7/8
053 / 180,000	1-1/8	1-1/8	1-1/8
070 / 240,000	1-1/8	1-1/8	1-1/8
088 / 300,000	1-1/8	1-1/8	1-1/8
105 / 360,000	1 3/8	1 3/8	1 3/8

**NOTE**

Vertical runs are based on a total rise of 30 equivalent feet. For longer sizes, individual calculations must be made. Sizes assume the use of single risers; double risers may be necessary.

Consult ASHRAE standards and refer to the Copeland applications data guide for more detailed information regarding refrigerant line traps and line sizing.

**272 Water/Glycol and Hot Water Piping**

Field piping may not necessarily be the same size as the pipe connection on the unit. Piping should be sized to match the system pressure drop and flow capacity and may require reducing fittings to match the connection size on the air conditioner. An air vent and several Schrader valves are installed in the unit piping. Refer to the piping diagram supplied with your unit. Provide manual shut-off valves in both the supply and return lines for servicing the unit and for emergency isolation.

**NOTE**

A 20 mesh (opening size = 865 microns) stainless steel Y-strainer with blowdown is recommended to be installed in the supply line. The strainer screen should be cleaned periodically.

**CAUTION** 

Fluid coils and associated piping circuits are **pressurized (up to 100 psi)** and sealed when the unit leaves the factory. Before installing the interconnecting piping, release the pressure via an available stem valve or Schrader valve prior to uncapping the pipes.

If newly installed supply and return piping is used, it is recommended that the piping system be cleaned prior to connecting it to the unit. **If solvents/cleaning solutions are used, ensure they are completely flushed from the piping before connecting it.** Failure to do so could result in equipment problems.

**CAUTION** 

When installing and filling water, water/glycol and hot water reheat loops, all air must be bled from the piping system.

**NOTE**

Water/glycol cooled systems with low entering fluid temperatures should have insulated piping to prevent condensation from forming on the pipes if ambient dew point temperatures are higher than the fluid temperatures.

The recommended ethylene glycol solution ratio is 40% glycol to 60% water. (STULZ recommends Dowtherm SR1 manufactured by Dow Chemical Co.) Use only ethylene glycol with inhibitors for corrosion protection.

**WARNING** 

Glycol is hazardous. Consult the manufacturer's MSDS for detailed safety information.

**273 Condensate Drain**

**2.7.3.1 Gravity Drain**

A drain line is provided to drain the condensate pan. If an optional humidifier is used, the drain line from the humidifier is typically connected to the condensate drain line. The end of the drain line is clamped inside the cabinet. The installer must connect a customer supplied drain hose to the end of the drain line to remove water from the cabinet. See the installation drawing provided with your unit for the size and location of the condensate drain line.

**NOTE**

In most cases the humidifier drains (hot) water into the condensate drain during normal operation. As an option, a separate drain line may be provided for the humidifier.

The drain line 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 condensate drain pan prior to start-up. This fills the trap and prevents air from being drawn up the drain lines.

**WARNING** 

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

**2.7.3.2 Condensate Pump**

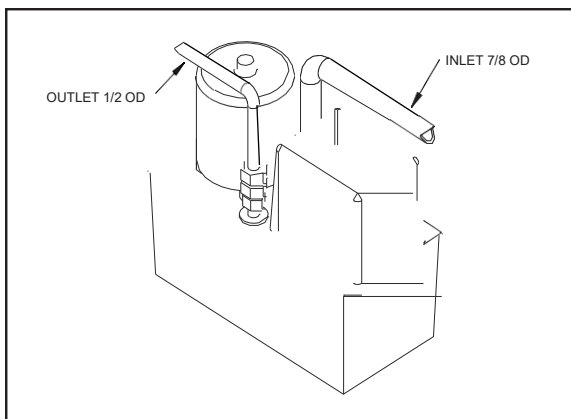
An optional condensate pump is normally factory installed with a 1/2" OD copper drain. The drain is stubbed outside of the A/C unit cabinet for the installer to connect a drain line to direct water away from the cabinet. The drain line may be 1/2" ID vinyl tubing or a 1/2" OD copper to copper sweat connection may be used.

See the installation drawing provided with your unit for the location of the drain connection.

If an optional field installed condensate pump is used, it must be positioned at the same level or below the level of the A/C cabinet. The condensate drain pan is equipped with a drain line inside the A/C cabinet. A p-trap is provided on the end of the drain line. Interconnect tubing must be field installed from the end of the drain line to the inlet side of the condensate pump (see Figure 14).

Pour some water into the condensate drain pan prior to start-up.

The condensate pump discharge line should be 1/2 inch ID vinyl tubing or 1/2 inch O.D. (maximum) copper pipe to prevent excessive back flow to the condensate pump.



**Figure 14- Field Installed Condensate Pump**

**274 Humidifier**

STULZ CyberAir systems utilize an electrode steam humidifier. A water supply line for the humidifier must be connected to the end of the copper tubing provided by the factory. 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 particulate, an external filter may be needed.

**CAUTION** 

Do not use de-mineralized water.

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

In most cases the humidifier empties into the condensate drain line during the flush/drain cycle. As an option, the drain for the humidifier may have a separate connection. Refer to the installation drawing provided with your unit for the size and location of the connection.

## 2.8 Utility Connections

### 2.8.1 Main Power

It is important that the unit nameplate be examined to determine the operating voltage, frequency and phase of the system (see Figure 15). The nameplate also provides the full load amps (FLA), the current 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's nameplate is located inside the cabinet, within the electrical box.



Manufactured By		
		
STULZ Air Technology Systems, Inc. Frederick, Maryland, USA www.stulz-ats.com Cage Code: OB716 Tel: (301) 620-2033 Fax: (301) 620-1396		
<b>CyberAiR®</b>		
Sales Order Number: -----		
Model Number:		
Item Number:		
Serial Number:		
		
Electrical Data:		
SCCR:	kA RMS Symmetrical	
Voltage:	Phase:	Hz:
No. Wires:	(Including Ground)	
FLA:	MCA:	
Max Fuse / Ckt. Bkr (HACR type per NEC):		
Heater:	kW (Nominal)	
Humidifier:	kW (Nominal)	
Evaporator Motor (1):	HP:	FLA:
Evaporator Motor (2):	HP:	FLA:
Evaporator Motor (3):	HP:	FLA:
Evaporator Motor (4):	HP:	FLA:
Condenser Motor (1):	HP:	FLA:
Condenser Motor (2):	HP:	FLA:
Condensate Pump:	HP:	FLA:
Compressor (1):	RLA:	LRA:
Compressor (2):	RLA:	LRA:
Refrigerant Type:		
Charge: Circuit #1	lb	oz
Charge: Circuit #2	lb	oz
High Side Design Pressure:	psig	
Low Side Design Pressure:	psig	
Max. Output Air Temperature:	°F	
Blower/Fan Ext. Static Press.:	in. w.g.	
Max. Inlet Hot Water Temp.:	°F	
Hot Water or Steam Pressure:	psig	
Minimum Installation Clearance:	in.	
Remote Condenser Type: -		
Suitable for Indoor:	X	Outdoor: Use
Date of Manufacture:		
Q.A. Acceptance:		

Figure 15- Sample Nameplate

#### NOTE

If the nameplate states MAX FUSE/CKT BKR, it is required to use fuses or a HACR type circuit breaker to protect the system. Other protection devices are not allowed based upon the product listing.

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

#### **CAUTION**

Improper wire connections will result in the reverse rotation of the scroll compressors and may eventually result in damage to the compressor. To correct this problem, exchange any two of the incoming main power wires at the main power disconnect switch. Do NOT rewire the unit's individual components.

#### **WARNING**

Verify power 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 become loose during transit of the equipment; therefore, it is required to verify that all wiring terminations be checked to verify they are secure.

It is important to verify that the main power supply coincides with the voltage, phase and frequency information specified on the system nameplate. The supply voltage measured at the unit must be within ±10% of the voltage specified on the system nameplate.

Downflow units are provided with pilot holes in the floor of the cabinet for the entry of the main power and control field-wiring. If necessary, these holes may be enlarged to properly fit the connector. A label stating "MAIN POWER INPUT" is in close proximity. As an option, piping and wiring may be routed through the top of the cabinet.

For upflow units with top piping, pilot holes for entry of power and control wiring are located in the top of the cabinet. For upflow units without top piping, pilot entrance holes are provided in the cabinet floor or may be field drilled into a side wall if necessary. See the installation drawing provided with your unit for recommended entrance hole locations.

Route the main power wires into the electric box and terminate the wires at the line side of the main power disconnect switch as shown in the electrical drawing.  
A

separate equipment ground lug is provided within the electrical box for termination of the earth ground wire.

**CAUTION** ⚡

Prior to unit operation, an adequate unit-to-earth ground must be connected to the unit.

**2.8.1.1 Optional Dual Power**

Route the primary and alternate power source wires to the disconnect switches in the electric box. Terminate the primary power source to switch A and the alternate power source to switch B as shown in the electrical drawing. Leave both switches in the ON position during normal operation. The system will operate with power source A unless a switchover (auto or manual) occurs. See Section 1.5.6.

The size of the electric box and location of components vary according to the STULZ CyberAir model and options selected. Figure 16 shows a sample electric box layout (with dual power option) and identifies the major components. The numbered call-outs in Figure 16 coincide with the numbered items listed below:

- |   |   |
|---|---|
| 1. Microprocessor Controller I/O Module       | 6. Alternate Power Disconnect Switch (Optional) |
| 2. Control Interface Terminals                | 7. Ground Lug                                   |
| 3. Preferred Power Selector Switch (Optional) | 8. Velocity Sensor (Optional)                   |
| 4. Contactors for Dual Power (Optional)       | 9. Motor Starter Protectors (Quantity Varies)   |
| 5. Main Power Disconnect Switch               | 10. Expansion Module (Optional)                 |



Figure 16- Electric Box

## 282 Optional Equipment

Additional control conductors may be required depending on the options purchased with the equipment. Refer to the supplied electrical schematic to determine the total number of interconnecting conductors required for your system. It is important to note that the control transformer(s) supplied with the equipment have been sized and selected based upon the expected loads for the system.

### CAUTION

Do not connect any additional loads to the system control transformers. Connecting additional loads to the factory supplied control transformers may result in overloading of the transformer.

### NOTE

All control wiring must be provided in accordance with local and national electrical code requirements for class 2 circuits.

### NOTE

Do not route control conductors together with power conductors.

### 2.8.2.1 Remote Temperature/Humidity Sensor

Field installed remote temperature/humidity sensors require a three conductor shielded cable, with the shield terminated at the unit electric box. Both the electric box and the sensor are provided with a terminal strip for the wire connections. Refer to the electrical schematic supplied with your unit for proper wire terminations.

### 2.8.2.2 Remote Water Detector

Each remote water detector requires two conductors to be wired to the control terminal board within the unit electrical box (see Figure 14). If customer furnished, the wire insulation must be rated at 600V. Refer to the electrical schematic supplied with your unit for proper wire terminations.

### 2.8.2.3 Remote Shut Down

The unit is provided with a means to remotely shut down the air conditioning unit. A normally closed switch rated at 5 amperes at 24VAC is required for this purpose. Two conductors from the normally closed switch must be connected to the control terminal board located in the electric box. Refer to the supplied electrical drawing for the appropriate wire terminations.

## 283 Interconnecting Remote Equipment

### 2.8.3.1 Water Cooled Systems (CFD/CFU-\_\_\_-D2W Models)

Systems equipped with an internal water cooled condenser do not require field wiring to external components other than to optional sensors as selected (e.g. Flow Sensors, Remote Supply Air T/H sensor, Air Pressure, Customer Alarm Inputs).

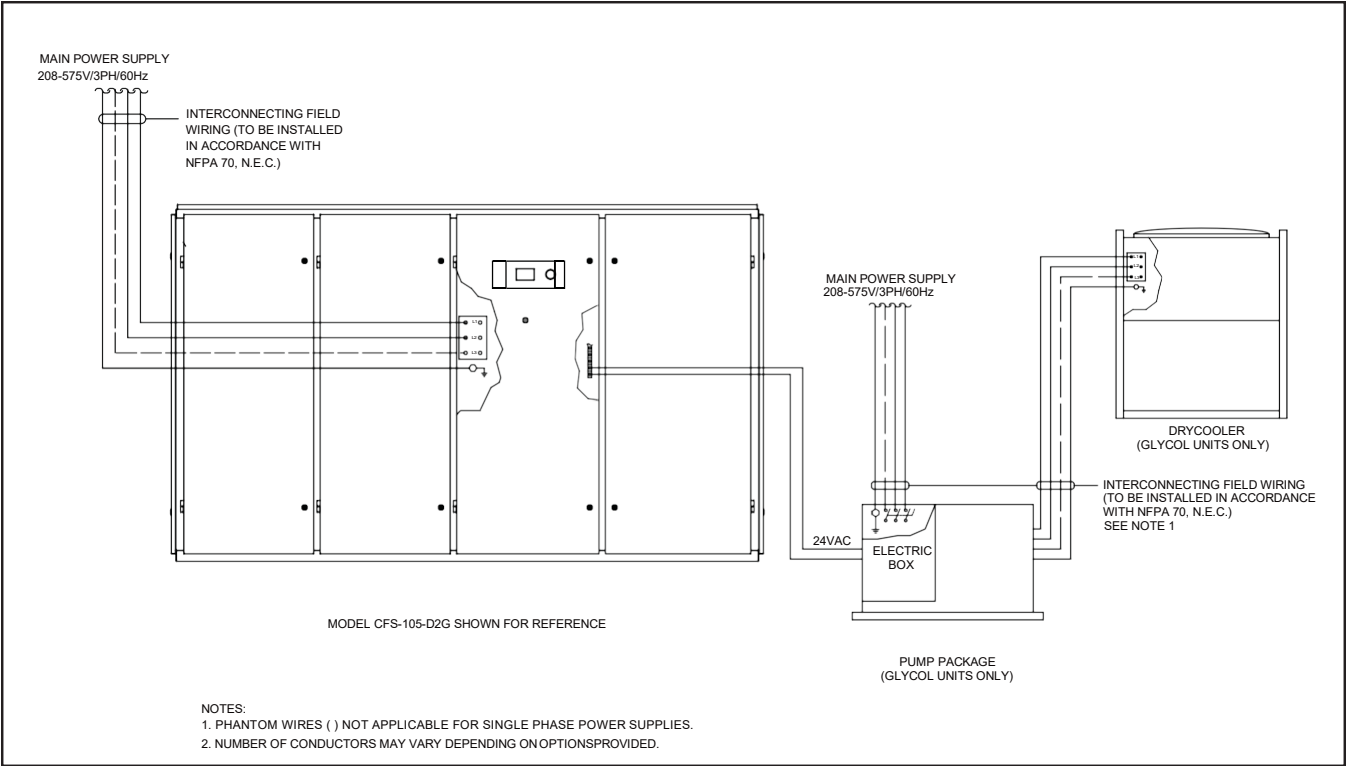
### 2.8.3.2 Glycol Cooled Systems (CFD/CFU-\_\_\_-D2G Models)

For systems equipped with a glycol-cooled system/pump package, the installer must provide main power wiring to the main power distribution block located in the pump package and the drycooler control boxes. The drycooler and pump package may each be connected directly to main power (separate connections), or the drycooler may be interconnected to main power in the pump package control box as shown in Figure 17 (single-point connection). A separate equipment ground lug is provided within each box for termination of the earth ground wire. The installer must also wire two control conductors from the control terminal board within the A/C unit to the pump package electrical box. Refer to the supplied electrical drawing for proper wire terminations.

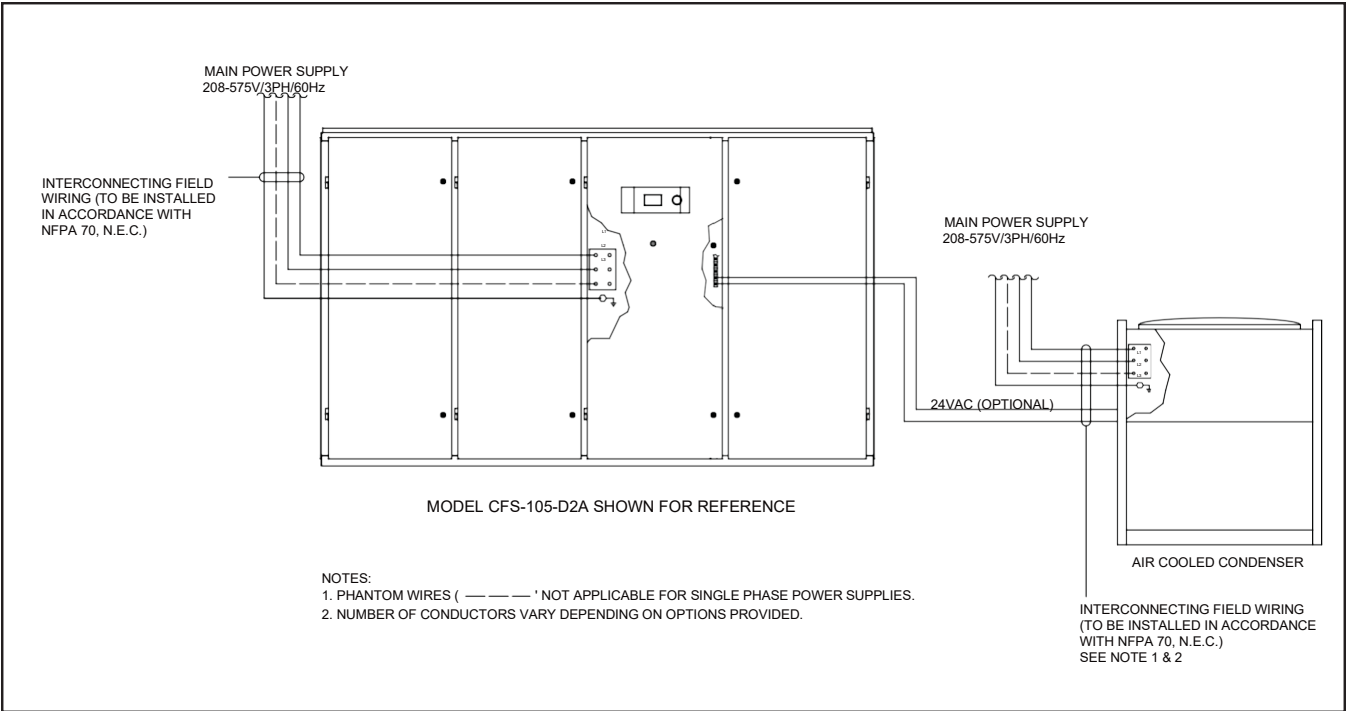
### 2.8.3.3 Air Cooled Split Systems With Remote Condenser (CFD/CFU-\_\_\_-D2A Models)

See Figure 18. For systems equipped with a remote condenser, the installer must provide main power wiring to the main power distribution block located within the remote condenser control box. A separate equipment ground lug is provided within the electrical box for termination of the earth ground wire. Refer to the electrical drawing supplied with your unit and the wiring diagram supplied with the condenser (typically located in the condenser electric box).

As an option, control wiring may be installed between the A/C system and the condenser for the system controller to enable condenser operation only when the compressor is running. You must remove the jumper from the remote condenser terminal board (see the condenser wiring diagram). Wire 24 VAC control conductors from the terminal board within the A/C unit to the remote condenser terminal board. If control wires aren't installed (and the jumper remains in place), the condenser is always enabled and will turn on and off based on the condenser's pressure control settings. Refer to the electrical drawing for the correct number of field wires needed and for the appropriate wire terminations required specifically for your system.



**Figure 17 - Field Wiring Glycol Systems**  
**Single Point Power Connection Shown for Drycooler & Pump Package**



**Figure 18 - Field Wiring Air Cooled Systems**



## 2.9 System Charging Procedures

### 291 Water-Water/Glycol Systems

All self-contained water-water/glycol cooled units (units that require no refrigerant field piping) are factory charged with R-410A refrigerant. No field charging is required. The following precautions must be observed when installing and filling the water/glycol loop:

- The **pipng** system must be **cleaned** prior to adding water/glycol to the system.
- Glycol must be **mixed** with water **before** it is added to the system. All **air** must be **bled** from the piping system. Use only **water/glycol solution** with **inhibitors** for corrosion protection.

#### CAUTION

The piping system must be flushed prior to operating the system. Failure to do so will result in equipment problems.

1. Open the vent valve at highest point of the system.
2. Fill the system until the solution is discharging from the vent with minimal signs of foaming due to air in the system.

#### 2.9.1.1 Pump

If a pump is to be used, ensure the system is filled before turning the pump on. The pump is not self-priming so it is important that there is a pressure on the suction inlet.

#### CAUTION

Do not run the pump dry.

If the pump has no pressure on the discharge side, leave the discharge valve partially shut to create a back pressure in the pump so that liquid can build up in the impeller housing to keep the impeller housing from getting too hot. Make sure there is always liquid flowing through the pump to cool the impeller and housing. If there is no liquid leaving the pump, shut the pump off immediately to prevent damage to the pump. Check for proper rotation of the motor observing the arrow on the side of the impeller.

### 292 Refrigerant Charging

#### 2.9.2.1 Remote Air-Cooled Systems

Remote air-cooled systems are provided with a dry nitrogen holding charge which must be removed before piping and charging the unit. Before charging, check the unit nameplate to confirm that charging

is performed with the correct type of refrigerant. CyberAiR systems utilize R-410A refrigerant.

#### NOTE

Refrigerant charging must be performed by a qualified air conditioning technician.

R-410A is a blended refrigerant recognized for being safer for the environment. Refrigerants that are multi-component blends have component parts with different volatilities that result in a change in composition and saturation temperature as evaporation and condensation occur. The composition of liquid R-410A refrigerant, however, remains relatively constant.

#### CAUTION

POE oil is used in systems with R-410A refrigerant. POE oil quickly absorbs moisture when exposed to air. High POE oil moisture levels react with refrigerant to form acid, which results in system contamination. Keep entire system sealed as much as possible and minimize exposure of POE oil to outside air.

R-410A operates at high pressures which must be considered when checking the operating temperatures/ pressures while charging or troubleshooting the system. Tables are provided in Section 2.9.6 showing the temperature/pressure characteristics for R-410A.

### 293 Estimating Refrigerant Charge

When charging a system with R-410A refrigerant it will be necessary to weigh in the refrigerant and confirm the charge is correct by checking the superheat and subcooling temperatures (see Section 2.9.6.1).

You can estimate the amount of refrigerant needed by adding the amount of refrigerant required for the A/C unit (Table 1) plus the condenser (Table 2) plus the interconnecting refrigerant piping between the A/C unit and the condenser (Table 3).

The values in the tables are the estimated weights for the refrigerant circuits. Depending upon site specific conditions, refrigerant may need to be added or removed when fine tuning the charge to obtain the correct superheat and sub-cooling temperatures.

**Table 1: Weight of R-410A Refrigerant For A/C Unit- Per Compressor Circuit**

A/C Unit	Approximate R-410A Charge	
Model Number	Base Charge Circuit 1	Base Charge Circuit 2
CFD-021-D2A	2.7 lbs	2.7 lbs
CFU-021-D2A	2.7 lbs	2.7 lbs
CFD-028-D2A	2.7 lbs	2.7 lbs
CFU-028-D2A	2.7 lbs	2.7 lbs
CFD-035-D2A	2.7 lbs	2.7 lbs
CFU-035-D2A	2.7 lbs	2.7 lbs
CFD-053-D2A	4.5 lbs	4.5 lbs
CFU-053-D2A	4.5 lbs	4.5 lbs
CFD-070-D2A	4.5 lbs	4.5 lbs
CFU-070-D2A	4.5 lbs	4.5 lbs
CFD-088-D2A	4.5 lbs	4.5 lbs
CFU-088-D2A	4.5 lbs	4.5 lbs
CFD-105-D2A	12.3 lbs	12.2 lbs
CFU-105-D2A	12.3 lbs	12.2 lbs

Table 2 shows the estimated charge weights for each compressor circuit in STULZ condensers. A receiver is included with the condenser if it is designed for applications where ambient conditions may drop to -30°F or lower. When selecting the condenser refrigerant weight from Table 2, determine if your condenser includes a receiver and ensure you select the charge weight from the correct column in the table.

**Table 2: Weight of R-410 Refrigerant for Condensers (Lbs. per Compressor Circuit**

SCS Condensers		
Model Number	R-410A Charge (Condenser Less Receiver)	R-410A Charge (Condenser With Receiver)
SCS-096-D	1.4	7.5
SCS-120-D	2.1	11.3
SCS-144-D	2.8	15.1
SCS-192-D	3.2	17.2
SCS-252-D	3.2	17.2
SCS-276-D	4.8	25.8
SCS-312-D	4.8	25.8
SCS-447-D	6.4	34.5
SCS-525-D	7.2	38.5
SCS-597-D	7.2	38.5
SCS-683-D	9.6	51.0
SCS-940-D	12.7	68.2

SCS-MC Micro-Channel Condensers		
Model Number	R-410A Charge (Condenser Less Receiver)	R-410A Charge (Condenser With Receiver)
SCS-MC-035-D	1.3	6.4
SCS-MC-056-D	1.3	6.4
SCS-MC-071-D	2.4	11.3
SCS-MC-111-D	2.4	11.3
SCS-MC-128-D	3.0	16.9
SCS-MC-142-D	3.9	17.8
SCS-MC-223-D	3.9	17.8
SCS-MC-264-D	5.4	19.3
SCS-MC-334-D	5.4	19.3

**Table 3: Weight of R-410A Refrigerant (Lbs./100Ft of Type L Tubing)**

Line Size O.D.	Liquid Line	Discharge Line
1/2	5.88	1.27
5/8	9.44	2.03
7/8	19.62	4.22
1 1/8	33.44	7.20
1 3/8	50.95	10.97
1 5/8	72.11	15.53
2 1/8	158.29	34.09

**Example:** Estimate the amount of R-410A refrigerant required for each compressor circuit in a system consisting of a 10 ton (CFD-035-D2A) A/C unit, connected with a 1/2" x 30 foot liquid line and 7/8" x 30 foot discharge line to a STULZ Model SCS-252-DSA dual circuit condenser.

**Circuit 1**

$$\begin{aligned}
 &+ \text{A/C Unit (Circuit 1)} &= & 2.7 \text{ lbs} \\
 &+ \text{1/2" Liquid Line: } 30 \times \frac{5.88}{100} &= & 1.764 \text{ lbs} \\
 &+ \text{7/8" Discharge Line: } 30 \times \frac{4.22}{100} &= & 1.266 \text{ lbs} \\
 &+ \text{Condenser} &= & 3.2 \text{ lbs}
 \end{aligned}$$

$$\text{Estimated Refrigerant Charge} = 8.93 \text{ lbs}$$

**(Round off to nearest lb = 9.0 lbs)**

**Circuit 2**

$$\begin{aligned}
 &+ \text{A/C Unit (Circuit 2)} &= & 2.7 \text{ lbs} \\
 &+ \text{1/2" Liquid Line: } 30 \times \frac{5.88}{100} &= & 1.764 \text{ lbs} \\
 &+ \text{7/8" Discharge Line: } 30 \times \frac{4.22}{100} &= & 1.266 \text{ lbs} \\
 &+ \text{Condenser} &= & 3.2 \text{ lbs}
 \end{aligned}$$

$$\text{Estimated Refrigerant Charge} = 8.93 \text{ lbs}$$

**(Round off to nearest lb = 9.0 lbs)**

**2.9.4 Preparing System For Charging**

1. With all the system piping connections made, perform a dry nitrogen leak detection test on the system. Using dry nitrogen only, pressurize the system to 150 psig. Ensure all service and solenoid valves are energized open and that no part of the system is isolated from the pressurized nitrogen.
2. Since there is no refrigerant in the system to detect at this point, leaks may be detected by observing if there's been a change in the standing pressure after 12 hours. A significant drop in pressure (>10 psig) indicates a leak in the system that needs to be repaired. After the system is determined to be free of leaks, you may evacuate the system.

**EVACUATE THE SYSTEM**

**CAUTION** 

A proper vacuum must be drawn on the refrigerant system to remove moisture prior to charging. If this is not done the refrigerant charge will combine with moisture in the pipes to form an acid that will eventually lead to compressor failure. A triple evacuation procedure with dry nitrogen is recommended especially for systems with newly installed refrigerant piping.

**NOTE**

A vacuum pump should be used that is capable of evacuating the entire volume of the A/C system, including newly installed or existing piping. It is essential to use a well maintained pump that is in good operating condition. Always ensure it contains clean, fresh oil. Manufacturers recommend you change the oil in the pump regularly to maintain its ability to remove moisture.

**NOTE**

Use high quality hoses ensuring they are free of defects and don't leak. It is recommended to use copper tubing instead of hoses if possible due to the low vacuum that must be attained when evacuating the system. The use of short, large diameter hoses helps reduce evacuation time.

3. After ensuring there are no leaks, relieve pressure and evacuate the entire system while maintaining all the solenoids open. Pull an initial vacuum of 1500 microns or lower using the suction and discharge service ports.

**NOTE**

When pulling a vacuum, the Schrader valves will unnecessarily restrict the openings, increasing the evacuation time. During the evacuation process it is recommended to remove the Schrader valve cores with a Schrader valve removal tool and draw the vacuum through the port on the removal tool.

4. If you cannot evacuate the system below 1500 microns, close the vacuum pump isolation valve and perform a rate-of-rise test by observing the standing pressure over time. If the pressure rises slowly (up to 200 microns in 15 minutes) it indicates moisture is in the system that still needs to be boiled off. Proceed to step #5. If the pressure rises rapidly up to atmospheric pressure (more than 50 microns per minute) it indicates a leak that wasn't detected during step #2. In this case troubleshoot the entire system for leaks and repair them. Then begin the initial evacuation process again starting at step #3.
5. If no leaks are detected after the initial vacuum, release the vacuum and pressurize the system with 2-3 lbs of dry nitrogen. Allow the system to stand for two hours with the dry nitrogen charge. This gives time for the nitrogen molecules to disperse in the system absorbing moisture.
6. After two hours, release the pressure. Then turn on the vacuum pump and evacuate the system a second time down to 1500 microns or less. Close the vacuum pump isolation valve and pressurize the system again with dry nitrogen and allow the system to stand for two hours as in step #5.
7. After two hours release the pressure. Turn on the vacuum pump and complete the process of evacuating the system, this time with a goal of achieving a 250 micron vacuum or less. Close the vacuum pump isolation valve. When you can hold the vacuum at 500 microns or lower for at least 2 hours with no significant rise in pressure, the system is ready to charge.
8. Replace the Schrader valve cores if you removed them during the evacuation steps. You may now introduce the refrigerant charge through the Schrader valves.

**2.9.5 Refrigerant Charging Procedures**

R-410A refrigerant must be weighed in when performing the charge. Referring to Section 2.9.3, calculate the estimated amount of refrigerant needed for your system.

When charging a system using a blended refrigerant, it is essential that the composition of the refrigerant is maintained. To ensure correct composition, introduce the refrigerant (R-410A) into the system in liquid form rather than vapor form. Cylinders which are not provided with dip tubes should be inverted to allow **only liquid** refrigerant to charge the system. Keeping the temperature of the cylinder below 85°F will help maintain the correct refrigerant composition while the cylinder is emptied.

**WARNING** 

If refrigerant gas is released in an enclosed area, it may accumulate in low areas and near the floor displacing available oxygen. If a major leak occurs, there is a risk of asphyxiation. In such case the area should be immediately evacuated and ventilated. Personnel should remain away from the area until it is determined to be safe.

**INITIAL SYSTEM CHARGE**

Follow the step by step instructions below to charge systems using R-410A refrigerant. The initial charge will be performed by introducing liquid refrigerant to the discharge side of the compressor or an available liquid line port with the A/C unit turned Off.

1. Bleed air from hoses and break the vacuum by supplying **liquid** refrigerant (R-410A) to the discharge port near the compressor until the pressure is equalized. This holding charge allows the low pressure switch to "hold" enabling the compressor to operate throughout the process of charging the system.

**FINE TUNING THE SYSTEM CHARGE**

Once the initial charge is completed, refrigerant will need to be added with the unit running.

**CAUTION** 

An adequate heat load must be supplied to ensure a proper charge.

2. Disconnect the refrigerant cylinder from the discharge side of the compressor and connect it to the suction side.

- Referring to Section 3.0, start the A/C system and use the system controller to lower the room temperature set point 3-5°F below actual room temperature thus ensuring cooling remains on as the unit is charged.

When fine tuning the charge on cool days it may be necessary to restrict the airflow across the condenser coil to raise the pressure. The fan closest to the header must be running. When fine tuning the charge, ensure the pressures are correct for the type of refrigerant used. Refer to the tables in Section 2.9.6 for the operating temperature and pressure ranges for R-410A refrigerant.

- Block off a portion of the intake air to the condenser until a constant discharge pressure can be obtained. This will lower the possibility of overcharging. Allow the discharge pressure to rise to 445-480 psig and hold it constant.
- Slowly meter **liquid** refrigerant through the suction side while watching the pressure gauges and monitoring superheat and sub-cooling temperatures.

**CAUTION** 

Add liquid refrigerant slowly to prevent the refrigerant oil from “washing out” of the compressor.

- Take a superheat temperature reading near the feeler bulb from the auxiliary control module with the temperature measuring device being well insulated. The ideal superheat temperature is 12-15°F. Maximum allowable superheat temperature is 20°F.

**CAUTION** 

Do not exceed 20°F superheat. Exceeding this temperature may cause failure of the compressor.

- While monitoring the pressure, take a sub-cooling temperature reading on the output side of the condenser. The sub-cooling temperature should be 10-20°F.
- If necessary, (slowly) add **liquid** refrigerant to the suction side to achieve the correct sub-cooling temperature.

**CAUTION** 

Remove the blockage from the air intake of the condenser.

- Fill out the applicable sections of the Warranty Registration and Start-Up Checklist.

**29.51 -20°F Variable Speed Control**

The following instructions are for charging systems with condenser variable fan speed control using R-410A refrigerant.

- Partially block the airflow to the condenser with cardboard to raise the discharge pressure. Allow the discharge pressure to rise high enough to start the first fan only, then maintain a constant pressure between 445-470 psig. This will lower the possibility of overcharging.
- Slowly meter **liquid** refrigerant through the suction side while watching the pressure gauges and monitoring superheat and sub-cooling temperatures.

**CAUTION** 

Add liquid refrigerant slowly to prevent the refrigerant oil from “washing out” of the compressor.

- Take a superheat temperature reading near the feeler bulb from the thermal expansion valve with the temperature measuring device being well insulated. The ideal superheat temperature is 12-15°F. Maximum allowable superheat temperature is 20°F.
- While monitoring the pressure, take a sub-cooling temperature reading on the output side of the condenser. The sub-cooling temperature should be 10-20°F.
- If necessary, (slowly) add **liquid** refrigerant to the suction side to achieve the sub-cooling temperature.
- If the unit has hot gas reheat (optional), the previous steps are still followed except the hot gas reheat valve must be open to allow refrigerant to flow into the reheat coil to obtain the proper amount of refrigerant charge. This can be done by using the system controller to enable a call for dehumidification (lower the humidity set point). This process may need to be repeated several times. After cycling the system through the hot gas reheat cycle, recheck the system charge with the system only in the Cooling mode.

**CAUTION** 

Remove the blockage from the air intake of the condenser.

- Fill out the applicable sections of Warranty Registration and Start-Up Checklist.

**2952 -30°F Ambient Applications**

For units designed for -30°F operation, a receiver is used to store the refrigerant during the time the condenser is not utilizing the extra refrigerant charge.

1. Follow steps 1 - 8 in Section 2.9.5. Once superheat and sub-cooling temperatures are stabilized, additional refrigerant must be added to the receiver.

It is important not to exceed 80% of the total condenser and receiver volume to allow room for expansion.

2. The head pressure control valve setting is printed on the side of the valve body. This setting is the lowest head pressure that will be maintained during system operation. It may be necessary to add additional refrigerant to raise the head pressure to the value printed on the valve (290 psig for R-410A).
3. If a refrigerant level sight glass is included on the side of the receiver, it may be used to assist in charging the air conditioning system. The proper charge can be confirmed by viewing the level of refrigerant in the receiver(s) while the unit is running at an elevated discharge pressure.
4. Keep the air intake to the condenser blocked and maintain the discharge pressure at 445 psig and hold it constant. The condenser fan nearest the condenser header should be operating continuously. All other fans, if additional fans exist, should be off during this time.
5. Add additional refrigerant charge to the receiver as needed until the refrigerant level rises to the center of the sight glass, indicating the receiver is 80% filled.

When the refrigerant in the receiver reaches the sight glass, the unit is fully charged.

**CAUTION** 

Remove the blockage from the air intake of the condenser.

6. Fill out the applicable sections of the Warranty Registration and Start-Up Checklist.

**2.9.6 Refrigerant Characteristics**

**2961 Pressure/Temperature Settings**

The following table is provided to assist with the normal settings of the system for R-410A refrigerant. Where applicable, minimum and maximum settings are given along with normal operating pressure.

R-410A Refrigerant Pressure/Temperature Settings			
Sub-cooling °F	Normal Min.		Max.
		10	5
Superheat °F	15	10	20
Design Condensing Temp. @ 95°F Ambient	125	105	140
Suction Pressure (psig)-	130	105	155

**2962 Saturated Refrigerant Pressure**

This refrigerant temperature/pressure table is provided for reference for R-410A refrigerant.

**R-410A Refrigerant Pressures**

Temp. (°F)	Pressure (psig)
20	78.4
22	81.9
24	85.5
26	89.2
28	93.1
30	97.0
32	101
34	105
36	109
38	114
40	118
42	123
44	128
46	133
48	137
50	143
55	155
60	170
65	185
70	201

Temp. (°F)	Pressure (psig)
75	218
80	236
85	255
90	274
95	295
100	318
105	341
110	365
115	391
120	418
125	446
130	477
135	508
140	541

**294 Settings and Adjustments**

**295 Low/High Pressure Limit Switch**

Air conditioning systems utilizing DX refrigerant are equipped with hermetically sealed high-pressure and low-pressure switches. These switches are pre-set and cannot be adjusted. The high-pressure switch opens at 630 psig and has a manual reset. The low-pressure switch opens at 65 psig (± 10) and closes at 105 psig (± 10) and has an automatic reset.

## 29.6 Head Pressure Controls- Air Cooled Systems

### 2.9.6.1 -20°F Condenser Fan Speed

Used for outdoor or indoor installations where ambient condenser air inlet temperatures may fall to -20°F, variable speed condenser motor control is used to maintain head pressure. The variable speed motor is located closest to the header end of the condenser.

The fan speed control is a continual modulation of the motor's speed. The condenser fan speed controller

is factory installed in the remote outdoor condenser electric box. The fan speed controller requires no adjustment.

Wire the condenser in accordance with the electrical schematic and appropriate codes. The fan speed controller will automatically control the head pressure. On systems with more than one fan on the condenser, the remaining motors cycle on and off based on pressure.

Factory setting: Switch contacts are set to close on a pressure rise to 440 psig and open at 330 psig. Set point range is 200 to 610 psig. The differential is set at 110 psi and is adjustable.

### 2.9.6.2 -30°F Flooded Head Pressure Control

Used for outdoor or indoor installations where ambient condenser air inlet temperatures may fall to -30°F, flooded head pressure control is designed to maintain head pressure during low ambient conditions. A head pressure control valve and a receiver is used in the refrigeration circuit to back up liquid refrigerant into the condenser coil. The head pressure control valve is a 3-way modulating valve controlled by discharge pressure.

When the A/C unit begins to operate, the discharge pressure rises to 320 psig and the condenser fan is cycled on, as described in Section 2.10.2.1. When ambient temperature drops, the discharge pressure drops also. When the discharge pressure drops, the head pressure control valve diverts discharge gas away from the condenser to the receiver. Liquid flow from the condenser is restricted, causing liquid to back up in the condenser.

Flooding the condenser reduces the area available for heat transfer. The desired result is to increase the pressure into the condenser, maintaining a minimum discharge pressure during low ambient operation thus ensuring proper condensing temperature. The head pressure control valve requires no adjustment.

While the fan is running, the flooded head pressure control valve modulates the amount of discharge gas entering the receiver. As the pressure increases, the valve diverts more discharge gas to the condenser, allowing more liquid to flow from the condenser to the receiver.

When using this method of head pressure regulation there must be enough refrigerant in the system to ensure adequate charge at the lowest expected ambient temperature in which the system will be operating. A receiver is used to store the extra refrigerant when the condenser is not using it.

#### **NOTE**

Systems utilizing air cooled condensers, (D2A models), must not have a refrigerant line pressure drop over 14 psig across the condenser and the interconnecting piping to the condenser sections. See the line sizing tables in section 2.7.1.2.

## 29.7 Head Pressure Control- Water-Water/Glycol Cooled Systems

Condensing temperature is maintained by liquid flowing through a regulating valve and then into the condenser. The regulating valve opens to increase the liquid flow as the refrigerant pressure rises (or closes as the refrigerant pressure falls).

CyberAir DX units have two refrigeration circuits. Each circuit has its own pressure transducer. The system controller monitors a signal from each pressure transducer to determine how far to open the regulating valve. The controller automatically changes the control valve position to maintain head pressure based on the difference between the set point value and the actual measured value. The controller transmits a proportional 0 to 10 VDC signal to the regulating valve with 10 VDC corresponding to the valve opening 100%.

The system controller is factory set for the correct condensing pressure however, it can be adjusted to increase or decrease the pressure. Adjustment is made by entering the Factory menu in the **E<sup>2</sup>** controller. Refer to the IOM manual provided under separate cover for the system controller before making adjustments to the controller.

Adjustments should be made in small increments. Adequate time must be allowed between adjustments for the valve to fully respond to the control signal and for the changes in system operation to be observed.

## 298 Electronic Expansion Valve

STULZ CyberAir precision A/C units utilize an expansion valve for each refrigeration circuit. The electronically controlled expansion valve (EEV) maintains constant superheat at the outlet of the evaporator by metering the flow of refrigerant into the evaporator. Superheat is the difference between the refrigerant vapor temperature and its saturation temperature at a given suction pressure. By controlling superheat, the EEV keeps nearly the entire evaporator surface active while preventing liquid refrigerant from returning to the compressor.

Superheat is factory set at 12-15°F and should not need adjustment. The superheat temperature is monitored and controlled by the *E<sup>2</sup>* system controller mounted inside the electric box. Should adjustment be necessary, refer to the IOM manual provided under separate cover for the system controller. Adjustment is made by entering the Service menu.

### CAUTION

Do not exceed 20°F superheat. Exceeding this temperature may cause failure of the compressor.

## 299 Snap Acting Hot Gas Bypass (Optional)

The snap acting hot gas bypass system provides some modulated capacity control and freeze protection. The hot gas bypass system consists of a discharge bypass valve that allows some hot gas from the compressor discharge line to flow directly to the evaporator coil, in order to maintain a preset suction pressure.

The snap acting hot gas bypass system also provides freeze protection for the evaporator coil by limiting the minimum refrigerant pressure, thereby preventing the surface temperature of the evaporator coil from dropping below 32°F.

The normal control setting is 120 psig (suction pressure), read from the suction (low) side of the compressor as it operates in full hot gas bypass operation. The valve is factory set and no adjustment should be necessary. If adjustment is required, block one half of the coil and remove the adjustment cap from the end of the valve. Using a 3/8 inch wrench, turn clockwise to increase pressure or counterclockwise to lower pressure.

## 29.10 Hot Gas Reheat (Optional)

The hot gas reheat feature incorporates a hot gas reheat solenoid valve and a hot gas reheat coil. Under normal operation when no reheat is required, the hot gas reheat valve is de-energized and hot

gas flows directly from the compressor discharge to the condenser. When there is a call for reheat, the controller energizes the hot gas reheat solenoid valve. The hot gas reheat solenoid valve diverts hot gas from travelling to the condenser and directs it to the reheat coil which is mounted directly downstream of the evaporator coil. The *E<sup>2</sup>* controller can be adjusted to increase or decrease the reheat temperature.

Adjustment is made by entering the Service menu.

## 29.11 EC Fans

The speed of the EC fans is controlled via a 0 to 10 VDC signal from the system controller. The controller is pre-set by the factory for the correct fan speed configuration and should not require adjustment. If it is determined that the air flow needs adjustment, this may be done using the controller's programming menu selections. Refer to the *E<sup>2</sup>* Controller Operators Manual provided separately.

## 29.12 Humidifier Adjustment

The humidifier has an adjustable capacity potentiometer on the humidifier control circuit board. The potentiometer may need to be field adjusted if the humidifier is not supplying enough capacity for current room conditions.

It is recommended that if the humidifier capacity potentiometer requires adjustment, the adjustment is made in small increments and verified. Refer to the humidifier manual sent under separate cover with your unit for the location of the capacity adjustment potentiometer.



## 30 START-UP/COMMISSIONING

### 31 Operation

For new installations, ensure the unit is ready to operate by going through the Checklist for Completed Installation, located in Appendix A, prior to start-up.

#### **NOTE**

A Warranty Registration and Start-Up Checklist is provided with the unit data package. It should be completed during start-up and sent to STULZ. This checklist should be used as a guideline for items that need to be confirmed during start-up.

Start-up must be performed by a journeyman, refrigeration mechanic or an air conditioning technician.

### 32 Step-by-Step Start-Up Instructions

1. Ensure that the control circuit breakers, fan power switch (motor starter protectors) and additional built in optional equipment power switches are turned on.
2. Close all cabinet doors and replace all equipment removed prior to performing start-up checks.
3. Apply power to the STULZ CyberAir system at the main power disconnect switch.
4. Turn on the A/C unit using the system controller and set the desired values (set points) for room temperature and humidity. (Refer to the separate controller operating instructions included in the data package with your unit.)
5. Ensure that all fans are rotating correctly and freely without any unusual noise.

#### **WARNING**

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

6. Test cooling operation by setting the temperature set point below actual room temperature. The compressor should come on and the discharge air should feel cooler than the return air.

Both refrigeration circuits must be tested at start-up. There are several ways to force the second circuit into operation. Refer to Section 3.3 in the STULZ *E<sup>2</sup>* Series Controller Operators Manual sent in the data package with your unit.

7. Test humidification operation by creating a demand for humidification. Use an amp meter to determine current draw of the humidifier. Visually check for vapor leaving the steam head or feel if the cylinder is warm to verify if the humidifier is operational.

In all cases, 1 to 6 hours might be required to achieve the desired level or rise in humidity in the conditioned space. Once room conditions have been programmed or set, a repeat visit to the conditioned space may be required to ensure the humidifier is meeting the room's requirements.

8. Test dehumidification operation by creating a demand for dehumidification. If necessary, set the dehumidification set point 10% below actual room conditions, (the set point may already be below actual room conditions, especially at start-up). The compressor will energize to begin the dehumidification process. While in this mode, room temperature may decrease and the reheat function may activate. As conditions in the room change, you may have to readjust the set point as you check operation.
9. For electric reheat, use an amp meter on the heater circuit to determine if the heater is operational. For Hot Water Reheat ensure that the control signal has energized the hot water control valve and the temperature of the water has decreased as it passes through the unit. In all cases, 1 to 6 hours might be required to see a desired level of humidity in the conditioned space. Once room conditions have been programmed or set, a repeat visit to the conditioned site may be required to ensure the dehumidification mode is meeting the room's requirements.

### 33 Microprocessor Controller Programming

The *E<sup>2</sup>* 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 *E<sup>2</sup>* controller. The operator may view all the available menu screens through a BMS, however, changes may be made only to basic parameters such as adjusting set points and setting and acknowledging alarms. More advanced parameter adjustments may be made through the user interface display. Operating instructions for the *E<sup>2</sup>* controller are provided separately.

## 4.0 MAINTENANCE

### 4.1 Periodic General Maintenance

Systematic, periodic general maintenance of the STULZ CyberAir system is recommended for optimum performance. General maintenance should include, but is not limited to the following: replacing filters and humidifier cylinders, tightening electrical connections, checking the condensate drain line to ensure it is free of debris, cleaning the interior of the unit, inspecting the units' components visually, checking level of refrigerant and ensuring no moisture is in the refrigerant.

Use copies of the Periodic General Maintenance Checklist in this manual (see Appendix A) 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 by a journeyman or a qualified refrigeration technician only.

#### **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 electric box at the motor start protectors and at the heater and humidifier 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. Always disconnect main power prior to performing any service or repairs.

#### **WARNING**

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. To prevent personal injury, stay clear of rotating components as automatic controls may start them unexpectedly.

#### 4.1.1 Precision A/C Unit

Check the refrigerant sight glass on a monthly basis while the unit is running and ensure it is free of bubbles. Bubbles in the sight glass indicate a low

refrigerant charge or a clogged filter-drier. Check for humidity in the refrigerant by viewing the color of the indicator in the center of the sight glass and comparing it to the color scale on the outer ring. If humidity is present, the system must be evacuated and recharged.

Check the superheat and sub-cooling temperatures semi-annually and ensure they are within the range shown in the refrigerant pressure/temperature table in Section 2.9.6. If necessary, adjust the refrigerant charge to achieve the correct values. If the refrigerant level is low, check the system for leaks.

#### 4.1.1.1 Air Filter

The air filter is usually the most neglected item in an air conditioning system. To maintain efficient operation, the filter should initially 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.

#### 4.1.1.2 Fans

Periodic checks of the EC fans should include checking the wiring, fan motor mounts, housing and impeller wheel. Ensure all electrical connections are tight. Check that all mounts are secure and the impeller wheel is tightly mounted. The impeller blades should be kept free of debris.

#### 4.1.1.3 Drain Pan

To ensure proper drainage, inspect the drain pan regularly. Make sure the drain pan outlets are always free of debris and ensure the drain pan does not leak.

#### 4.1.1.4 Coils

The coil(s) should be inspected semiannually and cleaned as required following standard coil cleaning practices. Using a brush, clean the coil fins of all debris that will inhibit airflow. This can also be done with compressed air or with a commercial coil cleaner.

Check for bent or damaged coil fins and repair as necessary. Check all refrigerant lines and capillaries for vibration isolation and support as necessary. Check all piping for signs of leaks.

#### 4.1.1.5 Heat/Reheat

The heat/reheat equipment should be inspected semi-annually to ensure it is operational. If you have electric heat/reheat, inspect the heating elements to ensure they are free of debris.

### 4.1.2 Humidifier

The steam 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 location, 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.

Refer to Section 4.3.4.4 and the humidifier operator's manual supplied under separate cover for detailed instructions on changing the cylinder.

### 4.1.3 Condensate Pump

The condensate pump should be inspected semi-annually and cleaned. Ensure that the float works freely. Wipe the float with a wet cloth and detergent to remove debris. Clean the tank bottom. Check that the discharge line is open and water can pass through it freely.

### 4.1.4 Condenser

For air-cooled condensers, clean the condenser coil of all debris that will inhibit airflow. This can be done with compressed air or with a commercial coil cleaner. Check for bent or damaged coil fins and repair as necessary.

On outdoor units in winter, do not permit snow to accumulate on or around the condensing unit. Check all refrigerant lines and capillaries for vibration isolation and support as necessary. Check all refrigerant and coolant lines for signs of leaks.

## 4.2 Troubleshooting

Turn off all power to the unit before conducting any troubleshooting procedures unless the procedure specifically requires the system to operate. For troubleshooting purposes, the system may be operated with the doors open by using vice-grip pliers to turn the shaft of the main power disconnect switch to the "On" position. **NOTE: When the switch is turned on, high voltage will be present inside the cabinet.** Exercise caution 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.

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
<b>Suction Pressure Too Low</b>	a. Loss of refrigerant (bubbles in sight glass). b. Expansion valve stuck or obstructed (short cycle or continuous running). c. Clogged drier/strainer (feels cold). d. Dirty air filters (reduced airflow).	Locate leak and repair. Recharge system. Remove and clean or replace valve. Replace with new drier/strainer. Clean/replace filters.
<b>Evaporator Coil Ices</b>	a. Low airflow. b. Temperature setting too low c. Discharge air short circuiting back to return. d. Low refrigerant charge.	1. Check filters. Replace as needed. 2. Check for and clear any obstructions across or in the (supply) discharge airstream. 3. Check evaporator fan is operating 4. Check fan speed. Increase if needed using the system controller. Increase temperature set point. (68°F min.). Check discharge airflow orientation in the conditioned space. Find leak, repair and recharge system.

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
<p><b>Evaporator Fan(s) Fail to Start</b></p>	<p>a. Power failure.</p> <p>b. Motor starter protector tripped.</p> <p>c. Control transformer circuit breaker tripped.</p> <p>d. Defective contactor</p> <p>e. No control signal to fan(s).</p> <p>f. EC fan's internal overheat protection interrupted fan motor operation</p>	<p>1. Check main power source voltage.</p> <p>2. Check power input cable.</p> <p>Reset motor starter protector and check amperage of motor.</p> <p>Check for short circuit or ground fault, if none, reset circuit breaker.</p> <p>Repair or replace.</p> <p>Check the Control I/O Board for a 0-10 VDC control signal to the fan(s). Refer to the electric drawing to determine the correct I/O board terminal numbers.</p> <p>This must be done within 15 seconds of turning the disconnect switch "On" or the controller will go into "Air Proving Alarm" mode.</p> <p>Determine the cause of the interruption and correct. Possible causes are:</p> <ol style="list-style-type: none"> <li>1. Blocked rotor</li> <li>2. Low supply voltage &gt; 5 seconds</li> <li>3. Loss of phase &gt; 5 seconds</li> </ol> <p>After causes 1, 2, and 3 above are corrected, the motor will automatically reset.</p> <p>After causes 4 and 5 below are corrected, the fan(s) must be manually reset by turning off power for 20 seconds:</p> <ol style="list-style-type: none"> <li>4. Over temperature of electronics</li> <li>5. Over temperature of motor</li> </ol>
<p><b>Control is Erratic</b></p>	<p>Wiring improperly connected or broken.</p>	<p>Check wiring against schematic diagram.</p>
<p><b>Condenser Pressure Too High</b></p>	<p>a. Non condensable gas or air in the refrigeration system.</p> <p>b. Condenser air intake is blocked.</p> <p>c. Overcharge of refrigerant.</p> <p>d. Condenser fan not operating.</p> <p>e. Control pressure set too high</p> <p>f. Water/glycol temperature too high.</p> <p>g. Flow of water/glycol too low.</p>	<p>Recover refrigerant. Replace drier/strainer. Evacuate to 50 microns and recharge.</p> <p>Remove debris and clean condenser. Reclaim excess refrigerant from system.</p> <p>Check pressure/temperature operating switches and motor. Replace as needed.</p> <p>Adjust setting to obtain correct pressure.</p> <p>Check flow and operation of drycooler.</p> <ol style="list-style-type: none"> <li>1. Check glycol solution level and concentration.</li> <li>2. Valves not open or partially open. Repair or replace as needed.</li> <li>3. Air in system - bleed system.</li> </ol>

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
<b>Condenser Pressure too High (cont.)</b>	g. Flow of water/glycol too low. (cont.)	4. Check all strainers and clean if needed.
	h. Water/glycol solution not mixed	Remove solution and premix.
	prior to adding to system.	Refill system.
<b>Condenser Pressure too Low</b>	a. Loss of refrigerant (indicated by bubbles in sight glass).	Locate and repair leak. Recharge system.
	b. Condenser fan controls not set properly.	Adjust or repair controls.
	c. Control pressure set too low.	Readjust to 440 psig.
<b>Noisy Compressor</b>	<p>a. Expansion valve stuck in open position (abnormally cold suction line).</p> <p>b. Worn or scarred compressor bearings.</p> <p>c. Liquid slugging.</p> <p>d. Scroll compressor not properly phased.</p>	<p>Ensure feeder bulb is tight on suction line. Check operation and superheat.</p> <p>Replace compressor.</p> <p>System overcharged. Reclaim excess refrigerant.</p> <p>Phase correctly at main power source. <b>DO NOT REWIRE COMPRESSOR.</b></p>
<b>Compressor Fails to Start</b>	<p>a. Temperature set point too high.</p> <p>b. Compressor internal protector is open.</p> <p>c. Complete loss of refrigerant charge (low pressure safety switch).</p> <p>d. Condenser pressure too high (high pressure safety switch).</p> <p>e. Minimum off time has not expired.</p>	<p>Adjust to desired temperature.</p> <p>Check compressor for short circuit or ground.</p> <p>Locate and repair leak. Recharge system.</p> <p>Check condenser for obstructions.</p> <p>Wait for time to expire.</p>
<b>System Short of Capacity</b>	<p>a. Low refrigerant (indicated by bubbles in sight glass).</p> <p>b. Expansion valve stuck or obstructed (short cycling or continuous running).</p> <p>c. Clogged drier/strainer (feels cold).</p> <p>d. Reduced airflow.</p>	<p>Check for leaks. Repair and recharge system.</p> <p>Remove valve and clear obstruction or replace valve.</p> <p>Replace with new drier/ strainer.</p> <p>Check fan speed setting, filters and evaporator coil.</p>
<b>Compressor Short Cycles</b>	<p>a. Low line voltage causing compressor to overheat.</p> <p>b. Dirty or iced-over evaporator coil.</p> <p>c. Reduced airflow.</p>	<p>Check power source for cause of low line voltage.</p> <p>Defrost and/or clean coil.</p> <p>Check air filters and supply fan speed setting (when applicable).</p>

SYMPTOM	PROBABLE CAUSE	RECOMMENDATION
<p><b>Compressor Short Cycles (cont.)</b></p>	<p>d. Lack of refrigerant.</p> <p>e. Short circuiting of conditioned air.</p> <p>f. Return temperature sensor is improperly located.</p>	<p>Check for leak. Repair and recharge system.</p> <ol style="list-style-type: none"> <li>1. Supply and/or return grilles are incorrectly oriented. Reorient grilles.</li> <li>2. Supply and return grilles are too close together. Move further apart.</li> <li>3. Insufficient heat load. Add temporary heat load to compensate.</li> </ol> <p>Check for supply registers that may be too close to the return temperature sensor. Relocate sensor if necessary.</p>
<p><b>Water- Water/Glycol Valve Fails to Open or Close</b></p>	<p>a. Temperature set point too high or too low.</p> <p>b. No control power to the valve.</p> <p>c. Actuator failed.</p>	<p>Adjust temperature setting.</p> <p>Valve actuator wiring is faulty. Check wiring against schematic and rewire if necessary.</p> <p>Replace actuator.</p>
<p><b>Electric Heater Inoperable</b></p>	<p>a. Circuit breaker tripped.</p> <p>b. Temperature set point too low.</p> <p>c. Overheat switch open.</p> <p>d. Manual reset overheat safety switch tripped.</p> <p>e. Heater element burned out.</p>	<p>Check for short circuit; reset circuit breaker.</p> <p>Increase temperature set point.</p> <p>Insufficient air flow across heater elements. Check for dirty filters or obstructions that may reduce air flow. Correct or replace as needed.</p> <p>Reset manual overheat safety switch (see item immediately above).</p> <p>Check continuity with an ohmmeter Replace heater element.</p>
<p><b>Hot Water Heater Inoperable</b></p>	<p>a. Low hot water flow.</p> <p>b. Hot water supply temperature too low</p> <p>c. Temperature set point too low</p> <p>d. Control power interrupted</p>	<p>Check hot water flow at supply source. Inspect piping for leaks or obstructions.</p> <p>Check hot water supply</p> <p>Increase temperature set point</p> <p>Check for loose or broken wires</p>

## 4.3 Field Service

### NOTE

Do not attempt to make 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.

### **WARNING**

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

### 4.3.1 Leak Detection

Several methods can be used to detect a leak in the refrigeration system. The most modern and easiest method 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.

### 4.3.2 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.

### 4.3.3 Refrigerant Piping

When replacing components within the cabinet of the unit, 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. For liquid line repairs at the drier, strainer, 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.

## 4.3.4 General Common Repairs/ Component Replacement

### 4.3.4.1 Compressor Failure

The compressor is the most important component of the air conditioner. Numerous safety devices are provided to protect the compressor from failing.

If a compressor failure has occurred, 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.

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

### **CAUTION**

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

All electrical connections should be checked to ensure they are tight and properly made. Check all circuit breakers, contactors and wiring. The contactors 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 by using a burnout filter kit before a new compressor is placed in service. Not only must the compressor be replaced, but also the entire refrigeration circuit must be cleaned of the harmful contaminants left by the burnout. See section 4.3.4.3 (Burn-Out/Acidic Cleanup) for the proper cleaning procedure.

If there is no acid in the oil, there has been a mechanical failure. See section 4.3.4.2 (Standard Cleanout) 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 the compressor.

**CAUTION** 

POE oil is used in systems with R-410A refrigerant. If a replacement compressor is provided, ensure that it is filled with POE oil before installing.

**4.3.4.2 Standard Cleanout Procedure**

**NOTE**

Cleaning operations must be performed by a journeyman, refrigeration mechanic, or air conditioning technician.

1. Turn off power to the unit at the main power disconnect switch.
2. Remove the old compressor and install the new compressor.
3. Remove the liquid line drier and install an oversized liquid line filter-drier (one size larger than the normal selection size).
4. 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.
5. Recharge the system.
6. Turn on the power at the main power disconnect switch and start the system at the controller.

**4.3.4.3 Burn-Out/Acidic Cleanup Procedure**

**CAUTION** 

Avoid touching or allowing the gas and oil from contacting bare skin. Severe burns will result. Use long rubber gloves to handle contaminated parts.

**NOTE**

Cleaning operations must be performed by a journeyman, refrigeration mechanic, or air conditioning technician.

1. These systems should be cleaned using the suction line filter-drier method.
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 an oversized liquid line filter-drier (one size larger than the normal selection size).
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 at the controller.
10. The permanently installed 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 2 weeks, examine oil to determine if another suction line filter-drier change is necessary.

**4.3.4.4 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. Refer to the humidifier operator's manual supplied under separate cover for detailed instructions on changing the cylinder. The following procedures are to be followed when replacing 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 ambient humidity to allow the cylinder to cool down before removing the cylinder.

1. Turn the A/C unit Off by pressing (and holding) the Enter key on the **E<sup>2</sup>** controller.
2. Turn off the water supply to the humidifier.
3. Turn the main power disconnect switch(es) Off and open the doors of the A/C unit.
4. Turn the fan motor starter protectors (Q01, Q02, Q03,...) to the Off position.
5. Fashion a jumper wire and install it across the terminals on the airflow switch (F40).



6. Using a pair of vise grips, turn the shaft of the main power switch to the On position to provide power for the humidifier drain solenoid.
7. Drain the cylinder by pushing the “On-Off-Drain” switch to the Drain position.
8. When drained, push the “On-Off-Drain” switch to the Off position.
9. Turn the main power disconnect switch Off to disconnect power from the humidifier and remove the jumper from the airflow switch.
10. The power wires to the cylinder are attached by cylinder plugs to the electrode pins on top of the cylinder. Pull these plugs vertically off the pins.

**CAUTION** 

The cylinder and steam hose may be hot and burns may result.

11. Loosen the steam hose clamp(s) and pull the steam hose off vertically.
12. Using a flat head screwdriver, press the tab on the cable tie to release it. Lift the cylinder straight up to disengage it from the humidifier.

13. Place the new cylinder on the side mounting slots within the unit, ensuring the cylinder mounting stubs are seated properly.
14. Replace the cylinder plugs on the pins, ensuring the white sensor plug goes on the single pin, which is offset from the others.
15. Ensure the plugs are secured on the pins. If the plugs are loose, they may be temporarily squeezed together, however, the plugs must be replaced since a loose plug could generate enough heat to melt and destroy the plug.
16. Replace the steam hose and tighten the clamp(s).
17. Push the “On-Off-Drain” switch to the On position.
18. Turn the fan motor starter protectors (Q01, Q02, Q03,...) to the On position.
19. Close the A/C unit doors and turn the main power disconnect switch(es) to the On position.
20. Turn on the water supply to the humidifier.
21. Turn the A/C unit On by pressing the Enter key on the **E<sup>2</sup>** controller.
22. Adjust the humidity to the desired set point.

If the humidifier is to be shut down for an extended period, always drain the cylinder first. Follow the above steps (1 through 8) ensuring the “On-Off-Drain” switch is in the Off position. Failure to do this will drastically shorten the cylinder life.

**4.3.4.5 Air Filter Replacement**

The air filters are accessed from inside the cabinet. To change the filters, open the front doors of the cabinet. For upflow units, the filters are located behind the air intake grilles. For downflow units, the filters are located at the top where the label “FILTER ACCESS” appears. Remove the old filters from the trays. Insert the new filter(s) ensuring the directional airflow arrows on the filters are correct.

## 5.0 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

### 5.1 Factory Authorized Start Up/Warranty Inspection

STULZ recommends purchasing Factory Authorized Start Up/Warranty Inspection for all new STULZ precision cooling equipment. Factory Authorized Start Up/Warranty Inspection ensures that your equipment is installed and operating per STULZ recommended guidelines. This essential service guarantees that STULZ equipment has the best warranty coverage available.

STULZ precision cooling equipment is covered by an industry leading 24 Month Upgraded Parts Warranty and 90 Day Labor Warranty once Factory Authorized Warranty Inspection/Start-Up is performed and Start Up Checklists are returned and validated by STULZ Product Support.

A Limited 12 Month Parts Only Warranty applies if Factory Authorized Start Up/Warranty is not purchased and Start Up Checklists are received from an unauthorized party and validated by STULZ Product Support.

The STULZ Product Support coordinates all Factory Authorized Services and ensures only STULZ certified technicians are dispatched to perform your Factory Authorized Start Up/Warranty Inspection. Please contact the STULZ Product Support with field service requests at (888) 529-1266 Monday through Friday from 8:00 a.m. to 5:00 p.m. EST.

### 5.2 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

### 5.3 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

am 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
- Serial Number
- STULZ Item 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.

## 5.4 Obtaining Spare/Replacement Parts

Maintaining a recommended spare parts inventory is an industry best practice for critical facilities. Onsite 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. To receive credit for returned repair/replacement parts, the parts must be returned to STULZ within 30 days of the purchase date. Spare part sales over 30 days old will be considered final and the parts will remain the sole property of the ordering party.

APPENDIX A –FORMS

Checklist for Completed Installation

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li><input type="checkbox"/> 1 Proper clearances for service access have been maintained around equipment.</li> <li><input type="checkbox"/> 2 Equipment is level and mounting fasteners (if applicable) are tight.</li> <li><input type="checkbox"/> 3 Piping completed to refrigerant or coolant loop (if required).</li> <li><input type="checkbox"/> 4 All field installed piping leak tested.</li> <li><input type="checkbox"/> 5 Refrigerant charge added (if required).</li> <li><input type="checkbox"/> 6 Condensate pump installed (if required).</li> <li><input type="checkbox"/> 7 Condensate drain line connected and trap is filled with water.</li> <li><input type="checkbox"/> 8 Water supply line connected to humidifier (if required). If manual cut-off valve is installed, open valve.</li> <li><input type="checkbox"/> 9 Humidifier “On/Off/Drain” switch is in “On” position.</li> <li><input type="checkbox"/> 10 Plenum box installed (if required).</li> <li><input type="checkbox"/> 11 Filter(s) installed.</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> 12 Ductwork completed (if required).</li> <li><input type="checkbox"/> 13 Incoming line voltage matches equipment nominal nameplated rating <math>\pm</math> tolerances.</li> <li><input type="checkbox"/> 14 Main power wiring connections to the equipment, including earth ground, have been properly installed.</li> <li><input type="checkbox"/> 15 Customer supplied main power circuit breaker (HACR type) or fuses have proper ratings for equipment installed.</li> <li><input type="checkbox"/> 16 All wiring connections are tight.</li> <li><input type="checkbox"/> 17 Control wiring connections completed to evaporator and condenser/condensing unit (if required), including wiring to wall mounted control panel and optional controls.</li> <li><input type="checkbox"/> 18 Foreign materials have been removed from inside and around all equipment installed (ship- ping materials, construction materials, tools, etc.).</li> <li><input type="checkbox"/> 19 Inspect all piping connections for leaks during initial operation.</li> </ul> |
|--|---|



STULZ USA  
 (888) 529-1266  
[www.stulz-usa.com](http://www.stulz-usa.com)

### Maintenance Checklist

<b>Prepared by</b>		<b>Model Number</b>	
<b>Title</b>		<b>Item Number</b>	
<b>Date</b>		<b>Serial Number</b>	

### Monthly

Filters	Y/N	Fans	Y/N	Condensate Drain	Y/N
Cleanliness		Fan(s) rotate		Drain is open	
No obstructions				Condensate pan safety switch operates freely	
Additional					
Check chilled water/hot water circuits for air (bleed as required)					
Coils clean and clear of obstructions					
Humidifier cylinder and controls operate properly					

### Semi-Monthly

Tasks	Y/N	Tasks	Y/N
Tighten electrical connections		Clean coils	
Check contacts on contactors for pitting		Clean condensate pump	
Heat/reheat operational		Inspect and clean CW screen	
Clean unit			

### Annually

Tasks	Y/N
Inspect chilled water unit for leaks and corrosion	
Conduct a complete check of all services listed above	
Clean unit interior	

## Comments

Identify below all unit concerns for follow up actions below.

If you need technical support, call 888 529 1266 or email [stulztechnicalsupport@stulz-ats.com](mailto:stulztechnicalsupport@stulz-ats.com). Support is available 24/7/365. Provide the model number, serial number, and STULZ item number from the unit nameplate. This will speed up the process and ensure accuracy.

Signature: \_\_\_\_\_

## Appendix B- Glossary

Term	Definition	Term	Definition
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers	IT	Information Technology
BTUH/Hr	British Thermal Units Per Hour	IOM	Installation, Operation, and Maintenance Manual
CCD	Compact-CWE	Kw	kilowatt
CFM	Cubic Feet Per Minute	kVA	Kilo Volt Amps
CNDCT	Conductor	LWT	Leaving Water Temperature
CRAC	Computer Room Air Conditioner	MAX CKT BKR	Maximum Circuit Breaker
CRAH	Computer Room Air Handler	MAX FUSE	Maximum Fuse
CW	Chilled Water	MCA	Minimum Circuit Ampacity
DB	Dry Bulb	NEC	National Electric Code
DF	Downflow	NFPA	National Fire Protection Agency
E <sup>2</sup>	Energy Efficiency	PH	Phase
EC	Electronically Commutated	PSI	Pounds Per Square Inch
DP	Dewpoint	PSIG	Pounds Per Square Inch Gauge
DX	Direct Expansion Systems	RLA	Run Load Amps
ESD	Electrostatic Discharge	RMA	Return Material Authorization
EST	Eastern Standard Time	R-Value	Thermal Resistance
°F	Degrees Fahrenheit	SATS	STULZ Air Technology Systems, Inc.
FLA	Full Load Amps	SDS	Safety Data Sheet
FOB	Freight on Board	SPDT	Single Pole, Double Throw
HGBP	Hot Gas Bypass	UF	Upflow
HACR	Heating, Air Conditioning, Refrigeration	UL	Underwriters Laboratories
HP	Horsepower	UPS	Uninterruptible Power Supply
HVAC	Heating, Ventilation and Air Conditioning	V	Volt
HX	Heat Exchanger	VA	Volt-Amperes
Hz	Hertz	VAC	Volt, Alternating Current
IAQ	Indoor Air Quality	VFD	Variable Frequency Drive
in. w.g.	Inches of Water Gauge	W	Watt(s)



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