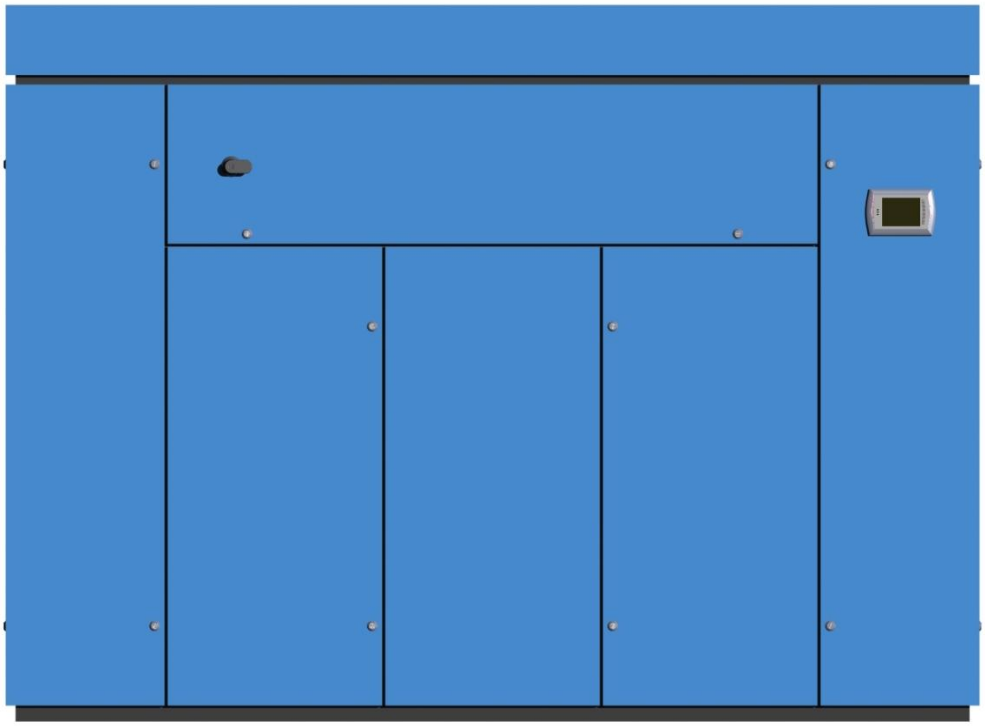
COMPU-AIRE INC.
Specialized Environmental Air Conditioning Systems

SYSTEM 2000
CHILLED WATER (CAC) EC SERIES
-INSTALLATION OPERATIONS AND MAINTENANCE MANUAL-



8167 Byron Road Whittier, CA 90606
Phone: (562) 945-8971 Fax: (562) 696-0724
www.compu-aire.com

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1.0 CONTACTING COMPU-AIRE FOR TECHNICAL ASSISTANCE

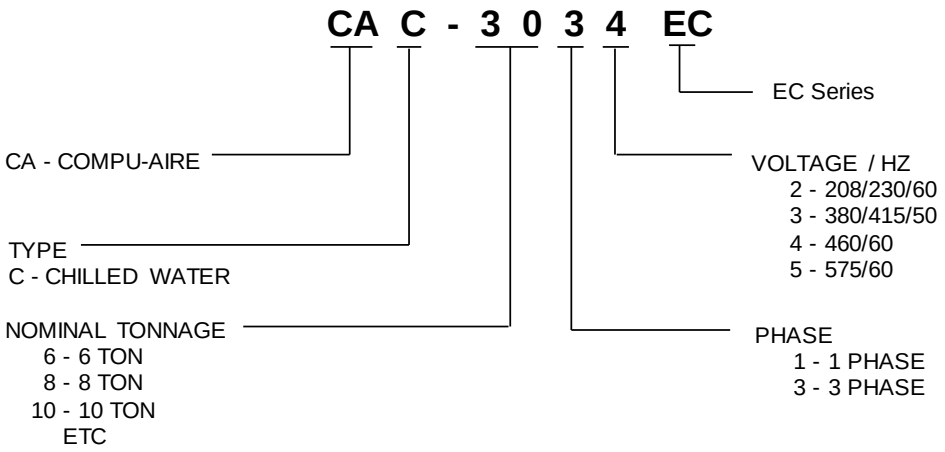
Compu-Aire, Inc. uses the latest in electronic and software technologies to develop some of the most reliable and cost efficient air conditioning systems in the world. Since many of our customer installations are sensitive to down time, we stock nearly all components for your system ready for same day shipment. In addition, our service departments can usually diagnose and repair the electronic components and return them to you within a few days.

Our customer support staff is available should you require assistance in diagnosing a problem or in setting up your air conditioning system. During usual business hour, you may call at (562) 945-8971 between 8:00am and 5:00pm Pacific time, Monday through Friday except holidays, or you may send a facsimile message at (562) 696-0724 anytime. Finally, you may write us at Compu-Aire, Inc., 8167 Byron Road, Whittier, CA 90606.

Please do not return system components without prior authorization from Compu-Aire. Whether repair or replacement is required for in warranty or out of warranty parts, Compu-Aire must know what is being returned to keep proper records of returned parts. Call Compu-Aire's service center for a returned materials authorization number (RMA) and clearly mark all packages on the outside with the number before sending them to us.

When contacting the factory, please have information ready as to the model and size of the air conditioner system and most important, the job number. Compu-Aire keeps a file on each machine sold detailing system components using this latter number. All such information can be found on the Warranty Plate attached to each machine.

2.0 PRODCUT MODEL INFORMATION



SAFETY INSTRUCTIONS

This user's manual contains important safety instructions that should be followed to properly install and maintain Compu-Aire system 2000 Chilled Water EC series. Read this manual thoroughly before attempting to install or operate this unit. Store this manual at safe place for future reference.

Adhere to all warnings, cautions and safety instructions on the unit and in this manual. Follow all local codes and safety requirements to install and service this unit.

WARNING

Installation and service of this equipment should be done by qualified personnel who have been specially trained and qualified in the installation of specific HVAC equipment. Improper installation could result in unaccountable loss or damage. ***COMPU-AIRE System 2000 series equipment requires a permanent power connection from an isolated circuit breaker. Customer must provide earth ground to the unit per NEC, CEC and local codes as applicable.***

- Risk of high speed moving parts can cause injury or death.
- Risk of heavy unit falling over
- Risk of hot surfaces, sharp edges, splinters and exposed fasteners can cause injury

WARNING

High voltage danger!

Arc flash and electric shock hazard.

Disconnect main power supply from the feeder before working on this unit. Proceed with caution and always wear protective equipment per NFPA 70E before working within electrical control panel. Failure to comply can cause serious injury or death.

WARNING

Evaporator unit requires drain connections and water supply. Do not locate these connections above any equipment that could sustain water damage.

NOTICE

- Improper storage can cause unit damage. Keep the unit upright and store it indoor. Protect the unit from dampness, freezing temperatures and contact damage.
- Risk of overhead interference. The unit may be too tall to fit through a doorway. Measure the unit and doorway heights and follow the installation plans to verify clearances prior to moving the unit.
- Risk of clogged or leaking drain lines. Drain line must be inspected and maintained to ensure that drain water runs freely through the drain system. Improper installation, application and service practices can result in water leakage from the unit. Water leakage can cause severe property damage and loss of critical data center equipment. Suitable leak detection system shall be installed for the unit and water supply lines to minimize the damage.
- Risk of leaking unit coil/or piping due to freezing and/or corrosion can cause equipment and building damage. Use proper antifreeze and inhibitors to prevent freezing and premature coil corrosion. If required, the water or water/glycol solution shall be analyzed every six months to determine the pattern of inhibitor depletion.

3.0 GENERAL EQUIPMENT DESCRIPTION

The Compu-Aire chilled water series is a complete environmental control system, factory wired, tested, and specifically designed to provide temperature, humidity, and dust control for computer room installation. System 2000 is designed to provide precise temperature control by utilizing advanced digital and analog control via a programmable logic controller. Discharge air in the unit is provided by utilizing variable frequency fan blowers also known as plug or EC fans. The unit as shipped from the factory includes blower/motor package, chilled water coil, water control valve, electrical control package, and other specified special options.

4.0 RECEIPT OF UNIT AND TRANSPORTATION

Upon receipt of the unit, a visual inspection is required. The unit packaging should be entirely intact and the crate should not be damaged. Transport the unit to the desired location in the upright position to avoid damaging to any external panels or internal components. Once the unit is uncrated and in the desired location, inspection of the unit for any external damage is crucial as this may be indicative of internal damage. Any signs of damage to the packaging or system panels or incomplete shipments require a claim to be filed with the shipping company. Freight damage claims are the responsibility of the receiver.

Any items designated as field installed shall be packaged inside of the unit and must be removed and installed prior to startup of the equipment.

Optional articles such as jack-stand parts, condensate pump, and remote control panel are packaged separately.

REPORT ANY DAMAGE TO THE CARRIER. COMPU-AIRE IS NOT RESPONSIBLE FOR FILING OF ANY CLAIMS. ALL NEEDED INSPECTION AND CLAIM FILING IS THE RESPONSIBILITY OF THE RECEIVER.

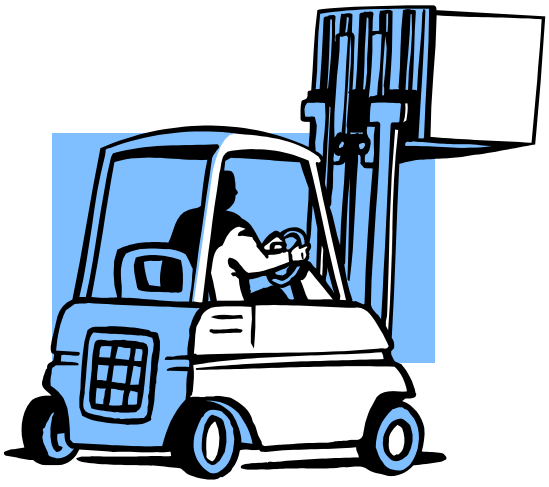


Figure 1: LOADING UNITS

5.0 LOCATING THE UNIT

The location of the unit shall be selected based on air distribution in the room and service access requirement. System 2000 CW EC series units are available with two air flow configurations. The down flow units are used for raised floor applications. The up flow units with plenum or duct connection are available for rooms without raised floor. Refer to unit dimension drawing for dimension and access requirements. Proper clearance is important for the unit function and access to various components for service.

Front clearance: 36”

Left clearance: 36”

Right clearance: 36”

- Install unit on leveled solid floor that can support the unit weight and vibrations.
- Securely mount the unit with floor and brace it with wall if needed.
- Install the unit closer to the largest heat load.

Air distribution is very important for proper unit operation. Air balancing is required to obtain design CFM at site. Fan speed can be adjusted from the controller as needed. Several feet of clearance must be maintained between the supply air and return air intake of the unit. In existing room, the unit supply air shall be directed towards the air intake side of the heat load. Always locate air intake of the servers and any other heat load in the cold aisle for efficient air distribution. The unit supply air shall never be directed towards the exhaust fan of any heat load in the room.

Down Flow Units:

Down flow units are required to be installed on floor stands. Verify that the raised floor has been properly sized for the design air flow. The raised floor shall be free of air flow restrictions. The height of the adjustable floor stand can be raised or lowered through the use of the

adjusting rods. The supply air shall be directed into the cold aisles and avoid any short cycling of cold air back to the unit return air. Floor stand height for down flow models shall be selected based on unit CFM, fan size and static pressure requirement. The floor stand must be securely mounted and all locknuts must be tightened to assure rigidity. See provided floor stand drawing for installation detail.

Up Flow units: The unit may be placed directly on the sub floor. The up flow unit may have duct connection or an optional discharge air plenum. Typical up flow unit has front return configuration but optional rear return with filter box is available.

WARNING

Risk of high-speed moving parts can cause injury or death. Disconnect all local and remote electric power supplies and make sure blowers are stopped rotating before working on the unit.

Do not operate up-flow units without installing a supply air plenum, ductwork or protective guard over the blower openings.

6.0 UNIT DIMENSIONS

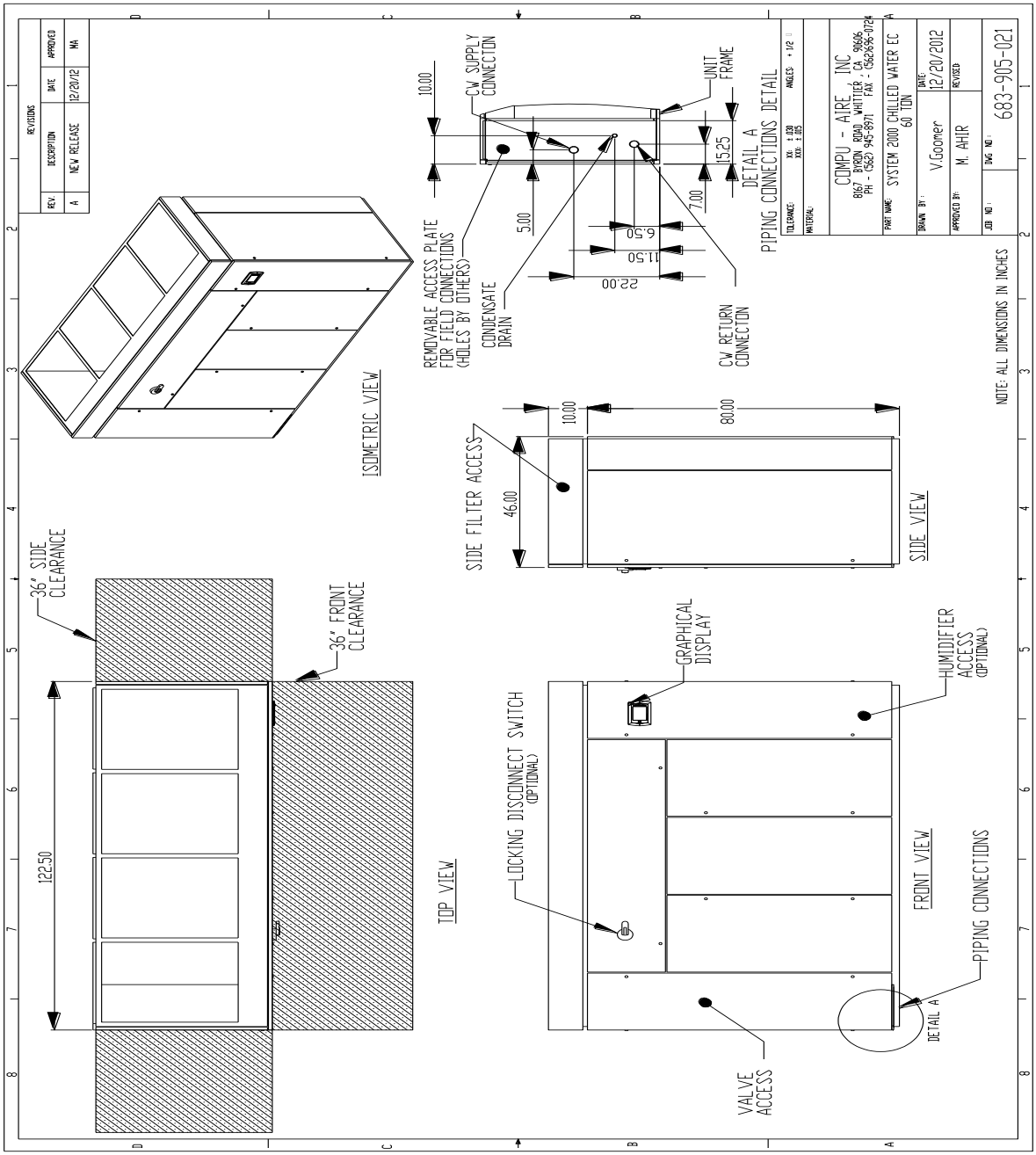


Figure 2: SYSTEM OVERVIEW

7.0 COMPONENT INDENTIFICATION

7.1 Front Layout

Figure 3: FRONT VIEW LAYOUT

NUMBER	NAME
1, 4, 8, 9	ACCESS DOOR
2	HIGH VOLTAGE CONTROL PANEL
3	CHILLED WATER COIL
5	CHILLED WATER PIPING
6	EC PLUG FAN1
7	LOW VOLTAGE CONTROL PANEL
10	EC PLUG FAN2
11	EC PLUG FAN3

Table 1: SYSTEM COMPONENTS

7.2 High Voltage Control Panel

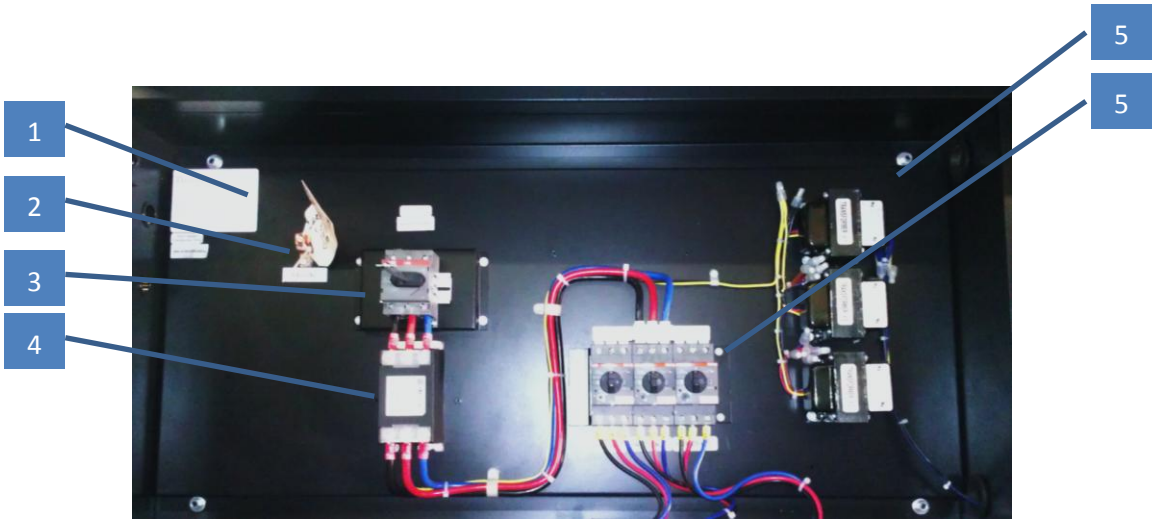


Figure 4: HIGH VOLTAGE CONTROL PANEL LAYOUT

NUMBER	NAME
1	WARNING LABELS
2	GROUND LUG
3	DISCONNECT SWITCH
4	EMC FILTER
5	TRANSFORMER
6	MOTOR PROTECTOR

Table 2: CONTROL PANEL COMPONENTS

7.3 Sensors

NUMBER	NAME
1	TEMPERATURE/HUMIDITY SENSOR
2	SMOKE DETECTOR
3	AIR FLOW SWITCH

Table 3: SMOKE DETECTOR

7.4 Low Voltage Control Panel

Figure 5: LOW VOLTAGE CONTROL PANEL LAYOUT

NUMBER	NAME
1	AUXILARY RELAY
2	TERMINAL BLOCK
3	SMOKE ALARM RECTIFIER
4	CONDENSATE MODULE
5	PLC CONTROLLER
6	AIR FLOW SWITCH

Table 4: LOW VOLTAGE COMPONENTS

7.5 Chilled Water Components

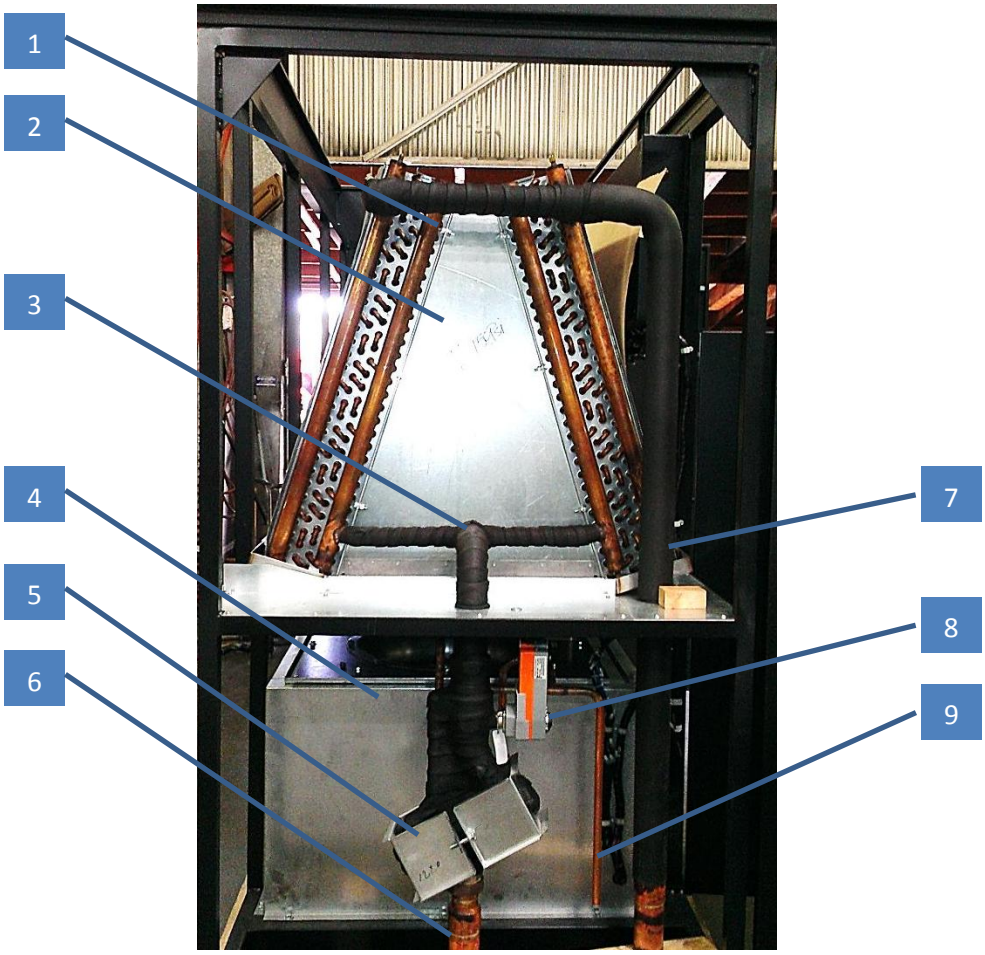


Figure 4: CHILLED WATER COMPONENT LAYOUT

NUMBER	NAME
1, 7	RETURN WATER
2	CHILLED WATER COIL
3, 6	CHILLED WATER SUPPLY
4	EC PLUG FAN
5	CHILLED WATER VALVE
8	CHILLED WATER VALVE ACTUATOR
7	CONDENSATE DRAIN

Table 4: CHILLED WATER COMPONENTS

7.6 Condensate Probe Sensor

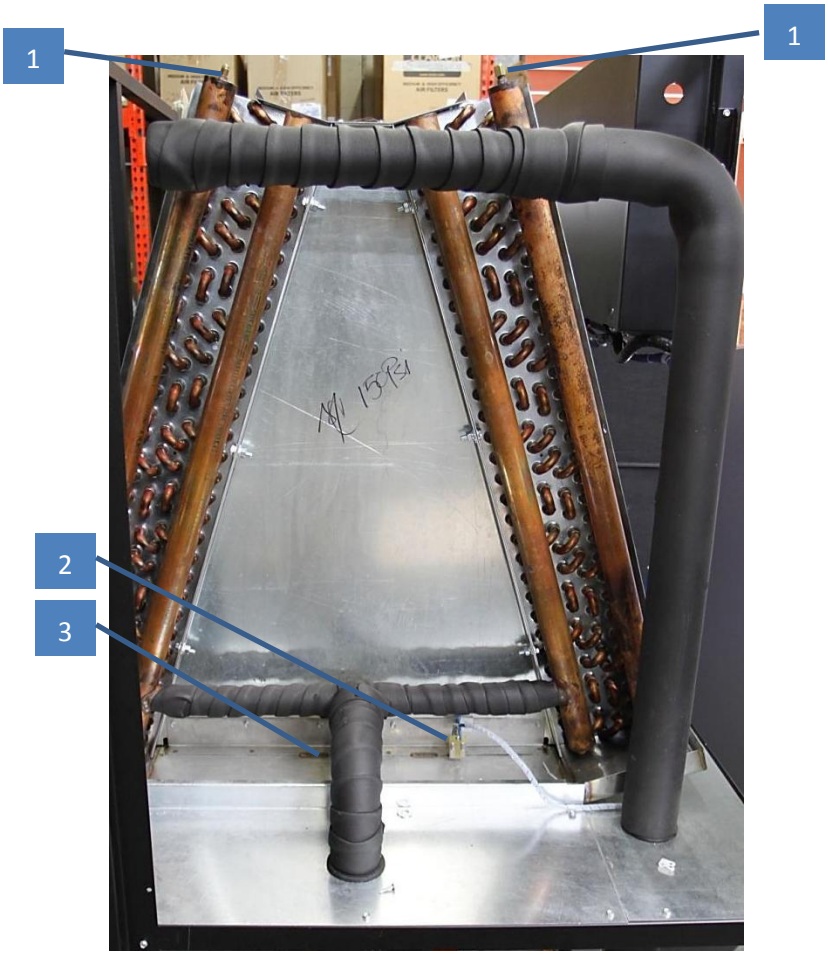


Figure 6: CONDENSATE SENSOR

NUMBER	NAME
1	AIR VENT
2	CONDENATE SENSOR
3	DRAIN PAN

Table 5: CONDENSATE SENSOR

7.7 Floor Stand

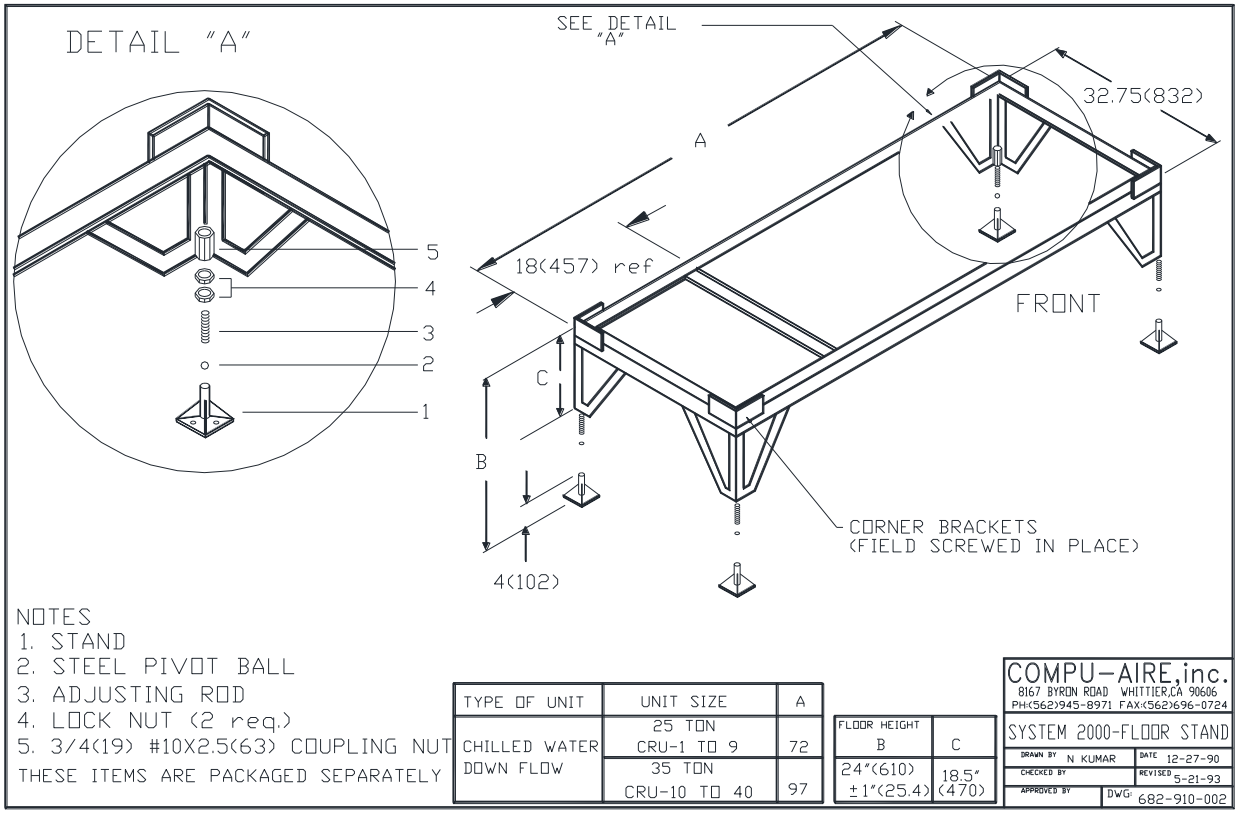


Figure 7: JACK-STANDS

8.0 SYSTEM CUT-OUT JUMPER FOR EMERGENCY SHUT-DOWN

The unit is completely factory wired with self-contained controls to run without using external system cut-out. When external system cut-out is used, remove the jumper between terminal 5 and 6 and use NC dry contact of field provided system cut-out relay.

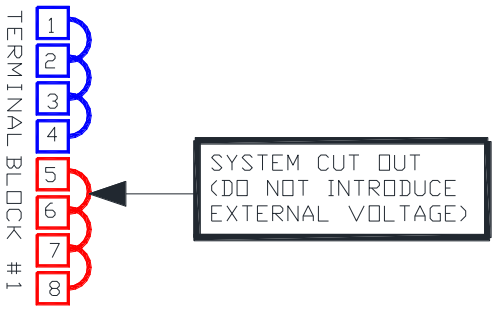


Figure 8 - Terminal Block with System Cut-Out

The system cut-out terminal on the terminals strip is for connection to a “panic button” or EPO Switch when emergency shut-down is required. The system cut-out jumper shall only be replaced by separate dry contact for each unit and **NO EXTERNAL SOURCE OF POWER SHOULD BE INTRODUCED AT THIS POINT**. The EPO relay must be installed in the unit control panel to minimize voltage drop in control circuit.

Remote ON/OFF relay shall not be used for emergency shut-down purpose. This relay is design to provide systematic shut down by the controller programming. Remote ON/OFF relays can be disabled from controller programming and unit may not shut-down in case of emergency.

9.0 REMOTE ALARMS

One Alarm Relay with a set of dry contact is provided for remote connection whenever the unit alarm is energized. Default setting for this alarm relay is programmed to be energized for global alarm however; it can be changed to selectable alarm to customize for specific alarms only. See controller guide for more detail on how to program this relay for selectable alarms.

If unit is provided with extra relays, see unit wiring diagram and submittal for detail.

If the unit is provided with condensate overflow sensor, the unit mounted control panel includes a condensate probe module. The condensate probe sensor shall be shipped loose for field installation. Condensate probe sensor shall be located underneath the unit where water may collect to sense any condensate overflow. To check the operation of the probe, submerse it in a cup of water. The condensate alarm should energize.

If the unit is provided with sensing cable type leak detection system, use specific manual provided by the manufacturer to install the complete system. Alarm relay dry contact from sensing cable type leak detection system can be connected to the digital input for condensate alarm of unit controller. Use 24VAC power from the unit terminal block for this alarm input.

10.0 PIPING CONNECTIONS LAYOUT

Note: Water side operating pressure not to exceed 125 PSIG. Optional high pressure rated valve is available from the factory.

Down Flow Unit: All plumbing field piping is brought to the unit through the bottom rear left of the frame as shown below.

Up Flow Unit: Field piping is brought through the bottom left hand access panel or back panel.

After all connections are made to the unit, close-off and seal all air openings around the pipes using tubing insulation material such Armaflex.

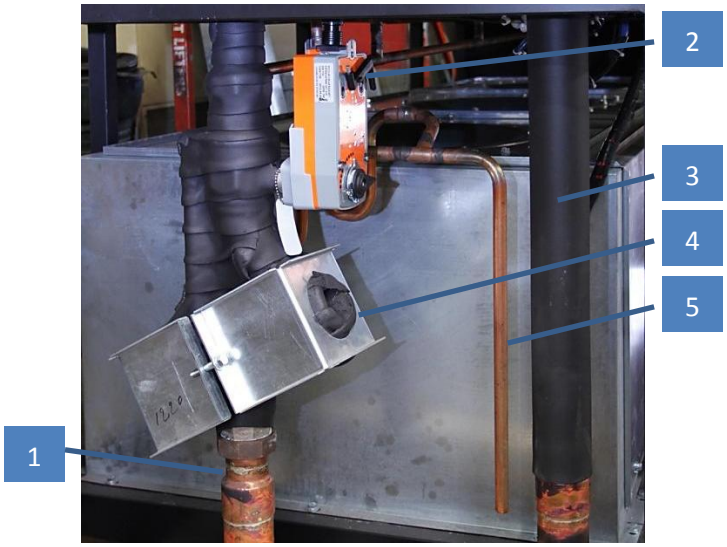


Figure 9: PIPING

NUMBER	NAME
1	CHILLED WATER IN
2	CHILLED WATER VALVE ACTUATOR
3	CHILL WATER OUT
4	CHILLED WATER VALVE
5	DRAIN PIPE

Table 6: PIPING LOCATION

Shutoff valves should be used on the inlet and outlet water lines to isolate the unit from building water loop. A fill valve with hose bib connection should also be used to either the supply or return line at the lowest point of the system. This valve may be used to fill as well as to drain the system if necessary.

Unions may be used for unit connections. A strainer should be installed in the system and must be cleaned periodically. Automatic air vents should be installed in various locations in the piping system to remove air. More than one vent may be necessary. It is preferable to install these vents at the highest point of the system. For more information on piping, please refer to ASHRAE Standards or any other common practice trade publication.

The water "in" and "out" connections sizes are as follows. Piping connection may be different if unit has non-standard GPM. Use submittal information for non-standard application.

CAC 10	1-1/8" O.D. STUB
CAC12	1-3/8" O.D. STUB
CAC15 & 20	1-5/8" O.D. STUB
CAC25 & 30	2-1/8" O.D. STUB
CAC35 & 50	2-1/8" O.D. STUB
CAC60	2-5/8" O.D. STUB

Note: These connection sizes are provided at the unit. Building Chilled Water supply and return headers shall be selected by others in the field. Larger size pipes may have to be used on some applications depending on pressure drop, length of run, number of fitting and valves, and the size of the pump used in the system. To assist the installer in determining the equivalent linear foot-run of different pipe fittings, following table is provided.

LIFE SIZE NOMINAL	90° STD	45° STD	GLOBE VALVE	GATE VALVE	SWING CHECK	"Y" STRAINER*
1 ¼"	3.3	1.7	38	1.5	14	9
1 ½"	4.0	2.1	43	1.8	16	10
2"	5.0	2.6	55	2.3	20	14
2 ½"	6.0	3.2	69	2.8	25	20
3"	7.5	4.0	84	3.2	30	40

*Screwed end

11.0 INSTALLATION

11.1 Room Preparation

The room should be well insulated and sealed for water vapor. Door gaps and cracks should also be sealed to minimize outside air from introducing into the insulated room.

11.2 Location Considerations

Unit can sit on an elevated flooring while remains fully accessible. Floor stand or other support maybe used to further support the unit.

After moving the unit to the desired location, the system needs to be leveled and anchored to the floor as directed by the building design engineer, typically using wedge anchors. Prior to anchoring the unit to the floor, verify locations for Chilled Water Supply and Chilled Water Return line connections, drain line connection as well as the electrical power input locations are matching with unit location requirement. Proper electrical supply power is an absolute necessity as the unit is designed specifically for the requirements on the nameplate.

Water supply and return as well as the condensate drain connection are sweat type, the humidifier supply water is a compression connection and the high voltage electrical power supply and low voltage power are for a conduit connection. All knock-out shall be provided by others in the field.

The unit is designed with draw-thru air pattern with negative pressure inside. The condensate drain connection must be installed with a proper p-trap as without it, the condensate water will not drain thus possibly causing water carry over into the air space. The p-trap must be calculated as per Figure 7 below. **After installation of the p-trap, verify trap operation by running the system blowers at full speed and adding water to the drain pan, water should drain out of the condensate pan and through the trap with supply fan running at full speed.**

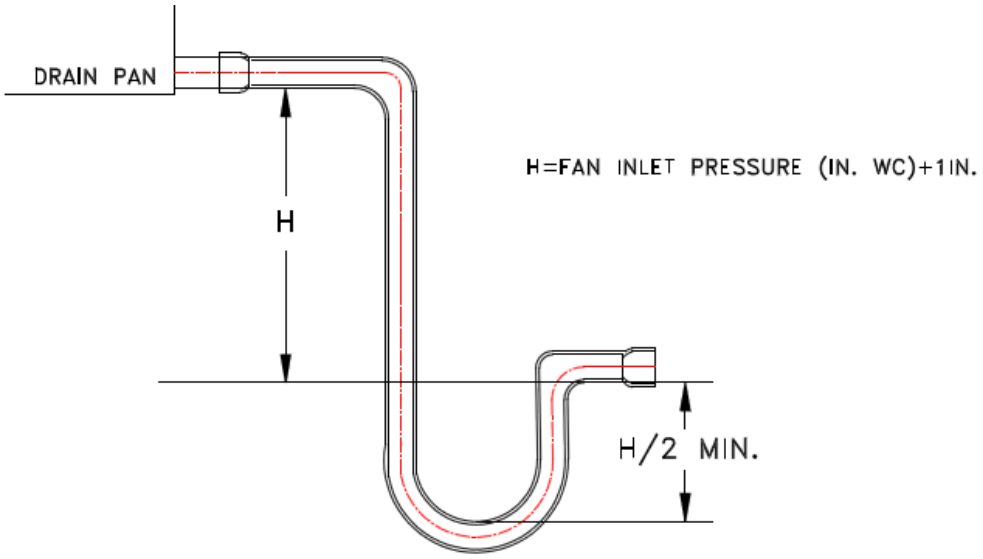


Figure 10: P-TRAP SCHEMATIC

Prior to making the electrical connections, verify the proper voltage, phase and frequency as required on the unit nameplate. Electrical connections must be made in accordance with the National Electric Code and any local ordinance which may apply. Connection should be completed using copper conductors only. The unit must have an uninterrupted or unbroken electrical ground to minimize the risk of personal injury in the case of an electrical fault. It is important the ground wire is of adequate size and is securely fastened to the ground lug in the control panel.

11.3 Piping

Field installed piping must be installed in accordance with local codes and must be properly assembled, isolated and supported. Refer to the submittal for piping requirements.

11.4 Drain Connection

Unit is provided with 3/4" copper stubs for condensate removal. These lines are marked as primary and secondary drain lines. Primary drain line is provided with built-in trap. If the location of unit does not have provision to add external P-trap on secondary line, it must be capped-off. It is recommended that unions be installed in each line to permit ready disconnection from the unit for easy cleaning. Where local codes permit, PVC pipe

may be used for drain lines. It is important that the drain line used for drain lines. It is important that the drain line installed with sufficient slope to permit easy draining. Drain lines should have a pitch away from the unit not less than 1/4" for each 10 feet of run. Do not reduce the size of the drain line.

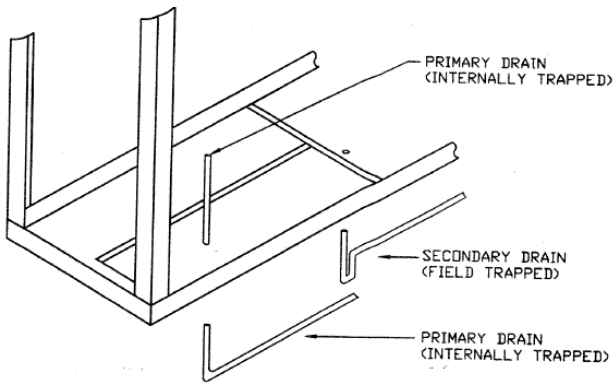


Figure 11: DRAIN CONNECTION

A secondary drain connection is provided to from the bottom pan of the unit. Secondary drain line provides drain connection from the base pan of the unit that is the lowest point in the unit. The secondary drain connection is 3/4" stub and external P-trap is required for this drain. **If secondary drain line is provided with the unit but it is not connected to the building drain, it must be capped off.**

On some applications were a floor sink or other means of condensate disposal is not available, a condensate pump of adequate size should be used. There are several condensate pumps available complete with built in floats for automatic condensate removal. The correct choice of pump depends greatly on the pressure head (vertical riser) that must be overcome. In some instances, where the head is higher than pump head capacity, two pumps pipes in series may be necessary. A check valve must be installed at the discharge side of all condensate pumps to reduce short cycling. If unit has humidifier, the pump must be selected based on humidifier drain capacity and temperature.

Note: For units having an automatic flush cycle on the humidifier, a condensate pump with metal sump tank should be used, due to the high temperature of the water being flushed. Power supply for external condensate pump should be from a separate source,

usually 115V outlet, and must not in any way be connected with the air conditioning unit.

11.5 Leak Testing

After installation, the entire unit piping shall be pressurized and leak tested. Leak test shall not exceed 250psi pressure for Chilled Water system. Record the leak test pressure and duration on start-up sheet.

12.0 STARTUP AND TEST PROCEDURE

A. With all power to unit off – Check that all wiring is correct

Check that properly sized fuses are installed in the disconnect switch. Correct fuse size and minimum circuit ampacity are listed on the unit nameplate. Now, check the wiring connections in the Main Control Panel to see if they are tight. It is best that this be checked prior to operating the machine. After checking, close the Main Control Panel cover and proceed as follows:

Solid-State Control Panel - With the system switch in the "OFF" position, apply power to the unit. The "Power On" light should illuminate.

B. **Check for correct phasing**

The equipment should now be checked for correct phasing required to make the blower motor turn in the correct directions. For this test it is necessary to open the front access panel or the right side doors of the unit to observe the blower and blower motor. Now, momentarily switch the system switch to the "ON" position and then back to "OFF". The blower will have started and it is therefore possible to determine rotation. On Compu-Aire units, the blower should be rotating in a

CLOCKWISE direction in the down flow units and COUNTER CLOCKWISE in the up flow units, looking in the right side of the unit. Heaters and humidifiers are not affected by phasing.

C. **Blower speed adjustment**

Adjustment of the air flow may be desired based on air balancing requirement. The air flow must be checked and adjusted for minimum and maximum CFM requirements. The air flow can be readily adjusted with the minimum and maximum output voltage limit from the controller. After the unit has been started and the air flow properly adjusted, check the blower motor current to ensure that the motor is not overloaded. Any time the blower speed is increased, the blower motor current should be checked. If a field adjustment is made, the motor should run for at least one hour at maximum design room temperature to see if motor trips on internal overload.

D. No air flow & Clogged filter adjustment

The "No Air Flow" light and alarm should be checked prior to the completion of the installation. Although the control adjusted at the factory, varying local conditions make it impossible to provide accurate pressure adjustments.

To check the filter pressure switch, let the unit operate on cooling for about 30 minutes. This will allow the evaporator coil surface to become wet. The air pressure differential switch is provided with adjustable knob. Set the knob to desire pressure drop for dirty filter and verify the Dirty Filter alarm. With the unit cooling and filters in place, block off approximately 75% of the air intake. If the sensing device is correctly adjusted, the "Clogged Filter" alarm should energize; the sensing device should have just turned on the alarm at the 75% blocked inlet condition. An Air Flow Sail switch is also provided at the discharge side of the blower and will activate the No Air Flow malfunction light and alarm.

Similar to the clogged filter switch, adjustment may be necessary for the no air flow switch(s). The loss of airflow switch is wired in the normally closed position to open on airflow and the dirty filter switch is wired to the normally open position and set

to close with dirty filter. Adjustment can be made by removing the top cover and turning the dial to the proper pressure. See Figure 9 below.

Figure 12: AIR PRESSURE DIFFERENTIAL SWITCH

13.0 GENERAL MAINTENANCE

General maintenance must be performed in regular intervals to provide continued operation of the entire unit. The maintenance intervals must be determined site specifically. Use the maintenance checklist at the end of this manual when performing maintenance. Typically, air filters should be replaced no less than two times per year.

FILTERS

1. The filters should be checked and changed periodically. When they become dirty, an alarm is activated the filter pressure switch. If the filters are dirty, they must be changed for efficient operation of your system. To check the alarm indicator, cover approximately 75% of the return air opening; the alarm should energize. If the alarm energizes prematurely or does not energize when it should, adjust the filter switch. All doors to machine should remain closed before determining whether an adjustment is necessary.

2. Spare filters should be kept in stock. Filters should be checked monthly and replaced if necessary.

14.0 REFERENCE DOCUMENTS

COMPU-AIRE INC.
Specialized Environmental Air Conditioning Systems

MAINTENANCE CHECKLIST

Inspection Date _____
Job Name _____
Unit Model # _____
Unit Serial Number # _____
Room Temperature _____° Humidity _____%
Ambient Temperature _____°

Filters

___ 1. Check/replace filters
___ 2. Grille area unrestricted
___ 3. Wipe section clean
___ 4. Coil clean

Blower Section

___ 1. Blower wheel(s) free of debris
___ 2. Check belt tension and condition (replace if needed)
___ 3. Check bearings
___ 4. Check sheave/pulley (replace if worn)
___ 5. Check motor mount
___ 6. Motor amp draw L1_____ L2 _____ L3_____
____Compare measured amp draw to nameplate rating

Reheat

___ 1. Inspect elements
___ 2. Check wire connections (inside reheat box)
___ 3. Reheat amp draw _____ #1 _____ #2 _____ #3

Steam Generating Humidifier

___ 1. Check drain valve/drain lines/trap for clogs
___ 2. Check water make-up valve and all hoses for leaks
___ 3. Clean strainer
___ 4. Replace humidifier bottle if necessary

___ 5. Check operation of humidifier
___ 6. Humidifier amp draw L1 _____ L2 _____ L3_____

Condensate Pump
___ 1. Check for debris in sump
___ 2. Check operation of float(s) (free movement)

Electrical Panel
___ 1. Check fuses
___ 2. Check contactors for pitting
___ 3. Check all wire connections

Controls
___ 1. Check/Verify Control Operation (Sequence)
___ 2. Check operation of the airflow switch
___ 3. Check setting/operation of the clogged filter switch
___ 4. Check/test changeover device(s)
___ 5. Check/test water detection device(s)

Notes_____
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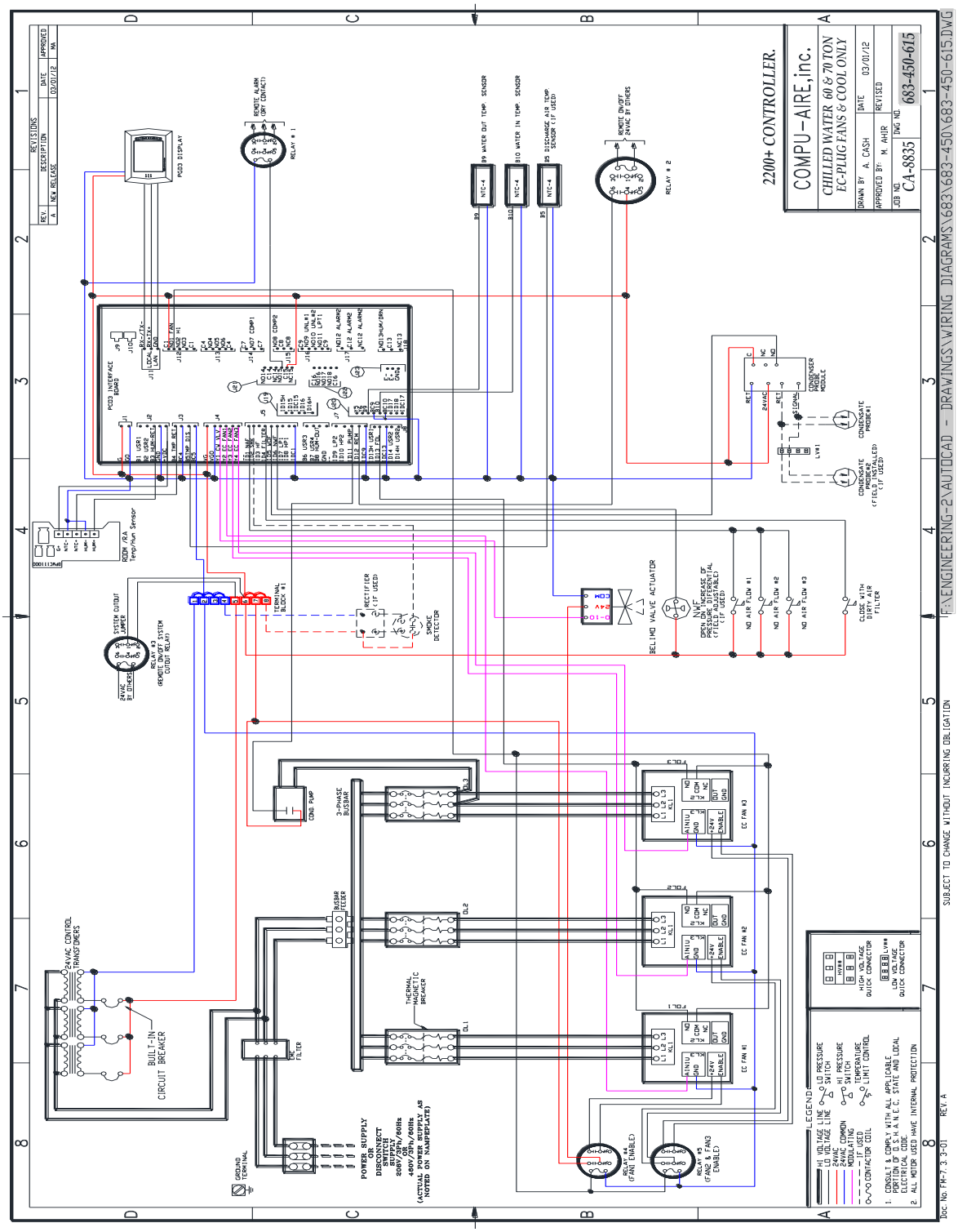

Figure 13: TYPICAL SCHEMATIC

COMPU-AIRE INC.
Specialized Environmental Air Conditioning Systems

TECHNICAL SUPPORTS

www.compu-aire.com
Tel: (562) 945-8971
Fax: (562) 696-0724

UNITED STATES OFFICE

Compu-Aire, Inc.
8167 Byron Rd.
Whittier, CA 90606

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