ClimaCool IOM
AR2 SERIES

Air Cooled Remote Condenser Modular Chillers

Installation, Operation, &
Maintenance Manual

CLIMACOOL®

THE ULTIMATE CHILLER SOLUTION®

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Refer to www.climacoolcorp.com for complete warranty details.

CONTENTS PAGES

ClimaCool Modular Air-Cooled Chillers

MODEL NUMBERS AND SPECIFICATIONS

Model	No.	Dimensions L x W x H (in.)	Voltage	Refrig. Circuits	No. of Compr's	Nominal Tons
AR2	25	45-5/8" x 29-1/2" x 77"*	208-230/3/60	2	2	25
AR2	25	45-5/8" x 29-1/2" x 77"*	460/3/60	2	2	25
AR2	25	45-5/8" x 29-1/2" x 77"*	575/3/60	2	2	25
AR2	30	45-5/8" x 29-1/2" x 77"*	208-230/3/60	2	2	30
AR2	30	45-5/8" x 29-1/2" x 77"*	460/3/60	2	2	30
AR2	30	45-5/8" x 29-1/2" x 77"*	575/3/60	2	2	30
AR2	50	46-5/8" x 33-1/2" x 78-3/8"*	208-230/3/60	2	2	45
AR2	50	46-5/8" x 33-1/2" x 78-3/8"*	460/3/60	2	2	45
AR2	50	46-5/8" x 33-1/2" x 78-3/8"*	575/3/60	2	2	45
AR2	65	N/A 2	08-230/3/60	2	2	60
AR2	65	46-5/8" x 33-1/2" x 78-3/8"*	460/3/60	2	2	60
AR2	65	46-5/8" x 33-1/2" x 78-3/8"*	575/3/60	2	2	60

SAFETY WARNING

High voltage is used to operate this equipment. Failure to observe standard electrical safety procedures may result in serious injury. Only persons qualified and /or properly trained should attempt to install, operate and maintain this equipment. These chillers come fully charged with refrigerant. Installation, and start - up should be accomplished by technicians who are fully certified to handle refrigerants, as required by 40 CER Part 82, subpart F of the Recycling and Emissions Reduction Act. Scroll compressors are used in this equipment. Phase verification is required for proper rotation direction. Incorrect rotation will result in elevated sound and internal overload trip failure.

Inspection

INSPECTION
Allow a sufficient amount of time to carefully follow these instructions to assure warranty coverage.

During inspection of the equipment remove the top doors to check the equipment for any damage during shipment. Inspect wiring connections, lines from expansion devices, thermostats, and pressure switches for damage.

General
During any correspondence concerning this machine, always reference the full model and serial numbers of your modules.

Receipt of the ClimaCool Modules
Upon receipt of the equipment, carefully check the shipment against the bill of lading. Make sure all modules ordered have been received. Inspect the carton or crating of each module and inspect each module for damage. ***You must make proper notation of any shortages or damage on all copies of the freight bill for your records. Make sure the carrier completes a common carrier inspection report listing any shortages or damage.***

Concealed Damage
Concealed damage not discovered during unloading must be reported to the carrier within fifteen (15) days of receipt of shipment. ***If not filed within fifteen (15) days, the freight company can deny the claim without recourse.*** Note: It is the responsibility of the recipient of the modules to file all necessary claims with the carrier. In addition, please notify the ClimaCool Customer Service Department of all damage within fifteen (15) days of receipt. Refer to the back cover for the Customer Service Department phone number.

Storage
Equipment should he stored as shipped in a clean, dry area. Store modules in an upright position at all limes. Plastic wrap should be left on until the module is ready to he installed.

Handling of Modules
The packaging allows for handling by fork lift or pallet jack (only lift the module from the side). See Lifting and Transporting Modules (Fig. 3) on page 5. Caution: modules are top heavy. Please use caution when rigging or moving.

Rigging for Lifting
Each module should he lifted by using lift straps threaded through each top header tube. See page 6 - Rigging and Lifting Procedures.

Preparing for Installation
Prepare the modules for installation by carefully removing the module's packaging, unbolt the module from the skid, and lift the module with a crane or hoist into its final position. Hardware kits are shipped in separate packaging along with the modules. Make sure the hardware kits are on site when connecting the modules.

SITE PREPARATION

Base Requirements
The minimum base requirement for the ClimaCool chiller is a level surface which has been checked to ensure that it is capable of bearing the combined operating weight of the modules (see page 4).

Anti-Vibration Mountings
Although the compressors are installed on anti-vibration mountings, further isolation of the chiller from the structure can be achieved by installing vibration-eliminating springs or pads under the base rails on which the chiller will rest. (see page 8 - Vibration Isolation).

Service Access
The minimum space required for electrical panel service is 36" in the front of each module. Allow 24" service clearance in the back of the module for refrigeration access. Allow a minimum of 18" of clearance above the module for service. Allow 12" side clearance of any ClimaCool modular chiller system (see Service Clearances page 7). Local building or electrical codes may require additional clearance.

Draining
When performing standard maintenance procedures such as flushing heat exchanger, it will be necessary to close off a section of a module. ClimaCool modular chillers come equipped with isolation valves for this purpose. Access to a floor drain is helpful when performing standard maintenance procedures.

INSTALLATION

Assembling Modules
Use of (2) 4" rails (minimum size) is required for ease of installation. One of the end modules should be chosen as the reference module and carefully located.

A factory supplied fastener kit is provided for the adjoining of each module. Each kit contains (2) gaskets, (16) ¾" fully threaded studs, (32) heavy duty hex nuts, (32) lock washers, and (32) flat washers.

A ¾"-10 tap should be run through each weld nut located at the bottom rear chiller header flange of each module. Screw the fully threaded studs into these four weld nut locations. At all other flange hole locations, insert fully threaded studs, attach washers, lock washers, and nuts from the fastener kit.

The gasket should be placed between the first reference module and the next module. Slide the next module into position while guiding the fully threaded studs into the flange holes of the next module. Finally, the washers, lock washers, and nuts are applied to the other end of the fully threaded studs to securely fasten the module flanges.

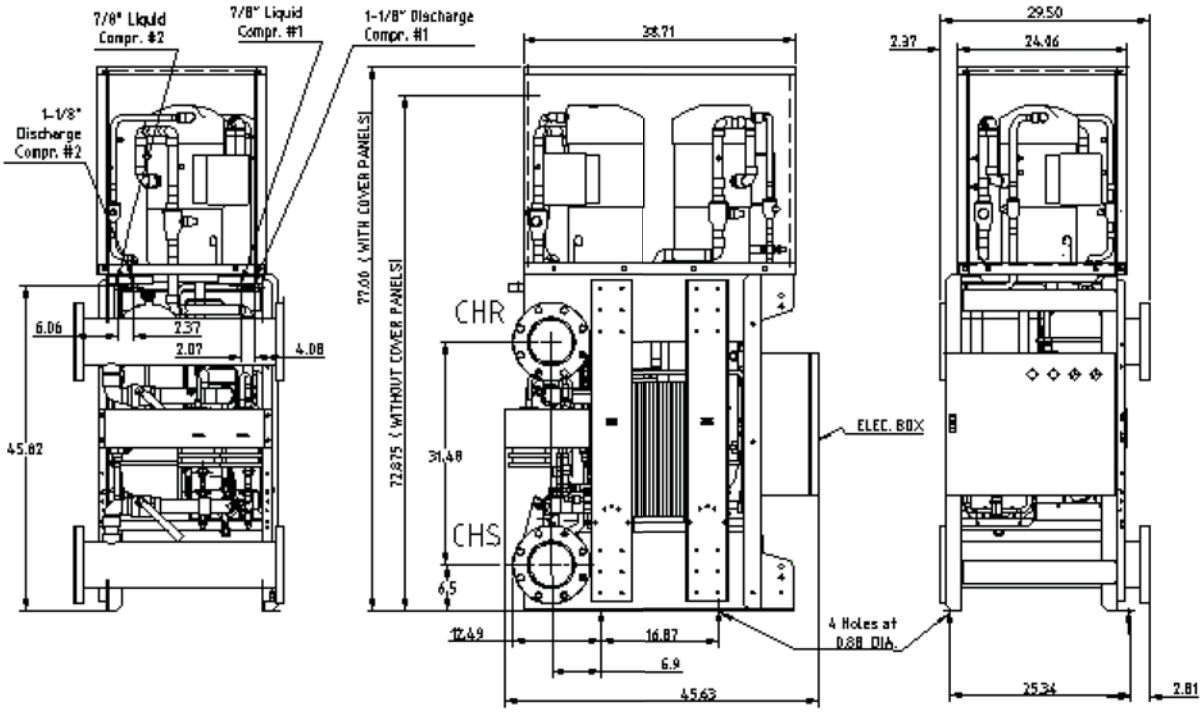
Tighten the flange bolts in a diametrically opposite pattern, in such a way as to pull the modules together evenly. It will be necessary to use a ¾" (12 point) box-end wrench when tightening. As each module is added, the alignment of the whole package should be confirmed.

Header and Flange Insulation
Chilled water piping is pre-insulated on each module at the factory with ¾" closed cell foam rubber. After the bolting the modules together, the installer must apply insulation on site over the chilled water header connection flanges.

Connecting the Water Piping to Modules
Water piping must be installed in accordance with applicable codes and standards. Flexible connections and supports should be installed to prevent load or stress on the module's flange connections (see page 11 - Water Piping Configurations).

ClimaCool Dimensional Data - 60 Hz

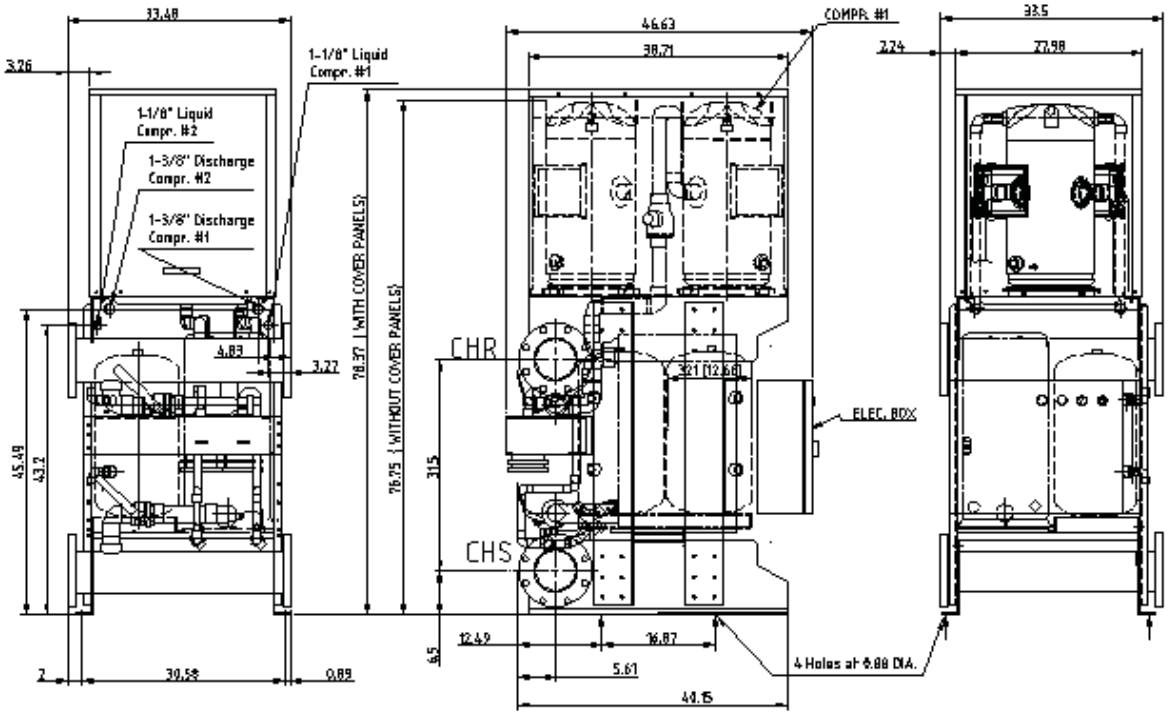
The ClimaCool Modular Chiller - Module Dimensional Data - Models AR2-25 & AR2-30



Model AR2	Voltage	Depth (inches)	Width (inches)	Height (No covers) (inches)	Height (w/ covers) (inches)	Weight[1] (lbs.)	Operating Weight[2] (lbs.)
25	208/230/3/60	45-5/8	29-1/2	72-7/8	77	1,689	1,755
25	460/3/60	45-5/8	29-1/2	72-7/8	77	1,689	1,755
25	575/3/60	45-5/8	29-1/2	72-7/8	77	1,689	1,755
30	208/230/3/60	45-5/8	29-1/2	72-7/8	77	1,709	1,785
30	460/3/60	45-5/8	29-1/2	72-7/8	77	1,709	1,785
30	575/3/60	45-5/8	29-1/2	72-7/8	77	1,709	1,785

NOTES:
1. Unit shipping weight includes refrigerant charge, compressor oil, and shipping base skid. Add two inches to base dimensions for shipping skid.
2. Operational weight includes refrigerant charge, compressor oil and water.

The ClimaCool Modular Chiller - Module Dimensional Data - Models AR2-50 & AR2-60



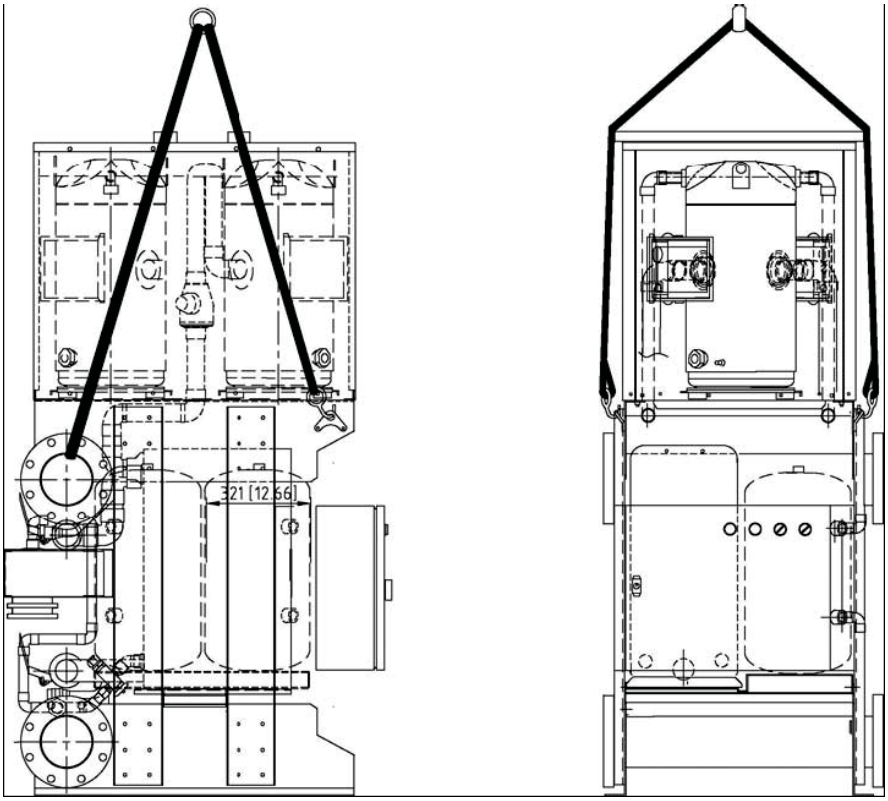
Model AR2	Voltage	Depth (inches)	Width (inches)	Height (No covers) (inches)	Height (w/ covers) (inches)	Weight[1] (lbs.)	Operating Weight[2] (lbs.)
50	208/230/3/60	46-5/8	33-1/2	76-3/4	78-3/8	1,913	2,123
50	460/3/60	46-5/8	33-1/2	76-3/4	78-3/8	1,913	2,123
50	575/3/60	46-5/8	33-1/2	76-3/4	78-3/8	1,913	2,123
65	208/230/3/60	46-5/8	33-1/2	76-3/4	78-3/8	2,030	2,240
65	460/3/60	46-5/8	33-1/2	76-3/4	78-3/8	2,030	2,240
65	575/3/60	46-5/8	33-1/2	76-3/4	78-3/8	2,030	2,240

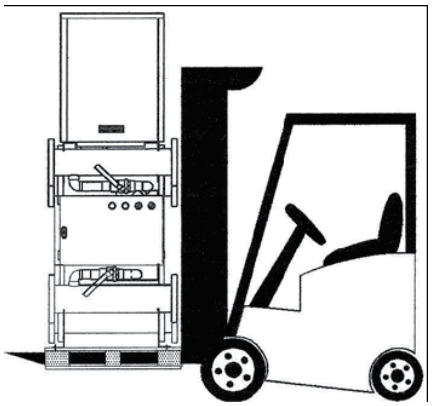
NOTES:
1. Unit shipping weight includes refrigerant charge, compressor oil, and shipping base skid. Add two inches to base dimensions for shipping skid.
2. Operational weight includes refrigerant charge, compressor oil and water.

The ClimaCool Modular Chiller Rigging and Lifting Procedures

Rigging Plates (Figures 1 and 2)

For overhead lifting, (2) rigging plates are provided with the module for lifting at the electrical box end, at the position shown. A spreader bar should be utilized when rigging with sound attenuation covers in place.

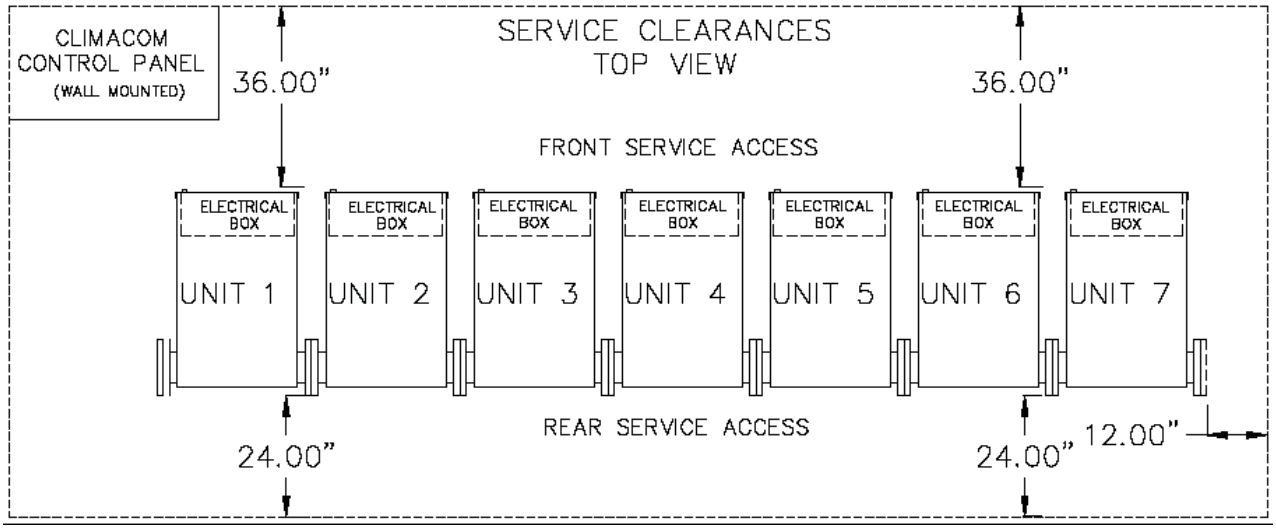




Lifting and Transporting Modules (Figure 3)
When lifting and transporting the module, it is very important to proceed as shown at right. Use of any other means for lifting and transporting may damage the module.

▲ CAUTION
Units are top heavy. Please use caution when rigging or moving.

The ClimaCool Modular Chiller - Service Clearances



Recommended Clearances

1. Allow 36” clearance for electrical panels and 24” clearance for rear service access to modules.
2. Allow a minimum of 18” height clearance for service and 12” for side clearances.
3. Local building or electrical codes may require additional clearance. Consult applicable codes.

Modular Chiller Bank Dimensions - w/Connnection Flange Gaskets and Blank Off Plates

Model AR2	Dimensions											
	Width (ft./ inches)			Depth (inches)			Height (w / o panels)			Height (w / panels)		
	25 & 30	50	65	25 & 30	50	65	25 & 30	50	65	25 & 30	50	65
1 module	2’ 7-1/8”	2’11-1/8”	2’11-1/8”	45-5/8”	46-7/8”	46-7/8”	72-7/8”	76-3/4”	76-3/4”	77”	78-3/8”	78-3/8”
2 modules	5’3/4”	5’ 8-3/4”	5’ 8-3/4”	45-5/8”	46-7/8”	46-7/8”	72-7/8”	76-3/4”	76-3/4”	77”	78-3/8”	78-3/8”
3 modules	7’ 6-3/8”	8’ 6-3/8”	8’ 6-3/8”	45-5/8”	46-7/8”	46-7/8”	72-7/8”	76-3/4”	76-3/4”	77”	78-3/8”	78-3/8”
4 modules	10’ 0”	11’4”	11’4”	45-5/8”	46-7/8”	46-7/8”	72-7/8”	76-3/4”	76-3/4”	77”	78-3/8”	78-3/8”
5 modules	12’ 5-5/8”	14’1-5/8”	14’1-5/8”	45-5/8”	46-7/8”	46-7/8”	72-7/8”	76-3/4”	76-3/4”	77”	78-3/8”	78-3/8”
6 modules	15’7/8”	17’7/8”	17’7/8”	45-5/8”	46-7/8”	46-7/8”	72-7/8”	76-3/4”	76-3/4”	77”	78-3/8”	78-3/8”
7 modules	17’ 6-1/2”	19’ 10-1/2” 1	9’10-1/2”	45-5/8”	46-7/8”	46-7/8”	72-7/8”	76-3/4”	76-3/4”	77”	78-3/8”	78-3/8”

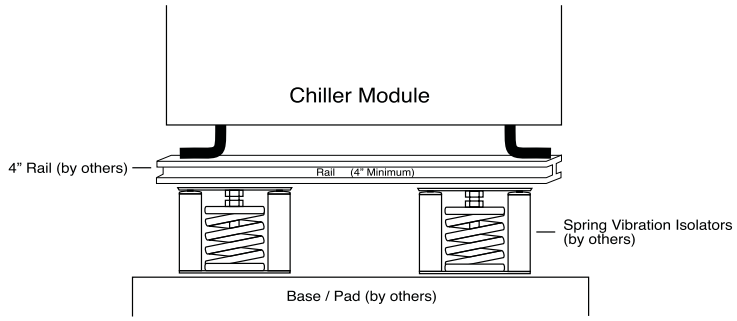
NOTES:

1. Modular chiller bank width dimensions above include (1/8”) between modules, plus (1 -1/2”) for required blank off plate flanges when piping for a direct return (Refer to Water Piping Configuration - Figure 1). Example: (5) AR2-65 modules 167-1/2” width + 1-1/2” (Blank off plates) + 5 x 1/8” (flange connection gaskets) = 169-5/8” (14’ 1-5/8”).
2. When piping 1 to 5 or more than 5 modules, use reverse return (Refer to Water Piping Configuration - Figure 2). Example: (7) AR2-30 modules 206-1/2” width + 1-1/2” (Blank off plates left) + 1-1/2” (Blank off plates right) + 8 x 1/8” (flange connection gaskets) = 210-1/2” (17’ 6-1/2”).

The ClimaCool Modular Chiller - Vibration Isolation Configuration Options

Due to the low vibration of the modules, ClimaCool does not require the application of spring isolators or pads. Should isolators or pads be desired, install in accordance with Figs. 1 and 2.

Figure 1 - Spring Vibration Isolators Option



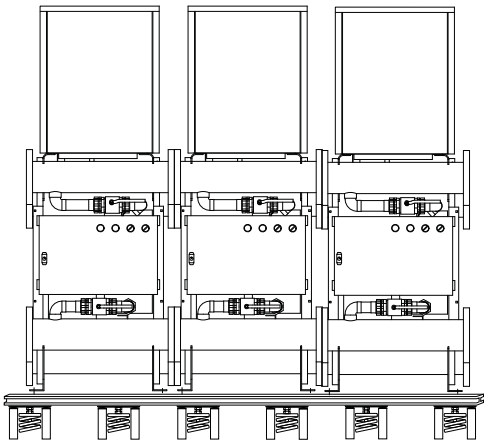
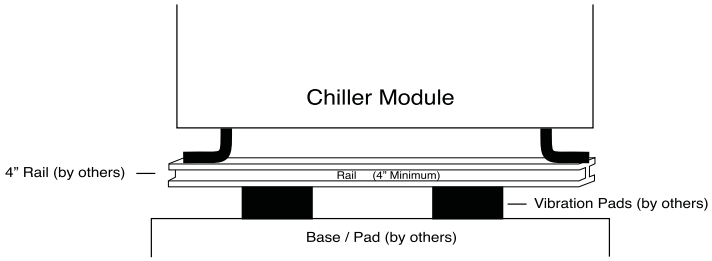
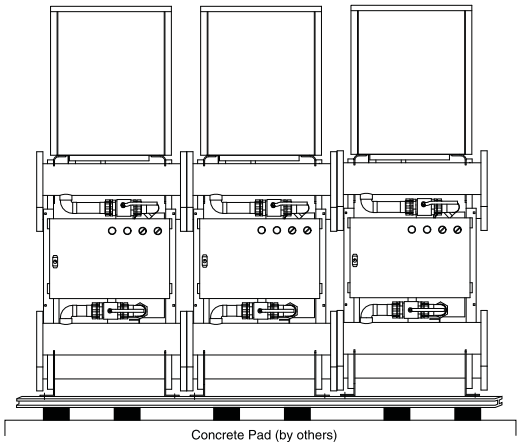


Figure 2 - Vibration Isolation Pads Option





NOTE: Size and weight distribution is to be determined by a qualified structural engineer per individual job requirements.

ELECTRICAL CONNECTION

The compliance of the installation to relevant electrical codes is the responsibility of the installer. Before carrying out any electrical work, confirm that the main power supply is isolated. The installer must ensure that the correct electrical drawing is available.

Module Power Wiring

The power for each module should be taken from a customer supplied, fused main power supply panel. It is further recommended that the incoming power be supplied from a properly sized disconnect switch. It is the responsibility of the installer to provide adequate fusing or circuit breaker protection for the incoming power to each module. Proper grounding of the module is mandatory. A typical power wiring schematic is located on page 63 - Power Distribution.

Module Control Wiring

After the power wiring has been run, the control wires can then be connected. The wires should be carefully marked and installed onto the terminals shown on the wiring diagram. External control wires should be connected to the relevant terminals and devices. All control wiring and external wiring to the sensors should not be run in the same conduit as the power wiring.

Control Wiring Sizes and Lengths

When running control wires, proper gauged wires should be used. The control wiring for the compressor contactors must be in accordance with the minimum wire gage shown on the wiring diagram. With 14 AWG the maximum distance allowed is 250 feet. With 16 AWG, 100 feet is acceptable. You should not exceed 50 feet when using 18 AWG. These lengths and gages are for the use of 24 volt control circuits.

Electrical Phase Sequencing

Proper clockwise rotation for scroll compressor motors is important to prevent damaging the compressors. If you have access to a phase sequence indicating instrument it is recommended to use this following the manufactures directions. If not, you may “bump test” the compressors one at a time with pressure gauges attached to the high and low gauge ports of the compressors to check for proper rotation. Energize the compressor for a few seconds to ensure the discharge pressure gauge increases significantly. If the discharge pressure docs not increase, proper rotation is reversed. You can quickly reverse compressor rotation by opening the main electrical disconnect and switching any two of the main power supply leads feeding that compressor’s contactor.

Proper Voltage Balance

Occasionally, in three phase circuits, a voltage imbalance occurs between phases. It is not recommended to operate equipment when an imbalance greater than 2% occurs. This causes motors to run at high temperatures and may affect their longevity. The following example describes how to calculate the average voltage of the three phases to see if the imbalance is greater than 2%.

Example: Line one = 226V; Line two = 230V; Line three = 228V
The average is: $\frac{226+230+228}{3} = 228V$

Next, $\frac{100 \times (228-226)}{228} = 0.9\%$

The voltage imbalance of the three phase circuit is 0.9%. This is well under the 2% range.

Checking

Before power is applied to the system, the wiring should he visually inspected for loose connections or frayed terminal connections. All control wiring should follow wiring instructions supplied in the project submittal package.

WATER PIPING SYSTEM

As with any water system, it is important that the system is clean. As with any water system care should he taken to maintain a clean system. The installing contractor should remove weld scale, rust and contamination during the fabrication of the piping system. We recommend the use of an alkaline flush of the piping system prior to start-up.

Necessary Components

All items depicted in figure 1 and 2 on page 11, other than the modules themselves, are provided by others as optional accessories and must he installed with the hydronics system. Several of these key components for the chilled water systems are: water pump, strainer, isolation valves, flow switch, temperature sensor wells, and pressure taps.

Pressure Taps

The installer must provide access ports for connecting flow switches (differential pressure or paddle style) for the chilled water system (see page 11 – Water Piping Configurations).

Temperature Sensor Wells

Two temperature sensors and wells are provided with each ClimaCool chiller system (chilled water inlet and chilled water outlet). The installing contractor must install these temperature sensor wells as shown in figures 1 and 2 on page 11.

Strainers - (Minimum 60 Mesh Screen Required)

ClimaCool chillers employ brazed plate heat exchangers which are extremely sensitive to debris. Therefore it is mandatory that the chilled water system include a strainer with a minimum of 60 mesh screen for proper filtration. The strainers must be installed as shown in Water Piping Configurations (see page 11).

Isolation Valves

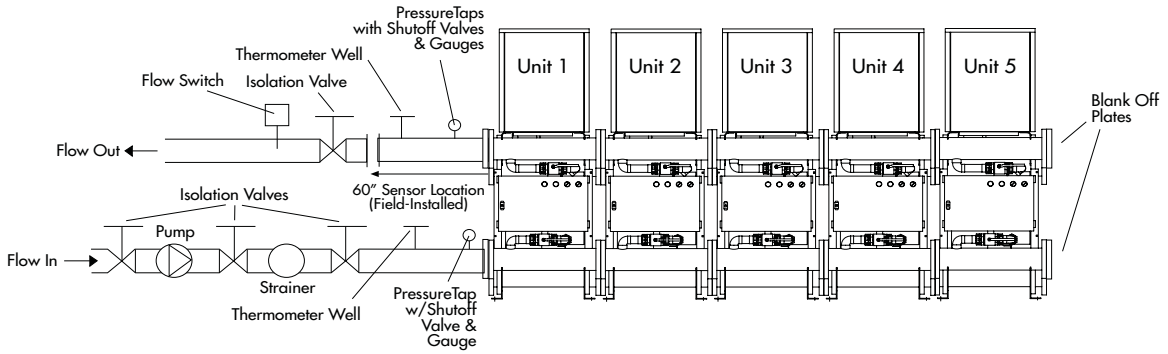
It is recommended that water isolation valves are provided for proper isolation and maintenance of the ClimaCool chiller, water pumps, and strainer (see page 11 - Water Piping Configurations).

Flow Switch

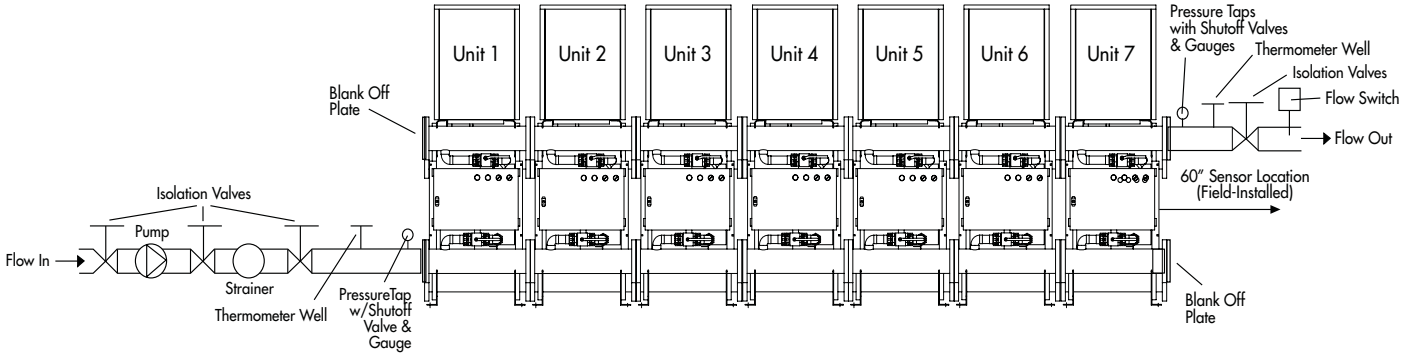
It is mandatory that a flow switch (or differential pressure switch) is installed in the chilled water circuit. This flow switch is supplied by others and is shown on page 11 - Water Piping Configurations.

The ClimaCool Modular Chiller - Water Piping Configurations

Field Piping Direct Return - Optional for 1-5 Modules (Figure 1)



Field Piping Reverse Return (Preferred for 1 to 5 Modules) Required for 6 to 7 Modules (Figure 2)

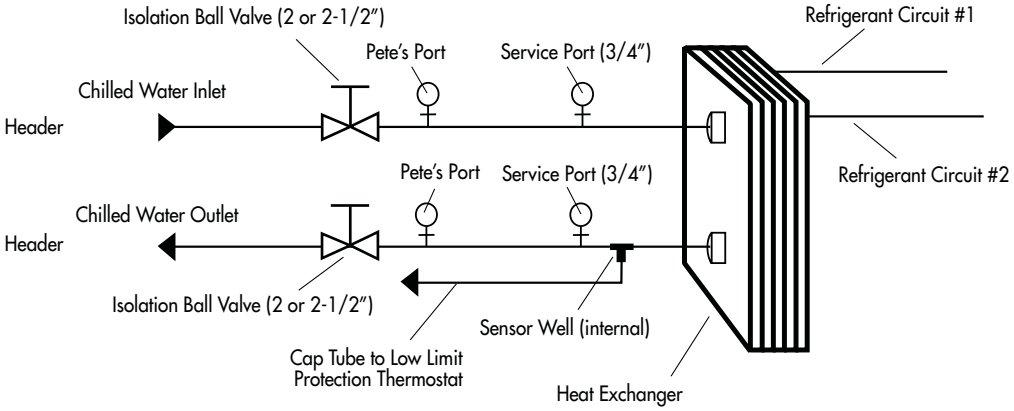


NOTES:

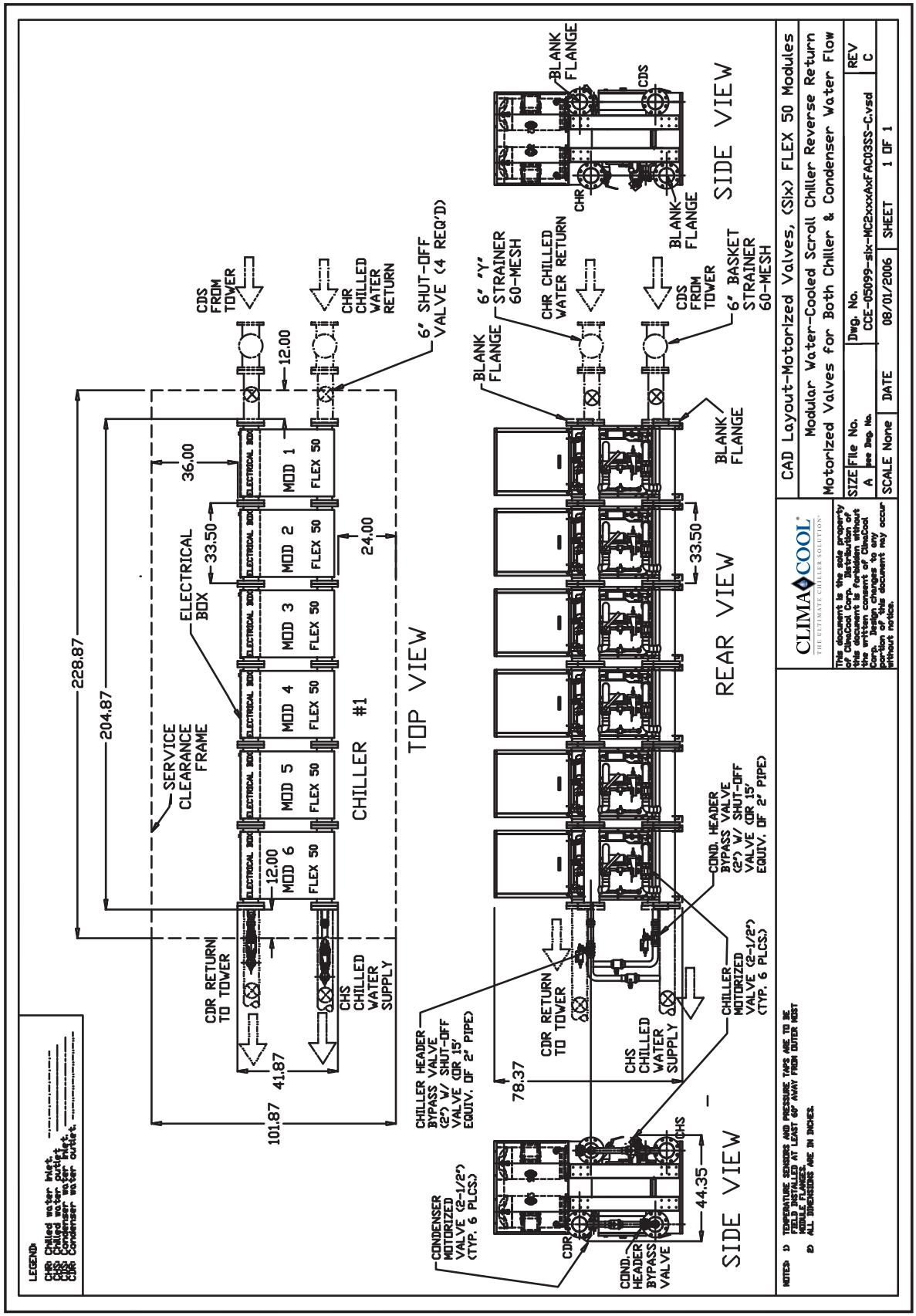
1. Figures 1 and 2 are required piping for proper water regulation and distribution through ClimaCool modular chillers.
2. Module order and incoming/outgoing water flow as shown in both Figure 1 and 2 can be set up as either a left-to-right or right-to-left configuration.
3. Condenser Hydronic Circuit shown. Piping configurations are similar for the chilled water hydronic circuit.
4. For condenser and chilled water (evaporator) inlet/outlet location dimensions, refer to Module Dimensional Data.
5. A flow switch (supplied by others) is a required safety device for ClimaCool modular chillers on the chilled and condenser water circuits.
6. Maximum water flow rates for both evaporator and condenser water header systems in one bank of modules is 1000 GPM. Field Piping Reverse Return - (Preferred 1 to 5 modules) Required for 6 to 7 Modules (Figure 2)
7. The chilled water piping on each module is pre-insulated at the factory with ¾" closed cell foam rubber. Insulation (3/4") on the chilled water header connection flanges is to be applied in the field by the installer, after the modules are bolted together on site.

The ClimaCool Modular Chiller - Hydronic Configuration

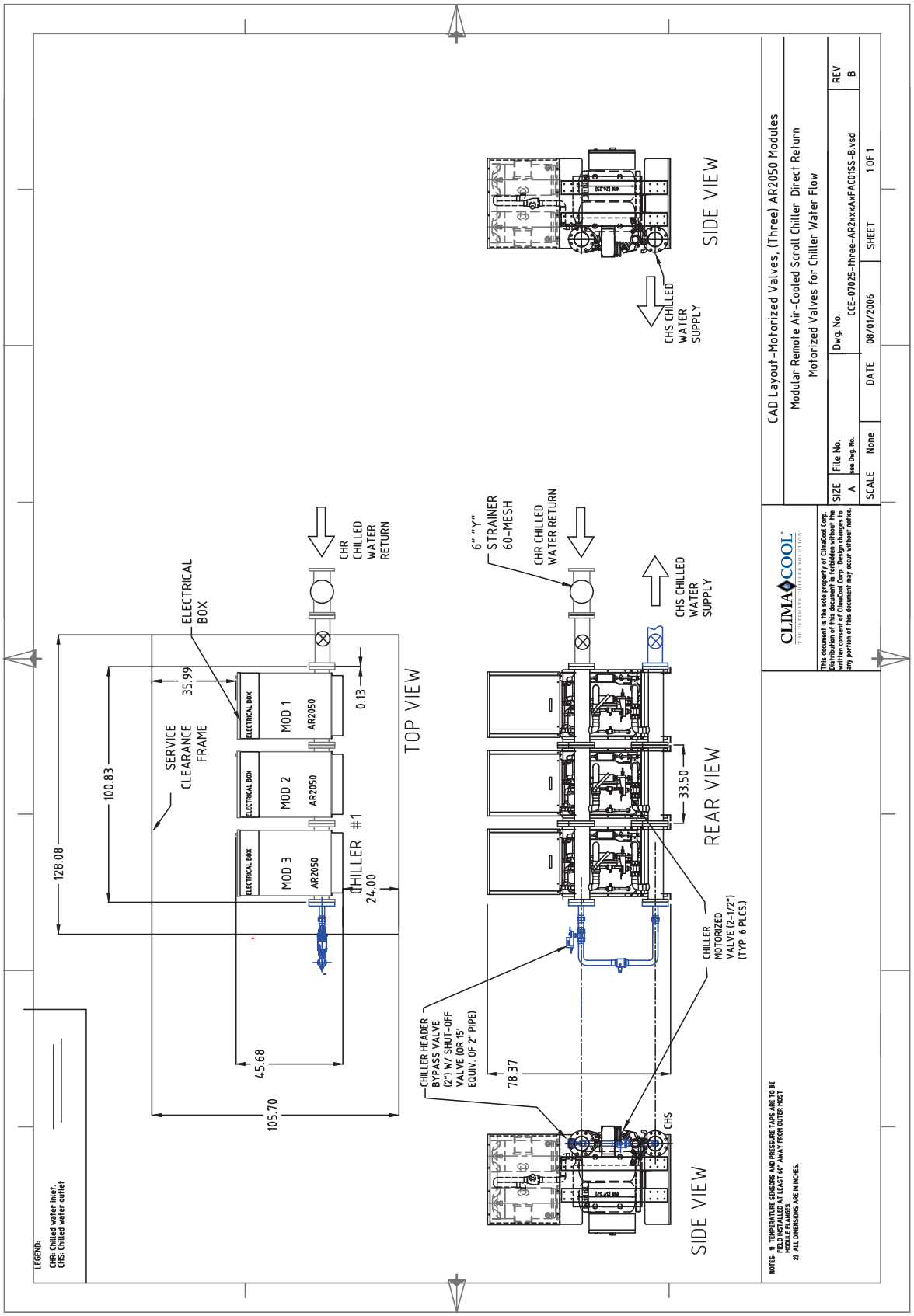
Figure 1 - Chilled Water Circuit



NOTE: Figures 1 depicts hydronic piping in each ClimaCool chiller module.


LEGEND:
CHR Chilled water inlet.
CHS Chilled water outlet.
CDR Condenser water inlet.
CDS Condenser water outlet.
TOP VIEW
CHILLER #1
MOD 1
MOD 2
MOD 3
MOD 4
MOD 5
MOD 6
FLEX 50
ELECTRICAL BOX
SERVICE CLEARANCE FRAME
228.87
204.87
101.87
36.00
33.50
24.00
12.00
41.87
CDS FROM TOWER
CHR CHILLED WATER RETURN
6" SHUT-OFF VALVE (4 REQ'D)
CDR RETURN TO TOWER
CHS CHILLED WATER SUPPLY
SIDE VIEW
CONDENSER MOTORIZED VALVE (2-1/2") (TYP. 6 PLCS.)
CHILLER HEADER BYPASS VALVE (2") W/ SHUT-OFF VALVE (OR 15' EQUIV. OF 2" PIPE)
COND. HEADER BYPASS VALVE
44.35
78.37
REAR VIEW
6" "Y" STRAINER 60-MESH
6" BASKET STRAINER 60-MESH
BLANK FLANGE
CHR CHILLED WATER RETURN
CDS FROM TOWER
CHILLER MOTORIZED VALVE (2-1/2") (TYP. 6 PLCS.)
COND. HEADER BYPASS VALVE (2") W/ SHUT-OFF VALVE (OR 15' EQUIV. OF 2" PIPE)
NOTES: 1) TEMPERATURE SENSORS AND PRESSURE TAPS ARE TO BE FIELD INSTALLED AT LEAST 60" AWAY FROM OUTER MOST MODULE FLANGES.
2) ALL DIMENSIONS ARE IN INCHES.
CLIMACOOL
THE ULTIMATE CHILLER SOLUTION
This document is the sole property of ClimaCool Corp. Distribution of this document is forbidden without the written consent of ClimaCool Corp. Unauthorized changes to any portion of this document may occur without notice.
CAD Layout-Motorized Valves, (Six) FLEX 50 Modules
Modular Water-Cooled Scroll Chiller Reverse Return
Motorized Valves for Both Chiller & Condenser Water Flow
SIZE A
File No. see Dwg No.
Dwg. No. CCE-05099-six-MC2xxxAxFAC03SS-C.vsd
REV C
SCALE None
DATE 08/01/2006
SHEET 1 OF 1

Direct Return w/Motorized Valves



FILLING THE WATER SYSTEMS

It is imperative that the water systems are free from debris prior to initial operation. See the Water Treatment section for a comprehensive list of precautions.

Filling, Purging and Leak Testing the System

After the water systems have been properly installed a visual inspection should be made to all joints for tightness. If the chiller is to be installed in an existing system, the cleanliness of the existing system can be judged from the operating conditions of the present machines. The cooling tower in particular, should be inspected and cleaned if required. It is a good practice to at least flush the existing system and ideally, to acid wash the system before connecting a new chiller.

We recommend the following sequence to fill and leak check the water systems:

1. Close all isolation valves inside each modular chiller.
2. Ensure that all drain valves are closed and that all water main isolation valves are opened.
3. The system should be filled with clean water send through a strainer and the system checked for leaks.
4. Once the main water lines and the chiller headers are filled with clean water, purge and repeat the filling process several times.
5. Open the isolation valves inside each modular chiller and repeat the filling process, this time also checking for leaks inside each module.
6. Following the final filling and leak checking procedure, air should be purged from the system.

Cleaning the System

We recommend the following sequence to properly clean the water systems:

1. If possible, install a temporary bypass line between the supply and return water lines of both water systems prior to cleaning the system.
2. Close all isolation valves inside each modular chiller before engaging the main water pumps.
3. The pumps should be run with the strainer in place (see the Starting the Pumps section for proper pump startup). All external hydronic branches should be open to all devices in the system.
4. After several hours of operation, the strainer should be isolated and cleaned.
5. Step 4 should be repeated until there is no more debris being collected by the strainer.
6. Finally, open all isolation valves inside each modular chiller and repeat step 4 and 5.

If it is not possible to install the bypass line in step 1 above, it is recommended to drain out the initial fill of water to help flush out debris. The chiller isolating valves should be closed to prevent debris from being washed into the chiller as the water drains out. Before refilling and purging the system again, the strainers should be removed and cleaned. This action should be repeated until there is no more debris being collected by the strainer.

Starting the Pumps

Follow manufacturer's recommendations when starting the pumps for the first time. The system should be checked for leaks and air purged with the pumps in operation. The pressure drop across the heat exchangers will give a good indication of flow through the system (see page 35). This should be immediately checked against the expected pressure drop for the flow rate required. If the pressure drop begins to fall and the flow rate is falling, this could indicate the need to clean the strainers.

WATER TREATMENT

Proper water treatment is a specialized industry. We recommend consulting an expert in this field to analyze the water for compliance with the water quality parameters listed in Table 1 below. The material used in the ClimaCool chiller exposed to the water are type 316 stainless steel, pure copper, and carbon steel. Other materials may exist external to the ClimaCool chiller. It is the users responsibility to ensure these materials are compatible with the treated water. Failure to provide proper water quality will void the ClimaCool module's warranty. NOTE: For warranty, proof of monthly water testing results showing compliance to Table 1 Water Quality Parameters is required. Failure to provide proper water quality will void the ClimaCool module's warranty.

It is further recommended to seek an experts advice to specify the appropriate water treatment required. Typical additives to hydronic systems include rust inhibitors, scaling preventative, antimicrobial growth agents, and algae preventatives. Anti-freeze solutions may also be used to lower the freezing point.

Heavily-Contaminated Water

In such instances whereby the particulates in the water are excessive it is recommended to install an intermediate plate & frame heat exchanger to isolate the ClimaCool chiller from the building water system.

Other Considerations

The following considerations are listed to help achieve system longevity.

Cooling Tower

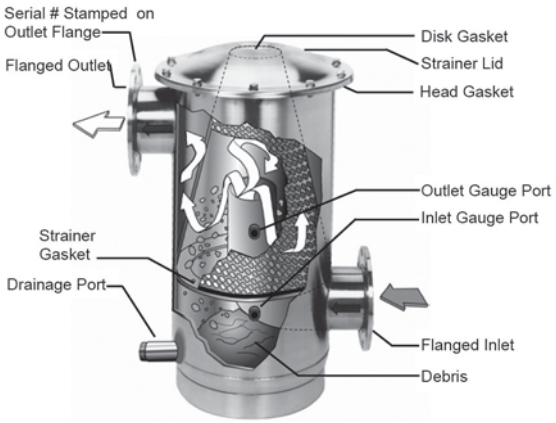
The cooling tower should be located away from sources of external contaminates such as trees, dust, or grass cuttings. Insect infiltration can be reduced by eliminating lights near the tower. A periodic visual inspection of the tower system should be made and contaminates removed as required.

Table 1 - Water Quality Parameters

WATER CONTAINING	CONCENTRATION
Sulphate	Less Than 200 ppm
pH	7.0 – 9.0
Chlorides	Less Than 200 ppm
Nitrate	Less Than 100 ppm
Iron	Less Than 0.2 mg/l
Aluminum	Less Than 0.2 mg/l
Manganese	Less Than 0.1 mg/l
Dissolved Solids	Less Than 1000 mg/l
CaCO3 Hardness	30 – 500 ppm
CaCO3 Alkalinity	30 – 500 ppm

ClimaCool CS STRAINER

Fig. 1



Safety Considerations

Read this manual carefully. Personal injury or product damage can occur if the following safety precautions are overlooked or ignored. We strongly recommend that you follow these safety precautions and avoid the potential hazards listed below when operating and maintaining your strainer:

1. After unpacking your strainer, carefully inspect your strainer housing, lid assembly and screen for damaged or missing parts. Contact our customer service representatives for replacement parts.
2. The strainer should not be modified or used in a manner not consistent with the manufacture's recommendations. If there are any questions regarding its application or installation, contact ClimaCool customer service.
3. The strainer lid or pressure gauges should not, be removed under ANY circumstance while the strainer is pressurized.
4. Standard bolted lid models should never exceed 150 PSI. V-Band clamp models should never exceed 125 PSI.
5. Install back-flow prevention devices (or check valves) both upstream and downstream of the strainer to prevent back flow or vacuum effects which can cause damage to the strainer housing or screen.
6. Install properly sized pressure relief valves both upstream and downstream of the strainer. This will help prevent Strainer damage to the strainer and screen in the event that water flow is stopped abruptly, or if water hammering occurs. The pressure relief valves should be set to relieve pressure at 1.2 times the strainer's maximum operating pressure (not to exceed the max. rated pressure). Consult your local dealer or pressure relief valve manufacturer to obtain properly sized valves for your application.

Note: At No Time Should The Internal Pressure Exceed The Maximum Rated Pressure For Your Strainer

Installation Recommendations

We recommend following the guidelines below when installing your strainer:

1. The ClimaCool Strainer should be placed on a firm, supporting surface. Failure to do so can cause stress on the weld joints. The weight of the ClimaCool Strainer should not be supported by the main water line's connecting it.
2. The inlet and outlet connections should be securely fastened. The arrows clearly depict flow direction (see fig. 1).
3. The back-mount pressure gauges should be installed in the gauge ports located on the front of the strainer body. These gauges will allow you to monitor the pressure differential across the strainer screen providing an indication when the strainer element is clogged and requires cleaning.
4. The ClimaCool Strainer lid must be securely fastened according to the following torque specifications to ensure product safety and an adequate seal.

Torque Specifications

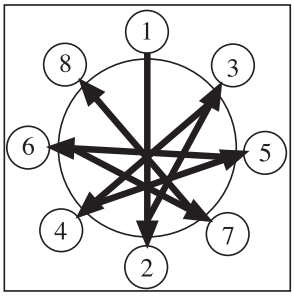
CLAMPED LID MODELS: ClimaCool Strainer models CS-2, CS-3, and CS-4C have "over-center latch clamp" lid designs. The over-center clamp does not require adjustment when installing or removing the lid. The lock washer is set at the factory for proper clamp compression and normally requires no field adjustment. Minor tightening may be necessary over time. The lids are installed as follows:

1. Place the clamp around the strainer lid.
2. Latch the T-bolt with the receiver, and push the latch handle towards the strainer body until the safety catch engages.

Table 1

STRAINER	BOLT SIZE	RECOMMENDED TORQUE
CS-2 (Clamp)	5/16 - 18	40 - 50 in. lbs.
CS-3 (Clamp)	5/16 - 18	60 - 80 in. lbs.
CS-4C (Clamp)	5/16 - 18	75 - 85 in. lbs.
CS-4B	3/8 -16	15 - 25 ft. lbs.
CS-6	1/2 - 13	45 - 55 ft. lbs.
CS-8	1/2 - 13	45 - 55 ft. lbs.
CS-10	5/8 - 11	80 - 100 ft. lbs.

Fig. 2 - Recommended Torquing Sequence



BOLTED LID MODELS: ClimaCool Strainer models CS-4B, CS-6, CS-8, and CS-10 have "bolted" lid designs. Grade 5 zinc-plated bolts, nuts, and washers are used to attach the lids to these strainers. See Table 1 for the proper lid bolt size and torque rating for each strainer. (Exercise care when tightening the lid bolts so as not to damage the strainer lid or housing).

It is important to follow the torque specifications as overtightening may result in premature failure of the bolts. It is equally important to follow a star wheel torque pattern when tightening the lid bolts (see Fig. 2). The strainer lid may not be seated down completely after the first torque sequence (this is especially evident on the larger strainers such as the CS-8 and larger). A second torque sequence should be adequate to seat the lid securely to the body.

Strainer Operation

Periodically, it will be necessary to flush out the debris that is collected and settles to the bottom of the strainer reservoir. The larger ClimaCool strainers (CS-4, CS-6, CS-8, and CS-10) are equipped with a flush port (or drainage port) extending inside the strainer. When it becomes time to clean the strainer, the flush port valve should be opened while the strainer is in operation (while pressurized and with water flowing). A thorough flushing of the strainer reservoir will depend upon the length of time the flush valve remains opened. This flush time will typically range from 15 to 60 seconds depending on the flow, inlet water pressure, and the amount of debris collected by the strainer. As a general rule, the larger strainers will require higher inlet water pressures in order to achieve a complete flushing. For example, the CS-4 model can be flushed with inlet water pressures as low as 15 PSI, while the CS-6 can be flushed with 30 PSI. The CS-8 and CS-10 models should be flushed with inlet water pressures greater than 40 PSI. Strainer

Note: When shutting down the chiller for extended periods of time, the strainer should be isolated and completely drained.

Strainer Element Cleaning

If your strainer assembly is equipped with optional pressure gauges, you will be able to monitor the pressure differential between the inlet and outlet sides of the strainer. Under a normal "clean" strainer operation this pressure difference should be slightly under 1 PSI. When this pressure differential reaches 5-10 PSI, the strainer element may require cleaning.

CAUTION: PRIOR TO DISMANTLING THE STRAINER FOR CLEANING, IT IS IMPERATIVE THAT THE STRAINER ASSEMBLY IS ISOLATED AND COMPLETELY DE-PRESSURIZED. Follow these steps when cleaning the ClimaCool Strainer element:

Step 1 (Bolted Lid Models): Remove the top of the ClimaCool Strainer by removing the Grade 5 Zinc plated bolts from the lid.

Step 1 (Band-Clamp Lid Models): Remove the top of the ClimaCool Strainer by taking off the band-clamp assembly.*

Step 2: Lift the strainer element (conical screen) out of the strainer body.

Step 3: Carefully scrub down the strainer element with a rigid nylon brush until all matter is loosened. DO NOT USE STEEL BRUSH

Step 4: Wash the strainer element off with clean water. It is preferable to use a hose with a significant amount of water pressure. DO NOT USE A PRESSURE WASHER.

Step 5: Wash all matter from the strainer gaskets and clean the inner-ring where the bottom of the strainer element rests.

Step 6: Make sure the U-shaped gasket is fitted securely to the bottom of the strainer element. Reposition the strainer element into the body of the strainer.

Step 7: Make sure the strainer head gasket is secure on the top of the strainer body. On V-Band models, O-rings should be seated completely in the body flange. Reposition the strainer lid back on the strainer body. Tighten the lid securely either with the bolts or with the band-clamp.

- For band-clamp models, opening and closing is achieved without adjusting the lock nut. It is tightened at the factory to the correct compression. (Minor tightening may be necessary if the gasket loses memory over time.) To open the clamp, depress the safety latch and pull the over-center lever outward. To close the clamp, make sure the T-Bolt is seated in its receiver and push the overcenter lever back toward the strainer housing. Be sure that the safety latch is engaged before putting the module to use.

What Is Water Hammer?

Water hammer is a phenomenon that can occur in fluid systems with long pipes. Water hammer is a rapid change of pressure caused by a rapid change in velocity. If the flow has been abruptly shut off downstream, the pressure in the entire system is raised very quickly.

What Causes Water Hammer?

Any action that can cause a rapid change in the velocity of the flow can set off a water hammer, such as closing a downstream valve, pump stoppage, etc. Typically, for short lengths of pipe (below 500 ft), downstream valves that are closed within 1/10th of a second can generate a water hammer.

What Can Water Hammer Do?

Pressure spikes from water hammer can raise fluid pressures to dangerously high values. These pressure spikes can cause serious damage to valves, pipes, strainers, joints, etc. The ClimaCool Strainer is rated to an absolute maximum pressure of 150 PSI for bolted lid models, and 125 PSI for band clamp lid models. A water hammer pressure spike that raises the pressure higher than the maximum rated pressure may result in strainer damage, voiding the manufacturer's warranty.

What Can I Do To Prevent Water Hammer?

There are certain precautions that can be taken to prevent or decrease the effect of water hammer. The addition of a surge tank or accumulator fitted with a suitable pressure relief valve and strategically located within the water system may provide adequate protection against the effects from water hammer. Careful attention should be given to the design and control strategy for valves and pumps so their actions do not invite a water hammer.

Automatic Timer Flush (AFT) Package

The ATF-EA-1.5 flush valve package provides an automatic method for flushing away the debris collected In the strainer's reservoir. The power supply and timer controls for the valve package are housed inside the ATF control box. The ATF controls can be preprogrammed to set the flushing duration and the time interval between flushes.

System Components:

A. Timer Based Valve Controller (see Fig. 1) sets the flush duration (length of the flush) and the flush interval (time between flushes).
B. Electric Ball Valve: designed for dirty water use (see Fig. 1 & 2).

Fig. 1

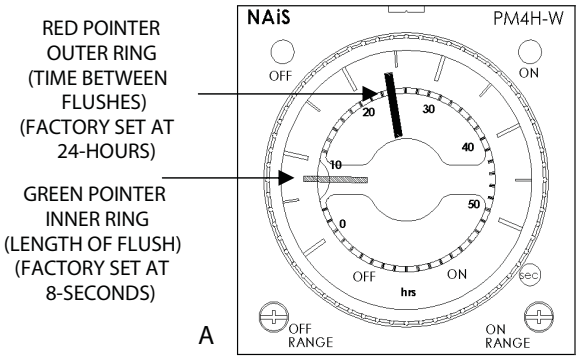
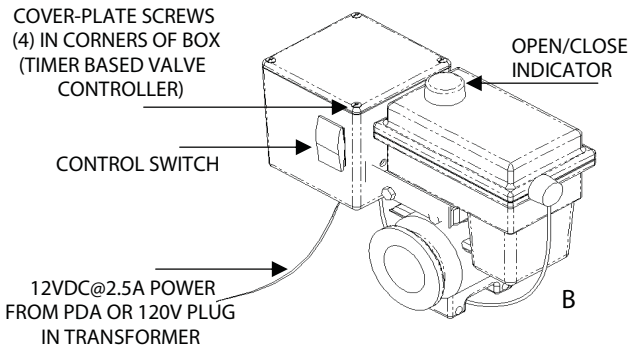


Fig. 2



Operation Instructions:

Flush valve line must be piped to atmospheric pressure such as an open floor drain. The flush line should not undergo any changes in elevation and should be sloped downward in the direction of drainage. DO NOT PIPE THE FLUSH OR DRAIN LINE INTO A PRESSURIZED LINE.

Note: The Automatic Timer Flush Package Needs To Be Programmed When It Is Received By The End-user. The programming is simple and takes only a few moments. However, because every application has different parameters that affect the required frequency between flushes and the duration of the flush, the end-user must choose the controller's settings (refer to your specific strainer manual).

To program the ATF Controller:

Plug the transformer into a 120-VAC outlet. Insert the 12-VDC plug coming from the transformer into the jack on the underside of the ATF box. Test for power by pressing the manual flush side of the control switch (lower switch light should come on and the valve will start to open). Adjust the "ON-TIME" (Valve Open) by turning the inner timer ring with the GREEN POINTER clockwise to increase duration. ("ON-TIME" RANGE, See Fig. 1) Adjust the "OFF-TIME" (Valve Close) by turning the outer ring with the RED POINTER clockwise to increase duration. ("OFF-TIME" RANGE, See Fig. 1) Set the control switch to auto flush. The red off light on the timer will come on and the upper light on the switch will come on and stay on. During the flush cycle the on light on the timer and the lower switch light will come on.

Control Switch: (see illustration)

Control switch flushing is initiated by pressing and holding down the manual control switch located on the front of the controller. The manual flush control switch can also be used to conveniently drain the water out of the strainer before removing the conical screen element from the strainer housing. A yellow indicator arrow on top of the ATF Valve will rotate in sync with the ball valve to show the valve position (open or closed). When the manual flush control switch is released, the valve will automatically close.\

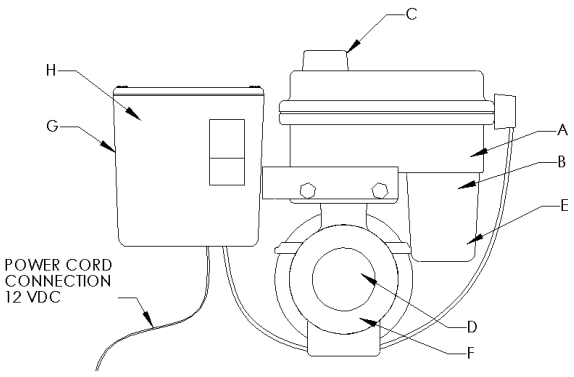
SAFETY FIRST!

Keep fingers away from valve opening to avoid getting caught in the moving parts. The electric motor supplies a sufficient amount of power to cause personal injury. Take precaution when handling.

Automatic Timer Flush ATF-EA-1.5 (optional)

Valve Specifications
A. Water-resistant Polypropylene Motor Case
B. High Torque Motors with Perma-lube Gears
C. Open & Close Indicator
D. Stainless Steel Ball Valve & Hardware
E. Auto Reset Circuit Breaker
F. 90 Degree Bidirectional Rotation
G. Controller Case

Fig. 3



TROUBLESHOOTING: If you require further assistance, please call us at (405) 745-3185.

PROBLEM	POSSIBLE CAUSE	SOLUTION
• Valve is leaking past ball	• Seals damaged or worn out • Valve is not stopping at proper closed position	• Install repair kit • Adjust limit switches
• Valve stem leaks	• Worn stem seals	• On metal valves: tighten stem packing nut 1/2 turn. **CAUTION! Over tightening stem nut could cause drag on motor and trip internal circuit breaker. May require repair kit or new valve.**
• Valve body leaks	• Loose body bolts or excessive operating pressure • Defective seals	• Check bolts and observe recommended ratings • Install repair kits or new valve
• Valve hard to turn	• Swollen seals or product buildup in valve chamber • Valve bolts too tight • Stem nut too tight	• Check valve for compatibility with product, may require valve cleaning or new valve • Loosen bolts slightly • Loosen stem nut slightly

GENERAL INFORMATION

Water Resistance:

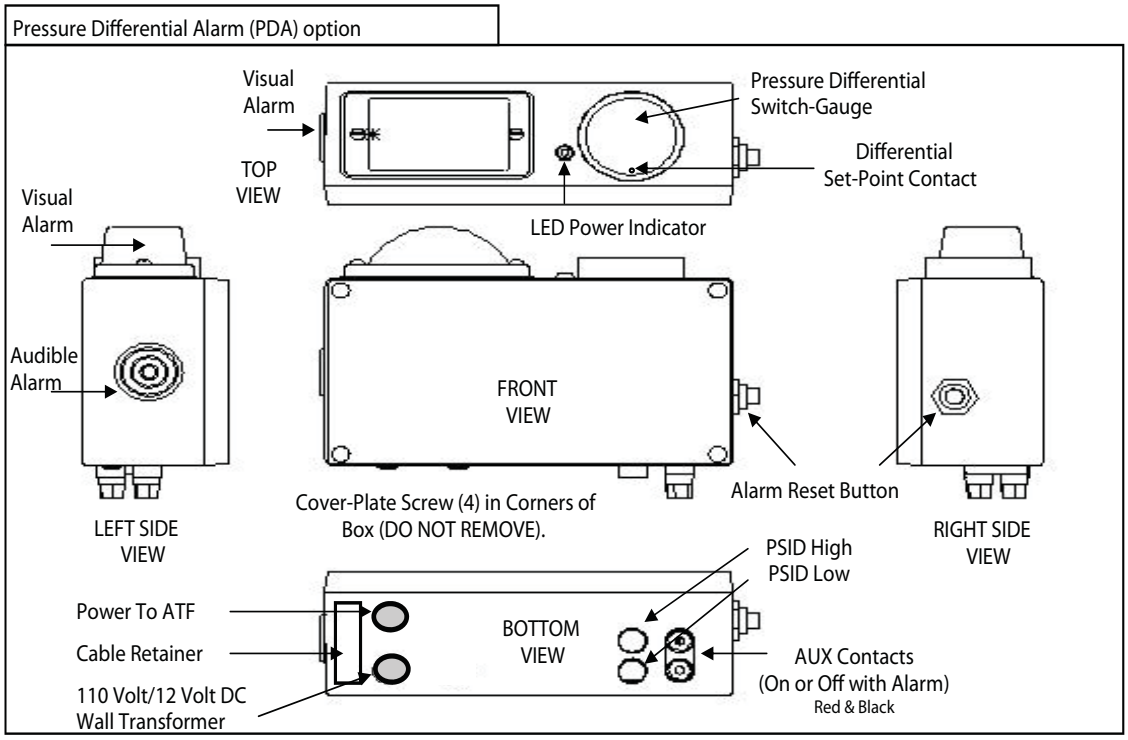
The Valve and Controller are water-resistant, but not waterproof. Do not install below ground level where the component can be submerged in water. Only remove the cover plate from the Valve Controller when setting or changing the flush settings. Keep the cover tightly sealed on the module during normal operation.

ClimaCool Corp. Return Policy:

New units or units less than 90-days old needing repair under warranty conditions must be returned to ClimaCool and must be accompanied by a Return Material Authorization (RMA) Number. To request a RMA Number, call (405) 745- 3185.

Please Follow Environmental Note:

All ATF valves sent to ClimaCool for repair must be cleaned and the valve rinsed and dried from all foreign residue or the shipment will be returned “as is” to the customer. We cannot expose our technicians to the vast variety of chemicals used with the valve. Thank you for your cooperation.



Description:
The pressure differential alarm option continually monitors and displays the strainer's inlet and outlet differential pressure. When the strainer element (conical strainer basket) becomes significantly clogged, the pressure differential switch-gauge will trigger an audible siren and a visual flashing alarm light. These alarms are intended to alert maintenance personnel that the strainer element must be removed and cleaned (see page 18 for complete strainer element cleaning instructions).

Operation Instructions:
Remove the power supply and insert the connector end into the socket on the bottom of the PDA housing, as indicated in the drawing above. Plug the transformer into the power source. Standard systems are supplied with a 120V power supply to the primary of the transformer, with an output, secondary of 12 VDC.

The pressure differential switch-gauge is factory set to 7-8 PSI. The ClimaCool Strainer operates at a pressure differential slightly less than 1 PSI during maximum flow when the strainer screen is clean. By the time this differential pressure reaches 7-8 PSI, the strainer element will be significantly clogged and require immediate removal and cleaning.

To adjust the pressure differential switch-gauge setting, insert a 1/16" allen wrench and rotate the differential set-point contact to the desired location (see Fig. 1).

Note: We do not recommend setting the differential switch-gauge higher than 10 PSI. Disabling the alarm or increasing the alarm set point could result in damage to the strainer element and allow debris to pass into the system.

Pressure Differential Alarm Package

When the differential set point is reached, both the audible and visual alarms will be triggered and will remain engaged until both the Alarm condition is corrected, and the Alarm-Reset button is pressed. (If the Alarm-Reset button is pressed but the differential pressure is beyond the set point, the alarms will re-engage immediately).

After the strainer is cleaned and put back in service, the differential pressure should return to 1 PSI.

If you have any questions about the Pressure Differential Alarm option, please call our technical product specialists at (405) 745-3185.

General Information

Auxiliary Contacts:
The PDA option is equipped with a remote alarm feature. The remote alarm contacts are located at the two Black & Red Banana Clip Posts (see illustration). The alarm can be set up in one of two ways: 1) a remote alarm signal of 12 VDC can be sent to a central monitoring station, or, 2) a set of auxiliary contacts will indicate a "closed" condition when the alarm activates. (See auxiliary Contact Schematic inside PDA Box). Remove the (4) screws on the cover plate and to access the schematic located inside the cover plate.) If you have any additional questions please contact a ClimaCool technical representative at (405) 745-3185.

Water Resistance:
The Pressure Differential Alarm Controller is water-resistant, but not water proof. Do not install below ground level where the box can be submerged in water. DO NOT REMOVE the cover plate from the PDA Controller. Keep the cover tightly sealed on the module during normal operation.

ClimaCool Corp. Return Policy:
Units in need of warranty repair, and less than 90 days old, must be returned to ClimaCool accompanied by a Return Material Authorization (RMA) number. To request a RMA, number call (405) 745-3185, then enter this number on the RMA form (available from the ClimaCool web site).

Please Follow Environmental Note:
All PDA Controllers sent to ClimaCool for repair must be cleaned and dried from all foreign residue or the shipment will be returned “as is” to the customer. We cannot expose our technicians to the vast variety of chemicals used around our systems. Thank you for your cooperation.

Maintenance:
The alarm functions of the PDA alarm package should be checked twice a year. Manually trip the differential set-point (see illustration) to engage the audible and visual alarms. Reset the differential setting and depress the alarm-reset button to verify the alarms are deactivated.

CLIMACOOL Y TYPE & BASKET TYPE STRAINERS

Strainer Installation Instructions:

A. Ensure all machined surfaces are free of defects and that the inside of the strainer is free of foreign objects.
B. The strainer should be installed so that the drain connection is pointed downwards.
C. For flanged end strainers, the flange bolting should be tightened gradually in a back and forth clockwise motion. Threaded end strainers should use an appropriate sealant.
D. Once installed, increase line pressure gradually and check for leakage around joints.
E. If the strainer is supplied with a start-up screen, monitor pressure drop carefully.

IMPORTANT! Ultimate responsibility for strainer and material selection rests with the end-user or facility manager, as only the end-user or facility manager knows the particular application and operating parameters to which the strainer will be subjected.

CAUTION: PRIOR TO DISMANTLING THE STRAINER FOR CLEANING, IT IS IMPERATIVE THAT THE STRAINER ASSEMBLY IS ISOLATED AND COMPLETELY DE-PRESSURIZED.
Strainer Removal Instructions

A. Drain piping.
B. Vent line to relieve pressure.
C. Loosen flange bolts (flanged ends).
D. Secure necessary lifting equipment to strainer assembly.
E. Remove inlet/outlet flange bolts (flanged end), or unthread (threaded ends) and carefully remove strainer.
F. Tighten cover. The strainer is ready for line start-up.

For Basket Strainers, Follow Steps G through L.

G. Drain piping.
H. Vent line to relieve pressure.
1. Loosen cover and open to access basket.
J. Remove, clean and replace basket in original position. (Note: In some instances, a high pressure water jet or steam may be required for effective cleaning).
K. Inspect cover gasket for damage. If necessary, replace. (Note: If spiral wound gaskets have been used, they must be replaced and can be used again).
L. Tighten cover. The strainer is ready for line start-up.

CAUTION SHOULD BE TAKEN DUE TO POSSIBLE EMISSION OF PROCESS MATERIAL FROM PIPING. ALWAYS ENSURE NO LINE PRESSURE EXISTS WHEN OPENING COVER.

Maintenance Instructions
For maximum efficiency, determine the length of time it takes for the pressure drop to double that in the clean condition. Once the pressure drop reaches an unacceptable value, shut down line and follow the "Strainer Removal Instructions" above.

A pressure gauge installed before and after the strainer in-line will indicate pressure loss due to clogging and may be used to determine when cleaning is required.

Trouble Shooting Guides and Diagnostic Techniques
A. After pressurizing, inspect cover and other joints for leakage. Gasket replacement or cover tightening is necessary if leakage occurs.
B. If the required filtration is not taking place, ensure the screen is installed in the correct position, and that the screen is mounted flush to the upper and lower seating surfaces.

PRE-START UP

Before the chiller is started, there are certain essential checks which must be carried out. Failure to carry out these checks could result in damage to the chiller voiding the warranty.

Electrical

It is imperative to turn off the main electrical power supply and follow proper lock-out, tag-out procedures prior to servicing any of the chiller's electrical components. The following procedures can be performed only after the electrical power is confirmed to be off:

1. The installation should have been inspected and approved by the respective agent and found to be in compliance with all local and national electrical codes.
2. Check & tighten as required all electrical terminal connections on each module. Utilize lock-out/tag-out procedures for this operation. A systematic tightening of all terminals inside the electrical control panel on each module should be carried out. This will include the compressor motor terminals, which would require removal of the compressor terminal cover. Check connections at each safety and every termination in the panel.
3. There are approx. (12) control wires which must be field connected from each module's electrical panel back to the "Master Control Panel". These control wires should be routed using a series of twisted pair conductors having #18 AWG minimum up to 50 ft., #16 AWG minimum up to 100 ft., and #14 AWG min. up to 250 ft. All field wiring must be identified (tagged).
4. All field connections should be checked for tightness.
5. Check all fuses for proper sizing as indicated on the chiller data plate and/or the electrical diagram on the inside door of the electrical panel.

Refrigeration

1. Remove the front and rear access covers from the top compressor sound enclosure of each module.
2. Refrigerant piping and components should be inspected for damage.
3. Check all refrigeration and water valves for proper positioning; once completed mark refrigerant valves with permanent marker. Make sure all refrigerant valves are fully opened and there are no visible signs of refrigerant leaks. Pre-Start Up
4. Place refrigerant gauges on the discharge and suction access ports of each refrigerant circuit to ensure a refrigerant charge is present. Leave the gauges on for compressor rotation check.
5. Confirm the settings on all pressure switches and thermostats.

Water System

1. Confirm that leak testing has been carried out.
2. Confirm that the system is clean.
3. Confirm that necessary water treatment systems are in place with both the evaporator and condenser water systems.
4. Confirm that appropriate water analysis has been conducted by the end-user.
5. Confirm that the results of this water analysis does not conflict with the acceptable constituent ppm levels as indicated in Table 1, page 16.
6. Extract a water sample from both the evaporator and condenser. Confirm that the sample bottles are filled to the top leaving no air in the bottles. Both sample bottles must have labels filled out per instructions included with bottles. Mail bottles immediately to the appropriate water testing laboratory as per instructions included with bottles.
7. Confirm that both the chilled water and condenser water circulating pumps are operational and water is flowing through both exchangers.
8. Shut entering water valve and blow out some water to check for particles or coloration from suspended particles. Record the differential pressures across the chiller condenser water header and across the condenser heat exchanger, measured at the "Pete's" ports at each module.
9. Confirm correct water flow rates through the condenser and evaporator. Acquire the "predicted" flow rates from the building's "hydronics system balancer". Compare the measured differential pressures from step 6 above with the predicted flow rates to ensure proper correlation to the flow results.

Chiller Pre-Start-Up Procedures

1. Turn selector switches on module panel off. Fill in circuit # and power panel identification inside each Module cover panel.
2. Ensure the correct fuses are installed in the control transformer fuse blocks inside each ClimaCool Module. Turn on the power to each module. The "Power" light should be on.
3. Override output with DX commissioning program or place a jumper between compressor 1 start terminals on the "field wiring" terminal strip (terminals 8 &9). With jumper in place, turn on the selector switch marked "compressor #1" to bump the compressor and check for proper rotation. Use pressure gauges to verify proper rotation. Once this is complete and correct rotation is verified, override output with DX commissioning program or place a jumper between compressor 2 start terminals on the control terminal strip (terminals 10 & 11). Turn on the switch marked "compressor #2" to bump the compressor and verify that circuit #2

compressor has correct rotation. Use pressure gauges to verify proper rotation. Always use proper electrical safety precautions.

4. Slowly close the chiller water inlet isolating valve and note that the flow switch stops the machine. Note the flow rate at which this occurs. If too much flow is lost before chiller is stopped, reset switch setting. The flow switch should be set so the chiller shuts down when the flow rate to each evaporator and condenser water circuits drops below 60% of rated ARI full load conditions (indicating a 10°F temp. change through both the evaporator and condenser heat exchangers).
5. Repeat the tests of all other safety interlocks which may be connected.
6. The anti-freeze thermostat for each module should be set to trip when the leaving chilled water temperature drops below 38°F.

Start Up

An anti-short cycle timer protects the chiller and there will be a delay before the controller will allow the compressors to start.

1. If the chilled water temperature is above the normal operating level, all load should be removed from the chilled water system and the suction temperature should be monitored to prevent high current draw.
2. If the condenser water temperature is below the normal operating level, ensure that the condenser water temperature control is in the correct position. Start Up
3. Re-install all fuses and set the controller.
4. When all temperatures are within operating limits, all high and low pressure safety switches should be tested for each refrigeration system.
5. The condenser temperature controller should be checked.

Once stable conditions have been achieved, the refrigeration system's high and low pressures, compressor amp draw, voltage Input level, and water system temperatures and pressures should be logged for each chiller module separately.

6. Check that oil level is between 1/3 and 1/2 of the sight glass. See page 51, Oil Levels.
7. The action of the controller should be checked for correct operation and control.

Mechanical and General

All covers, panels and doors should be in place and secured.

Start Up Documentation

All start-up paperwork and documentation must be submitted to ClimaCool.

SECTION 3.0 - START-UP

3.1 General

Once installation is complete, check the following:

- All refrigerant and electrical connections must be tight. Tighten all loose wire terminal connections that may have loosened in shipping.
- The compressor oil is at the proper level in the oil sight glass (when provided) for the compressor being used. See "Compressor Oil Charge."
- Check initial settings of thermostats and pressure controls. All adjustable pressure controls and valves will require a final adjustment with the use of a compatible gauge
- Check the control panel to be sure that all wiring is in accord with the unit wiring diagram.
- Check all three phase motors for proper rotation.

3.2 Compressor Precautions

Care must be taken when initially starting a system or when the system has been off for an extended period. At this time, the compressor may contain liquid refrigerant. Simply starting the system and walking away may result in irreparable compressor damage not covered under warranty. To prevent compressor damage, one or more of the following steps may be used:

- All compressors can be supplied with optional crankcase heater. These must be activated for 24 hours prior to starting the compressor. Be sure to check that the heater is functional. This can be done by simply touching the compressor in the area of the heater. It should feel warm to the touch. This check should be performed shortly after energizing the heater and again prior to starting the compressor. If the compressor is cold, do not attempt to start it. Locate the source of the problem, correct it and wait 24 hours before starting the compressor.
- Use a "safe" heat source such as a heat lamp on the compressor crankcase for approximately ½ hour before start-up. Never use a torch or heat gun. They can raise system pressures to dangerous levels in a very short time resulting in injury to personnel as well as property damage.
- After following steps 1 and 2 above, you can be relatively certain that no liquid refrigerant is left in the compressor. This does not mean that liquid refrigerant is not present elsewhere in the low side. To avoid compressor damage on startup, deactivate the liquid solenoid and "bump" the compressor, using the controller "POWER" switch, several times. The first 2 or 3 times the compressor is "bumped", it should not be allowed to run more than 2 or 3 seconds. Increase the run time to 5, 10 and 15 seconds over the next 3 "bumps". This will rapidly reduce low side pressure causing any liquid to boil off quickly. At this point it is usually safe to allow the compressor to run.
- After starting the compressor, listen for unusual sounds such as knocking. Should they be heard, immediately stop the compressor. Do not restart until the problem is resolved. While scroll compressors are more tolerant to liquid refrigerant than reciprocating types of compressors, the above precautions should still be observed Rotational direction is very important with three phase scroll compressors. Running these compressors with reversed rotation will result in damage not covered by warranty. When starting a three phase scroll compressor, refrigerant pressure gauges must be attached to both the high and low pressure ports provided on the system. With the compressor rotating in the proper direction, system suction pressure should drop and discharge pressure should rise to appropriate levels within a few seconds after the compressor is started. If this is not the case, the compressor is probably running in reversed rotation. Each chiller is computer tested and all three phase motors (i.e. pumps and compressors) are in proper phase when it leaves the factory. Turn the power off at the main disconnect and reverse any two of the three main power leads and restart. Observe the suction and discharge pressure gauges to verify that the compressor is rotating correctly. If pressures are still not appropriate, some other problem has developed which must be found and corrected prior to running the system.

CLIMACOOL®
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Start-Up and Warranty Registration Form (Air-Cooled)

Sign & date and fax: (405) 745-2072 Attn.: Technical Services
Or E-mail: techserv@climacoolcorp.com

Project Name: _____ Start-Up Date: _____
Address: _____
Module #: _____ Model #: _____ Serial Number: _____

Chiller # _____ Bank # _____ On-Site Location: _____
Evaporator 6" Main Inlet Pressure _____ Evaporator 6" Main Outlet Pressure _____ delta P_____
Evaporator "flow device" shut off chiller below approx. 40% loss of flow _____

Water Sample taken (Mark "X") Evaporator ___
Water sample bottles are provided. Follow instructions on label and mail same day sample is taken, if possible.

All wiring terminations in module panel, safeties and compressors tightened _____
Voltage / Ground L1 _____ L2 _____ L3 _____
Phase / Phase L1/ L2 _____ L2/ L3 _____ L1/ L3 _____

Circuit # 1 Refrigerant Type: (circle one) R-22 R-407C Field Charge (lbs)_____
Amperage L1 _____ L2 _____ L3 _____
Sight Glass Oil Level _____ Comments: _____
Suction Pressure (PSIG) _____ _____
Suction Temperature (°F) _____ _____
Discharge Pressure (PSIG) _____ _____
Discharge Temperature (°F) _____ _____
Compressor Superheat (°F) _____ _____
Evaporator Entering Water Temperature (°F) _____ _____
Evaporator Leaving Water Temperature (°F) _____ _____
Condenser Entering Air Temperature (°F) _____ _____
Condenser Leaving Air Temperature (°F) _____ _____
Condenser Entering Refrig. Liquid Temp (°F) _____ _____
Condenser Liquid Subcooling Temperature (°F) _____ _____
Evaporator Pressure Differential (PSIG) _____ _____
Verify Safety Settings: Low Limit_____ High Pressure Limit_____ Low Pressure Limit_____

Circuit # 2 Refrigerant Type: (circle one) R-22 R-407C Field Charge (lbs)_____
Amperage L1 _____ L2 _____ L3 _____
Sight Glass Oil Level _____ Comments: _____
Suction Pressure (PSIG) _____ _____
Suction Temperature (°F) _____ _____
Discharge Pressure (PSIG) _____ _____
Discharge Temperature (°F) _____ _____
Compressor Superheat (°F) _____ _____
Evaporator Entering Water Temperature (°F) _____ _____
Evaporator Leaving Water Temperature (°F) _____ _____
Condenser Entering Air Temperature (°F) _____ _____
Condenser Leaving Air Temperature (°F) _____ _____
Condenser Entering Refrig. Liquid Temp (°F) _____ _____
Condenser Liquid Subcooling Temperature (°F) _____ _____
Evaporator Pressure Differential (PSIG) _____ _____
Verify Safety Settings: Low Limit_____ High Pressure Limit_____ Low Pressure Limit_____

NOTE: Correct rotation of scroll compressors is extremely critical. Incorrect rotation could damage the compressor.

Contractor Name: _____ _____
Address: _____ (Authorized Signature)
_____
Phone: _____ Date: _____

Start-Up (Air-Cooled)0308 .doc

Start Up Check List

Fax completed form to: (405) 745-2072. Attn.: Tech Services or email to techserv@climacoolcorp.com

CLIMACOOL® "AR2" START-UP CHECK LIST

Start-Up Technician_____

Job Name_____ **Location** _____ **Chiller Bank No.**_____ **Date**_____

Module #1 Model #AR2-_____ Module #1 Serial #_____ // Module #2 Model #AR2-_____ Module #2 Serial #_____

Module #3 Model #AR2-_____ Module #3 Serial #_____ // Module #4 Model #AR2-_____ Module #4 Serial #_____

Module #5 Model #AR2-_____ Module #5 Serial #_____ // Module #6 Model #AR2-_____ Module #6 Serial #_____

Module #7 Model #AR2-_____ Module #7 Serial #_____ //

Start Up Procedure	Check Points	YES	No
Equipment Inspection	a. Unit damaged on arrival		
	b. Material received agrees with shipping papers		
Setting Unit	a. Vibration isolators used		
	b. Spring isolators adjusted for equal height		
	c. Rubber-in-shear isolators used, unit leveled by shimming		
Wiring	a. Power wiring complete		
	b. Main power voltage must be ± 10% of nameplate rated voltage. Ensure proper phase rotation of compressor - check with gauges at start-up.		
	c. Module circuit breakers &/or fuses agree with unit data plate.		
	d. Control wiring complete. Check ALL screw terminals for loose connections		
	e. Electrical service amperage is adequate for chiller load		
	f. Main Electrical Power (Volts/Ph/Hz) agrees with Chiller compressor data plate		
	g. External (fused) disconnect switch (or Ext. Cir. Brkr.) has proper amperage size		
	h. System wired per diagram		
	i. Wiring complies with local codes		
Refrigerant Condenser Piping	a. Piping complies with applicable codes		
	b. Head Pressure Control Valves (ORI/ORD) are field installed at condenser location		
	c. Fan cycling head pressure control switches properly set for ALL fans except HDR		
	d. All External, interconnecting condenser piping independently supported every 7'		
	e. Condenser vertical discharge piping includes inverted P-Traps every 15' vertical		
	f. Discharge piping includes hand valves & check valves located at condenser		
	g. Liquid piping includes hand valves & check valves located at condenser		
	h. Liquid line drier has replaceable drier core (shipped loose) properly installed		
	i. All horizontal discharge & liquid lines are sloped 1/8" per ft. downward with flow		
	j. If b. above is YES, All exposed discharge lines are insulated with ½" insulation		
Chilled Water Piping	a. Chilled water main lines insulated; Module pipe flange connections (6") insulated		
	b. Chilled water loop filled and vented at high points in system		
	c. Strainers installed and checked for cleanliness.		
Before Start-Up	a. Check compressor(s) for proper oil level		
	b. Ensure ALL compressor discharge, suction & liquid ball valves are OPEN		
	c. All hydronic isolation valves on evaporator chilled water circuit OPEN.		
	d. Apply service pressure gauges to suction and discharge access fittings		
	e. Check evap. water circuit flow switch interlock of modules & evap. water pumps. Check for proper water pump rotation & flow direction		
	f. Start auxiliary equipment (water pumps, fans, AHU fans, etc.)		
	g. CCH (if used) energized 24 hrs. before start-up		
	h. Check for proper water pressure drop across chiller barrel. Pressure gauges and thermometers should be installed on entering and leaving lines. (Pete's ports provided at each Module location).		
	i. Check for leaks, oily areas, flare nuts, control lines damaged in shipment		
After Start-Up	a. Recheck oil in crankcase(s) (1/3 to 2/3 sight glass while compressor running)		
	b. Check high pressure control setting to C/U at 375 psig (manual reset).		
	c. Check freeze thermostat control setting at 38°F.		
	d. Check and adjust (if necessary) Master Controller leaving chilled water setpoint		
	e. Check low pressure control setting to C/O at 50-52 psig (manual reset).		
	f. Check superheat and adjust if necessary (12°F to 20°F @ TXV bulb)		
	g. Check receiver liquid level within tolerance based on outdoor ambient temp.		
Clean Up	a. Final leak tests made. Refrigerant Type & charge (lbs) recorded on data plate		
	b. Receiver rotolok valves backseated (A/R), packing nuts tight and caps replaced		
	c. Control panel doors and/or covers secured		
	d. Replace ALL refrigeration access fitting caps. Clean up around unit		
Operating Personnel	a. Proper instructions given to customer's personnel in the operation of unit		

Remote Condenser Warranty Acknowledgement

Job Name on Quote / Submittal :_____Quote #: _____
Job Site Address: _____
Salesperson Name (Print): _____ Date: _____
Installing Contractor Name (Print): _____ Date: _____

In the left-hand margin, indicate you have verified the accuracy of each line item by initialing each numbered item below.
(S= REP/ClimaCool representative I= Installing Contractor)

S **I**

___ ___ 1. **Minimum Outdoor Temperature for Condenser Design**
The minimum winter outdoor temperature for design is (circle one): +45F / -20F
For +45F: (2-Stage Condenser fan cycling by refrigerant pressure is standard option for +45F minimum outdoor.(see Refdiag AR2-B.dwg).
For -20F: Flooded head pressure control must be factory approved. All condenser fans except the header end fan will cycle on individual pressure fan cycling controls. Field installed flooded head pressure controls are required (see RefrigDiag-AR2-Flooded-B.dwg).

___ ___ 2. **Compressor Hot Gas Bypass/ Combination Liquid Injection Unloading Option**
Only the first compressor stage (on electrical panel end) of each module can be equipped with a combination Hot Gas Bypass/ Liquid Injection system into evaporator. Is this option required? Yes / No

___ ___ 3. **A/C Condenser Location relative to Chiller Module**
A/C Condenser is located at a HIGHER elevation relative to chiller Module Yes / No

___ ___ 4. **Refrigerant Piping Geometry to Remote A/C Condenser; Vertical Distance**
A/C Condenser is located **Less than 10 feet Higher Elevation** relative to chiller module _____
A/C Condenser is located **Less than 30 feet Higher Elevation** relative to chiller module _____

___ ___ 5. **Refrigerant Piping Geometry to Remote A/C Condenser; Horizontal Distance**
A/C Condenser is located at an aggregate total distance equal to the sum of the vertical distance from Item 4 above plus the total horizontal distance, which **SHALL NOT EXCEED 100 FEET**. Enter the distance: _____

___ ___ 6. **Refrigerant Piping Geometry to Remote A/C Condenser; Oil Return "P" Traps**
The installing contractor MUST agree to the installation of the following: If the A/C Condenser is located **Greater than 10 feet Higher Elevation** relative to the chiller module, install ALL inverted "P" traps as shown on page 2 of this document (#RAC2-AR2 Install_blk1.dwg)

___ ___ 7. **Refrigerant Piping Geometry to Remote A/C Condenser; Oil Return "P" Traps with Hot Gas Bypass**
If the module's 1st stage refrigeration circuit is equipped with hot gas bypass/ combination liquid injection system, the installing contractor MUST agree to the installation of the following: If the A/C Condenser is located **Greater than 10 feet Higher Elevation** relative to the chiller module, install ALL inverted "P" traps with double vertical riser lines as shown on ClimaCool drawing (#RAC2-AR2 Install_blk1.dwg).

___ ___ 8. **Refrigerant Piping Geometry to Remote A/C Condenser: Sloped for Oil Return**
The installing contractor MUST agree to the installation of the following: The discharge line TOI Condenser AND the condenser liquid return line FROM condenser must slope downward in the direction of the refrigerant flow at 1/8" per foot

___ ___ 9. **Refrigerant Piping Geometry to Remote A/C Condenser; Isolation and Check Valves**
The installing contractor MUST agree to the installation of the following: All necessary isolation and check valves as shown on the following three diagrams, (#RAC2-AR2 Install_blk1.dwg), (#Refdiag AR2-B.dwg), and (RefrigDiag-AR2-Flooded-B.dwg)

___ ___ 10. **Refrigerant Piping Geometry to Remote Condenser; NO change in ^/v Direction**
Starting at the module, the discharge line to condenser and the condenser liquid return line from condenser DO NOT have any changes in the elevation direction throughout the piping runs, e.g. UP 20 feet, then DOWN 10 feet to the condenser connections. In other words, all piping runs MUST follow a Consistent Upward Path from the module to the condenser, with the only exception being 1/8" per foot sloped piping, as outlined in Item 7 above.

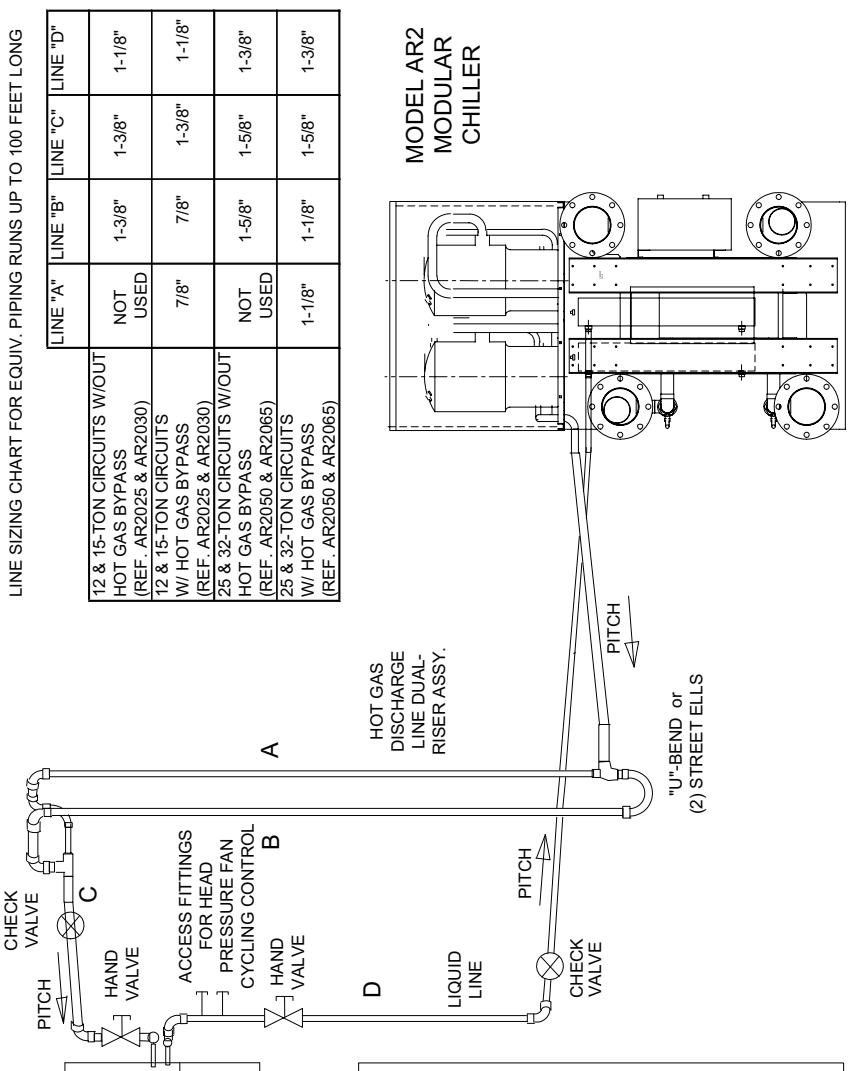
By signing below, the Salesperson/Representative warrants the accuracy of the information contained in this document. Further, by signing below, the Installing Contractor warrants that the installation work scope will include but shall not be limited to ALL of the items presented herein. Failure to provide accurate information and/or the failure to follow the above minimum installation instructions may result in an interruption in and/or cause the Warranty provided on the unit to be void. Fax completed form to: (405) 745-2072. Attn.: Tech Services or email to techserv@climacoolcorp.com.

_____ _____
REP/ClimaCool representative Installing Contractor

Remote Condenser

LINE SIZING CHART FOR EQUIV. PIPING RUNS UP TO 100 FEET LONG

	LINE "A"	LINE "B"	LINE "C"	LINE "D"
12 & 15-TON CIRCUITS W/OUT HOT GAS BYPASS (REF. AR2025 & AR2030)	NOT USED	1-3/8"	1-3/8"	1-1/8"
12 & 15-TON CIRCUITS W/ HOT GAS BYPASS (REF. AR2025 & AR2030)	7/8"	7/8"	1-3/8"	1-1/8"
25 & 32-TON CIRCUITS W/OUT HOT GAS BYPASS (REF. AR2050 & AR2065)	NOT USED	1-5/8"	1-5/8"	1-3/8"
25 & 32-TON CIRCUITS W/ HOT GAS BYPASS (REF. AR2050 & AR2065)	1-1/8"	1-1/8"	1-5/8"	1-3/8"



NOTES:
1. Line A" is only used for systems with hot gas bypass. See chart above for line sizes for 15 and 25 ton circuits. Line "A" is sized to carry the oil at minimum load conditions.

2. Line "B" incorporates inverted "p"-traps as shown, with additional "p"-traps each additional 15 feet of rise, up to 50 ft. max. See chart above for line sizes.

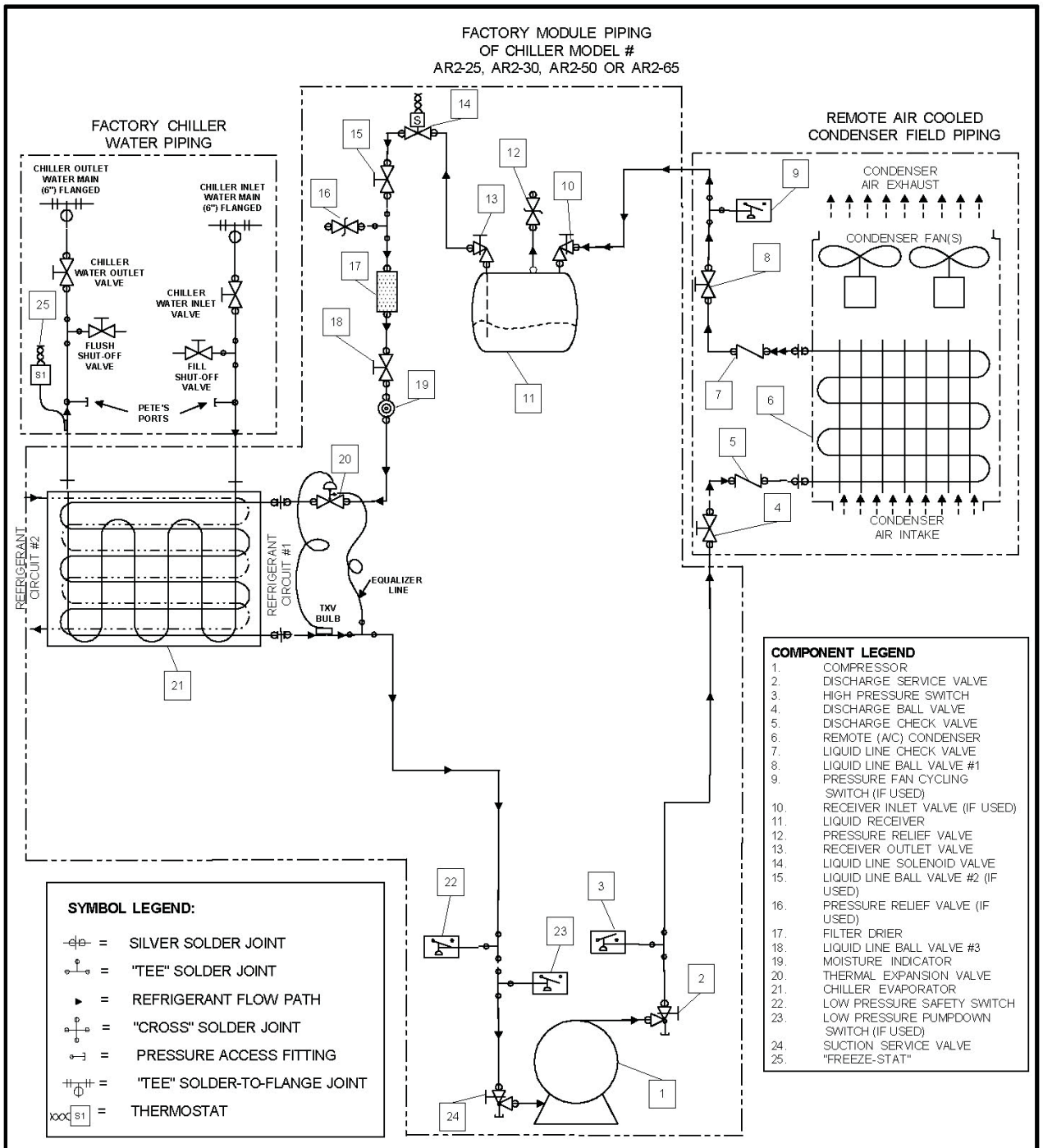
3. Line "C" is for horizontal hot gas lines and carries the full flow. See chart above for line sizes.

4. The liquid line "D" should incorporate a check valve for applications where the condenser is at a lower temperature than the receiver, to prevent refrigerant migration during the off-cycle. See chart above for line sizes.

5. All pitches are 1/8" per foot downward in the direction of the refrigerant flow.

6. One refrigerant circuit is shown. There are two separate refrigerant circuits for each AR2 module.

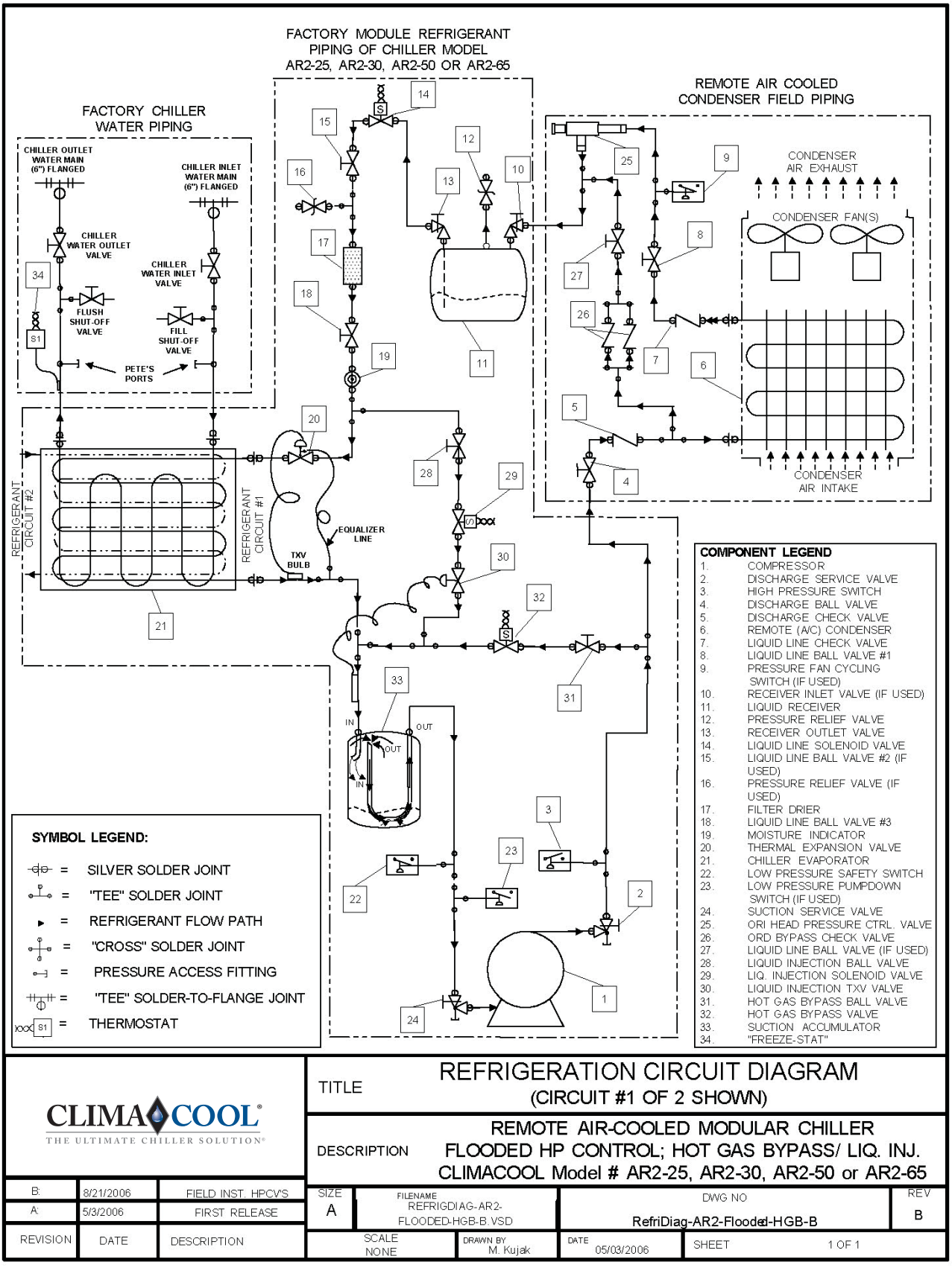
Refrigeration Circuit Diagram - Standard AR2



CLIMACOOL®
THE ULTIMATE CHILLER SOLUTION®

TITLE	REFRIGERATION CIRCUIT DIAGRAM (CIRCUIT #1 OF 2 SHOWN)				
DESCRIPTION	REMOTE AIR-COOLED MODULAR CHILLER STANDARD MODEL (NO OPTIONS) CLIMACOOL Model # AR2-25, AR2-30, AR2-50, AR2-65				
REVISED B: 10/01/2006					
REVISED A: Orig. Release	SIZE A	ClimaCool Corp. RefrigDiag-AR2-B.vsd	DWG NO RefriDiag-AR2-B	REV B	
APPROVED	DATE 5/3/2006	FILENAME REFRIGDIAG-AR2-B.VSD	SCALE NONE	DRAWN BY M. Kujak	DATE 05/03/2006	SHEET 1 OF 1

Refrigeration Circuit Diagram – ORI/ORD Head Press. Ctrl.



CLIMACOOL®
THE ULTIMATE CHILLER SOLUTION®

TITLE	REFRIGERATION CIRCUIT DIAGRAM (CIRCUIT #1 OF 2 SHOWN)
DESCRIPTION	REMOTE AIR-COOLED MODULAR CHILLER FLOODED HP CONTROL; HOT GAS BYPASS/ LIQ. INJ. CLIMACOOL Model # AR2-25, AR2-30, AR2-50 or AR2-65

REVISION	DATE	DESCRIPTION
B:	8/21/2006	FIELD INST. HPCV'S
A:	5/3/2006	FIRST RELEASE

SIZE	FILENAME	DWG NO	REV
A	REFRIGDIAG-AR2-FLOODED-HGB-B.VSD	RefriDiag-AR2-Flooded-HGB-B	B

SCALE	DRAWN BY	DATE	SHEET
NONE	M. Kujak	05/03/2006	1 OF 1

The ClimaCool® Remote "Air-Cooled" Chiller Models AR2-25, AR2-30, AR2-50 & AR2-65

Module and Compressors

Model AR2		25	30	50	65
Capacity (Tons) [1]		23.6	29.0	45.0	57.3
Chiller Module Type		Remote A/C	Remote A/C	Remote A/C	Remote A/C
Design Total Heat Rejection @ 1°F 'TD' | @ 30°F 'TD' (MBH)		12.2 | 365	15.1 | 452	23.4 | 702	30 | 899
Refrigerant Circuits (Quantity)		2	2	2	2
Compressor Type		Scroll	Scroll	Scroll	Scroll
Compressor Quantity		2	2	2	2
Compressor Nominal Hp (Per Circuit)		13	15	25	32
Minimum Unloading (Tons / Per Module)		12.8 / 50%	14.5 / 50%	22.5 / 50%	28.6 / 50%
Refrigerant Charge (Per Circuit) (R-22 or R-407C) (Lbs.)		14.5	14.5	16.5	18.5
Oil Charge (Per Circuit) (Oz.)		140	140	224	224
Module Overall Dimensions (Inches)	Length	45-5/8"	45-5/8"	46-7/8"	46-7/8"
	Width	29-1/2"	29-1/2"	33-1/2"	33-1/2"
* Denotes unit with covers	Height*	77"	77"	78 3/8"	78 3/8"
	Height	72 7/8"	72 7/8"	76 3/4"	76 3/4"
Module Operating Weight w/ Water (Lbs.) [3]		1755	1825	2163	2280
Module Shipping Weight (Lbs.) [4]		1599	1669	1833	1950

Evaporator

Model AR2		25	30	50	65
Heat Exchanger (Type)		Brazed Plate / Dual Circuit	Brazed Plate / Dual Circuit	Brazed Plate / Dual Circuit	Brazed Plate / Dual Circuit
Independent Refrigerant Circuits (Quantity)		2	2	2	2
Water Storage Volume HX Only (Gals.)		3.42	3.42	6.65	7.92
Water Storage Volume HX plus 6" Main Headers (Gals.)		11.27	11.27	16.12	17.41
Flow Rate (GPM)[5]	Min.	50	50	80	90
	Max.	100	100	180	210
Pressure Drop (Psig. / Ft H,0)		3.4 / 7.8	3.4 / 7.8	4.2 / 9.7	4.6 / 10.6
Maximum Design Working Pressure - Water Side (Psig.)		285	285	285	285
Evaporator Water Connections inlet/Outlet (Inches)		2"	2"	2-1/2"	2-1/2"
Evaporator insulation Thickness (inches)		3/4"	3/4"	3/4"	3/4"
Header Water Connections – Inlet/Outlet (Inches) [6]		6"	6"	6"	6"
Test Pressure Rating – Water/Fluid Header (Psig.)		450	450	450	450
Insulation Thickness - Header (Inches)		3/4"	3/4"	3/4"	3/4"

NOTES:

I. Unit Tonnage ARI Rating Conditions: 44°F leaving chilled water temperature, and 2.4 GPM per ton through the evaporator; 95°F entering condenser air temp. (dry bulb); 30°F condenser "TD" and 15°F liquid subcooling.

2. Min. chiller unloading % can be as low as 4.8% of total system. Calculate system unloading by dividing 1/2 of smallest module by total system tons.

3. Module operational weight includes water, compressor oil, and refrigerant charge. Multiply by # of modules for a total system operational weight.

4. Unit shipping weight includes refrigerant charge, compressor oil, and shipping base skid.

5. The minimum/maximum flow rates are based on a temperature differential of 7°F to l5°F through the evaporator.

6. Main Header water / fluid connections are ASME, 6" full-face flange, Class 150, eight bolt pattern.

Condenser Physical Data: 30°F TD & 105°F Ambient

Remote Condenser "H" Series Module Size →	AR2-25	AR2-30	AR2-50	AR2-65
Model RC (1140 RPM /30 F TD /105 F Max Ambient)	**RC1-07H**	**RC1-08H**	**RC2-26H**	**RC2-31H**
Quantity of Remote Condensers Needed	2	2	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	12	12	8	8
Independent Refrigerant Circuits (Quantity)	1	1	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 26"	Direct | 26"	Direct | 30"	Direct | 30"
Total CFM	13,700	12,900	39,600	38,100
Fan Speed	1140	1140	1140	1140
Fan Motor Hp (ea)	1/3 hp	1/3 hp	1.5 hp	1.5 hp
Quantity of Fan Motors	2	2	4	4
kW Input (ea.) Fan Motor | Total kW Input for All Motors	1.2 | 2.4	1.2 | 2.4	1.93 | 7.7	1.93 | 7.7
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	1.3 | 2.6	1.3 | 2.6	3.5 | 14	3.5 | 14
Total Heat Rejection @ 1°F TD | THR @ 30°F TD (MBH)	7.0 | 210	8.0 | 240	26.2 | 786	31.4 | 942
Max. Design Working Pressure – Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (Inches)	1 @ 1-1/8"	1 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (Inches)	1 @ 7/8"	1 @ 1-1/8"	2 @ 1-3/8"	2 @ 1-3/8"
Sound Level (dB @ 10')	74.5	74.5	78.4	78.4
Dimensions; W x L x H (Inches)	43 x 90 x 40.5	43 x 90 x 40.5	88 x 127 x 49	88 x 127 x 49
Net Weight | Shipping Weight (lbs)	510 | 650	530 | 680	1340 | 1520	1440 | 1620

Remote Condenser "X" Series Module Size →	AR2-25	AR2-30	AR2-50	AR2-65
Model RC (830 RPM / 30 F TD / 105 F Max. Ambient)	**RC2-18X**	**RC2-18X**	**RC2-26X**	**RC2-32X**
Quantity of Remote Condensers Needed	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	8	10	14
Independent Refrigerant Circuits (Quantity)	2	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 30"	Direct | 30"	Direct | 30"	Direct | 30"
Total CFM	31,700	31,700	30,500	29,300
Fan Speed	830	830	830	830
Fan Motor Hp (ea)	1.0 hp	1.0 hp	1.0 hp	1.0 hp
Quantity of Fan Motors	4	4	4	4
kW Input (ea.) Fan Motor | Total kW Input for All Motors	1.1 | 4.4	1.1 | 4.4	1.1 | 4.4	1.1 | 4.4
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	2.4 | 9.6	2.4 | 9.6	2.4 | 9.6	2.4 | 9.6
Total Heat Rejection @ 1°F TD | THR @ 30°F TD (MBH)	17.5 | 525	17.5 | 525	26.2 | 786	32.0 | 960
Max. Design Working Pressure – Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (Inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (Inches)	2 @ 1-1/8"	2 @ 1-1/8"	2 @ 1-3/8"	2 @ 1-5/8"
Sound Level (dB @ 10')	66.9	66.9	66.9	66.9
Dimensions; W x L x H (Inches)	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49
Net Weight | Shipping Weight (lbs)	1240 | 1420	1240 | 1420	1340 | 1520	1440 | 1620

Remote Condenser "Q" Series Module Size →	AR2-25	AR2-30	AR2-50	AR2-65
Model RC (540 RPM / 30 F TD / 105 F Max. Ambient)	**RC2-14Q**	**RC2-17Q**	**RC2-25Q**	**RC2-32Q**
Quantity of Remote Condensers Needed	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	12	14	12
Independent Refrigerant Circuits (Quantity)	2	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 30"	Direct | 30"	Direct | 30"	Direct | 30"
Total CFM	22,300	22,300	20,800	32,300
Fan Speed	540	540	540	540
Fan Motor Hp (ea)	1/2 hp	1/2 hp	1/2 hp	1/2 hp
Quantity of Fan Motors	4	4	4	6
kW Input (ea.) Fan Motor | Total kW Input for All Motors	0.43 | 1.72	0.43 | 1.72	0.43 | 1.72	0.43 | 1.72
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	1.75 | 7.0	1.75 | 7.0	1.75 | 7.0	1.75 | 10.5
Total Heat Rejection @ 1°F TD | THR @ 30°F TD (MBH)	14.3 | 429	17.3 | 519	24.5 | 735	32.4 | 972
Max. Design Working Pressure – Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (Inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. @ Size O.D. (Inches)	2 @ 1-1/8"	2 @ 1-1/8"	2 @ 1-3/8"	2 @ 1-5/8"
Sound Level (dB @ 10')	55.7	55.7	55.7	57.3
Dimensions; W x L x H (Inches)	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49	88 x 180 x 49
Net Weight | Shipping Weight (lbs)	1240 | 1420	1240 | 1420	1440 | 1620	1990 | 2230

Variable Speed Condenser Data: 30°F TD & 105°F Amb.

Remote Condenser "V" Series Module Size →	AR2-25	AR2-30	AR2-50	AR2-65
Model RC (Variable Spd /30 F TD /105 F Max. Amb.)	**RC2-20V**	**RC2-20V**	**RC2-25V**	**RC2-33V**
Quantity of Remote Condensers Needed	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	8	12	12
Independent Refrigerant Circuits (Quantity)	2	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Var Spd| 30.5	Var Spd| 30.5	Var Spd| 30.5	Var Spd| 30.5
Total CFM	46,700	46,700	46,700	44,100
Fan Speed	215 to 1030	215 to 1030	215 to 1030	215 to 1030
Fan Motor Hp (ea)	1.5 hp	1.5 hp	1.5 hp	1.5 hp
Quantity of Fan Motors	4	4	4	4
kW Input (ea.) Fan Motor | Total kW Input for All Motors	2.2 | 8.8	2.2 | 8.8	2.2 | 8.8	2.2 | 8.8
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	3.5 | 14	3.5 | 14	3.5 | 14	3.5 | 21
Total Heat Rejection @ 1°F TD | THR @ 30°F TD (MBH)	20.4 | 612	20.4 | 612	24.8 | 744	33.1 | 993
Max. Design Working Pressure – Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (Inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (Inches)	2 @ 1-1/8"	2 @ 1-1/8"	2 @ 1-3/8"	2 @ 1-3/8"
Sound Lvl @ 215 RPM | Sound Lvl @ 1030 RPM (dB @ 10')	46.5 | 73.1	46.5 | 73.1	46.5 | 73.1	46.5 | 73.1
Dimensions; W x L x H (Inches)	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49
Net Weight | Shipping Weight (lbs)	1290 | 1510	1290 | 1510	1290 | 1510	1390 | 1610

Variable Speed Condenser Data: 20°F TD & 115°F Amb.

Remote Condenser "V" Series Module Size →	AR2-25	AR2-30	AR2-50	AR2-65
Model RC (Variable Spd /20 F TD /115 F Max. Amb.)	**RC2-20V**	**RC2-25V**	**RC2-38V**	**RC2-46V**
Quantity of Remote Condensers Needed	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	12	12	10
Independent Refrigerant Circuits (Quantity)	2	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Var Spd| 30.5	Var Spd| 30.5	Var Spd| 30.5	Var Spd| 30.5
Total CFM	46,700	46,700	41,900	66,100
Fan Speed	215 to 1030	215 to 1030	215 to 1030	215 to 1030
Fan Motor Hp (ea)	1.5 hp	1.5 hp	1.5 hp	1.5 hp
Quantity of Fan Motors	4	4	4	6
kW Input (ea.) Fan Motor | Total kW Input for All Motors	2.2 | 8.8	2.2 | 8.8	2.2 | 8.8	2.2 | 13.2
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	3.5 | 14	3.5 | 14	3.5 | 14	3.5 | 21
Total Heat Rejection @ 1°F TD | THR @ 20°F TD (MBH)	20.4 | 408	26.2 | 524	38.3 | 766	46.2 | 924
Max. Design Working Pressure – Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (Inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (Inches)	2 @ 1-1/8"	2 @ 1-1/8"	2 @ 1-3/8"	2 @ 1-3/8"
Sound Lvl @ 215 RPM | Sound Lvl @ 1030 RPM (dB @ 10')	46.5 | 73.1	46.5 | 73.1	46.5 | 73.1	48.0 | 74.7
Dimensions; W x L x H (Inches)	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49	88 x 180 x 49
Net Weight | Shipping Weight (lbs)	1290 | 1510	1290 | 1510	1490 | 1710	2060 | 2510

Condenser Physical Data: 20°F TD & 115°F Ambient

Remote Condenser "H" Series Module Size →	AR2-25	AR2-30	AR2-50	AR2-65
Model RC (1140 RPM /20 F TD /115 F Max. Ambient)	**RC2-19H**	**RC2-26H**		**RC2-47H**
Quantity of Remote Condensers Needed	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	8	14	12
Independent Refrigerant Circuits (Quantity)	2	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 30"	Direct | 30"	Direct | 30"	Direct | 30"
Total CFM	41,000	39,600	38,100	59,400
Fan Speed	1140	1140	1140	1140
Fan Motor Hp (ea)	1.5 hp	1.5 hp	1.5 hp	1.5 hp
Quantity of Fan Motors	4	4	4	6
kW Input (ea.) Fan Motor | Total kW Input for All Motors	1.93 | 7.7	1.93 | 7.7	1.93 | 7.7	1.93 | 11.55
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	3.5 | 14	3.5 | 14	3.5 | 14	3.5 | 21
Total Heat Rejection @ 1°F TD | THR @ 20°F TD (MBH)	19.2 | 384	26.2 | 524	38.3 | 766	46.7 | 934
Max. Design Working Pressure – Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (Inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (Inches)	2 @ 1-1/8"	2 @ 1-1/8"	2 @ 1-3/8"	2 @ 1-3/8"
Sound Level (dB @ 10')	78.4	78.4	78.4	80.0
Dimensions; W x L x H (Inches)	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49	88 x 180 x 49
Net Weight | Shipping Weight (lbs)	1240 | 1420	1340 | 1520	1440 | 1620	1990 | 2230

Remote Condenser "X" Series Module Size →	AR2-25	AR2-30	AR2-50	AR2-65
Model RC (830 RPM / 20 F TD / 115 F Max. Ambient)	**RC2-18X**	**RC2-26X**		**RC2-47X**
Quantity of Remote Condensers Needed	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	10	14	12
Independent Refrigerant Circuits (Quantity)	2	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 30"	Direct | 30"	Direct | 30"	Direct | 30"
Total CFM	31,700	31,700	45,700	44,000
Fan Speed	830	830	830	830
Fan Motor Hp (ea)	1.0 hp	1.0 hp	1.0 hp	1.0 hp
Quantity of Fan Motors	4	4	6	6
kW Input (ea.) Fan Motor | Total kW Input for All Motors	1.1 | 4.4	1.1 | 4.4	1.1 | 6.6	1.1 | 6.6
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	2.4 | 9.6	2.4 | 9.6	2.4 | 14.4	2.4 | 14.4
Total Heat Rejection @ 1°F TD | THR @ 20°F TD (MBH)	17.5 | 350	26.2 | 524	39.4 | 788	47.0 | 934
Max. Design Working Pressure – Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (Inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (Inches)	2 @ 1-1/8"	2 @ 1-1/8"	2 @ 1-3/8"	2 @ 1-3/8"
Sound Level (dB @ 10')	66.9	66.9	68.5	68.5
Dimensions; W x L x H (Inches)	88 x 127 x 49	88 x 127 x 49	88 x 180 x 49	88 x 180 x 49
Net Weight | Shipping Weight (lbs)	1240 | 1420	1240 | 1420	1990 | 2230	2140 | 2380

Remote Condenser "Q" Series Module Size →	AR2-25	AR2-30	AR2-50	AR2-65
Model RC (540 RPM / 20 F TD / 115 F Max. Ambient)	**RC2-21Q**	**RC2-25Q**	**RC2-39Q**	**RC2-48Q**
Quantity of Remote Condensers Needed	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	14	14	12
Independent Refrigerant Circuits (Quantity)	2	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 30"	Direct | 30"	Direct | 30"	Direct | 30"
Total CFM	21,500	20,800	31,200	41,600
Fan Speed	540	540	540	540
Fan Motor Hp (ea)	1/2 hp	1/2 hp	1/2 hp	1/2 hp
Quantity of Fan Motors	4	4	6	8
kW Input (ea.) Fan Motor | Total kW Input for All Motors	0.43 | 1.72	0.43 | 1.72	0.43 | 2.58	0.43 | 3.44
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	1.75 | 7.0	1.75 | 7.0	1.75 | 10.5	1.75 | 14.0
Total Heat Rejection @ 1°F TD | THR @ 20°F TD (MBH)	20.7 | 414	24.5 | 490	39.5 | 790	47.6 | 952
Max. Design Working Pressure – Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (Inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (Inches)	2 @ 1-1/8"	2 @ 1-1/8"	2 @ 1-3/8"	2 @ 1-3/8"
Sound Level (dB @ 10')	55.7	55.7	57.3	58.6
Dimensions; W x L x H (Inches)	88 x 127 x 49	88 x 127 x 49	88 x 180 x 49	88 x 180 x 49
Net Weight | Shipping Weight (lbs)	1340 | 1520	1440 | 1620	2140 | 2380	2830 | 3650

THE CLIMACOOL MODULAR CHILLER APPLICATION PARAMETERS

Water Flow Rates

It is imperative that minimum and maximum water flow rates are not exceeded. Minimum and maximum water flow rates are defined in the Physical Data tables of this manual. A flow switch or differential pressure switch is required to confirm flow This device is supplied by others during initial installation.

Chilled Water Temperature Limits

ClimaCool air-cooled remote modules are designed for a leaving chilled water temperature range from 42°F to 59°F. All cataloged modules can operate safely in this range without the need of special controls or glycol additives. Leaving water temperatures below 42°F can result in evaporator suction temperatures below the freezing point of water. Therefore, we recommend a glycol solution additive that will protect the evaporator from freeze ups at lower operating suction temperatures.

Water Quality Parameters

Proper care should he given to maintaining a clean system. Foreign matter such as scale, dirt and corrosion material can severely affect system performance. Such matter may also cause blockage which increases water pressure drop and reduces water flow Due to the regional differences of water conditions, ClimaCool recommends that a local water treatment specialist be contacted to determine a proper water treatment program. ClimaCool does not recommend the use of salt or brackish water in chilled water systems. Both have a detrimental effect on the life of system components. ClimaCool modules use a .0001 (ft2-hr oF/Btu) fouling factor for the evaporator in determining performance ratings. See page 15 for Water Treatment guidelines.

Water Piping Practices

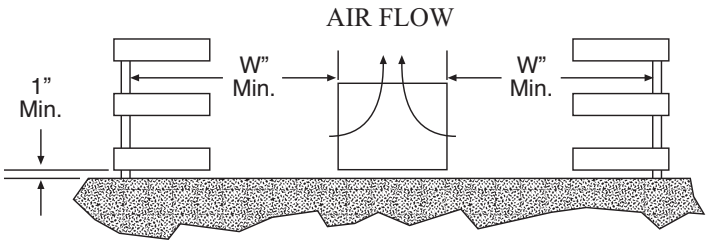
As with any water system, it is important that the system be clean. If care is taken during installation, the possibility of dirt related problems are avoided in future operation of the chiller.

The pipe work installer must remove weld scale- rust and contamination during pipe work fabrication. There are certain necessary components that should always be installed in the chilled water loop. (see Water Piping Configurations on page 11 in this manual) Isolation valves are required in the position shown to isolate the chiller for maintenance. It is also desirable and a good practice to have valves isolating the pumps.

Refer to the ClimaCool modular chiller water piping configurations (Figs. I and 2 on page 11) for piping configurations on multiple modules. Before final piping connections are made to the chiller, all external water piping must be thoroughly flushed. Sufficient insulation should be installed and sealed to prevent condensation and reduce heat gain. Chilled water volume can be accommodated with the use of expansion tanks.

Remote Condenser Location

It is vital to select a suitable location for your remote air cooled condenser in order to allow sufficient air flow into the cavity of the condenser It is important not to place the condenser into a "pit", unless the pit is not any deeper than the condenser height plus 10 feet, and there is at least a clearance of 2 times the width of the unit on both sides in between the condenser and the pit walls. The unit must also be level in relation to the pit opening.



Multiple units can be placed next to each other, side by side, as long as there is at least one width distance between them, that being the width of the largest unit.

Condensers can be located near fences, as long as there is approx. 50% free area in the fence and the unit is no closer than one width distance from the fence.

THE CLIMACOOL MODULAR CHILLER - APPLICATION PARAMETERS

Remote Condenser Control Panels Factory assembled fan cycling control panels are available to cycle fans for head pressure control either on ambient temperature or condensing pressure. Contact ClimaCool for Custom applications for fan speed control or custom built control panels.

- All fans are cycled with contactors.
- Condensers with a single row cycle fans separately with one contactor per fan (e.g. Model #RC1-08A).
- Condensers with two rows of fans will have each row of fans dedicated to one specific refrigeration circuit. Since the fans closest to the header end of the unit run continuously, the second fan in each row will cycle independently to control head pressure corresponding to the circuit it serves.
- Standard control circuit voltage is 24 volts. Optional Control circuit voltages of 230 or 115 volts are available on request.
- Standard control circuits require an external power supply for powering control circuit (by others).
- Optional factory mounted control circuit transformer is available on 460 volt condenser fan motor voltage to provide power to the control circuit

Head Pressure Control by Ambient Fan Cycling

Condenser fans are controlled by ambient temperature using electronic temperature controls. Ambient fan cycling is recommended for multi-circuited condensers or single circuit condensers where there is little variation in condenser load, such as the condenser model # RC1-08A, which is a single row of fans to serve one of the refrigeration circuits of a 30-ton module, model AR2-30.

Ambient fan cycling is limited in its ability to control head pressure to mild ambient conditions, see Table 2 for minimum recommended ambient temperatures for fan cycling. By request, ClimaCool can provide year round head pressure control by combining ambient fan cycling with other such methods as flooded head pressure control, or variable speed fans. Combining flooded controls with ambient fan cycling also provides the advantage of reducing the refrigerant required to flood the condenser. Refer to Table 3 for typical settings for ambient thermostats.

Table 2 - Minimum Ambient for Fan Cycling.

Number of Fans		Desi n T.D.*				
Single Row	Double Row	30	25	20	15	10
2	4	35	45	55	60	70
3	6	15	30	40	55	65
4	8	0	15	30	45	60
5	10	0	10	20	35	55
6	12	0	0	10	30	50

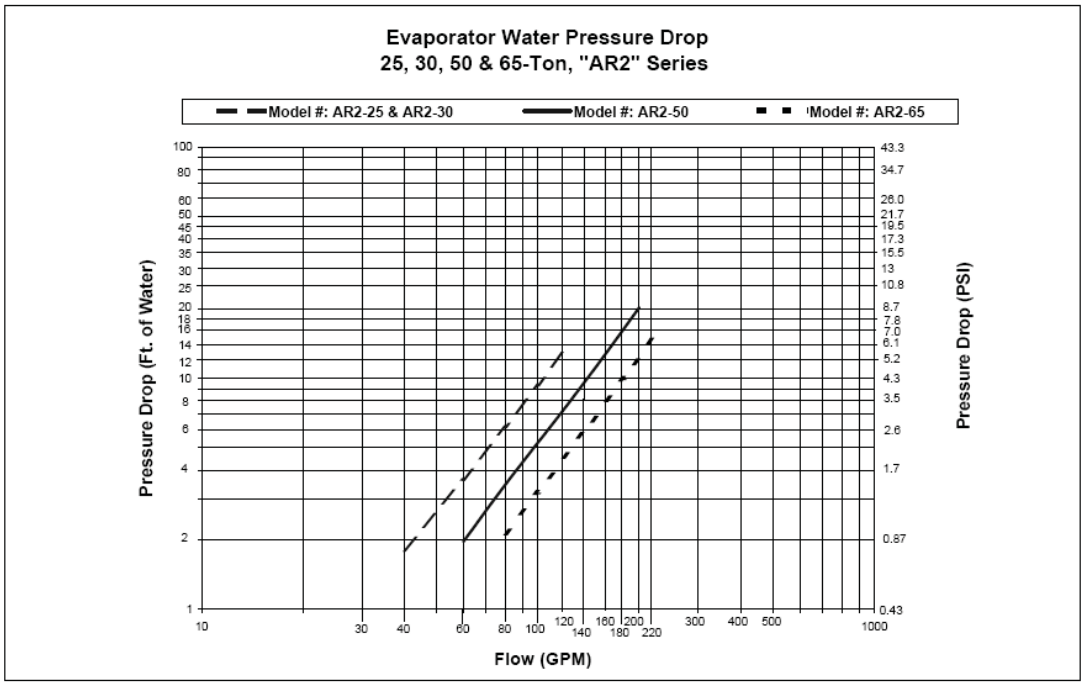
Table 3 - Ambient Fan Cycling Thermostat Settings

Number of Fans		Design	Thermostat Settin	
Single Bow	Double Row	T.D.	1	2
2	4	30	60	
		25	65	
		20	70	
		15	75	
3	6	30	60	40
		25	65	55
		20	70	60
		15	75	65

Head Pressure Control by Ambient Fan Cycling

The most common method for controlling head pressure is to cycle the condenser fans using high pressure control switches sensing condenser pressure. Again, the fans closest to the header end of the unit run continuously, thus second fan in each row will cycle independently to control head pressure corresponding to the refrigerant circuit it serves. As with ambient fan cycling, it is also possible to combine alternate methods of head pressure control with fan cycling by head pressure. Contact the factory for more precise regulation of head pressure as required.

Performance Multipliers & Pressure Drops



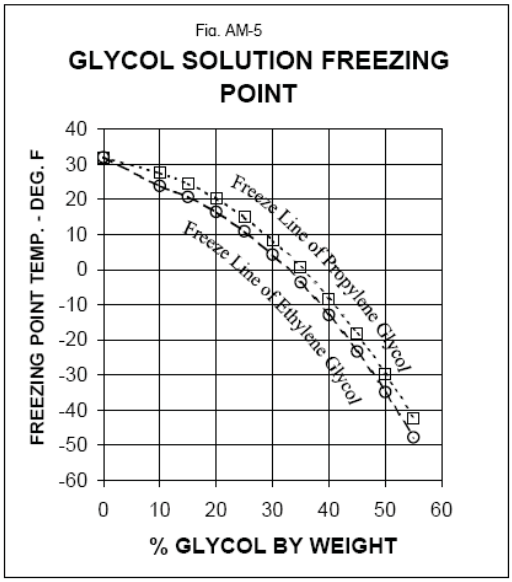
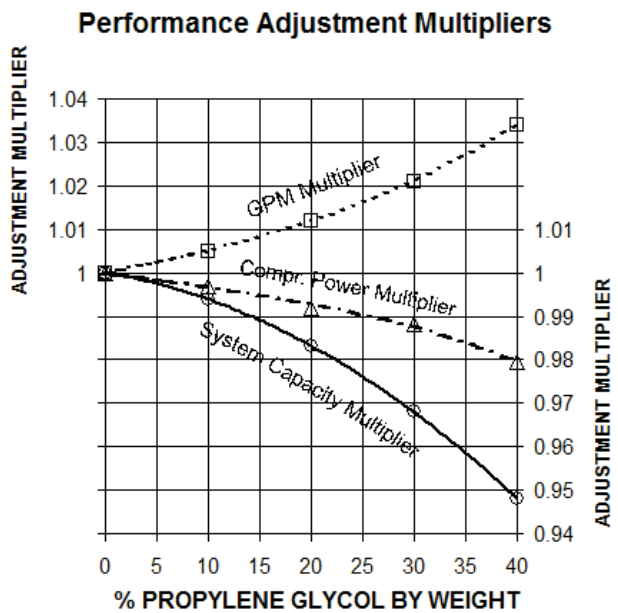


Table AM-6

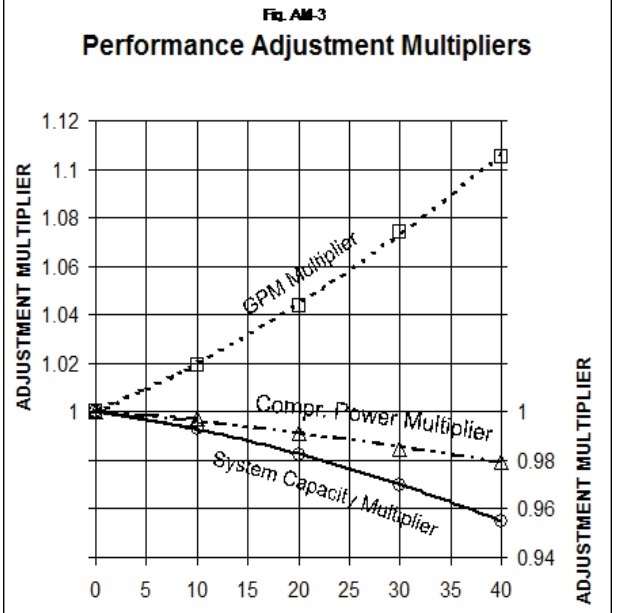
Performance Adjustment Factors vs. Altitude vs. Chiller Temperature Drop												
Chiller	**Sea Level**			**2000 ft.**			**4000 ft.**			**6000 ft.**		
Water Temp. F)	**Capacity Multiplier**	**Flow, gpm Multiplier**	**kW Power Multiplier**	**Capacity Multiplier**	**Flow, gpm Multiplier**	**kW Power Multiplier**	**Capacity Multiplier**	**Flow, gpm Multiplier**	**kW Power Multiplier**	**Capacity Multiplier**	**Flow, gpm Multiplier**	**kW Multiplier**
8	0.995	1.246	0.998	0.99	1.244	1.003	0.986	1.238	1.006	0.98	1.232	1.012
10	1.000	1.000	1.000	0.993	0.997	1.004	0.989	0.99	1.007	0.983	0.996	1.014
12	1.005	0.834	1.001	0.996	0.831	1.004	0.992	0.826	1.008	0.986	0.821	1.016
14	1.010	0.716	1.001	0.998	0.714	1.005	0.994	0.709	1.009	0.989	0.704	1.018

Fig. AM-1



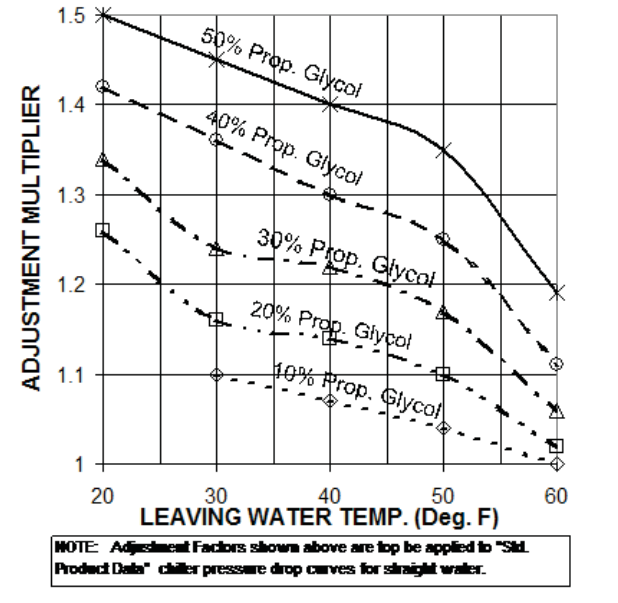
NOTE: Correction Factors shown above are top be applied to "Std. Product Data @ AR550/590-1998; 44F LVG. Chil. Water / 95F Ent. Cond. Air.

Fig. AM-3



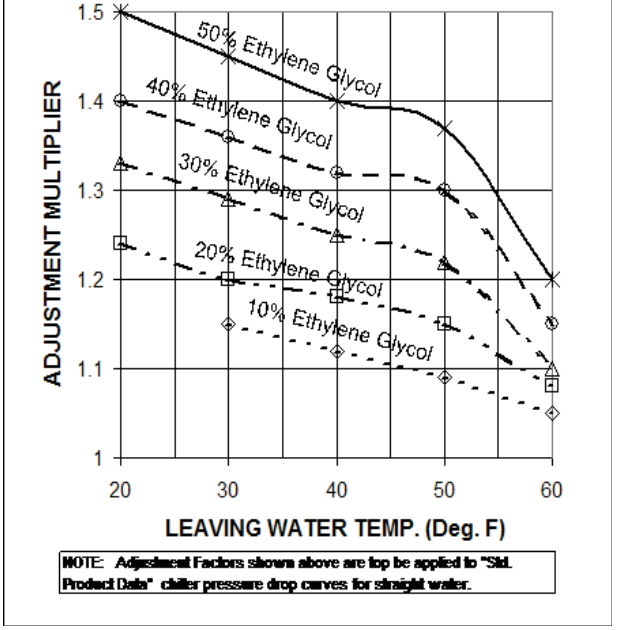
NOTE: Correction Factors shown above are top be applied to "Std. Product Data" @ AR550/590-1998; 44F LVG. Chil. Water / 95F Ent. Cond. Air.

Fig. AM-2



NOTE: Adjustment Factors shown above are top be applied to "Std. Product Data" chiller pressure drop curves for straight water.

Fig. AM-4



NOTE: Adjustment Factors shown above are top be applied to "Std. Product Data" chiller pressure drop curves for straight water.

SELECTION INPUT DATA

To select a ClimaCOOL Remote Air-Cooled Chiller system, the following information is required:

1. System Load in TONS.
2. Chilled water temperature drop (CWTD).
3. Leaving chilled water temperature (LCWT).
4. Ambient Air Temp. Entering Condenser (TA)
5. Condenser TD (or CTD). Saturated condensing temp. minus ambient air temp.

Using Performance Tables

When reading data from the performance tables on page 45, it is necessary to first calculate the 'Saturated Refrigerant Discharge Temperature' or TSD as follows:

TSD = TA + CTD
where TA = Ambient Air Temp. Entering Condenser and
CTD = Condenser TD (Temp. difference between ambient air temp. & sat. condensing temp.)

Given the leaving chilled water temp. (LCWT), and the calculated TSD, the CAPACITY in TONS are read from the appropriate performance table. The performance tables are based on a 10°F temp. drop in chilled water. For temp. drops other than 10°F, and/or for altitudes other than sea level, multiply the TONS by the factor found in Chart AM-6.

Chilled Water Selection Example

(Select AR2-30*H2 Modules)
Input Data:

1. LOAD = 84 TONS.
2. CWTD = 8°F.
3. LCWT = 44°F.
4. TA = 95°F.
5. CTD = 30°F.

1. Determine saturated discharge temperature (TSD) TSD = TA + CTD
   TSD = 95°F+30°F = 125°F
2. Select the appropriate performance table based on the selected module type (AR2-30*H2). Record the CAPACITY and KW of a single module at the leaving chilled water temperature specified (LCWT) of 44°F, and at the TSD calculated above at 125°F. CAPACITY = 28.3 TONS, KW = 30.6
3. To find the equivalent tons capacity at 8°F chiller drop by a single module tabulated at 10°F drop values, divide the tons capacity by the factor in Chart AM-6as:
   CAPACITY REQUIRED = 84/0.995= 84.4 TONS
   MODULES REQ'D = 84.4/28.3 = ~ 3 MODULES
   POWER INPUT = (30.6)(3) = 91.8 KW
   At 8°F temperature drop, applying Chart AM-6 performance adjustment factor results in:
   TONS = (84.9)(.995) = 84.5 vs sys. load of 84 TON
4. CHILLED WATER FLOW RATE Chilled water flow rate is determined as follows:
   GPM=(24)(TONS)/(CHILLED WATER TEMP DROP)
   or GPM = (24)(TONS)/(CWTD) GPM = (24)(83.7)/8 = 251.1
   To find GPM per Module:
   GPM/(# of Modules) = 251.1/3 = 83.7.
5. CHILLED WATER PRESSURE DROP Chilled water pressure drops are provided in Figure 1. Using the 'GPM/ Module' results from step 4 above, refer to Figure 1 on page 41, and read pressure drop from the middle curve for model # AR2-30*H2 as:
   Pressure Drop = 14 ft. of water

Chiller Performance With Glycols

When analyzing performance data of chillers employing glycol and water solutions, first derive the chiller performance data (CAPACITY, KW, GPM & PRESSURE DROP) assuming pure water flow through the chiller. Then you can apply adjustment factors to the performance data from the pure water case. These factors are found in Figures AM-1 through Fig. AM-4 on page 42, and depend upon the type and percent of glycol used in the chiller circuit. Fig. AM-1 and Fig.AM-2 provide factors for propylene glycol. Fig. AM-3 and Fig. AM-4 are for ethylene glycol. The factors in all Fig's AM-1 through Fig. AM-4 are based on 10°F drop in fluid temperature through the chillers, at sea level, and at 95F entering condenser air temp. Fig. AM-5 is provided for solution freeze temps. of glycol concentrations. Chart AM-6 provides adjustment factors for sea level changes and chiller temp. drops other than 10F, all assuming a fouling factor of 0.0001 in the chiller.

Propylene Glycol Selection Example

(Select AR2-30*H2 Module)
Determine CAPACITY, KW, GPM and Pressure Drop for an AR2- 30*H2 module, given the following Inputs:
CWTD = 10°F
LCWT = 42°F
TA = 95°F CTD = 30°F.
30% Propylene Glycol/ 70% Water in Chiller

1. Determine saturated discharge temperature
TSD = TA + CTD
TSD = 95°F+30°F = 125°F

2. From the Performance Tables: CAPACITY: 27.2 TONS; KW: 30.6
3. First find the water flow and pressure drop for pure water as In the previous example.
   GPM = (24)(27.2)/10 = 65.3 GPM
   From Fig. 1, read pressure drop from mid. Curve as:
   Pressure drop = 8.5 ft. of water
4. To convert performance data for pure water to data using 30% Propylene Glycol, record the adjustment multipliers from Fig. AM-1 & Fig. AM-2 on page 42:
   CAPACITY factor: 0.97
   KW factor: 0.988
   GPM factor: 1.022 Pressure Drop factor: 1.20
5. Calculate chiller performance using 30% Propylene Glycol by multiplying the chiller performance data for pure water by the adjustment factors as follows:

CAPACITY:	27.2 x 0.97 = 26.38 TONS
KW:	30.6 x 0.988 = 30.23 KW
GPM:	65.3 x 1.022 = 66.74
GPM Pressure Drop:	8.5 x 1.20 = 10.2 ft. of water

The ClimaCool Modular Chiller - Performance Data
Models AR2-25, AR2-30, AR2-50 & AR2-65

MODEL	LCWT	SATURATED DISCHARGE CONDENSING TEMPERATURE								
		115 °F			125 °F			135 °F		
	°F	TONS	kWi	EER	TONS	kWi	EER	TONS	kWi	EER
AR2-25	40	23.1	22.8	12.1	21.8	25.6	10.2	20.3	28.3	8.5
	42	24.1	22.8	12.6	22.6	25.3	10.7	21.1	28.3	8.9
	44	25.0	22.8	13.1	23.6	25.5	11.1	22.0	28.3	9.3
	45	25.5	22.8	13.3	24.0	25.5	11.3	22.5	28.3	9.5
	46	26.0	22.8	13.6	24.5	25.4	11.6	22.9	28.3	9.7
	48	30.9	27.3	13.6	29.3	29.3	12.0	23.8	28.3	10.1
	50	32.1	27.4	14.1	30.4	29.3	12.5	24.8	28.3	10.5
AR2-30	40	28.3	27.7	12.2	26.8	31.2	10.3	25.1	34.7	8.7
	42	29.5	27.7	12.7	27.9	30.2	11.1	26.2	34.7	9.0
	44	30.6	27.7	13.2	29.0	31.2	11.1	27.2	34.8	9.4
	45	31.2	27.7	13.4	29.5	31.3	11.3	27.9	34.8	9.5
	46	31.8	27.7	13.7	30.1	31.2	11.6	28.3	34.8	9.7
	48	33.1	27.7	14.2	31.3	31.3	12.0	29.4	34.9	10.1
	50	34.3	27.8	14.8	32.5	31.3	12.5	30.6	34.9	10.5
AR2-50	40	44.0	42.7	12.3	41.5	47.4	10.5	39.1	52.4	8.9
	42	45.8	42.8	12.8	43.2	46.3	11.2	40.1	52.7	9.2
	44	47.6	43.0	13.2	45.0	48.2	11.2	42.3	52.8	9.6
	45	48.5	43.1	13.5	45.9	48.3	11.4	43.1	52.9	9.8
	46	49.5	43.2	13.7	46.8	48.4	11.6	44.0	52.9	10.0
	48	51.4	43.3	14.2	48.7	48.0	12.2	45.8	53.1	10.3
	50	53.4	43.5	14.7	50.6	48.2	12.6	47.6	53.2	10.7
AR2-65	40	56.1	55.4	12.1	52.9	61.6	10.3	49.6	68.5	8.7
	42	58.3	55.7	12.5	55.1	61.8	10.7	51.7	68.7	9.0
	44	60.6	55.9	13.0	57.3	62.0	11.1	53.8	68.8	9.4
	45	61.7	56.0	13.2	58.5	62.1	11.3	55.0	68.9	9.6
	46	62.9	56.1	13.4	59.6	62.2	11.5	56.1	69.0	9.7
	48	65.3	56.3	13.9	61.9	62.3	11.9	58.3	69.1	10.1
	50	67.8	56.4	14.4	64.3	62.4	12.4	60.6	69.3	10.5

NOTES:

1. Unit tonnage rating conditions: 44°F leaving chilled water temperature,
   95°F entering condenser air temperature (dry bulb),
   30°F condenser "TD" and 15°F liquid subcooling.
2. Performance based on ARI 550-590-1998, Air-Cooled Chiller (Condenserless) conditions.
3. kWi input is for compressors plus control circuit.
4. EER = Energy Efficiency ratio (Btu/watt-hour). Power inputs include compressor and control power.
5. Interpolation between points is permissible. Extrapolation is not permitted.
6. Consult a ClimaCool representative for performance at temperatures outside the ranges shown
7. LCWT. Leaving Chilled Water Temperature in degrees F.

Operational Limitations

VOLTAGE LIMITATIONS		
The following voltage limitations are absolute and operation beyond these limitations may cause serious damage to the compressor.		
NOMINAL VOLTAGE	**MIN VOLTAGE**	**MAX VOLTAGE**
208/230-3-60	187	253
460-3-60	414	506
575-3-60	518	632

COMPRESSOR OPERATING LIMITATIONS	
Maximum Compression Ratio	9.5:1
Maximum Operating Pressure Differential (PSI)	270
Minimum Operating Pressuire Differential (PSI)	56
Maximum Suction Pressure (PSIG)	80
Maximum Discharge Temp. (°F)	225
Minimum Superheat At Compressor (°F)	10
Maximum Superheat At Compressor (°F)	25
Oil Temperature (Max.) (°F)	160
Maximum Sat. Discharge Temp. (°F)	140

WATER FLOW DATA	AR2-25	AR2-30	AR2-50	AR2-65
Min. Evaporator Water Flow (GPM)	50	50	80	90
Max. Evaporator Water Flow (GPM)	100	100	180	210
Min. Lvg. Evap. Water Temp. (No Glycol; R-407C) (°F)	42	42	42	42
Min. Lvg. Evap. Water Temp. (No Glycol; R-22) (°F)	40	40	40	40
Min. Lvg. Evap. Water Temp. (With Glycol) (°F)	20	20	20	20
Max. Lvg. Evap. Water Temp. (°F)	50	50	50	50
Max. Lvg. Evap. Water Temp. (UniFlow) (°F)	55	55	55	55
Max. Evaporator Water Differential Temp. (°F)	15	15	15	15
Min. Evaporator Water Differential Temp. (°F)	7	7	7	8

NOTES: 1. All temperatures stated are for counterflow HX flow configuration unless “UniFlow” is specified.

EQUIPMENT ROOM AMBIENT LIMITATIONS	AR2-25	AR2-30	AR2-50	AR2-65
Minimum Equipment Room Temp. (°F)	55	55	55	55
Maximum Equipment Room Temp. (°F)	105	105	105	105

LIQUID LINE DRIER- INSTALLATION AND REPLACEMENT INSTRUCTIONS

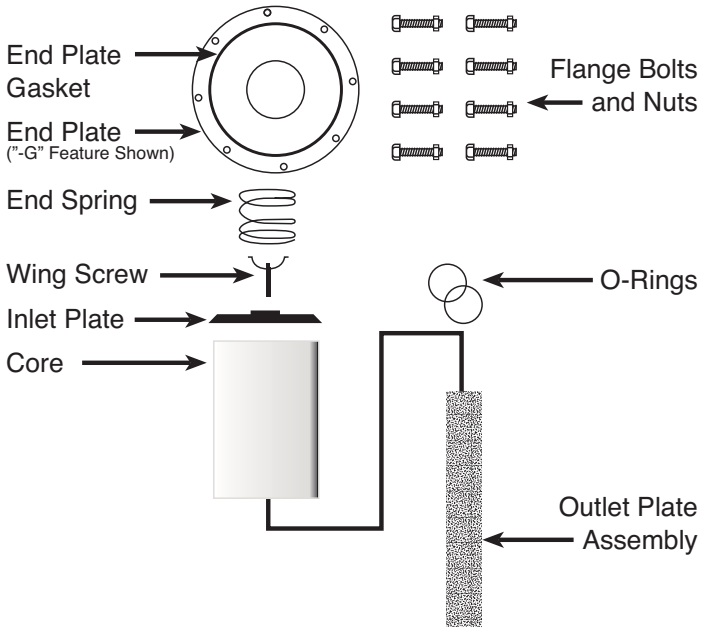
Replace any lost or damaged bolt and/or nut from a replaceable core Catch-All Filter-Drier. All bolts and nuts torqued to the proper value are required for proper safe fastening of the end plate and to prevent leakage. Bolts should be torqued to 14 to 16 ft-lbs on the C-480 Series Catch-Alls. The cores used in replaceable core Catch-All Filter-Driers are shipped in METAL CANS HERMETICALLY SEALED to protect them from contamination by moisture and dirt. The detailed instructions for assembly and changing cores are given on these cans. The following condensed instructions may be used if these cans are not available.

1. Always pump out the section of the line containing the filter-drier by closing the hand valve located just before the drier in the direction of refrigerant flow, and allow the compressor to operate. After isolated section has been pumped out, close the liquid line valve just after the filter drier, shut down the chiller electrically and then change the core. Disposal of the cores should be handled according to local laws. WARNING! Dangerous hydraulic pressures may develop if hand valves are closed and the filter-drier is full of liquid. When liquid is trapped in a section of line, even a slight increase in temperature results in a great increase in internal pressure.
2. Make sure all the refrigerant is pumped out of the Catch-All shell. The appropriate shut-off valves should be tightly closed.
3. Remove the end plate and internal assembly, and clean the internal parts. Remove the activated core from the sealed can. The metal pull tab and pull strip permit the can to be opened with the key or a pair of pliers. Do not replace the end plate gasket unless it is damaged. When replacement is necessary, select the outer gasket from the set supplied with each core. Do not cut or abrade the gaskets used in the end plate.
4. Remove the end spring, wing screw, and inlet plate from outlet plate assembly. After the replacement core is slid onto the outlet plate assembly with the proper o-rings, position inlet plate on the end of the tubular screen. Fasten finger tight the wing screw to assembly. The screw, when properly fastened, tightens the components in the assembly thereby prohibiting component movement and dirt bypassing around the cores. Assemble the end spring on to the wing screw. The design of the screw holds the spring in position so that the end plate can be easily installed (especially when the shell is mounted horizontally). The end spring is designed to fit into the circular groove on the end plate.
5. Insert the assembly in the shell, replace the flange bolts, tighten evenly to the recommended torque value (14 to 16 ft-lbs for the C-R480 Series).

CAUTION- The edge of the shell fits into the gasket groove on the end plate and makes a seal against the gasket to prevent refrigerant leakage. Be careful not to scratch or damage the edge of the shell when changing the cores. If the edge of the shell should become damaged, replace the shell to prevent possible refrigerant leakage.

WHEN TO CHANGE CORES — Cores should be changed when they become contaminated, or on a regular maintenance schedule. Disposal of the cores should be handled according to local laws. Cores that become contaminated with solid particles should be changed whenever the pressure drop increases to the point where it reduces system performance. When moisture is the major concern, change the drier cores according to the indication of the liquid line sight glass. The cores will remove their maximum amount of moisture and come to equilibrium in approximately one day of operation. When either acid or wax is the major contaminant involved, the cores should be left in the system at least three days to come to equilibrium thereby removing the maximum amount of contaminants. Many users of replaceable core Catch-Alls will change the cores every Spring and Fall as part of their normal maintenance schedule.

Sporlan Drier Core Model #RCW-48- This drier core is designed specially for use with POE oils, and is a high water capacity core. Order this core as separate item. This core should be used on all ClimaCool AR2 series chillers.



REFRIGERATION SYSTEM REPROCESSING

All ClimaCool remote air-cooled modular chillers leave the factory with both refrigeration circuits pressurized with 50 psig of dry nitrogen. These split system chillers require interconnecting refrigeration piping between the ClimaCool AR2 compressor/ evaporator module section and the remote condenser section. The condenser section provided by ClimaCool is typically a remote air-cooled condenser configuration. Contact the factory for guidelines for customer supplied, field integration to other permissible condenser types, such as evaporative condenser configurations. The refrigerant charge will be weighed-in in the field based on the condenser configuration and condenser model. The ClimaCool AR2-25 and AR2-30 models are equipped with a 72 pound liquid receiver capacity per compressor circuit. The AR2- 50 and AR2-65 models have an 84 pound liquid receiver installed per circuit. The installing contractor MUST make the determination of refrigerant type to be charged in the field. All ClimaCool AR2 module systems can be charged with either refrigerant R-22 or R-407C. Field installation of additional receiver capacity may be required depending on the refrigerant retaining volume of the remote condenser and interconnecting piping. After the total refrigerant amount is charged into each circuit (weighed in using an appropriate refrigeration scale at +/- 2 pound accuracy), the resultant weight should be recorded on the AR2 module data plate for future reference. See “System Refrigerant Charging” section for specific charging guidelines.

AR2 Module Refrigeration Piping Connections

The discharge and liquid line stub-out connections at the AR2 module section are equipped with shut-off valves with capped leads. Never uncap these leads without checking the shutoff valves to be sure that they are fully closed and the units are ready for piping. All scroll compressors in ClimaCool AR2 modules are equipped with POE refrigeration oil. Systems with compressors using POE oils must be kept closed at all times except when the interconnecting piping is being directly installed. POE oils are extremely hydroscopic in nature and will absorb an undesirable amount of moisture from normal ambient air within a few minutes.

Copper Tubing, Brazing and System Reprocessing Recommendations

Copper tubing must be refrigeration grade (ACR type “L”). Be sure to install appropriate copper fittings rated for ACR applications. Never leave refrigerant lines open when they are not directly being installed. Never rely on the last refrigerant connection joint at a specific section (AR2 module or condenser section) to provide structural support for the interconnecting piping. Line pulsation may occur at start-up and shut down of scroll compressors. Additional line support may be required to prevent vibration transmission or movement in the line. Ensure that all interconnecting piping is properly and independently braced at 7’ minimum intervals, and within 2’ from each section’s final connection location, to prevent joint fracture due to line vibrations or liquid hammering.

Use 15% silver-phosphorus braze filler rod when brazing copper-to-copper joints,. When brazing copper-to-brass joints, apply “sta-silv” brazing paste (or equivalent) sparingly to the joint areas, and use 45% silver-phosphorus braze filler rod. Always purge a generous flow of dry nitrogen (approx. 10 CFH) through the lines while brazing to prevent internal scaling of copper oxide on heated copper surfaces exposed to air.

When sizing the interconnecting refrigerant lines, never use the stub-out sizes at the AR2 module section as your determining factor. For proper operation, all discharge and liquid lines must be sized in accordance with the recommendations provided in the following piping sections. After installing the interconnecting piping, proper system evacuation and reprocessing guidelines are provided in the section titled, “Refrigeration System Reprocessing”.

Liquid Line Piping Recommendations

All liquid lines should be kept as short as possible, and the line sizing is determined to provide for a low-pressure drop to prevent liquid line flashing. There should always be a gradual negative elevation change when traversing from the remote condenser location to the AR2 module section. Avoid any reversing elevation changes throughout this liquid line run. Horizontal liquid lines should be sloped downward in the direction of refrigerant flow at a pitch of 1/8” per foot. The total equivalent distance between the condenser and the AR2 section (including allowances for U-bends and 90o elbows) should not exceed 100 feet. Avoid routing liquid lines through heated spaces which may result in undesirable flash gas generated at the TXV inlet. Avoid insulating liquid lines.

Discharge Line Piping Recommendations

All discharge lines should be kept as short as possible, and the line sizing is determined to provide for a low-pressure drop. There should always be a gradual negative elevation change when traversing from the remote condenser location to the AR2 module section. Avoid any reversing elevation changes throughout this discharge line run. Horizontal liquid lines should be sloped downward in the direction of refrigerant flow at a pitch of 1/8" per foot. The total equivalent distance between the condenser and the AR2 section (including allowances for U-bends and 90° elbows) should not exceed 100 feet. Vertical discharge lines greater than 5 feet require a "P"-trap at the base of the riser as well as an inverted trap at the top of the discharge line run (see Figure on page 32). The inverted trap should be the highest point in the discharge line. Additional "P"-traps should be added at every 10 feet of additional vertical rise in the discharge line. The maximum vertical distance between the lower AR2 module section and the higher remote condenser location should be less than 50 feet. AR2 modules equipped with optional compressor unloading by means of hot gas bypass/combination liquid injection require the use of double risers for vertical discharge line runs (see Figure 3 on page 32).

Remote Condenser Piping Connections

The discharge and liquid line connections at the remote condenser section are equipped with capped, stub-out tubes. It is mandatory that isolation ball valves and check valves are field installed at BOTH the inlet and outlet connection locations of each remote condenser. These ball valves and check valves are shipped loose with every ClimaCool AR2 split system chiller package. Refer to Figures on pages 33 and 34 for schematic representation of the isolation and check valve functions.

Leak Testing - Refrigeration Side

Prior to startup, the entire system should be leak tested using electronic leak detection. Carefully leak test both factory and field made joints including condenser coils. Although each unit is factory leak tested, joints do loosen and sometimes break during shipment.

Refrigeration System Reprocessing

Once a refrigeration system has been exposed to atmosphere for any length of time (several minutes to an hour), it is imperative that the system undergo a thorough evacuation to remove moisture and non-condensibles. With split systems, provisions should be made to evacuate the interconnecting discharge and liquid lines prior to opening the shutoff valves provided in each section. Noncondensibles (air, nitrogen trace gases, etc.) trapped in the system will elevate condensing pressures. This will result in inefficient system operation and potentially cause nuisance head pressure trips. Moisture in the system can cause chemical reactions with many POE oil additives resulting in the formation of undesirable acids which corrode the system.

IMPORTANT: NEVER start the compressor while in a vacuum. Serious damage can occur to the motor windings in this condition. Only use a vacuum pump of known reliable operation, specifically, one that can achieve a vacuum level of 100-200 microns with the pump service port closed. Prior to evacuation, make sure all refrigerant isolation valves are OPEN, and that the main liquid line solenoid valves are energized (apply 24VAC to the solenoid coils using a 75VA transformer or equivalent). Alternatively, you may choose to manifold multiple evacuation hoses together and connect vacuum lines to refrigeration access fittings on both sides of the liquid line solenoid valves. Ensure that the vacuum pump is connected to both high and low sides of the system with copper tube or vacuum hoses. A vacuum gauge capable of reading vacuum levels in microns (with readability as low as 100 microns) must be connected to the system, preferably close to the compressor module. **Ordinary gauges from a standard charging manifold are unacceptable!** Operate the vacuum pump until a vacuum level below 500 microns is achieved. Close the vacuum pump service valves to isolate the pump from the refrigeration system. This initiates a "vacuum decay test" by monitoring system pressure rise for a time period of 15 minutes. The refrigeration system vacuum gauge should not rise more than 200 microns within this 15 minute period. Pressures that rise beyond this decay criteria indicate the existence of a leak, or more likely, indicate the presence of moisture or non-condensibles in the system. If a leak is suspected, it must be identified and corrected before proceeding with the evacuation. If moisture contamination is the suspected problem, rapid evacuation processes may serve only to freeze the moisture inside the system, allowing only for the slow process of sublimation to remove all of the water. Then it is recommended to apply sun lamps to the compressor and receiver to elevate the temperature inside the system above the freezing point while evacuating. Successive dry nitrogen fills and purges can prove equally beneficial in removing excessive moisture form a system.

Refrigerant Charging

Once leak testing and evacuation are complete, refrigerant charging may commence. Always refer to the unit nameplate and the guidelines within this section in order to establish the quantity of refrigerant required. **IMPORTANT:** Always introduce refrigerant into a system using a charging manifold with gauges, along with a refrigerant scale to accurately weigh the refrigerant cylinder throughout the entire charging process. As noted in an earlier section, the end user and installing contractor must determine whether refrigerant R-22 or R-407C is to be used. It should be clearly understood that R-407C is a "tertiary blended refrigerant", which experiences a temperature glide (near 11°F rise) when traversing from saturated liquid to saturated vapor at constant pressure throughout an evaporation process. Because it is a "glide" refrigerant, vapor drawn off the top of a bulk R-407C cylinder will not have exact fractional constituents versus the mean bulk liquid in the cylinder. For this reason, we recommend ALL REFRIGERANT CHARGING to be drawn as liquid fractions from the bottom of the charging cylinder. When initially charging a system that is in a vacuum, liquid refrigerant can be weighed directly into the high side while the compressor is off.

CAUTION: Never dispense refrigerant amounts into the receiver which may exceed its liquid holding capacity. Both refrigeration systems in models AR2-25 and AR2-30 are equipped with 72 pound receivers (at 80% full). Both refrigeration systems in models AR2- 50 and AR2-65 are equipped with 84 pound receivers (at 80% full).

As much refrigerant as possible should be charged in this manner until the receiver holding capacity is achieved, or system pressures equalize preventing additional refrigerant from being added. Even if system equalization occurs, it is still possible to inject liquid refrigerant into the system by placing the refrigerant cylinder into a luke warm water bath **NO WARMER THAN 110°F!**

SAFETY/ALERT: Cylinder pressures must be closely monitored whenever a refrigerant cylinder is being heated in ANY manner. Allowing pressures to exceed those for which the cylinder is rated, may result in cylinder rupturing, personal injury and/or property damage or even death.

Once system and refrigerant cylinder tank pressures have equalized, it will be necessary to finish the refrigerant charging process by gradually metering small bursts of liquid refrigerant into the suction line of the compressor while it is operating.

SAFETY/ALERT: Never attempt to vapor charge into the system high side, whether the compressor is ON or OFF. This may result in refrigerant flowing from the refrigeration system into the charging cylinder. Cylinders can quickly be over pressurized causing them to rupture with resultant injury and property damage.

IMPORTANT: Never dispense liquid refrigerant into the suction port of a compressor while it is not running. If adding additional refrigerant is necessary, you must gradually meter liquid refrigerant into the suction port of the compressor ONLY WHILE THE COMPRESSOR IS RUNNING, and only through a metering valve.

The only exception to the above recommendations to meter in liquid refrigerant into the suction line is the following: Providing the ENTIRE contents of the refrigerant cylinder is intended to be added to a refrigeration system, it is perfectly acceptable to vapor charge form this cylinder into the compressor suction line until all refrigerant is injected.

While on the subject of "Fractionation" with refrigerant R- 407C (whereby the original weight fractions of the three refrigerant constituents is suspiciously altered following a noticeable refrigerant leak), it should be further understood that any refrigerant leak originating from a saturation, 2- phase area of the system is cause for concern. If enough refrigerant has escaped to effect normal refrigeration, the safest procedure is to reclaim the remaining refrigerant from the system, repair the leak, reprocess the system and weigh in a new liquid refrigerant charge. "Fractionation" is negligible in areas of the system where the refrigerant is predominantly liquid or predominantly vapor. However, systems having repetitive leaks may require complete evacuation and recharge.

The amount of refrigerant required in a system depends on the following:

- model size of the equipment,
- the distance of the interconnecting lines between the AR2 module and the condenser section;
- the specific head pressure control methods used for low ambient operation;
- what (if any) fan cycling controls are supplied with the condenser, and;
- whether optional compressor unloading is possible using hot gas bypass/combination liquid injection.

Refer to the tables to determine the amount of additional refrigerant required when using flooding type head pressure controls. They are for use with standard units and should not be used with oversized condensers. All systems use two refrigeration circuits. The additional charge shown is per circuit.

COMPRESSOR INFORMATION

The compressors used on the ClimaCool chiller are either scroll or reciprocating compressors. They are highly efficient and extremely reliable. However, the information contained in this document will be useful for their care.

Compressor Rotation

All scroll-type machines are unidirectional and will only compress in one direction. Operating in the reverse rotation can be destructive and will be indicated by a load operating noise together with a lack of compression.

Compressor Lubrication

The compressor operates on a sealed system and oil can only be lost if leak occurs. There are few cases when oil will need to be added to a machine in normal operation.

Oil Type

The oil in ALL scroll compressors used in ClimaCool chillers is polyester type oil, (POE), and is intended for the dual usage of either refrigerant R-22 or R 407C selected for use. All (POE) refrigerant oils require special handling and should be protected from contamination. They are extremely hygroscopic and will absorb moisture rapidly from the air. It is strongly recommended to store and dispense POE oils from sealed metal cans. Suitable POE oils are:

- Copeland Ultra 22 CC
- Mobil EAL Arctic 22 CC
- ICI Emkarate RL 32 CF

Oil Levels

The oil level in the compressor should be checked with the compressor running. The compressor oil level may vary during operation and particularly on start-up. The normal operating compressor oil level should be between 1/3 and 1/2 of the sight glass. During operation, a certain amount of oil is carried out into the refrigeration system. The system has been designed to bring the oil back to the compressor. If the level in the sight glass falls, it may be due to the operating conditions and enough time should be given to allow the oil to return before more oil is added. This could take up to 6 hours of operation. The compressor should not be allowed to operate with less than 1/8” oil sight glass for an extended period of time (longer than 4-6 hours).

Adding Oil

The compressor must never be run on a vacuum. A suitable hydraulic pump should be used to add oil and reserved for this process. Oil should only be added to a compressor while it is operating to observe valid oil sight glass levels. Oil is pressure-injected either into a gauge connection on the suction line or injected into the oil process port at the bottom of the compressor housing. Only enough oil should be added to raise the level above the 1/3 sight glass point.

Head Pressure Control Valve Operation ORI/ORD

ORI VALVE OPERATION — The ORI head pressure control valve is an inlet pressure regulating valve and responds to changes in condensing pressure only. The valve designation stands for Opens on Rise of Inlet pressure. As shown in Figure-1, the outlet pressure is exerted on the underside of the bellows and on top of the seat disc. Since the effective area of the bellows is equal to the area of the port, the outlet pressure cancels out and the inlet pressure acting on the bottom of the seat disc opposes the adjusting spring force. These two forces are the operating forces of the ORI. When the outdoor ambient temperature changes, the ORI opens or closes in response to the change in condensing pressure. An increase in inlet pressure above the valve setting tends to open the valve. And if the ambient temperature drops, the condenser capacity is increased and the condensing pressure drops off. This causes the ORI to start to close or assume a throttling position.

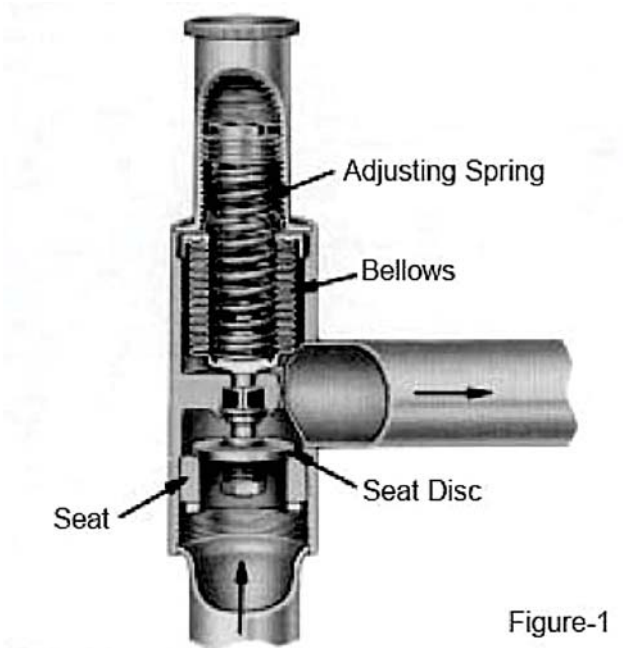
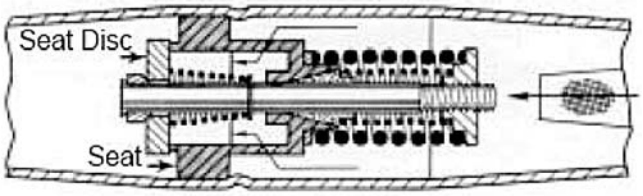


Figure-1

ORD VALVE OPERATION— The ORD valve is a pressure differential valve that responds to changes in the pressure difference across the valve, Figure-3. The valve designation stands for **Opens on Rise of Differential** pressure. Therefore, the ORD is dependent on some other control valve or action for its operation. And in this respect, it is used with the ORI for head pressure control.



As the ORI valve starts to throttle the flow of liquid refrigerant from the condenser, a pressure differential is created across the ORD. When the differential reaches 20 psi, the ORD starts to open and bypasses hot gas to the liquid drain line. As the differential increases, the ORD opens further until its full stroke is reached at a differential of 30 psi. Due to its function in the control of head pressure, the full stroke can be utilized in selecting the ORD. While the capacity of the ORD increases as the pressure differential increases, the rating point at 30 psi is considered a satisfactory maximum value. The standard pressure setting for the ORD is 20 psig. For systems where the pressure drop between the compressor and the receiver is higher than 14 psi, an ORD with a higher setting is available. See Table

Maximum Pressure Drop Between Compressor and Receiver (PSI)	Head Pressure Component Selection
Below 14	ORD-20 & ORI
15 to 19	ORD-25 & ORI
20 to 24	ORD-30 & ORI
25 to 29	ORD-35 & ORI

ADJUSTABLE ORI/ORD SYSTEM OPERATION — The adjustable ORI head pressure control valve and the nonadjustable ORD pressure differential valve comprise an improved system of head pressure control. For years the usual system utilized two adjustable or one adjustable valve with a check valve and an elevation requirement for "refrigerant side" head pressure control. With the introduction of the ORD-4 pressure differential valve in January 1968, not only was the system simplified due to a one valve adjustment and the ability to locate the condenser and receiver on the same elevation, but the ORI/ORD system was more economical to buy. The operation of the ORI/ORD system is such that a constant receiver pressure is maintained for normal system operation. Since the ORI is adjustable over a nominal range of 65 to 225 psig, the desired pressure can be maintained for all of the commonly used Refrigerants 12, 22, and 502. As shown in Figure-4, the ORI is located in the liquid drain line between the condenser and the receiver. And the ORD is located in a hot gas line bypassing the condenser. During periods of low ambient temperature, the condensing pressure falls until it approaches the setting of the ORI valve. The ORI then throttles, restricting the flow of liquid from the condenser. This causes refrigerant to back up in the condenser thus reducing the active condenser surface. This raises the condensing pressure. Since it is really receiver pressure that needs to be maintained, the bypass line with the ORD is required.

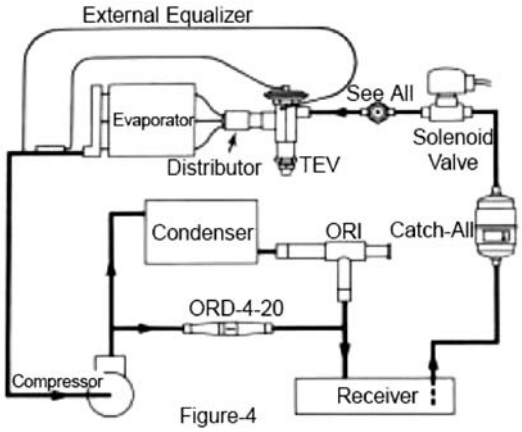


Figure-4

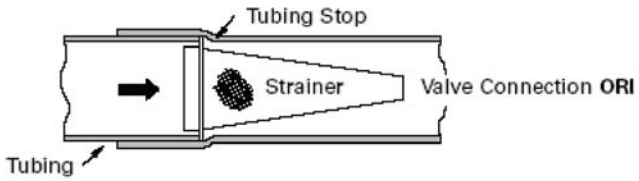
The ORD opens after the ORI has offered enough restriction to cause the differential between condensing pressure and receiver pressure to exceed 20 psi. The hot gas flowing through the ORD serves to heat up the cold liquid being passed by the ORI. Thus the liquid reaches the receiver warm and with sufficient pressure to assure proper expansion valve operation. As long as sufficient refrigerant charge is in the system, the two valves modulate the flow automatically to maintain proper receiver pressure regardless of outside ambient.

PROPER SELECTION OF HPC VALVES — To ensure proper performance, head pressure control valves must be selected and applied correctly. This is covered thoroughly in Bulletin 90-30. However, proper installation procedures are equally important.

VALVE LOCATION/PIPING SUGGESTIONS — The ORI and ORD valves can be installed in horizontal or vertical lines, whichever best suits the application, and permits easy accessibility of all valves. Consideration should be given to locating these valves so they do not act as an oil trap and so solder cannot run into the internal parts during brazing. Precautions should also be taken to install the valves with the flow in the proper direction. ***The ORI valve CANNOT be installed in the discharge line for any reason.***

Figure 4 is a piping schematic only to illustrate the general location of the ORI, and ORD valves in the system. ClimaCool recommends that recognized piping references be consulted for assistance in piping procedures. ClimaCool is not responsible for system design, or for misapplication of its products. If these valves are applied in any manner other than described in this bulletin, the ClimaCool warranty is void. The inlet connections on the ORI-10 valves should be sized the same as the outlet of the condenser where possible. The ORD-4 is available with 5/8" ODF and 7/8" ODF solder connections. On systems with discharge lines smaller than 5/8" OD, the bypass line can be the same size as the discharge line and the ORD-4 connections can be bushed down. If the system capacity is greater than any of the head pressure control valves ratings, these valves can be applied in parallel.

VALVE STRAINERS – Catch-All® filter-driers – See·All® moisture and liquid indicator — Just as with any refrigerant flow control device, the need for an inlet strainer is a function of system cleanliness and proper installation procedures. When the strainer is used with the ORI, the tubing is inserted in the valve connection until the tubing and strainer flange ring are up against the tubing stop, thus locking the strainer in place. See Below:



BRAZING PROCEDURES — Any of the commonly used brazing alloys for high side usage are satisfactory. However, when soldering or brazing, it is very important that the internal parts be protected by wrapping the valve with a WET cloth to keep the body temperature below 250°F for the ORI; and, 300°F for the ORD-4. Also, when using high temperature solders, the torch tip should be large enough to avoid prolonged heating of the copper connections. And, always direct the flame away from the valve body.

TEST and OPERATING PRESSURES — Excessive leak testing or operating pressures may damage these valves and reduce the life of the operating members. For leak detection an inert dry gas, such as nitrogen or CO2, may be added to an idle system to supplement the refrigerant pressure.

CAUTION: Inert gases must be added to the system carefully through a pressure regulator. Unregulated gas pressure can seriously damage the system and endanger human life. Never use oxygen or explosive gases.

The table below lists the maximum values each valve can withstand without damage. Precautions must be taken to keep test or operating

Type Valve	Maximum Rated Pressure PSIG
ORI-10 65/225 H	450
ORD-4	450

pressures below these values.

VALVE SETTINGS and ADJUSTMENT — A complete discussion on pressure settings is given in the Application Section of Bulletin 90-30. To determine the proper setting or a specific system, that section should be reviewed.

Head Pressure Control Valve Operation ORI/ORD

The table below lists the setting data for the ORI and ORD valves. Other ORI settings can be obtained by adjusting the valves a proportionate amount between those values shown.

Valve Type	Settings for Refrigerants R-22 and R-407C		
	Pressure Setting PSIG	Depth of adjusting nut from top of Spring Housing	Turns IN from Factory Setting
ORI-10	200	¾"	5
ORD-4-20	20	—	—

The ORD-4-20 setting means that the ORD-4 will start to open when the pressure difference between the discharge line and the receiver is 20 psig. This setting is suitable for all systems where the combined pressure drop through the condenser, the ORI and connecting piping is less than 14 psi. Therefore, if the ORI is selected for 2 psi □P, then the maximum allowable pressure drop through the condenser is 12 psi. Normally, condenser pressure drop on refrigeration systems is less than 10 psi. However, many condensers on air conditioning systems may have pressure drops up to 25 psi. Therefore, when in doubt, consult with the equipment manufacturer or, if possible, measure it by reading the discharge pressure at the compressor and the receiver pressure **during full load operation**. That is, this reading should be taken with a normal condensing temperature at full load. For systems where the condenser pressure drop is higher than normal, ORD valves with higher settings are available upon special request. To adjust the ORI valve, remove the cap and turn the adjustment screw with the proper size hex wrench (1/4" for ORI-6 and 5/16" for ORI- 10). A clockwise rotation increases the valve setting while a counter-clockwise rotation decreases the setting. To obtain the desired setting, a pressure gauge should be utilized at the compressor discharge service valve so the effects of any adjustment can be observed. Small adjustments are recommended to allow the system adequate time to settle out after each adjustment. NOTE: Even though the ORI valve is selected on the basis of the full load conditions or summer operation, it should be adjusted to maintain the desired condensing pressure whenever the ambient is below 70°F.

DETERMINING AMOUNT OF CHARGE — When "refrigerant side" head pressure control is utilized on a system, one of the most important factors is determining the total system refrigerant charge. While on most packaged units the amount of charge is listed on the unit, the required charge for a field built-up system cannot be listed by the manufacturer. Charge is usually added when the system is started up until "proper" system performance is reached. However, this is not satisfactory and if the system is to function properly year-round, the correct amount of extra charge must be calculated ahead of time.

1 — COMPLETELY FLOODED CONDENSER: The easiest method is to calculate the volume of the condenser coil and then use the density factor of the refrigerant shown in Table-1 to figure the pounds of refrigerant necessary to completely flood the condenser coil at the appropriate ambient. The factors involved in calculating the extra pounds of refrigerant are:

a. Length of tubing and return bends in condenser
b. Minimum ambient temperature at which systems will be required to function
c. Tubing size and wall thickness
d. Refrigerant

The primary point to remember in selecting the proper density factor is that when the liquid drain valve (ORI) is throttling, the refrigerant temperature will be at the same temperature as the ambient.

Example: Calculate the extra refrigerant charge necessary for a Refrigerant 22, roof-top, air conditioning unit (40°F evaporator and a minimum condensing temperature of 90°F) with compressor unloading to 50% of full compressor capacity. To determine the equivalent length of tubing in a condenser, proceed as follows: First, count the number of tubes and multiply this by their length.

Example: 150 tubes x 7.55 feet = 1132.5 feet
Next, count the return bends and multiply them by the factor shown in Table-1.

Example: 150 bends x .250 for 1/2 inch bends = 37.5 feet Then add this 37.5 feet to the 1132.5 feet for a total of 1170 feet

The system uses a 30 hp condensing unit with a condenser coil containing 1170 equivalent feet of 1/2 inch tubing tubes and return bends). Assume a design temperature of minus 20°F minimum ambient. From Table-1 we find the density factor necessary to calculate the pounds of extra refrigerant to **completely** flood the condenser at minus 20°F: 1170 feet x .102 pounds/foot = 119 pounds.

2 — PARTIALLY FLOODED CONDENSER:
On many systems it isn't necessary to completely flood the condenser to maintain sufficient operating head pressure (equivalent to approximately 90°F condensing temperature) because of a milder climate than Method 1 assumes. Therefore, a second method is available. The additional information found in Tables 2 and 3 can be used to figure more closely the charge necessary to properly flood the condenser for sufficient head pressure at various minimum ambient temperatures. (The multipliers are applied to the extra refrigerant charge that was calculated in Method 1 to **completely** flood the condenser.)

EXAMPLE: Our example calls for a compressor equipped with unloaders. Since the compressor would unload at the low ambients this must be taken into consideration. This is necessary since as the compressor unloads, the condenser's capacity increases and additional flooding is required. Using the same roof-top unit as in the earlier example (40°F evaporator and minus 20°F minimum ambient), a multiplier of .79 is shown in Table-2. And since we have unloaders (50%), this .79 is used to enter Table-3 to find a multiplier of .91. This final multiplier is applied to the 119 pounds calculated earlier to arrive at the final extra charge requirement: 119 x .91 = 108 pounds. This is added to the normal system charge to arrive at a total system charge.

REFRIGERANT	MINIMUM AMBIENT °F	EQUIVALENT LENGTH OF TUBING FOR EACH RETURN BEND — FEET			DENSITY FACTOR POUNDS PER FOOT OF TUBING					
					TUBING OD and WALL THICKNESS — Inches					
		3/8"	1/2"	5/8"	3/8 (.016)	1/2 (.017)	5/8 (.018)	7/8 (.045)	1-1/8 (.050)	1-3/8 (.055)
407C	- 40	.200	.250	.300	.053	.098	.156	.277	.472	.719
	- 20				.052	.095	.152	.270	.460	.701
	0				.050	.092	.148	.262	.447	.682
	20				.049	.090	.143	.254	.433	.660
	40				.047	.086	.138	.245	.418	.636
	60				.045	.083	.132	.235	.400	.610
	70				.044	.081	.129	.229	.391	.595
22	- 40	.200	.250	.300	.056	.104	.167	.296	.505	.769
	*- 20				.055	.102	.163	.289	.493	.750
	0				.054	.100	.159	.282	.481	.732
	20				.052	.097	.154	.274	.468	.712
	40				.051	.094	.150	.267	.454	.692
	60				.049	.091	.145	.258	.440	.670
	70				.048	.089	.143	.254	.433	.659

Condenser Ambient Temperature °F	Percent of Condenser to be Flooded			
	High Suction Temp. A/C Chillers			
	Evaporating Temperature °F			
	35	40	45	50
80	0	0	0	0
70	0	0	0	0
60	26	20	10	4
50	45	40	33	28
40	56	52	46	42
30	64	60	55	51
20	69	66	62	59
0	76	73	70	68
-20	80	79	76	73

Condenser Flooding with NO Unloading	Percent of Full Compressor Capacity = 50%
05	50
10	53
15	57
20	60
25	63
30	66
35	69
40	72
45	74
50	76
55	79
60	81
65	83
70	86
75	88
* 79	91
80	92
85	96

Head Pressure Control Valve Operation ORI/ORD

REFRIGERANT CHARGING PROCEDURES — Normally this information is supplied by the equipment manufacturer. And when it is available, it should be followed. When it is not available from the equipment manufacturer, the following suggestions are recommended. Once the amount of extra refrigerant charge is calculated, care must be taken in charging the system to insure the proper total amount of refrigerant getting into the system. This is especially true if the ambient temperature is below 70°F and the liquid drain valve (ORI) is throttling the refrigerant flow from the condenser. A step by step procedure is given below for the two possible situations that can exist. And depending on the ambient temperature at the time the system is charged, each should be carefully followed to insure proper system operation in both summer and winter. In either case, a liquid seal must be established in the receiver before the system can start to function correctly.

NOTE: While charging any system with head pressure control, the outdoor ambient temperature must be known. And if the system has compressor unloaders, it is important to know if they are functioning during the charging procedure. To keep this procedure as simple as possible, it is recommended that the unloaders be locked out (compressor fully loaded) during charging.

Charging of Systems with Sporlan Head Pressure Control in Ambients ABOVE 70°F (After normal evacuation procedures) BEFORE STARTING SYSTEM

1. Connect refrigerant cylinder to a charging or gauge port on the receiver outlet valve.
2. Open the receiver valve approximately one-half way (so receiver and liquid line are connected to charging or gauge port).
3. Charge liquid refrigerant into the high side of the system. Weighing the charge is recommended with the initial charge consisting of approximately 2.5 pounds per system ton.
4. Remove the refrigerant drum and connect it to the suction side of the compressor.
5. Charge refrigerant vapor into the low side until the pressure is above atmospheric pressure. Do not admit liquid refrigerant into the low side.
6. Start the system.
7. Observe sight glass (at receiver outlet) to see if system is properly charged for normal refrigeration cycle. CAUTION: Bubbles in the sight glass can be caused by flashing due to pressure drop from pipe or accessory losses, etc.
8. If the sight glass shows bubbles, more refrigerant should be added, while allowing sufficient time for the refrigerant to stabilize and clear the sight glass.
9. The extra refrigerant charge for head pressure control should be weighed in now by admitting liquid refrigerant to the high side.

Charging of Systems with Sporlan Head Pressure Control in Ambients BELOW 70°F (After normal evacuation procedures)
NOTE: When charging in ambients below 70°F the procedure is very critical. Be sure to adhere to the following steps without fail. Failure to do so will result in overcharging the system.

1. Follow instructions 1 through 7 above.
2. If the ORI valve setting is correct for the system being charged, it is quite likely that some refrigerant will be backed up into the condenser and the sight glass will indicate bubbles in the liquid line.
3. Add more refrigerant, while allowing sufficient time for the refrigerant to stabilize and clear the sight glass.
4. At this point the system is correctly charged for this type of head pressure control at the ambient temperature that exists while the charging procedure is taking place.
5. If the system is designed to operate at ambients below the ambient that exists during charging, additional charge will have to be added now.
6. To calculate the additional charge required, follow the examples outlined under “Refrigerant Charge” except remember that the “head pressure control charge” is partially charged already. Refer to Tables 2 and 3.

The difference in percentages between the minimum design ambient temperature and the ambient temperature at the time the system is charged gives the percent of extra charge still needed in the system. E.g., if this system was charged at an ambient of 50°F, we have approximately 40% of the extra charge in the system. This holds true as long as the compressor unloaders were not operating during charging. Therefore, the additional charge required is 95 minus 40 or 55% of the total extra charge calculated previously. This is .55 x 119 or 65 pounds. Since good system performance during low ambient operation depends on proper refrigerant charge, it is very important that this phase of the installation procedure be done carefully. Many times, poor system performance will be due to too little or too much charge. And in many cases this will be the last item suspected.

SERVICE PROCEDURES —
There are several possible causes for system malfunction with "refrigerant side" head pressure control and these may be difficult to isolate from each other. As with any form of system trouble-shooting, it is necessary to know the existing operating temperatures and pressures before system problems can be determined. Once the actual malfunction is established, it is easier to pinpoint the cause and then take suitable corrective action. The following chart lists the most common malfunctions, the possible causes, and the remedies. Since the ORI and ORD are hermetic valves and cannot be disassembled for inspection and/or replacement of parts, they must be replaced if they become inoperative.

	Possible Cause	Remedy
1.	Insufficient Refrigerant Charge to adequately flood condenser.	Add refrigerant.
2.	Low pressure setting on ORI.	Increase setting.
3.	ORI fails to close due to foreign material in valve.	Turn adjustment so foreign material passes through. If unsuccessful, replace valve.
4.	ORI fails to adjust properly.	See 3. above.
5.	ORD fails to open due to: a. Less than 20 psi pressure drop across ORD. b. Internal parts damaged by overheating when installed.	See below: a. Check ORI causes/remedies. b. Replace ORD.

	Possible Cause	Remedy
1.	Dirty condenser coil.	Clean coil
2.	Air on condenser blocked off.	Clean area around condenser.
3.	Too much refrigerant charge.	Remove charge until proper head pressure is maintained.
4.	Undersized receiver.	Check receiver capacity against refrigerant required to maintain desired head pressure.
5.	Non-condensibles (air) in system.	Purge from system.
6.	High pressure setting on ORI.	Decrease setting.
7.	ORI restricted due to inlet strainer being plugged.	Open inlet connection to clean strainer.
8.	ORI fails to adjust properly or to open due to foreign material in valve.	Turn adjustment so foreign material passes through. If unsuccessful, replace valve.
9.	Bypassing hot gas when not required due to: a. Internal parts of the ORD are damaged by overheating when installed. b. If pressure drop across the condenser, associated piping and ORI exceeds 14 psi under full load	See Below: a. Replace ORD. b. Use ORD with a higher setting.

WARNING: Serious injury could result from an explosion caused by the rapid expansion of trapped liquid refrigerant subjected to high temperature. ALWAYS OPEN OR VENT THE SYSTEM BEFORE APPLYING HEAT TO REMOVE SYSTEM COMPONENTS. Break the element charging cap tube on valve dome by hand or with a clean cut tool. DO NOT use side cutters, which may seal the opening.

INSTALLATION PRECAUTIONS

1. See page 54 for safe working pressures.
2. Do not overcharge — see charge and charging procedures on pages 54 and 55.
3. Be sure that the piping does not allow liquid refrigerant to be trapped in sections where hydrostatic pressure can develop. 4. Be sure that the receiver is large enough to hold the entire charge during "warm" operation.
5. Do not overheat — see brazing procedures on page 53.
6. "Caution:" on page 53, right column.
7. "Caution:" on page 54, left and right column.
8. "Caution:" on page 55, left column.

CHILLER OPERATION AND MAINTENANCE

Pressure and Temperature Log

A log of temperatures and pressures should be taken regularly. Periodically conduct a visual inspection of the chiller to identify problems before they reach the point of failure. As with any mechanical system, it is necessary to conduct a series of checks to the ClimaCool chiller to confirm correct operation.

HEAT EXCHANGERS

Back Washing

It may become evident from the recorded daily log data that the performance of the chiller is gradually degrading. This could be due to a buildup of debris or sludge obstructing the free passage of flow through the heat exchangers. This debris can be removed by a "back washing" process, which involves the introduction of a forced, violent, backwards flow through the heat exchanger, using a carefully formulated flushing solution. To be effective, this back flow should be slightly higher than the normal flow, and, in the opposite direction. The difficulties and practicality of this method depends on the back wash pumping system itself. Another method would be to back flush each heat exchanger using city water as opposed to system water (see Fig. 1 page 59, City Water Cleaning Arrangement). Note: Check city water pressure meets requirements for back washing. The back washing procedure is accomplished by isolating each individual heat exchanger, and introducing the city water using a connection hose to the 3/4" service port to flow in an opposite direction from the "normal" heat exchanger flow direction. On the opposite 3/4" service port, connect a drain hose to run to a suitable floor drain. Continue back flow until all debris is removed.

Chemical in Place Washing

"Chemical Clean In-Place Washing" will typically provide the best debris removal, even from severely clogged heat exchangers. It is only necessary to mechanically and electrically isolate one chiller module at a time which undergoes the "Clean In-Place Washing". The rest of the chiller modules can continue to operate to satisfy the cooling load required. The cleaning tank, pump and pump strainer should be arranged in the manner shown in Fig. 2 page 59, In Place Cleaning Arrangement. The flow of the cleaning is arranged in the opposite flow to the normal operational direction. Connection points are provided using the 3/4" service ports at each heat exchanger. The cleaning solution used can be either a detergent or hot water to remove particles and simple cleaning. If correct water treatment has been implemented this should provide adequate cleaning for most situations. The solution can be pumped through the heat exchangers and allowed to "soak" for a time and then pumped again.

If it is required to remove carbonates, then an acidic wash should be used. A 2% solution of phosphoric or sulfamic acids in pure water are generally acceptable. These acid solutions should only be allowed to circulate within the heat exchanger for 10 to 15 minutes, followed by a thorough pure water flush for 10 to 15 minutes. Hydrochloric or sulfuric acids must not be used. In any case, you should consult the chemical supplier to establish the correct formulation and handling process. The materials, which will be exposed to the wash, are stated on page 16 - Water Treatment.

Once the washing is complete, the solution should be flushed out completely by pumping clean, fresh water through the chiller. To achieve a reasonable level of dilution, it may be required to change the water several times. After cleaning, the water quality and water treatment should be confirmed.

If you have questions related to the suitability of a solution, please contact ClimaCool for more information.

Fig. 1
City Water
Cleaning Arrangement.

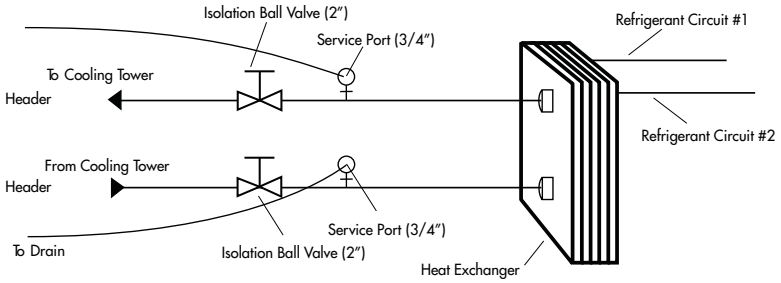
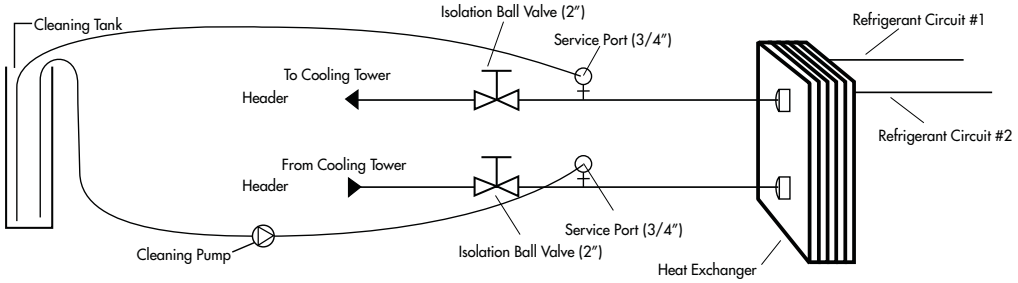


Fig. 2
In Place
Cleaning Arrangement.



Recommended Maintenance Schedule

Pressure and Temperature Log

A log of temperatures and pressures should be taken regularly. Periodically conduct a visual inspection of the chiller to identify problems before they reach the point of failure. As with any mechanical system, it is necessary to conduct a series of checks to the ClimaCool chiller to confirm correct operation.

Date _____ Chiller No. _____	Data Log _____ Technician _____						
	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.
Chilled Water Entering Temp.							
Chilled Water Leaving Temp.							
Condenser Water Entering Temp.							
Condenser Water Leaving Temp.							
Chilled Water Pressure Drop							
Condenser Water Pressure Drop							
Faults: Note By Module Number							

Daily

- A daily operational log should be kept
- Perform visually inspection
- Record entering and leaving chilled water and condenser water temperatures and pressures
- Note any problems that may exist. Immediately plan for further investigation. If repair is necessary, schedule for earliest possible date.
- Properly document all data taken

Weekly

- Review daily log from previous week
- Perform visual inspection
- Properly document all data taken
- Note any problems that may exist. Immediately plan for further investigation. If repair is necessary, schedule for earliest possible date.

Monthly

Extract a water sample from the evaporator. Confirm that the sample bottle is filled to the top leaving no air in the bottle. Sample to be tested and kept in compliance with the water quality parameters listed in Table 1 on the water treatment page of this manual. NOTE: Monthly records of compliance and testing are required throughout the warranty period for warranty.

Quarterly

- Check controller operating parameters and set points
- Check refrigerant pressures and temperatures
- Check compressor amps
- Check compressor oil level
- Check and test all safeties
- Check water flow rates and pressure drops across evaporator and condenser
- Properly document all data taken

Annual

- Isolate chiller, drain all water circuits
- Back flush all heat exchangers (use only ClimaCool recommended de-scalers)
- Remove and clean all waterside strainers
- Perform leak test on all refrigerant circuits
- Check all interconnecting flanges for proper tightness
- Perform oil analysis on each compressor
- Check and test all refrigerant safeties for proper operation
- Check all electrical terminal connections for tightness
- Manually operate all waterside isolation valves on each module
- Check all peripheral systems for proper operation
- Check and test main controller
- Verify set points, sensors and general configuration
- Properly document all data taken

SEQUENCE OF OPERATION
GENERIC INTERFACE - MANUAL ISOLATION VALVES

Sequence of Operations

Chiller shall be enabled locally or remotely from enable/ disable contact by BAS via selector switch on face of the "Master Control Panel". Pumps for chilled water supply and condenser water supply shall be started by others. When proof of flow is established in both the chilled water and condenser water lines, the ClimaCool chiller shall start. The "Chilled Water Supply" (CHWS) temp. sensor (TS1), located in the discharge line of respective chiller shall be used to cycle compressor stages sequentially to maintain setpoint of 45°F (adjustable from the LCD Display on the Face of the "Master Control Panel", or Remotely via either 0-10 VDC or 4-20 ma signal, as selected..)

Chillers will be disabled until "Chilled Water Return" (CHWR) temperature sensor is below 90°F and when the water entering temperature is above 60°F.

Each module of the chiller has 2 compressors. Stage 1 compressors shall be started first on lead week and stage 2 compressors shall be started first on lag weeks to equalize run hours between compressors 1 and 2 of the modules automatically. Compressors shall be staged with a single compressor per module as required, until all available modules of the chiller have one compressor running. The remaining compressors will stage per module, as load requires. Compressors shall be energized and de-energized by the program, in an order which will maintain equal run time.

The compressor with most run time will de-energize as the setpoint is satisfied, and compressor with least run time will energize, as additional cooling capacity is required.

If a fault is detected the compressor will be disabled and displayed on the "Master Control Panel" LCD Screen. (Faults must be manually reset at the chiller).

The Chiller Status and Run Time in hours for each Compressor shall be shown on the LCD Display on the "Master Control Panel". Common Alarm contact and Chiller Status contact is provided at the panel.

Electrical Data – 60 Hz

Model #	Voltage	Power Wiring - per Module				Internal Wiring - per Compressor			
		Rated Load RLA[1]	Min.Cir. Amps MCA[2]	MaxFuse Size MOP[3,8]	Rec. Fuse[4,8] Size	Rated Load RLA[1]	Min.Cir. Amps MCA[2]	Locked Rotor LRA[5]	Rec. Fuse[4] Size
AR2-25(AHF)	208V-230V/3PH/60HZ	94	105	150	125	46.8	58.5	425	80
AR2-25(AFF)	460V/3PH/60HZ	42	48	60	60	21.2	26.5	187	35
AR2-25(ANF)	575V/3PH/60HZ	34	38	50	45	16.9	21.2	148	30
AR2-30(AHF)	208V-230V/3PH/60HZ	117	132	175	150	58.7	73.4	425	90
AR2-30(AFF)	460V/3PH/60HZ	53	60	80	70	26.6	33.2	187	45
AR2-30(ANF)	575V/3PH/60HZ	42	48	60	60	21.2	26.6	148	35
AR2-50(AHF)	208V-230V/3PH/60HZ	179	201	275	225	89.5	111.8	500	150
AR2-50(AFF)	460V/3PH/60HZ	81	91	125	110	40.4	50.6	250	70
AR2-50(ANF)	575V/3PH/60HZ	65	73	100	90	32.4	40.4	198	50
N / A[9]	208V-230V/3PH/60HZ	--	--	--	--	--	--	--	--
AR2-65(AFF)	460V/3PH/60HZ	105	118	150	150	52.4	65.5	310	80
AR2-65(ANF)	575V/3PH/60HZ	84	94	125	110	41.9	52.4	255	70

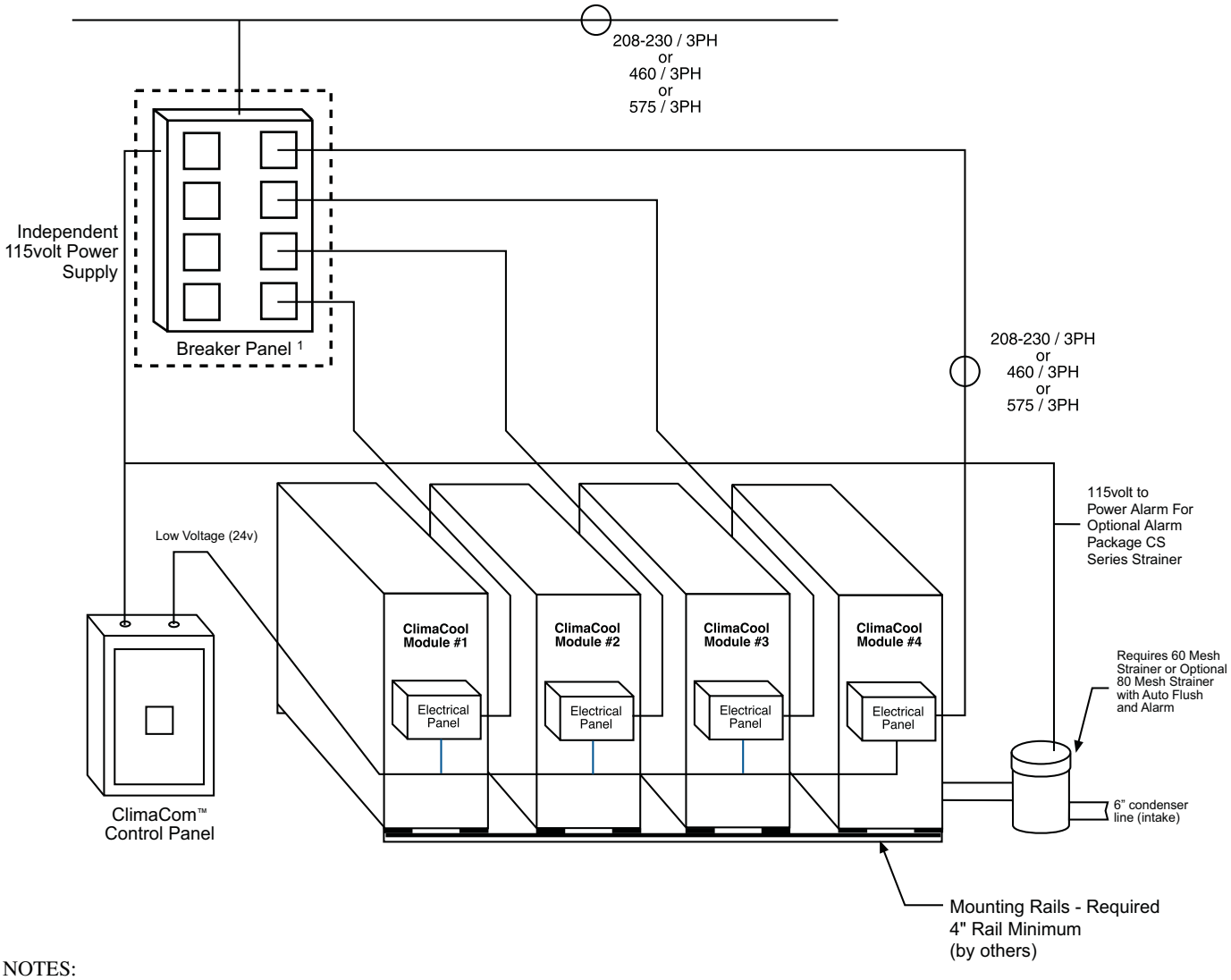
NOTES:

1. RLA. Rated Load Amps are calculated as per UL1995.
2. MCA. Minimum Circuit Ampacity is: [125% of the RLA of the largest compressor motor plus 100% of the RLA of all other concurrent motors and/or electrical loads].
3. MOP. Maximum Overcurrent Protection or Max.Fuse Size is rounded down from: [225% of the RLA of the largest compressor motor plus 100% of the RLA of all other concurrent electrical loads].
4. Recommended Dual Element Fuse Sizing: Rounded up from 150% of the RLA of the largest compressor motor plus 100% of the RLA of all other concurrent electrical loads.
5. Locked Rotor Amps are instantaneous starting amperage per compressor.
6. Module internal wiring is per NEC.
7. Voltage Tolerance Range
   - 208-230V / 60 Hz: Min. 187V Max. 253V
   - 460V / 60 Hz: Min. 414V Max. 506V
   - 575V / 60 Hz: Min. 518V Max. 632V
8. MOP Device or Recommended Fusing Device for Module Power Wiring supplied by others. These are recommended values for electrical power protection of Modules selected.
9. Model # AR2065AHF @ 208-230V-3-60 power supply is not available.

LEGEND:

- RLA - Rated Load Amps
- LRA - Locked Rotor Amps
- MCA - Minimum Circuit Amps
- MOPD - Maximum Overcurrent Protection Device

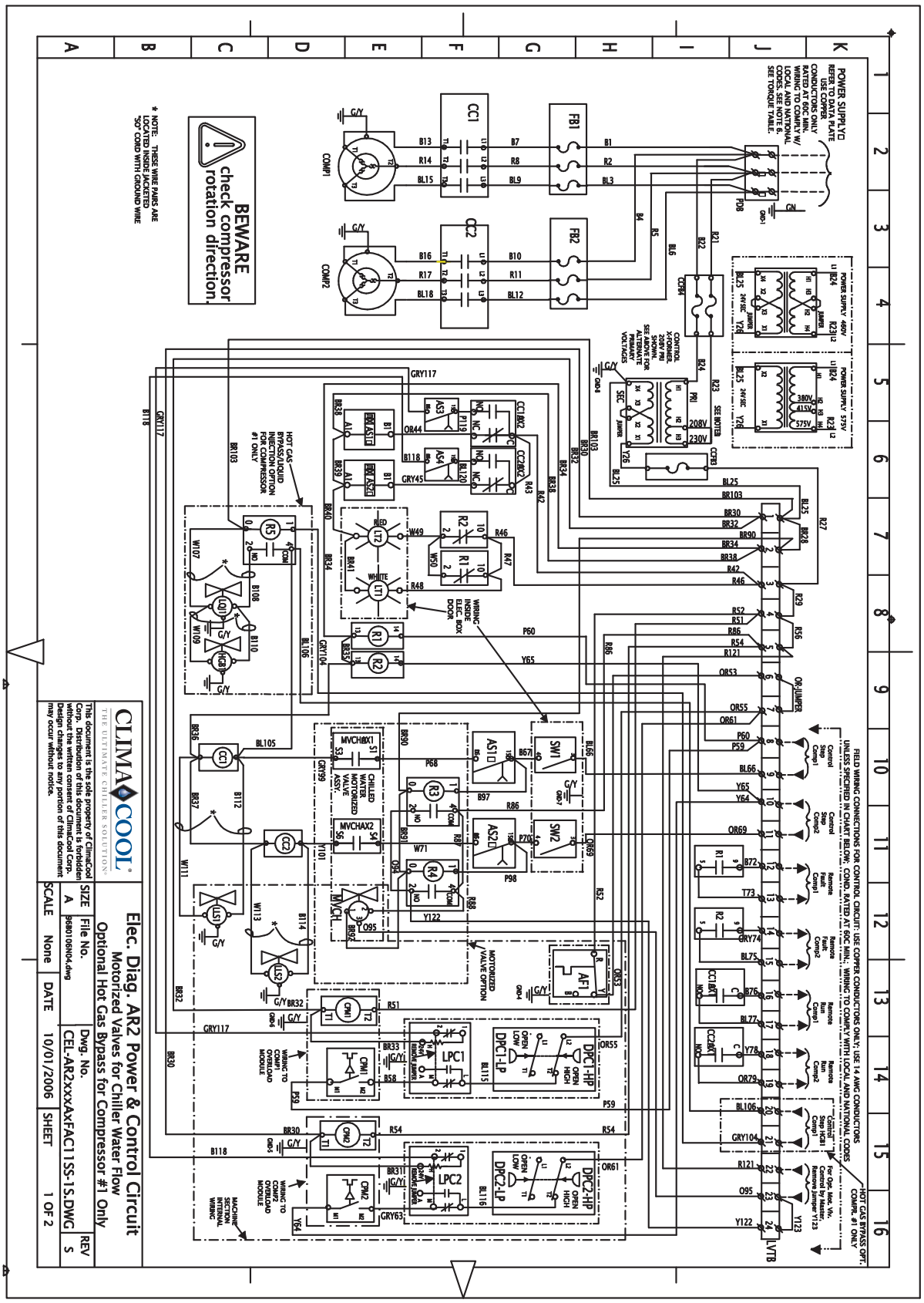
The ClimaCool® Modular Chiller - Multi-Source Power Typical Installation



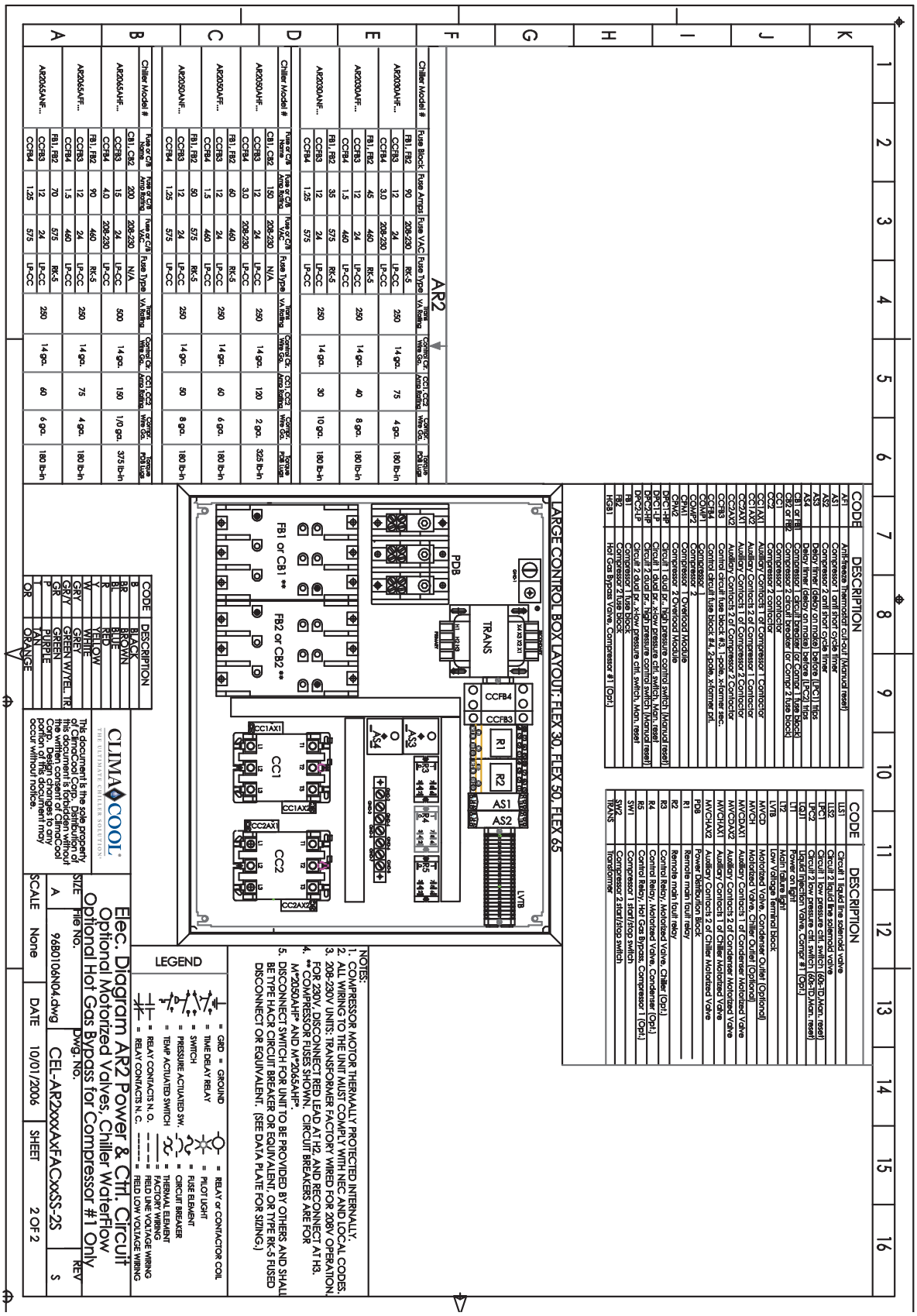
NOTES:

1. Breaker panel represents field power supply and is to be installed by others. Not provided as part of ClimaCool® modular chiller system.
2. Breaker panels can be supplied for skid mount pump/tank packages or new construction projects as options. Consult your local ClimaCool® representative.
3. Control wiring is by others.

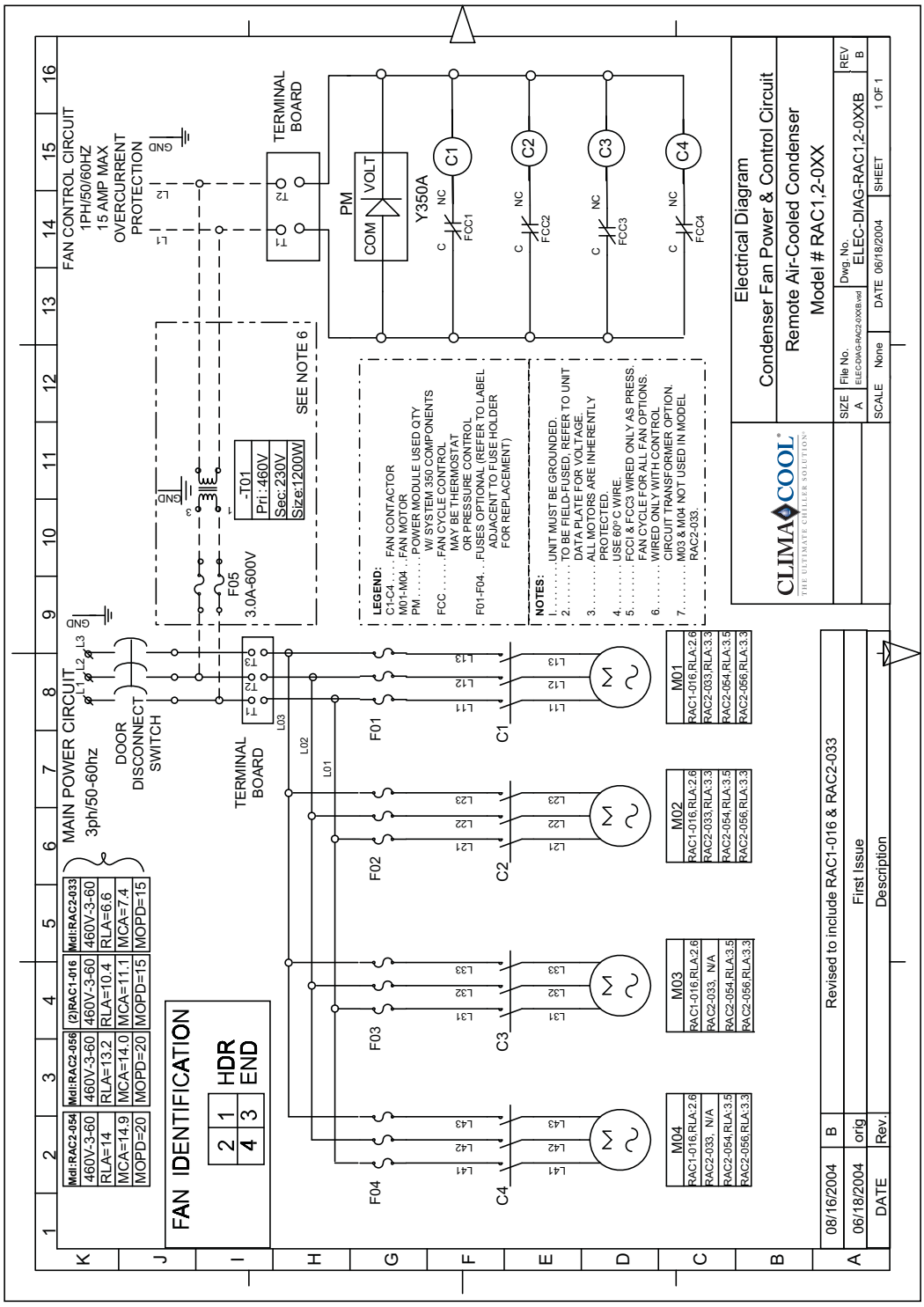
The ClimaCool Modular Chiller - Electrical Wiring Diagram - Power/Control Circuit - Model AR2, Sheet 1



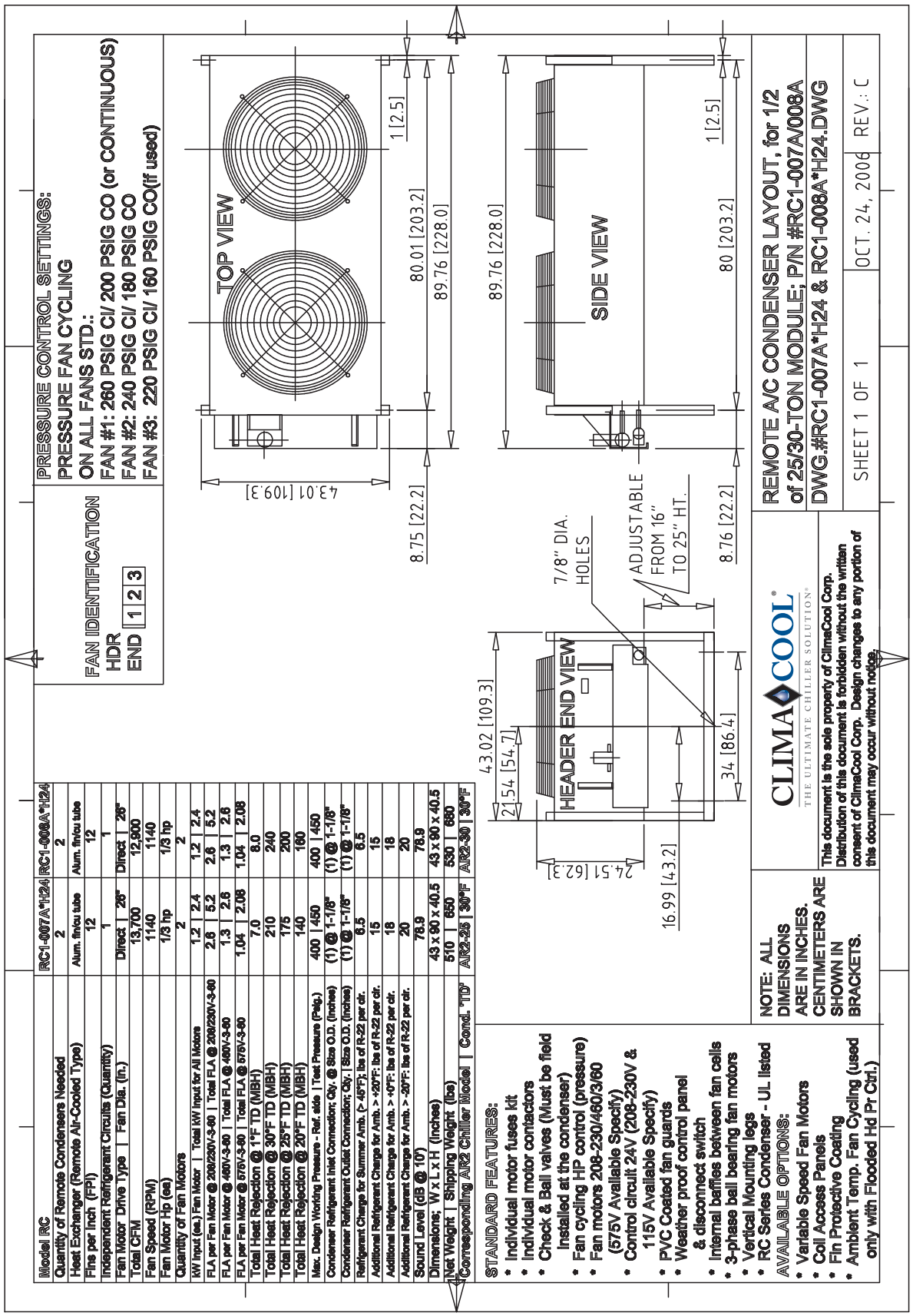
The ClimaCool Modular Chiller - Electrical Wiring Diagram - Power/Control Circuit - Model AR2, Sheet 2



The ClimaCool® Modular Chiller - Electrical Wiring Diagram Condenser Power / Control Circuit



Remote A/C Condenser Layout - RC1-007*H & RC1-008*H; 1-Row, 2-Fan, 1140 RPM

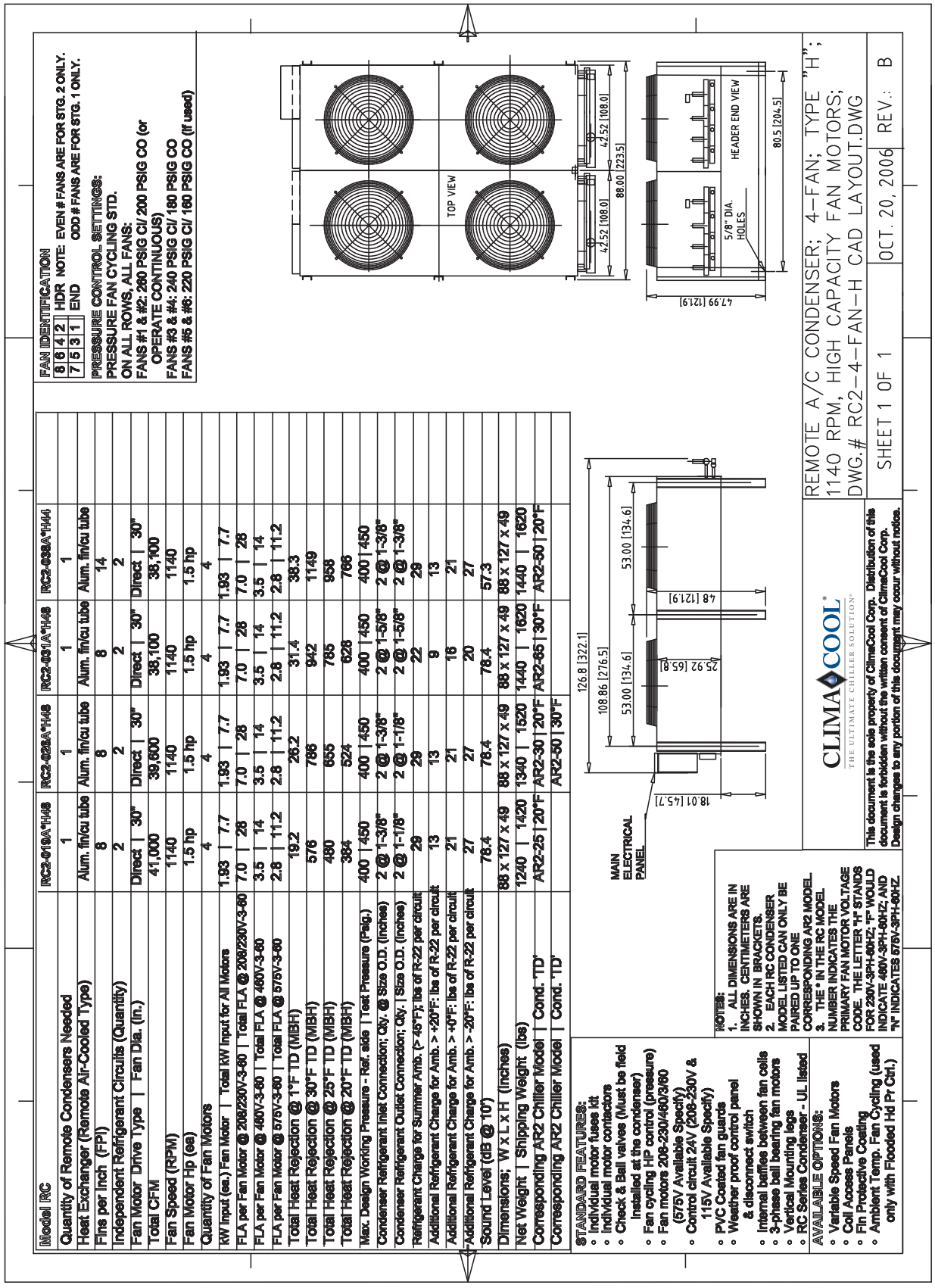


Model RC	RC1-007A*H24	RC1-008A*H24
Quantity of Remote Condensers Needed	2	2
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	12	12
Independent Refrigerant Circuits (Quantity)	1	1
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 26"	Direct | 26"
Total CFM	13,700	12,900
Fan Speed (RPM)	1140	1140
Fan Motor Hp (ea)	1/3 hp	1/3 hp
Quantity of Fan Motors	2	2
kW Input (ea.) Fan Motor | Total kW Input for All Motors	1.2 | 2.4	1.2 | 2.4
FLA per Fan Motor @ 208/230/1-3-60 | Total FLA @ 208/230/1-3-60	2.6 | 5.2	2.6 | 5.2
FLA per Fan Motor @ 460/1-3-60 | Total FLA @ 460/1-3-60	1.3 | 2.6	1.3 | 2.6
FLA per Fan Motor @ 575/1-3-60 | Total FLA @ 575/1-3-60	1.04 | 2.08	1.04 | 2.08
Total Heat Rejection @ 1°F TD (MBH)	7.0	8.0
Total Heat Rejection @ 30°F TD (MBH)	210	240
Total Heat Rejection @ 25°F TD (MBH)	175	200
Total Heat Rejection @ 20°F TD (MBH)	140	160
Max. Design Working Pressure - Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (inches)	(1) @ 1-1/8"	(1) @ 1-1/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (inches)	(1) @ 1-1/8"	(1) @ 1-1/8"
Refrigerant Charge for Summer Amb. (> 45°F); lbs of R-22 per cir.	6.5	6.5
Additional Refrigerant Charge for Amb. > +20°F; lbs of R-22 per cir.	15	15
Additional Refrigerant Charge for Amb. > +0°F; lbs of R-22 per cir.	18	18
Additional Refrigerant Charge for Amb. > -20°F; lbs of R-22 per cir.	20	20
Sound Level (dB @ 10')	78.9	78.9
Dimensions; W x L x H (inches)	43 x 90 x 40.5	43 x 90 x 40.5
Net Weight | Shipping Weight (lbs)	510 | 650	530 | 680
Corresponding AR2 Chiller Model | Cond. "TD"	AR2-25 | 30°F	AR2-30 | 30°F

STANDARD FEATURES:
* Individual motor fuses kit
* Individual motor contactors
* Check & Ball valves (Must be field installed at the condenser)
* Fan cycling HP control (pressure)
* Fan motors 208-230/460/3/60 (575V Available Specify)
* Control circuit 24V (208-230V & 115V Available Specify)
* PVC Coated fan guards
* Weather proof control panel & disconnect switch
* Internal baffles between fan cells
* 3-phase ball bearing fan motors
* Vertical Mounting legs
* RC Series Condenser - UL listed

AVAILABLE OPTIONS:
* Variable Speed Fan Motors
* Coil Access Panels
* Fin Protective Coating
* Ambient Temp. Fan Cycling (used only with Flooded Hd Pr Ctrl.)

Remote A/C Condenser Layout - RC2-014*H thru RC2-025*H; 2-Row, 4-Fan, 540 RPM



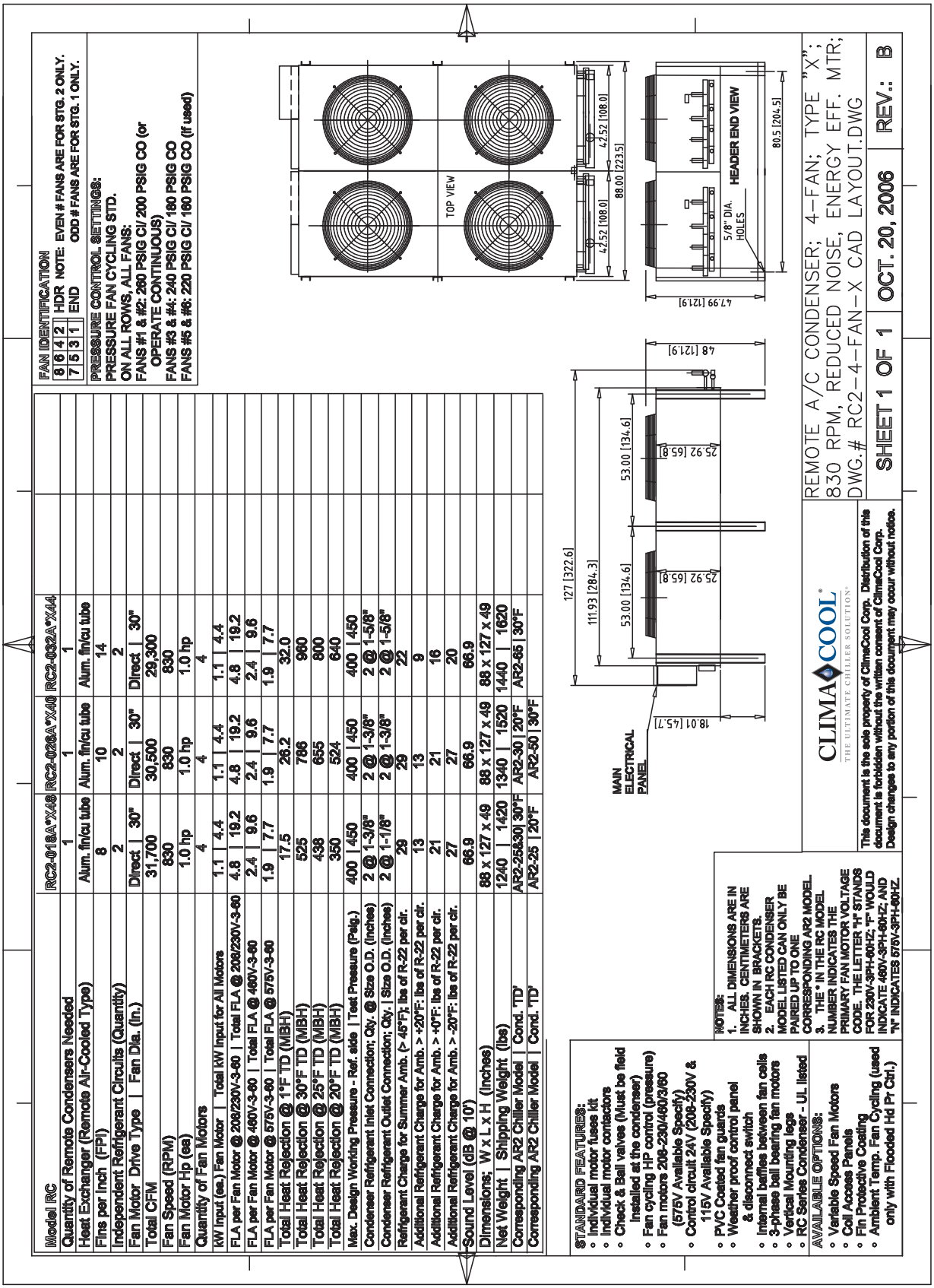
Model RC	RC2-018A*H48	RC2-028A*H48	RC2-031A*H48	RC2-038A*H44
Quantity of Remote Condensers Needed	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	8	8	14
Independent Refrigerant Circuits (Quantity)	2	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 30"	Direct | 30"	Direct | 30"	Direct | 30"
Total CFM	41,000	39,600	38,100	38,100
Fan Speed (RPM)	1140	1140	1140	1140
Fan Motor Hp (ea)	1.5 hp	1.5 hp	1.5 hp	1.5 hp
Quantity of Fan Motors	4	4	4	4
kW Input (ea.) Fan Motor | Total kW Input for All Motors	1.93 | 7.7	1.93 | 7.7	1.93 | 7.7	1.93 | 7.7
FLA per Fan Motor @ 208/230V-3-60 | Total FLA @ 208/230V-3-60	7.0 | 28	7.0 | 28	7.0 | 28	7.0 | 28
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	3.5 | 14	3.5 | 14	3.5 | 14	3.5 | 14
FLA per Fan Motor @ 575V-3-60 | Total FLA @ 575V-3-60	2.8 | 11.2	2.8 | 11.2	2.8 | 11.2	2.8 | 11.2
Total Heat Rejection @ 1°F TD (MBH)	19.2	26.2	31.4	38.3
Total Heat Rejection @ 30°F TD (MBH)	576	786	942	1149
Total Heat Rejection @ 25°F TD (MBH)	480	655	785	958
Total Heat Rejection @ 20°F TD (MBH)	384	524	628	766
Max. Design Working Pressure - Ref. side | Test Pressure (Pkg.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"	2 @ 1-3/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (inches)	2 @ 1-1/8"	2 @ 1-1/8"	2 @ 1-5/8"	2 @ 1-3/8"
Refrigerant Charge for Summer Amb. (> 45°F); lbs of R-22 per circuit	29	29	22	29
Additional Refrigerant Charge for Amb. > +20°F: lbs of R-22 per circuit	13	13	9	13
Additional Refrigerant Charge for Amb. > +0°F: lbs of R-22 per circuit	21	21	16	21
Additional Refrigerant Charge for Amb. > -20°F: lbs of R-22 per circuit	27	27	20	27
Sound Level (dB @ 10')	78.4	78.4	78.4	57.3
Dimensions; W x L x H (inches)	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49
Net Weight | Shipping Weight (lbs)	1240 | 1420	1340 | 1520	1440 | 1620	1440 | 1620
Corresponding AR2 Chiller Model | Cond. °TD°	AR2-25 | 20°F	AR2-30 | 20°F	AR2-65 | 30°F	AR2-50 | 20°F
Corresponding AR2 Chiller Model | Cond. °TD°		AR2-50 | 30°F		

STANDARD FEATURES:
- Individual motor fuses kit
- Individual motor contactors
- Check & Ball valves (Must be field installed at the condenser)
- Fan cycling HP control (pressure)
- Fan motors 208-230/460/3/60 (575V Available Specify)
- Control circuit 24V (208-230V & 115V Available Specify)
- PVC Coated fan guards
- Weather proof control panel & disconnect switch
- Internal baffles between fan cells
- 3-phase ball bearing fan motors
- Vertical Mounting legs
- RC Series Condenser - UL listed

AVAILABLE OPTIONS:
- Variable Speed Fan Motors
- Coil Access Panels
- Fin Protective Coating
- Ambient Temp. Fan Cycling (used only with Flooded Hd Pr Ctrl.)

NOTES:
1. ALL DIMENSIONS ARE IN INCHES. CENTIMETERS ARE SHOWN IN BRACKETS.
2. EACH RC CONDENSER MODEL LISTED CAN ONLY BE PAIRED UP TO ONE CORRESPONDING AR2 MODEL.
3. THE " IN THE RC MODEL NUMBER INDICATES THE PRIMARY FAN MOTOR VOLTAGE CODE. THE LETTER "H" STANDS FOR 230V-3PH-60HZ, "F" WOULD INDICATE 460V-3PH-60HZ; AND "N" INDICATES 575V-3PH-60HZ.

Remote A/C Condenser Layout - RC2-018*X thru RC2-032*X; 2-Row, 4-Fan, 830 RPM



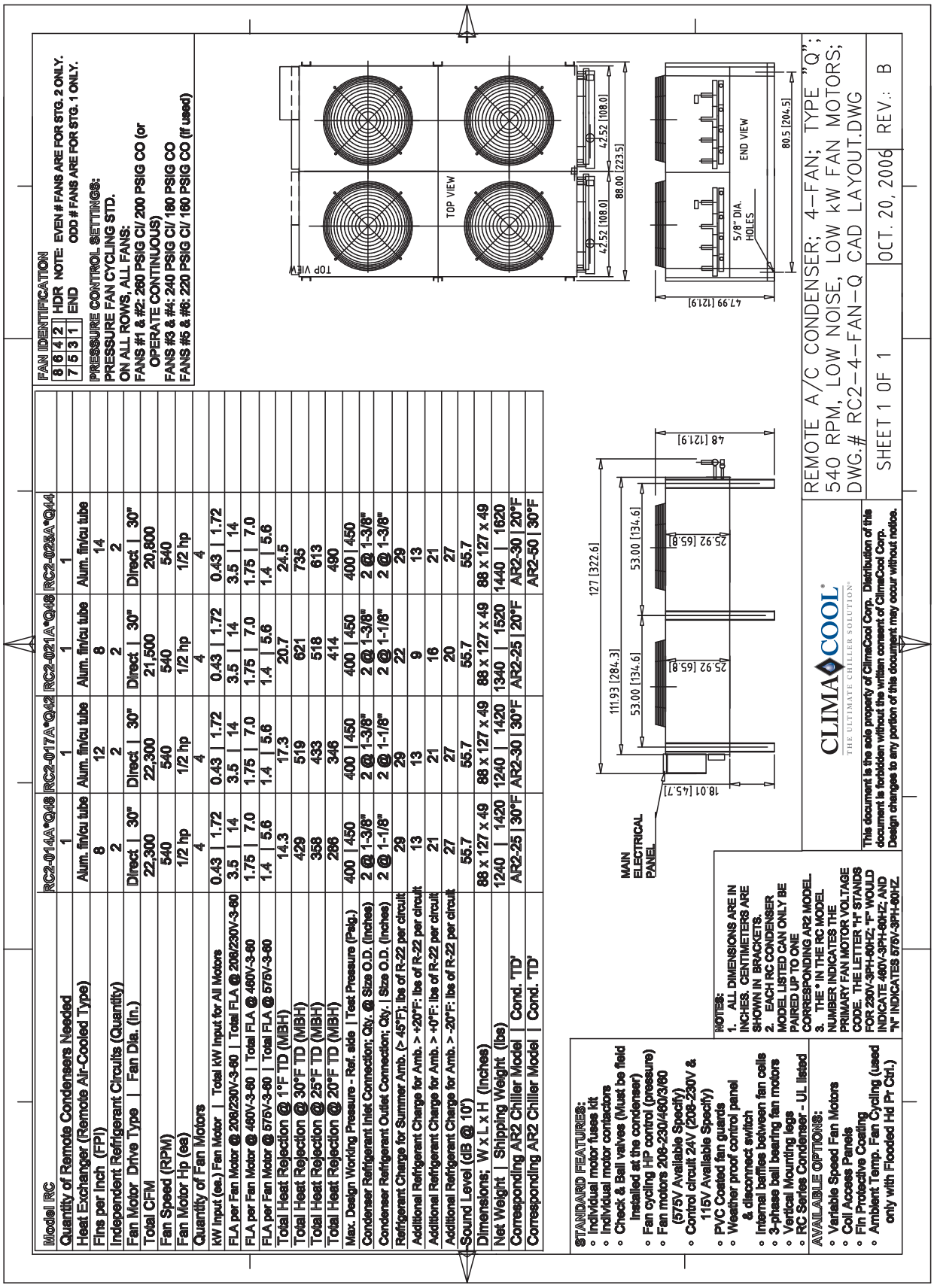
Model RC	RC2-018A*X48	RC2-026A*X48	RC2-032A*X44
Quantity of Remote Condensers Needed	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	10	14
Independent Refrigerant Circuits (Quantity)	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 30"	Direct | 30"	Direct | 30"
Total CFM	31,700	30,500	29,300
Fan Speed (RPM)	830	830	830
Fan Motor Hp (ea)	1.0 hp	1.0 hp	1.0 hp
Quantity of Fan Motors	4	4	4
kW Input (ea.) Fan Motor | Total kW Input for All Motors	1.1 | 4.4	1.1 | 4.4	1.1 | 4.4
FLA per Fan Motor @ 208/230V-3-60 | Total FLA @ 208/230V-3-60	4.8 | 19.2	4.8 | 19.2	4.8 | 19.2
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	2.4 | 9.6	2.4 | 9.6	2.4 | 9.6
FLA per Fan Motor @ 575V-3-60 | Total FLA @ 575V-3-60	1.9 | 7.7	1.9 | 7.7	1.9 | 7.7
Total Heat Rejection @ 11°F TD (MBH)	17.5	26.2	32.0
Total Heat Rejection @ 30°F TD (MBH)	525	786	960
Total Heat Rejection @ 25°F TD (MBH)	438	655	800
Total Heat Rejection @ 20°F TD (MBH)	350	524	640
Max. Design Working Pressure - Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (inches)	2 @ 1-1/8"	2 @ 1-3/8"	2 @ 1-5/8"
Refrigerant Charge for Summer Amb. (> 45°F); lbs of R-22 per cir.	29	29	22
Additional Refrigerant Charge for Amb. > +20°F: lbs of R-22 per cir.	13	13	9
Additional Refrigerant Charge for Amb. > +0°F: lbs of R-22 per cir.	21	21	16
Additional Refrigerant Charge for Amb. > -20°F: lbs of R-22 per cir.	27	27	20
Sound Level (dB @ 10')	66.9	66.9	66.9
Dimensions: W x L x H (inches)	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49
Net Weight | Shipping Weight (lbs)	1240 | 1420	1340 | 1520	1440 | 1620
Corresponding AR2 Chiller Model | Cond. °TD'	AR2-25&30 | 30°F	AR2-30 | 20°F	AR2-65 | 30°F
Corresponding AR2 Chiller Model | Cond. °TD'	AR2-25 | 20°F	AR2-50 | 30°F	

STANDARD FEATURES:
- Individual motor fuses kit
- Individual motor contactors
- Check & Ball valves (Must be field Installed at the condenser)
- Fan cycling HP control (pressure)
- Fan motors 208-230/460/3/60 (575V Available Specify)
- Control circuit 24V (208-230V & 115V Available Specify)
- PVC Coated fan guards
- Weather proof control panel & disconnect switch
- Internal baffles between fan cells
- 3-phase ball bearing fan motors
- Vertical Mounting legs
- RC Series Condenser - UL listed

AVAILABLE OPTIONS:
- Variable Speed Fan Motors
- Coil Access Panels
- Fin Protective Coating
- Ambient Temp. Fan Cycling (used only with Flooded Hd Pr Ctrl.)

NOTES:
1. ALL DIMENSIONS ARE IN INCHES. CENTIMETERS ARE SHOWN IN BRACKETS.
2. EACH RC CONDENSER MODEL LISTED CAN ONLY BE PAIRED UP TO ONE CORRESPONDING AR2 MODEL.
3. THE * IN THE RC MODEL NUMBER INDICATES THE PRIMARY FAN MOTOR VOLTAGE CODE. THE LETTER "H" STANDS FOR 230V-3PH-60HZ; "F" WOULD INDICATE 460V-3PH-60HZ; AND "N" INDICATES 575V-3PH-60HZ.

Remote A/C Condenser Layout - RC2-015*Q thru RC2-044*Q; 2-Row, 4-Fan, 540 RPM



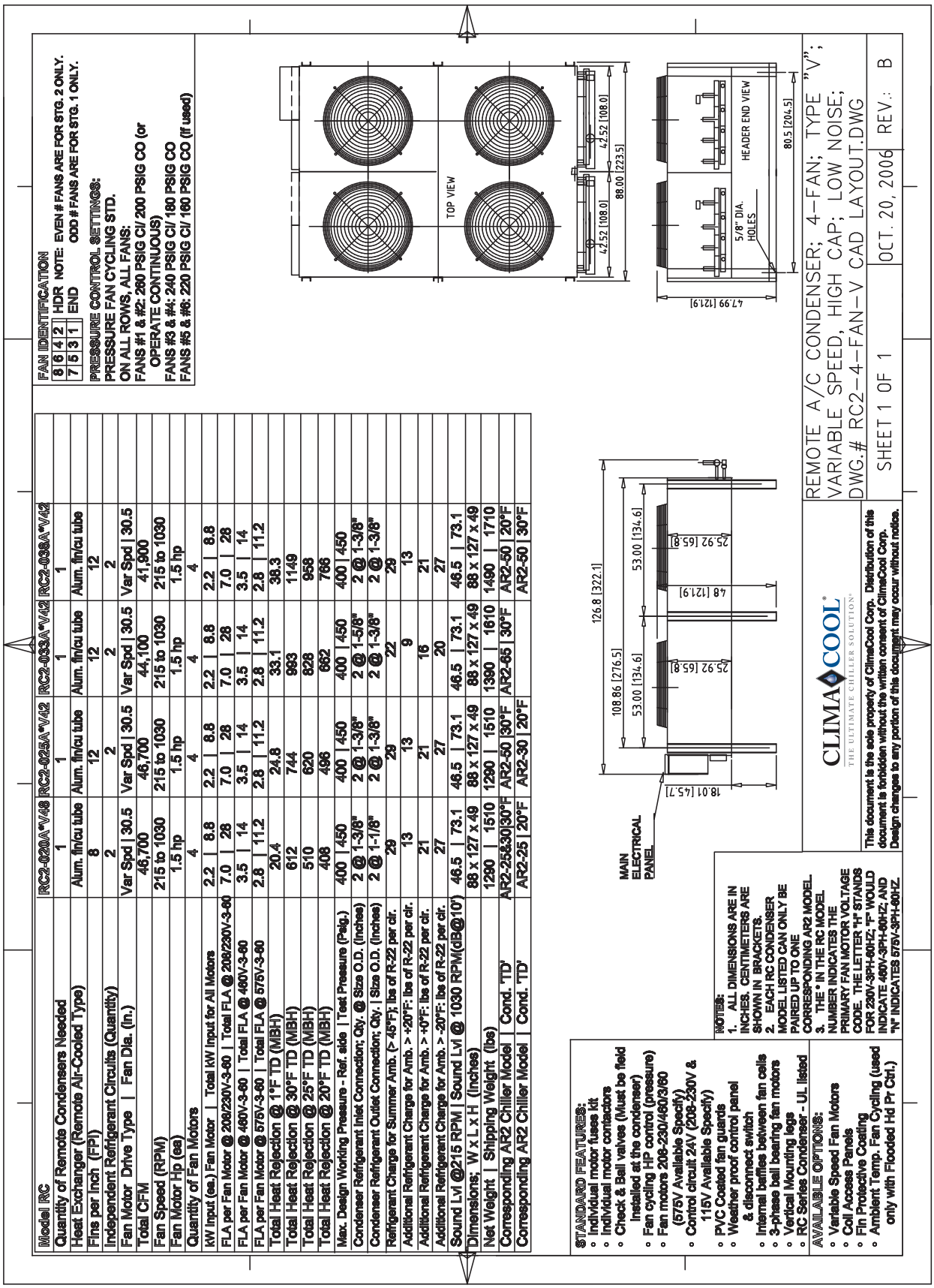
Model RC	RC2-014A*Q48	RC2-017A*Q42	RC2-021A*Q48	RC2-025A*Q44
Quantity of Remote Condensers Needed	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	12	8	14
Independent Refrigerant Circuits (Quantity)	2	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 30"	Direct | 30"	Direct | 30"	Direct | 30"
Total CFM	22,300	22,300	21,500	20,800
Fan Speed (RPM)	540	540	540	540
Fan Motor Hp (ea)	1/2 hp	1/2 hp	1/2 hp	1/2 hp
Quantity of Fan Motors	4	4	4	4
kW Input (ea.) Fan Motor | Total kW Input for All Motors	0.43 | 1.72	0.43 | 1.72	0.43 | 1.72	0.43 | 1.72
FLA per Fan Motor @ 208/230V-3-60 | Total FLA @ 208/230V-3-60	3.5 | 14	3.5 | 14	3.5 | 14	3.5 | 14
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	1.75 | 7.0	1.75 | 7.0	1.75 | 7.0	1.75 | 7.0
FLA per Fan Motor @ 575V-3-60 | Total FLA @ 575V-3-60	1.4 | 5.6	1.4 | 5.6	1.4 | 5.6	1.4 | 5.6
Total Heat Rejection @ 1°F TD (MBH)	14.3	17.3	20.7	24.5
Total Heat Rejection @ 30°F TD (MBH)	429	519	621	735
Total Heat Rejection @ 25°F TD (MBH)	358	433	518	613
Total Heat Rejection @ 20°F TD (MBH)	286	346	414	490
Max. Design Working Pressure - Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (Inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (Inches)	2 @ 1-1/8"	2 @ 1-1/8"	2 @ 1-1/8"	2 @ 1-3/8"
Refrigerant Charge for Summer Amb. (> 45°F); lbs of R-22 per circuit	29	29	22	29
Additional Refrigerant Charge for Amb. > +20°F: lbs of R-22 per circuit	13	13	9	13
Additional Refrigerant Charge for Amb. > +0°F: lbs of R-22 per circuit	21	21	16	21
Additional Refrigerant Charge for Amb. > -20°F: lbs of R-22 per circuit	27	27	20	27
Sound Level (dB @ 10')	55.7	55.7	55.7	55.7
Dimensions; W x L x H (Inches)	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49
Net Weight | Shipping Weight (lbs)	1240 | 1420	1240 | 1420	1340 | 1520	1440 | 1620
Corresponding AR2 Chiller Model | Cond. "TD"	AR2-25 | 30°F	AR2-30 | 30°F	AR2-25 | 20°F	AR2-30 | 20°F
Corresponding AR2 Chiller Model | Cond. "TD"				AR2-50 | 30°F

STANDARD FEATURES:
- Individual motor fuses kit
- Individual motor contactors
- Check & Ball valves (Must be field Installed at the condenser)
- Fan cycling HP control (pressure)
- Fan motors 208-230/460/3/60 (575V Available Specify)
- Control circuit 24V (208-230V & 115V Available Specify)
- PVC Coated fan guards
- Weather proof control panel & disconnect switch
- Internal baffles between fan cells
- 3-phase ball bearing fan motors
- Vertical Mounting legs
- RC Series Condenser - UL listed

AVAILABLE OPTIONS:
- Variable Speed Fan Motors
- Coil Access Panels
- Fin Protective Coating
- Ambient Temp. Fan Cycling (used only with Flooded Hd Pr Ctrl.)

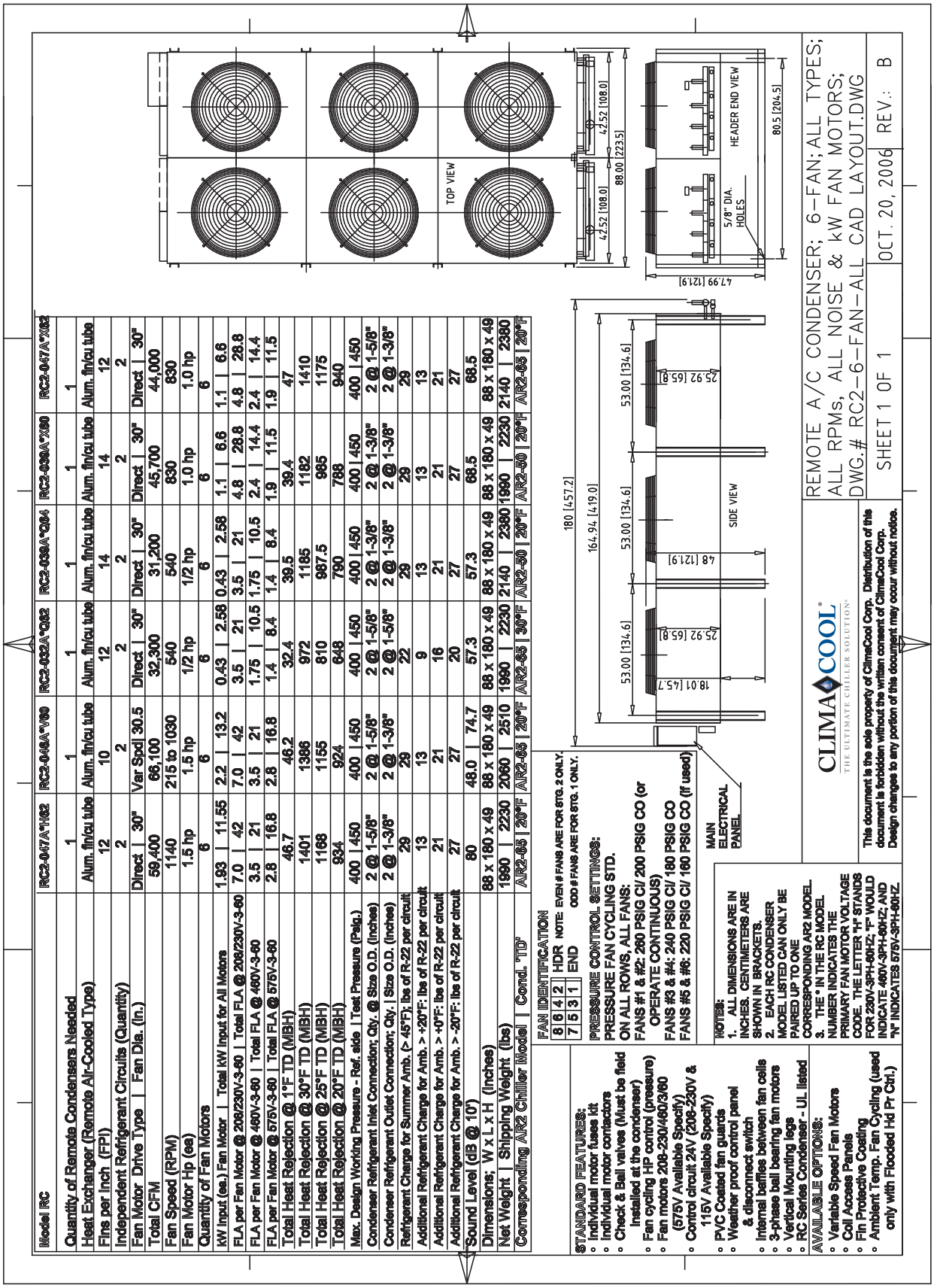
NOTES:
1. ALL DIMENSIONS ARE IN INCHES. CENTIMETERS ARE SHOWN IN BRACKETS.
2. EACH RC CONDENSER MODEL LISTED CAN ONLY BE PAIRED UP TO ONE CORRESPONDING AR2 MODEL.
3. THE " IN THE RC MODEL NUMBER INDICATES THE PRIMARY FAN MOTOR VOLTAGE CODE. THE LETTER "H" STANDS FOR 230V-3PH-60HZ; "F" WOULD INDICATE 460V-3PH-60HZ; AND "N" INDICATES 575V-3PH-60HZ.

Remote A/C Condenser Layout - RC2-020*V thru RC2-038*V; 2-Row, 4-Fan, Variable Speed



Model RC	RC2-020A*V48	RC2-025A*V42	RC2-033A*V42	RC2-038A*V42
Quantity of Remote Condensers Needed	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	8	12	12	12
Independent Refrigerant Circuits (Quantity)	2	2	2	2
Fan Motor Drive Type | Fan Dia. (In.)	Var Spd | 30.5	Var Spd | 30.5	Var Spd | 30.5	Var Spd | 30.5
Total CFM	46,700	46,700	44,100	41,900
Fan Speed (RPM)	215 to 1030	215 to 1030	215 to 1030	215 to 1030
Fan Motor Hp (ea)	1.5 hp	1.5 hp	1.5 hp	1.5 hp
Quantity of Fan Motors	4	4	4	4
kW Input (ea.) Fan Motor | Total kW Input for All Motors	2.2 | 8.8	2.2 | 8.8	2.2 | 8.8	2.2 | 8.8
FLA per Fan Motor @ 208/230V-3-60 | Total FLA @ 208/230V-3-60	7.0 | 28	7.0 | 28	7.0 | 28	7.0 | 28
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	3.5 | 14	3.5 | 14	3.5 | 14	3.5 | 14
FLA per Fan Motor @ 575V-3-60 | Total FLA @ 575V-3-60	2.8 | 11.2	2.8 | 11.2	2.8 | 11.2	2.8 | 11.2
Total Heat Rejection @ 1°F TD (MBH)	20.4	24.8	33.1	38.3
Total Heat Rejection @ 30°F TD (MBH)	612	744	993	1149
Total Heat Rejection @ 25°F TD (MBH)	510	620	828	958
Total Heat Rejection @ 20°F TD (MBH)	408	496	662	766
Max. Design Working Pressure - Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (Inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"	2 @ 1-3/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (Inches)	2 @ 1-1/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"
Refrigerant Charge for Summer Amb. (> 45°F); lbs of R-22 per cir.	29	29	22	29
Additional Refrigerant Charge for Amb. > +20°F: lbs of R-22 per cir.	13	13	9	13
Additional Refrigerant Charge for Amb. > +0°F: lbs of R-22 per cir.	21	21	16	21
Additional Refrigerant Charge for Amb. > -20°F: lbs of R-22 per cir.	27	27	20	27
Sound Lvl @215 RPM | Sound Lvl @ 1030 RPM(dB@10')	46.5 | 73.1	46.5 | 73.1	46.5 | 73.1	46.5 | 73.1
Dimensions; W x L x H (Inches)	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49	88 x 127 x 49
Net Weight | Shipping Weight (lbs)	1290 | 1510	1290 | 1510	1390 | 1610	1490 | 1710
Corresponding AR2 Chiller Model | Cond. °TD'	AR2-25&30|30°F	AR2-50 |30°F	AR2-65 | 30°F	AR2-50 | 20°F
Corresponding AR2 Chiller Model | Cond. °TD'	AR2-25 | 20°F	AR2-30 | 20°F		AR2-50 | 30°F

Remote A/C Condenser Layout - RC2-032*Q thru RC2-047*X; 2-Row, 6-Fan, All Speeds



Model RC	RC2-047A*H02	RC2-048A*V00	RC2-032A*Q02	RC2-038A*Q04	RC2-038A*X00	RC2-047A*X04
Quantity of Remote Condensers Needed	1	1	1	1	1	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube	Alum. fin/cu tube
Fins per Inch (FPI)	12	10	12	14	14	12
Independent Refrigerant Circuits (Quantity)	2	2	2	2	2	2
Fan Motor Drive Type | Fan Dia. (in.)	Direct | 30"	Var Spd | 30.5	Direct | 30"	Direct | 30"	Direct | 30"	Direct | 30"
Total CFM	59,400	66,100	32,300	31,200	45,700	44,000
Fan Speed (RPM)	1140	215 to 1030	540	540	830	830
Fan Motor Hp (ea)	1.5 hp	1.5 hp	1/2 hp	1/2 hp	1.0 hp	1.0 hp
Quantity of Fan Motors	6	6	6	6	6	6
kW Input (ea.) Fan Motor | Total kW Input for All Motors	1.93 | 11.55	2.2 | 13.2	0.43 | 2.58	0.43 | 2.58	1.1 | 6.6	1.1 | 6.6
FLA per Fan Motor @ 208/230V-3-60 | Total FLA @ 208/230V-3-60	7.0 | 42	7.0 | 42	3.5 | 21	3.5 | 21	4.8 | 28.8	4.8 | 28.8
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	3.5 | 21	3.5 | 21	1.75 | 10.5	1.75 | 10.5	2.4 | 14.4	2.4 | 14.4
FLA per Fan Motor @ 575V-3-60 | Total FLA @ 575V-3-60	2.8 | 16.8	2.8 | 16.8	1.4 | 8.4	1.4 | 8.4	1.9 | 11.5	1.9 | 11.5
Total Heat Rejection @ 1°F TD (MBH)	46.7	46.2	32.4	39.5	39.4	47
Total Heat Rejection @ 30°F TD (MBH)	1401	1386	972	1185	1182	1410
Total Heat Rejection @ 25°F TD (MBH)	1168	1155	810	987.5	985	1175
Total Heat Rejection @ 20°F TD (MBH)	934	924	648	790	788	940
Max. Design Working Pressure - Ref. side | Test Pressure (Psig.)	400 | 450	400 | 450	400 | 450	400 | 450	400 | 450	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (inches)	2 @ 1-5/8"	2 @ 1-5/8"	2 @ 1-5/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (inches)	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-5/8"	2 @ 1-3/8"	2 @ 1-3/8"	2 @ 1-3/8"
Refrigerant Charge for Summer Amb. (> 45°F); lbs of R-22 per circuit	29	29	22	29	29	29
Additional Refrigerant Charge for Amb. > +20°F: lbs of R-22 per circuit	13	13	9	13	13	13
Additional Refrigerant Charge for Amb. > +0°F: lbs of R-22 per circuit	21	21	16	21	21	21
Additional Refrigerant Charge for Amb. > -20°F: lbs of R-22 per circuit	27	27	20	27	27	27
Sound Level (dB @ 10')	80	48.0 | 74.7	57.3	57.3	68.5	68.5
Dimensions; W x L x H (inches)	88 x 180 x 49	88 x 180 x 49	88 x 180 x 49	88 x 180 x 49	88 x 180 x 49	88 x 180 x 49
Net Weight | Shipping Weight (lbs)	1990 | 2230	2060 | 2510	1990 | 2230	2140 | 2380	1990 | 2230	2140 | 2380
Corresponding AR2 Chiller Model | Cond. "TD"	AR2-65 | 20°F	AR2-65 | 20°F	AR2-65 | 30°F	AR2-50 | 20°F	AR2-50 | 20°F	AR2-65 | 20°F

FAN IDENTIFICATION
8 6 4 2 HDR NOTE: EVEN # FANS ARE FOR STG. 2 ONLY.
7 5 3 1 END ODD # FANS ARE FOR STG. 1 ONLY.

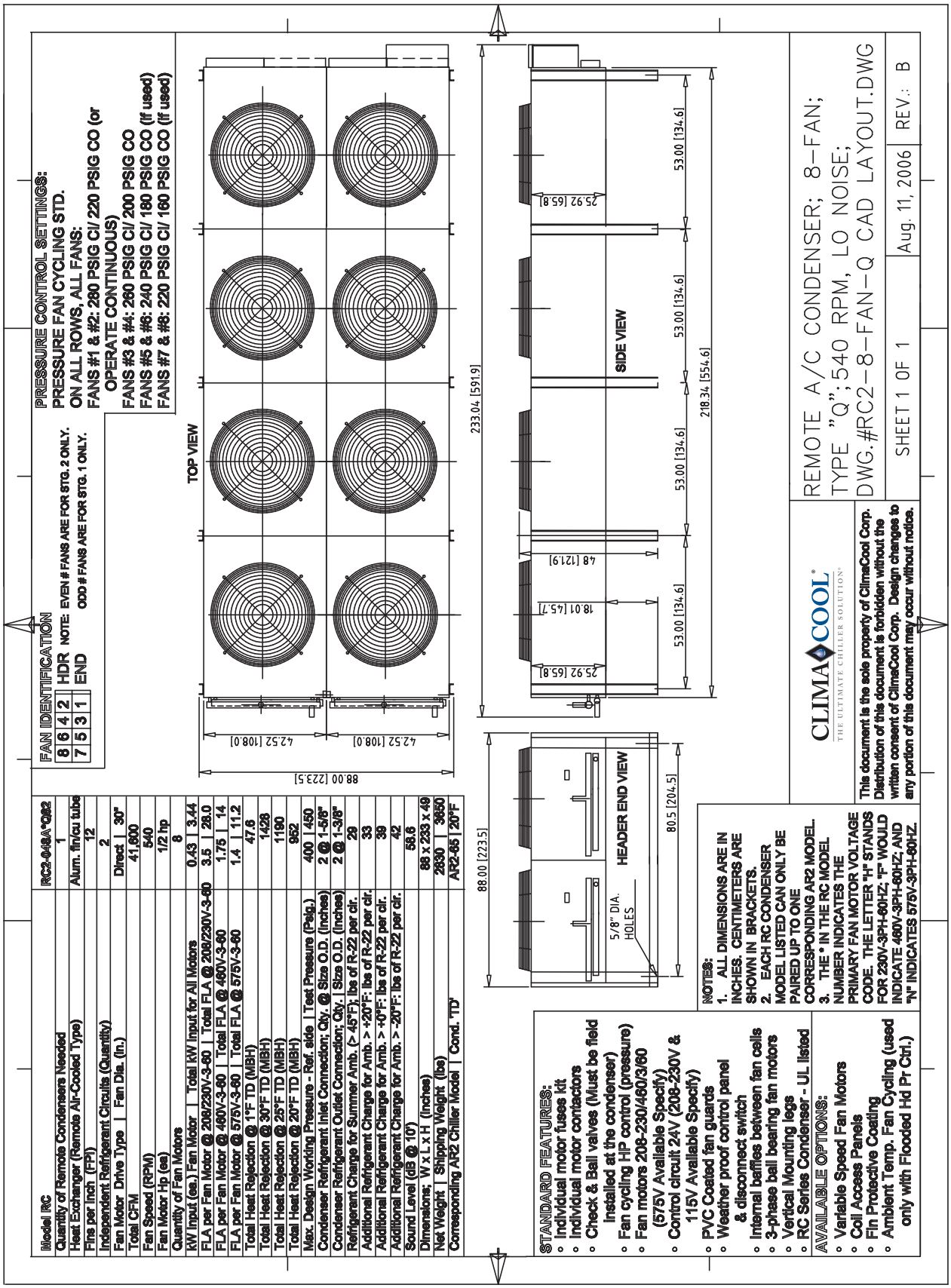
PRESSURE CONTROL SETTINGS:
PRESSURE FAN CYCLING STD.
ON ALL ROWS, ALL FANS:
FANS #1 & #2: 260 PSIG CI/ 200 PSIG CO (or OPERATE CONTINUOUS)
FANS #3 & #4: 240 PSIG CI/ 180 PSIG CO
FANS #5 & #6: 220 PSIG CI/ 160 PSIG CO (if used)

NOTES:
1. ALL DIMENSIONS ARE IN INCHES. CENTIMETERS ARE SHOWN IN BRACKETS.
2. EACH RC CONDENSER MODEL LISTED CAN ONLY BE PAIRED UP TO ONE CORRESPONDING AR2 MODEL.
3. THE "H" IN THE RC MODEL NUMBER INDICATES THE PRIMARY FAN MOTOR VOLTAGE CODE. THE LETTER "H" STANDS FOR 230V-3PH-60HZ. "F" WOULD INDICATE 460V-3PH-60HZ; AND "N" INDICATES 575V-3PH-60HZ.

STANDARD FEATURES:
- Individual motor fuses kit
- Individual motor contactors
- Check & Ball valves (Must be field Installed at the condenser)
- Fan cycling HP control (pressure)
- Fan motors 208-230/460/3/60 (575V Available Specify)
- Control circuit 24V (208-230V & 115V Available Specify)
- PVC Coated fan guards
- Weather proof control panel & disconnect switch
- Internal baffles between fan cells
- 3-phase ball bearing fan motors
- Vertical Mounting legs
- RC Series Condenser - UL listed

AVAILABLE OPTIONS:
- Variable Speed Fan Motors
- Coil Access Panels
- Fin Protective Coating
- Ambient Temp. Fan Cycling (used only with Flooded Hd Pr Ctrl.)

Remote A/C Condenser Layout - RC2-048*Q; 2-Row, 8-Fan, Type Q 540 RPM



Model RC	RC2-048A*QB2
Quantity of Remote Condensers Needed	1
Heat Exchanger (Remote Air-Cooled Type)	Alum. fin/cu tube
Fins per Inch (FPI)	12
Independent Refrigerant Circuits (Quantity)	2
Fan Motor Drive Type | Fan Dia. (In.)	Direct | 30"
Total CFM	41,600
Fan Speed (RPM)	540
Fan Motor Hp (ea)	1/2 hp
Quantity of Fan Motors	8
kW Input (ea.) Fan Motor | Total kW Input for All Motors	0.43 | 3.44
FLA per Fan Motor @ 208/230V-3-60 | Total FLA @ 208/230V-3-60	3.5 | 28.0
FLA per Fan Motor @ 460V-3-60 | Total FLA @ 460V-3-60	1.75 | 14
FLA per Fan Motor @ 575V-3-60 | Total FLA @ 575V-3-60	1.4 | 11.2
Total Heat Rejection @ 1°F TD (MBH)	47.6
Total Heat Rejection @ 30°F TD (MBH)	1428
Total Heat Rejection @ 25°F TD (MBH)	1190
Total Heat Rejection @ 20°F TD (MBH)	952
Max. Design Working Pressure - Ref. side | Test Pressure (Psig.)	400 | 450
Condenser Refrigerant Inlet Connection; Qty. @ Size O.D. (inches)	2 @ 1-5/8"
Condenser Refrigerant Outlet Connection; Qty. | Size O.D. (inches)	2 @ 1-3/8"
Refrigerant Charge for Summer Amb. (> 45°F); lbs of R-22 per ckt.	29
Additional Refrigerant Charge for Amb. > +20°F: lbs of R-22 per ckt.	33
Additional Refrigerant Charge for Amb. > +0°F: lbs of R-22 per ckt.	39
Additional Refrigerant Charge for Amb. > -20°F: lbs of R-22 per ckt.	42
Sound Level (dB @ 10')	58.6
Dimensions; W x L x H (inches)	88 x 233 x 49
Net Weight | Shipping Weight (lbs)	2830 | 3650
Corresponding AR2 Chiller Model | Cond. "TD"	AR2-65 | 20°F

STANDARD FEATURES:
- Individual motor fuses kit
- Individual motor contactors
- Check & Ball valves (Must be field installed at the condenser)
- Fan cycling HP control (pressure)
- Fan motors 208-230/460/3/60 (575V Available Specify)
- Control circuit 24V (208-230V & 115V Available Specify)
- PVC Coated fan guards
- Weather proof control panel & disconnect switch
- Internal baffles between fan cells
- 3-phase ball bearing fan motors
- Vertical Mounting legs
- RC Series Condenser - UL listed

AVAILABLE OPTIONS:
- Variable Speed Fan Motors
- Coil Access Panels
- Fin Protective Coating
- Ambient Temp. Fan Cycling (used only with Flooded Hd Pr Ctrl.)

NOTES:
1. ALL DIMENSIONS ARE IN INCHES. CENTIMETERS ARE SHOWN IN BRACKETS.
2. EACH RC CONDENSER MODEL LISTED CAN ONLY BE PAIRED UP TO ONE CORRESPONDING AR2 MODEL.
3. THE * IN THE RC MODEL NUMBER INDICATES THE PRIMARY FAN MOTOR VOLTAGE CODE. THE LETTER "H" STANDS FOR 230V-3PH-60HZ, "F" WOULD INDICATE 460V-3PH-60HZ AND "N" INDICATES 575V-3PH-60HZ.

Troubleshooting Guide

WARNING!

The troubleshooting guidelines recommended in this section could result in exposure to electrical safety hazards. Refer to the safety warnings provided in this manual. Failure to follow all of the recommended safety warnings provided could result in death or serious injury. When possible, disconnect all electrical power including remote disconnects before servicing. Follow proper lockout-tagout procedures. Only a qualified licensed electrician or persons trained to handle live electrical components should only be allowed to work with energized electrical components.

CHILLER UNIT WILL NOT START

Possible Cause	*Remedy*
1. Power off	1. Check main disconnect switch
2. Main line open	2. Check main fuses
3. Incorrect wiring	3. Check the wiring diagram
4. Loose terminals/connections	4. Tighten the terminal connections
5. Control circuit open	5. Check interlocks with auxiliary equipment, pressure and temperature controls
6. Improper phasing of main power	6. Change any 2 of 3 phases of main power

COMPRESSOR HUMS BUT DOES NOT START

Possible Cause	*Remedy*
1. Low voltage	1. Check at main power entry and power entry at unit (consult power company if low)

COMPRESSOR RUNS BUT DOES NOT COOL

Possible Cause	*Remedy*
1. Improper phasing of main power	1. Change any 2 of 3 phases of main power
2. Refrigeration service valves closed	2. Open all refrigeration system service ball valves

COMPRESSOR CUTS OUT ON LOW PRESSURE SAFETY CONTROL

Possible Cause	*Remedy*
1. Refrigerant shortage	1. Check for leaks - add refrigerant
2. No load on water chiller	2. Check water pump operation
3. Restriction in liquid line	3. Plugged liquid line drier - replace liquid line drier
4. Suction valve partially closed	4. Open valves fully
5. Expansion valve clogged or inoperative	5. Repair / Replace the expansion valve
6. Low discharge pressure	6. Raise and control discharge pressure within design limits
7. Low water flow through the cooler	7. Check water flow through the cooler
8. Chilled water temp. too cold	8. Raise water temperature
9. Fouled evaporator brazed plate HX	9. Clean-in-place HX as described in previous section
10. Defective low pressure switch	10. Replace low pressure switch

COMPRESSOR CYCLES ON HIGH PRESSURE CONTROL

Possible Cause	*Remedy*
1. Compressor discharge valve partially closed	1. Open valve fully
2. Non-condensable gases in hydronic system	2. Purge non-condensable gases from bleed valve on condenser or at bleed valve of the building condenser water system
3. Overcharge of refrigerant (R-22 or R-407C)	3. Purge refrigerant from system while in operation until the first sign of bubbles are shown in sight glass. Add back refrigerant just until bubbles clear.
4. Air temp entering condenser too high	4.
5. Insufficient air flow thru condenser	5. Check fan blade operation and condenser for debris
6. Fouled air cooled condenser entering face	6. Clean entering face of air cooled condenser
7. Defective high pressure switch	7. Replace
8. Non-condensable gases in refrigerant	2. Purge refrigerant from system, properly evacuate, recharge with new refrigerant

CAUSES AND PREVENTION OF FREEZE-UP

Possible Cause	*Prevention*
1. Improper charging	1. Charge per manufacturer's recommendation
2. Improperly set low pressure freeze ctrl	2. Check the safety time delay low pressure control for proper setting at the beginning of each season
3. Operating with LPC bypassed	3. The safety time delay low pressure control is wired in series with the compressor motor contactors. (Do not bypass it)
4. Improper chilled water circulation	4. Use an ample sized cleanable strainer in the chilled water circuit. Make certain in the strainer is clean to insure full flow and velocity of chilled water. It may sometimes be necessary to treat the water to prevent formation of deposits
5. Not draining for winter shutdown	5. When the system is shut down for the winter, remove the drain plugs and drain the cooler. Blow out remaining water with air
6. Improper setting of low water temp. control	6. Check setting of (freeze-stat) temperature control

Warranty Information

For complete warranty details refer to ClimaCool's web site at www.climacoolcorp.com or contact customer service at (405) 745-3185.

CLIMACOOL CORPORATION

THE ULTIMATE CHILLER SOLUTION

LIMITED EXPRESS WARRANTY/LIMITATION OF REMEDIES AND LIABILITY

WARRANTY DISCLAIMER

It is expressly understood that unless a statement is specifically identified as a warranty, statements made by ClimaCool Corp., an Oklahoma corporation ("CC"), or its representatives, relating to CC's products, whether oral, written or contained in any quote, sales literature, catalog or any agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely CC's opinion or commendation of CC's products. **EXCEPT AS SPECIFICALLY SET FORTH HEREIN, THERE IS NO EXPRESS WARRANTY AS TO ANY OF CC'S PRODUCTS. CC MAKES NO WARRANTY AGAINST LATENT DEFECTS. CC MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.**

GRANT OF LIMITED EXPRESS WARRANTY

CC warrants CC's products purchased and retained in the United States of America and Canada to be free from defects in material and workmanship under normal use and maintenance only as follows: (a) All modular chillers built or sold by CC for twelve (12) months from date of unit start-up or eighteen (18) months from date of shipment (from CC's warehouse), whichever comes first; and (b) Repair and replacement parts, which are not supplied under warranty, for ninety (90) days from date of shipment (from CC's warehouse). All parts must be returned to CC's warehouse in Oklahoma City, Oklahoma, freight prepaid, no later than sixty (60) days after the date of the failure of the part. If CC determines the part to be defective and within CC's Limited Express Warranty, CC shall, when such part has been either replaced or repaired, return such to a CC recognized dealer, contractor or service organization, F.O.B. CC's warehouse, Oklahoma City, Oklahoma, freight prepaid. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

This warranty does not cover and does not apply to : (1) Fuses, refrigerant, fluids, oil; (2) Products relocated after initial installation; (3) Any portion or component of the system that is not supplied by CC, regardless of the cause of the failure of such portion or component; (4) Products on which the module identification tags or labels have been removed or defaced; (5) Products on which payment to CC is or has been in default; (6) Products which have defects or damage which result from improper installation, wiring, electrical imbalance characteristics or maintenance (including, without limitation, defects or damages caused by voltage surges, inadequate voltage conditions, phase imbalance, any form of electrical disturbances, inadequate or improper electrical circuit installation or protection, failure to perform common maintenance, etc.); or are caused by accident, misuse or abuse, fire, flood, alteration or misapplication of the product; (7) Products which have defects or damage which result from a contaminated or corrosive air or liquid supply, operation at abnormal temperatures, or unauthorized opening of refrigerant circuit; (8) Products subjected to corrosion or abrasion; (9) Mold, fungus or bacteria damage; (10) Products manufactured or supplied by others; (11) Products which have been subjected to misuse, negligence or accidents; (12) Products which have been operated in a manner contrary to CC's printed instructions; or, (13) Products which have defects, damage or insufficient performance as a result of insufficient or incorrect system design or the improper application of CC's products; (14) Products which have defects or damages due to freezing of the water supply, an inadequate or interrupted water supply, corrosives or abrasives in the water supply, or improper or inadequate filtration or treatment of the water or air supply.

CC is not responsible for: (1) The costs of any fluids, refrigerant or other system components, or associated labor to repair of replace the same, which is incurred as a result of a defective part covered by CC's Limited Express Warranty; (2) The costs of labor, refrigerant, materials of service incurred in removal of the defective part, or in obtaining and replacing the new or repaired part; or, (3) Transportation costs of the defective part from the installation site to CC or of the return of any part not covered by CC's Limited Express Warranty.

Limitation: This Limited Express Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined that other warranties exist, any such warranty, including without limitation any express warranties or any implied warranties of fitness for particular purpose and merchantability shall be limited to the duration of the Limited Express Warranty.

LIMITATION OF REMEDIES

In the event of a breach of the Limited Express Warranty, CC will only be obligated at CC's option to repair the failed part or module or to furnish a new or rebuilt part or module in exchange for the part or module which has failed. If, after written notice to CC's Head Office in Oklahoma City, Oklahoma of each defect, malfunction or other failure and a reasonable number of attempts by CC to correct the defect, malfunction or other failure and the remedy fails of its essential purpose, CC shall refund the purchase price paid to CC in exchange for the return of the sold good(s). Said refund shall be the maximum liability of CC. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER AGAINST CC FOR THE BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR CC'S OWN NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY

CC shall have no liability for any damages if manufacturer's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to, any war, civil unrest, government restrictions or restraints, strikes or work stoppages, fire, flood, accident, shortage of transportation, fuel, material, or labor, acts of God or any other reason beyond the sole control of CC. **CC EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OF IMPLIED WARRANTY, OR IN TORT, WHETHER FOR CC'S OWN NEGLIGENCE OR AS STRICT LIABILITY.**

OBTAINING WARRANTY PERFORMANCE

Normally, the contractor or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any CC recognized contractor or service organization. If assistance is required in obtaining warranty performance, write:

ClimaCool Corp. • P.O. Box 2055 • Oklahoma City, Oklahoma 73102 • (405)745-3185 • e-mail: Claims@climacoolcorp.com

NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusion of consequential or incidental damages, so the foregoing exclusion and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province.

Please refer to the CC Installation, Operation and Maintenance manual for operating and maintenance instructions.

ClimaCool Contacts

Customer Service **(405) 745-3185**
Technical Assistance **(405) 745-3185**

IOM Revision Log:

Date	Page #	Description
3/31/08	All	First published
2/2/10	76	Warranty Updated

CLIMACOOL®
THE ULTIMATE CHILLER SOLUTION®

7300 S.W. 44th St.
Oklahoma City, OK 73179
Phone: 405-745-3185
Fax: 405-745-2072
www.climacoolcorp.com

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Quality: First & Always

ClimaCool works continually to improve its products. As a result, the design and specifications of each product at the time for order may be changed without notice and may not be as described herein. Please contact ClimaCool's Customer Service Department at (405) 745-3185 for specific information on the current design and specifications. Statements and other information contained herein are not express warranties and do not form the basis of any bargain between the parties, but are merely ClimaCool's opinion or commendation of its products. For the most current version of this document please visit www.climacoolcorp.com.

The management system governing the manufacture of ClimaCool's products is ISO 9001:2000 certified.