DUNHAM-BUSH®

ACDX/AUDX

Screw Type Air-Cooled Packages

Installation, Operation, and Maintenance Instructions

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INTRODUCTION

This manual is designed to provide all the necessary information for installation, operation and maintenance of the latest generation of the Dunham-Bush small screw compressor air-cooled packaged chillers.

To use this manual effectively, you must first identify your unit model from the unit nameplate.

Your Dunham-Bush package has been manufactured under a careful quality control system. If the package is installed, operated and maintained with care and attention to the instructions contained herein, it will give many years of satisfactory service.

It is assumed the user of this manual and those who install, operate and maintain this equipment are experienced and qualified air conditioning equipment personnel.

PRODUCT IDENTIFICATION

ACDX [ ] [ ] [ ]

SIZE	CIRCUITS
040	1
050	1
060	1
080	2
095	2
120	2
150	3
170	3
185	3
210	4
235	4
255	4

CONTROL METHOD
A Electro-Mechanical
B Micro-computer

VOLTAGE
AK - 200
AN - 230
AR - 460
AU - 400 (50Hz)

PHYSICAL SPECIFICATIONS

MODEL SIZE	040	050	060	080	095	120
Compressor						
Model (Qty)	SSCA050 (1)	SSCA060 (1)	SSCA075 (1)	SSCA050 (2)	SSCA060 (2)	SSCA075 (2)
Displ (CFH)/Compr.	5850	7212	8880	5850	7212	8880
Oil Chg/Compr (Qts.)(Type)	5 3/4(D/B SR 30)	6 3/4(D/B SR30)	6 3/4(D/B SR30)	5 3/4(D/B SR 30)	6 3/4(D/B SR30)	6 3/4(D/B SR30)
% Capacity Reduction	100 - 33% MIN.	100 - 25% MIN.	100 - 25% MIN.	100 - 16.5% MIN.	100 - 12.5% MIN.	100 - 12.5% MIN.
Oil Lubrication	PRESSURE	PRESSURE	PRESSURE	PRESSURE	PRESSURE	PRESSURE
Crank Case Htr Watts/Compr	200	200	200	200	200	200
Air Cooled Condenser						
Front Module	W-156-316-080	W-156-316-120	W-156-316-120	W-156-316-160	W-156-316-200	W-156-316-240
Rear Module	N/A	N/A	N/A	N/A	N/A	N/A
Fan Dia. (Qty)	30(4)	30(6)	30(6)	30(8)	30(10)	30(12)
Total Fan KW	6.84	6.0	10.26	13.68	17.10	20.52
Motor RPM	1100	1100	1100	1100	1100	1100
DX Cooler (Std)						
Model	CHSO10601B	CHSO11601B	CHS013601B	EXD14102J09	EXD16112J09	EXD16122J07
Shell Diameter	10	11	13	14	16	16
Nom. Shell Lgth.	60	60	60	102	112	122
Water Conn. In/Out	4"	4"	4"	5"	6"	6"
Connection Type	VICTAULIC	VICTAULIC	VICTAULIC	VICTAULIC	VICTAULIC	VICTAULIC
General						
No. of Refrig. Circuits	1	1	1	2	2	2
Refrig. Charge (lbs.)/Circ.	83	103	125	84	104	126
Shipping Weight	3517	4639	4910	7462	9331	10341
Operation Weight	3592	4732	5044	7712	9684	10726

MODEL SIZE	150	170	185	210	235	255
Compressor						
Model (Qty)	SSCA060 (3)	SSCA060(1), SSCA075(2)	SSCA075(3)	SSCA060(4)	SSCA060(2) SSCA075(2)	SSCA075(4)
Displ (CFH)/Compr.	7212	7212, 8880	8880	7212	7212, 8880	8880
Oil Chg/Compr (Qts.)(Type)	6 3/4(D/B SR30)	6 3/4(D/B SR30)	6 3/4(D/B SR30)	6 3/4(D/B SR30)	6 3/4(D/B SR30)	6 3/4(D/B SR30)
% Capacity Reduction	100 - 8.3% MIN.	100 - 8.3% MIN.	100 - 8.3% MIN.	100 - 6.3% MIN.	100 - 6.3% MIN.	100 - 6.3% MIN.
Oil Lubrication	PRESSURE	PRESSURE	PRESSURE	PRESSURE	PRESSURE	PRESSURE
Crank Case Htr Watts/Compr	200	200	200	200	200	200
Air Cooled Condenser						
Front Module	W-156-316-200	W-156-316-240	W-156-316-240	W-156-316-200	W-156-316-200	W-156-316-200
Rear Module	W-156-316-120	W-156-316-120	W-156-316-120	W-156-316-200	W-156-316-200	W-156-316-200
Fan Dia. (Qty)	30(16)	30(18)	30(18)	30(20)	39(20)	30(20)
Total Fan KW	27.36	30.78	30.78	34.2	34.2	34.2
Motor RPM	1100	1100	1100	1100	1100	1100
DX Cooler (Std)						
Model	EXT18122J07	EXT18122J07	EXT20122J07	EXF20122J07	EXF20122J07	EXF20122J07
Shell Diameter	18	18	20	20	20	20
Nom. Shell Lgth.	122	122	122	122	122	122
Water Conn. In/Out	8"	8"	10"	10"	10"	10"
Connection Type	VICTAULIC	VICTAULIC	VICTAULIC	VICTAULIC	VICTAULIC	VICTAULIC
General						
No. of Refrig. Circuits	3	3	3	4	4	4
Refrig. Charge (lbs.)/Circ.	114	(1) 103 (2) 125	128	106	(2) 106 (2) 128	128
Shipping Weight	14482	15423	16213	17979	18165	18311
Operation Weight	14987	15928	16778	18544	18730	18876

GENERAL
Packaged chillers are designed to cool water or other non-corrosive liquids. Water is circulated through the direct expansion cooler where it is cooled to the desired temperature then circulated to cooling coils for air conditioning, or to other types of heat exchangers for process cooling.

Care should be taken to see that the equipment is properly installed and adjusted. An installer or operator should first become familiar with the information contained in this manual.

INSPECTION
When the equipment is delivered, it is important that the following inspection be completed in the presence of the carrier's representative.

1. Check all crates and cartons received against the Bill of Lading/Shipping Papers to be sure they agree.

2. Check the model number and the electrical characteristics on the nameplate to determine if they are correct.

3. Check for freight damage, shortages or other discrepancies and note them on the delivery receipt before signing.

In the event that any damage is found, a damage claim should immediately be filed by the purchaser against the delivering carrier as all shipments are F.O.B. Factory.

RIGGING

General - Each unit has been carefully tested and crafted at the factory where every precaution is taken to assure that the unit reaches you in perfect condition. It is very important that the riggers and movers should use the same care and precaution in moving the equipment into place. Make sure that chains, cables, or other moving equipment are placed so as to avoid damage to the unit or piping. The refrigerant piping must not be used as a ladder or as a hand hold. Do not attach a chain hoist sling to the piping or equipment. Move the unit in an upright position and let it down gently from trucks or rollers.

Rigging and Moving - Any unit mounted on skids may be moved with a forklift, but care must be taken not to damage the unit with forks. The skids should not be removed until the unit is at its final location.

The ACDX/AUDX 040-060 units are to be rigged thru the small holes at the bottom of each leg. On units with optional louvers, it will be necessary to remove labeled louver panels to gain access to the rigging holes. Models 080 thru 255 are to be rigged thru the holes in the base side rails. In all cases, spreader bars must be used between rigging lines to prevent coil or fan deck damage. The unit must be lifted using **All Rigging Points**. Refer to Rigging Instructions on page 36.

All models can be pushed or pulled (with chains) from the control box end only. Truck forks must be kept level and not tilted back. Do not raise the end of the unit more than 2" off the floor.

LOCATION & MOUNTING
Model ACDX Air Cooled Packaged Water Chillers and AUDX Air Cooled Condensing Units are designed for outdoor application and may be mounted on roof or at ground level.

Since these units are air cooled, the flow of air to and from the condenser coil must not be impeded. There must be no obstruction above the unit that would tend to deflect discharge air downward where it could be recirculated back to the inlet of the unit. Ductwork must not be applied to the fan outlets.

The unit must be installed with sufficient clearance for air entrance to the condenser coil and for servicing access. The unit should be located no closer than four feet from any wall or other obstruction. See Condenser Clearance Drawing page 35. Clearance must be provided at either end of the unit to permit removal of tubes from the chiller.

Units must not be located in the vicinity of steam, hot air or fume exhausts.

Another consideration which must be taken into account is that the unit should be mounted away from noise sensitive spaces and must have adequate support to avoid vibration and noise transmission into the building. Units should be mounted over corridors, utility areas, rest rooms or other auxiliary areas where sound levels are not an important factor. Sound and structural consultants should be retained for recommendations on critical installations.

FOUNDATION

Refer to index for unit dimensions and load points. Foundations must be level for proper operation and functioning of controls and provision must be made for supporting the individual load points as shown in the unit dimensions. Roof mounted units must be supported on adequate steel structure. If units are located on the ground level, a concrete base is recommended.

VIBRATION ISOLATION

Under certain critical conditions, it may be necessary to install vibration isolators under the base of the Packaged Chiller.

Rubber-in-shear or spring vibration isolators are offered as optional items. When spring isolators are used, flexible connections must be installed in the water piping system and in the refrigerant lines of split systems. Note: These flexible connectors must be suitable for the fluid and pressures involved.

All piping which is external to the packaged chiller must be supported by spring mounted hangers and any piping which goes through the wall, ceiling or floor should be properly sheathed to prevent transmission of piping vibration to the structure.

When spring isolators are used, electrical service to the unit must also be flexibly connected, by means of a 36" section of flexible conduit.

PIPING CONNECTIONS

Water Connections, Chilled Water Piping - After the unit has been leveled, the external water piping may be made up. Be sure water piping is connected to the correct fittings. The water out connection is closest to the expansion valve (R-in) end. A chilled water flow switch must be installed in the external chilled water outlet piping.

It must be located in a horizontal section on the pipe where there are at least five (5) pipe diameters on both sides of the flow switch before any other connections. The flow switch paddle must be adjusted to the size pipe in which the paddle is installed. Consult the wiring diagram accompanying the unit for the electrical connections to interlock the flow switch with the control panel.

Water flow through the cooler must remain constant for proper chiller operation. Water pressure gauges are recommended to check the water pressure and flow rate in the system, before and after the cooler, and to determine if variations occur in the cooler and system.

If sub-freezing ambient temperatures are possible, all exposed field water piping should have heater tape and insulation or a glycol mixture to prevent freezing. Main power is required to keep the sump heaters on. A separate 115 volt circuit is required for the chiller heaters.

When installing pressure taps to measure the amount of pressure drop across the water side of the cooler, the taps should be located in the water piping a minimum of twenty-four (24) inches downstream from any connections (flange, elbow, etc.).

There are many piping and control systems which may be used to assure constant water flow through the cooler. A typical system is shown in Figure 1A. It uses a three way motorized valve which operates in response to the discharge air temperature of the cooling coil.

Another system which is sometimes used consists of a two way modulating control valve, which also responds to the discharge air temperature of the cooling coil, used in conjunction with a spring loaded bypass regulating valve as shown in Figure 1B. The bypass valve must be set to assure the full flow of circulating chilled water when the modulating valve is completely closed.

Other systems are noted in the ASHRAE Handbook and may serve equally well. Whatever system is selected, water flow must be constantly maintained through the chiller.

If the system is arranged for the dual purpose of cooling in the summer and heating in the winter, **THE COOLER MUST BE VALVED OFF DURING THE HEATING SEASON SO THAT HOT WATER WILL NOT PASS THROUGH THE COOLER. THIS MAY BE EITHER A MANUAL OR AUTOMATIC CHANGE-OVER OPERATION.** There are also times, such as early spring and late fall, when both heating and cooling are required. This should also be considered when designing heating and cooling systems. For various piping arrangements, consult the ASHRAE Handbook.

Water Connections - Multiple Packaged Chillers - Multiple unit packaged chillers have been successfully applied to parallel and series piping systems for years. Special attention, however, must be given to the particulars involved for each application or serious operational problems can result.

The following are guidelines which should be followed for multiple unit application. **NOTE**: A constant chilled water flow rate is assumed to be maintained through all coolers.

Parallel Chilled Water Flow Units - Method A. Both units operate simultaneously, modulating with load variations. Each packaged chiller operating controller senses leaving water temperature using standard controls (see Figure 1C). The set point of each controller will be set to maintain the desired unloading.

Method B. Install units the same as Method A, but add a third thermostat in the return water, as shown in Figure 1E. This thermostat will be set to cycle off one of the units when the load drops below 40%. When this condition is reached, leaving mixed water temperature will rise, causing the return water temperature to rise and the unit operating will load up. The "off" unit is sequenced to start again before full system load temperature is reached.

This system will not provide as stable an operation as Method A, but in normal air conditioning applications, this is not detrimental. The advantage of Method B is a better part load efficiency.

Series Chilled Water Flow Units - Units should be equally sized. The upstream unit will carry a larger load because it cools higher temperature water. The controllers are to sense leaving water temperatures (see Figure 1D). The number 1 unit controller should be set to start the unit at system design leaving water temperature plus 50% of the minimum loading of the number 1 unit times unit number 1 design temperature differential [example: system design supply water temperature is 45EF, design temperature differential is 12EF; Unit #1 minimum loading is 15% and the design temperature difference is 6.5EF: (.5 x 12) + (.15 x 6.5) +45 = 52EF]. The number 1 unit controller should be set to cycle the unit off at system supply water temperature plus number 2 unit design temperature differential times .9 [example: 45EF + (.9 x 5.5) = 50EF]. These settings will ensure enough load on the number 1 unit to prevent short cycling.

The above series flow controller set points are for the electromechanical units. Contact the factory for microcomputer controlled units.

Water Quality ACDX - Coolers used in these packages are made of steel, copper and brass and are suitable for operation with well-maintained water systems. However, if the water used in cooler is corrosive, high in mineral content or entrained solids, the water can cause reduced performance and even failure of heat exchangers. Therefore, it may be necessary to obtain the services of a water treatment consultant and to provide and maintain water treatment. This is particularly important with glycol systems.

For information concerning the installation, operation and servicing of Dunham-Bush coolers, consult the latest revision of Form 8110.

AUDX AIR COOLED CONDENSING UNIT PIPING

The suction and liquid line sizing should be in accordance with ASHRAE recommendations. Following is a list of requirements for split systems:

1. The evaporator must be within 50 ft. of the condensing unit.
2. There should be no more than an 18 inch rise in the suction line.
3. The system piping must be submitted to Dunham-Bush, Inc. for review.
4. The system should be started by a Dunham-Bush, Inc. authorized service agency.

The unit is supplied with a suction filter to protect the compressor from dirt, etc., which may have gotten into the system low side components. **THE FILTER SHOULD BE REMOVED FROM THE SYSTEM AFTER A WEEK'S RUNNING.** This will allow plenty of time for system clean up. Leaving the filter in the system will cause an increased pressure drop in the suction line and decrease the unit capacity and efficiency.

TYPICAL CHILLED WATER PIPING

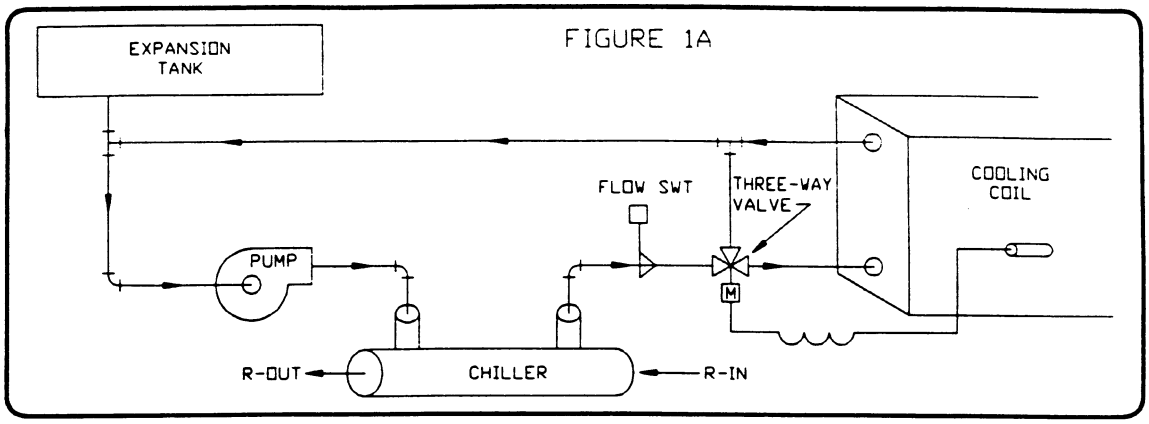


FIGURE 1A

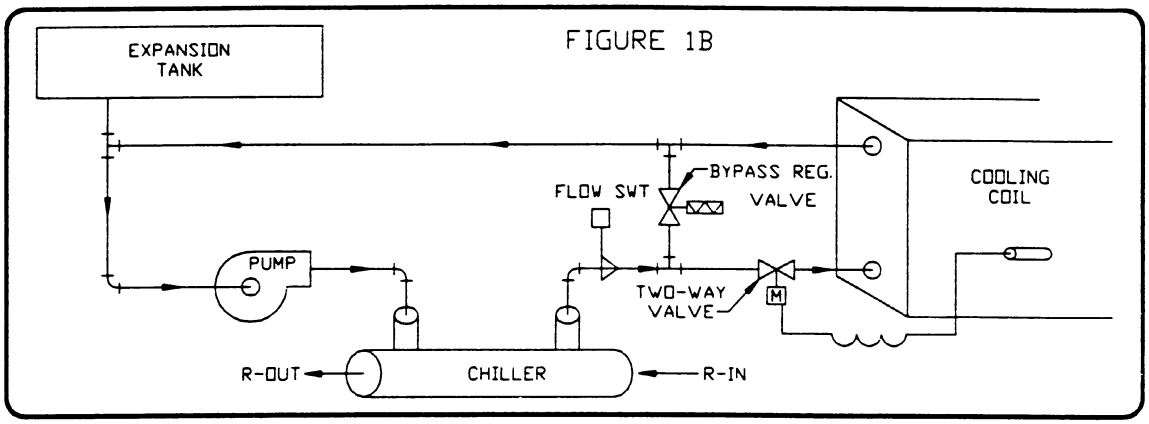


FIGURE 1B

TYPICAL MULTIPLE PACKAGED CHILLED WATER CONNECTIONS

PARALLEL FLOW

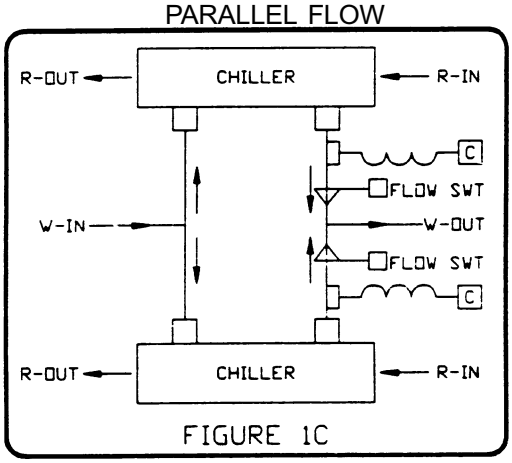


FIGURE 1C

PARALLEL FLOW

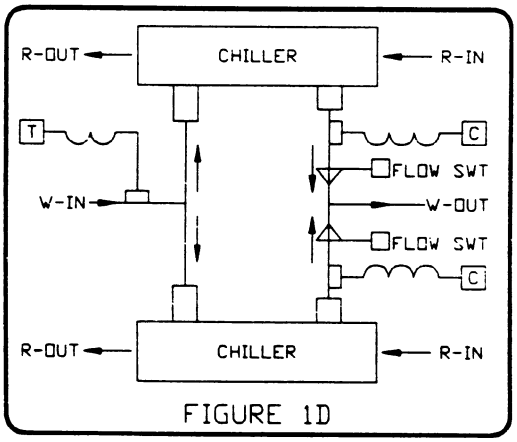


FIGURE 1D

SERIES FLOW

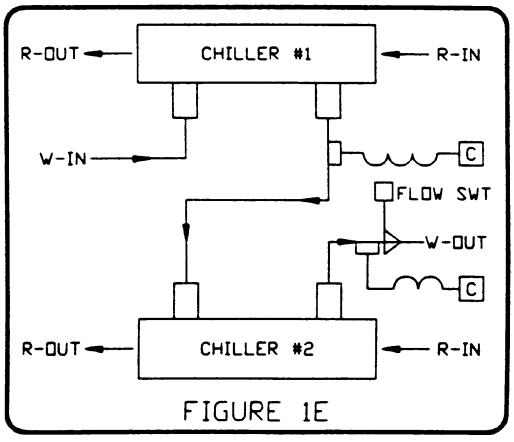


FIGURE 1E

ELECTRICAL CONNECTIONS

All units are wired as completely as possible at the factory prior to delivery. The connections which must be made by the installer are to the main power source, control power source, separate chiller heater power source and interlocking the satellite equipment. In connecting power wiring to the unit, the following precautions should be taken:

! All field wiring is to be in accordance with the National Electrical Code and state and local codes.

! All wiring is to be checked for damage and all terminal connections tested for tightness. Unit terminal blocks are to be connected with copper conductors only, sized per ampacity listed on unit data plate.

! The power supply should match the unit nameplate in volts, phase and Hertz. Voltage must be within ± 10% of nameplate value and voltage imbalance between phases must not exceed 2%.

! For minimum circuit ampacity and maximum fuse size, see Unit Nameplate.

Two separate 115 volt power sources must be field supplied to provide power for control and heater circuits. If optional control circuit transformer is provided, only one separate 15 Amp, 115V power source is required for chiller heater circuit. All electrical connections should be periodically tightened.

Refer to the unit nameplate data for the minimum circuit ampacity and maximum allowable dual element fuse size. The factory supplied field power block is sized to accept wires sized per NEC, 75C (3-in-conduit) up to 500MCM as required. When multiple wires per pole are required to stay at or below 500MCM, the power block supplied will have multiple wire per pole capability.

A separate 15 amp 115V field power supply is required to power the main control circuit (which includes the compressor sump heaters) unless the control transformer option is included.

OPERATION - ACDX

GENERAL

The unit should be started up only by a refrigeration technician who is familiar with accepted operation practices for refrigeration systems.

Use small screw unit start-up report, Form NS1157 to record all temperature, pressure, electrical readings and control settings. A copy must be forwarded to Dunham-Bush, Inc., North American Service, Harrisonburg, Virginia before the warranty will be honored.

AIR COOLED PACKAGE CHILLER START-UP - ACDX

The unit is ready for start-up when the following procedures have been completed.

1. Water piping for the cooler is installed and tested.
2. Electrical connections are made and properly fused.
3. Unit has been leak tested, leaks corrected, and charge completed.
4. Compressor crankcase heater(s) has been energized for a minimum of 24 hours.
5. Calibrated refrigerant gages have been connected to the suction and discharge.
6. Turn on the chilled water pump, check direction of rotation and adjust the water flow through the cooler to the specified flow rate. Bleed off all entrained air.
7. Manually energize the fan starters and check the fan rotation. Fans should pull air through the condenser coil and discharge vertically upwards.
8. Check all refrigerant valves to be sure they are open.
9. Proceed to System Start-up.

SYSTEM START UP

1. Request for Start-Up Representative - Start-up service is an option for these units and is requested when the unit is ordered. If you purchased start-up service, then after the installation has been completed and checked, Form 9180 must be filled out and sent to the local Dunham-Bush representative who sold the unit. Following receipt of this signed form, a representative will be sent to the customer. The purchaser should have competent service and operating personnel in attendance to assist in the work involved, and also to be trained in the operation and maintenance of this unit.

   The representative will inspect the installation to determine whether it meets Dunham-Bush, Inc. requirements, perform the initial start-up of the installation, determine whether it is in satisfactory operating condition, and instruct specified customer personnel in its operation and maintenance for the length of time specified in the purchase contract.

   NOTE: Sump oil heaters should be energized a minimum of 24 hours and the oil sump temperature must be at a minimum of 100EF (38EC) prior to arrival of start-up representative. This will ensure that the oil is warm enough to vaporize any dissolved refrigerant and that the oil is within the normal operating temperature range.

2. Before starting the compressor(s), check all three phases of supply voltage, of all legs of the motor. They must be within ± 10% of the nameplate voltage. Check to be sure compressor is not running backwards.

3. Start compressor(s), check the gages and note if the pressures are within the prescribed limits.

4. Check the refrigerant sight glass at the TX Valve to be sure it is free of bubbles. If not, charge as required to clean sight glass. .

5. Stage unit down until all compressors are off and check the compressor crankcase sight glass for oil level. It should be 1/2 to 3/4 of the compressor sight glass. If not, see procedure for adding oil on page 7.

6. Restart the compressor. After an hour of operation, the expansion valve superheat setting should be checked, it should be between 9E and 12EF at full load design conditions. In some instances, it will be necessary to lower the superheat setting to ensure proper distribution. Turn the TX valve adjustment stem clockwise to increase the superheat setting and counterclockwise to decrease the setting. Be sure and allow ample time between each adjustment for the system to rebalance.

7. The electrical control settings should be checked and, if necessary, reset to those settings indicated on the wiring diagram. Safety controls are factory set and must be maintained at settings indicated on the wiring diagram.

8. The temperatures of the chilled water both in and out, should be checked to insure the unit is operating within the desired temperatures.

MAINTENANCE

CONDENSER
Units are equipped with direct drive fans that have inherently protected motors with permanently lubricated bearings.

The air inlet of the condenser coil should be kept clean through a regular maintenance program.

COMPRESSOR

1. **OIL LEVEL** - The oil level in the compressor(s) should be checked periodically, with the compressor stopped. Stage the unit down until all compressors are off and check the compressor crankcase sight glass for oil level. If the oil level is below one half (1/2) the sight glass, oil must be added.

2. **A. RECOMMENDED OIL FOR R-22 MACHINES**
   Compressor Model Series SSC**A** - The compressor is factory charged with DB Karlube #10 Oil.
   Compressor Model Series SSC**B** - The compressor is factory charged with DB Karlube #21 Oil.

   Do not mix above oils or attempt to operate the screw compressor with any other oil. It is suggested that a gallon or more of the appropriate oil be obtained and kept at the job site.
   DB Karlube #10
   DB Karlube #21

   B. RECOMMENDED OIL FOR R407C MACHINES DO NOT USE DB Karlube #10.
   Compressor Models SSC**A** use DB Karlube #16 Oil.
   Compressor Models SSC**B** use DB Karlube #21 Oil.
   Contact factory for price.

   The above-listed oils are synthetic lubricants of the Polyol Ester (POE) type. Due to the complex nature of the POE, great precaution must be taken to prevent any moisture from entering the system when servicing or adding oil. POE oil has a greater solvency for water. Water reacts chemically with the ester to form acids and alcohols in a process called "hydrolysis". POE molecules attract moisture. Moisture removal by evacuation is more difficult because the POE "holds water more tightly" than mineral oil. Moisture causes corrosion and copper plating at an unacceptable, high level. This reaction occurs where temperatures are the highest within the compressor.

   To prevent moisture entering the system and contaminating the oil **extra care is necessary**. Follow the enclosed procedure to add or remove oil from the system.

   The holding tank must be clean and free of any moisture. (Evacuate tank to 200 microns). The holding tank can be a receiver or reclaiming tank of a size large enough for the total oil change and must be able to withstand the operating pressure of the system. When adding oil, it should be transferred from the container supplied to a holding tank and then evacuated through the vapor port down to 200 microns. Do not allow the container to vent to the atmosphere as the transfer must be done through a closed loop. An oil pump will be required.

   PROCEDURE FOR ADDING OIL
   Manually close liquid line service valve. Lower return water T-stat (4TAS) setting to start the compressor. Run compressor until unit shuts down on low pressure. Place the control circuit on/off switch in the off position. Locate the high pressure port adjacent to solenoid valve UL-3 (see drawing page 8) and remove the cap. Attach oil pump to holding tank high pressure port. Pump oil into this port until the oil level is 1/2 of the sight glass.

   Replace the port cap, open the liquid line shut off valve and place the control circuit on/off switch in the on position. Set the operating T-stat to the normal operating temperature and reset the low pressure switch.

   Oil can also be added, through the suction port of the compressor, while running the compressor.

3. **COMPRESSOR REPAIRS (Internal)** - Contact factory or an authorized DB Service Agency if a compressor malfunction is suspected.

4. **COMPRESSOR REPAIRS (External)** - Proper operation of unloaded start, loading, and unloading is controlled by solenoid valves UL-1, UL-2 and UL-3. Any of these three (3) solenoid valves may be repaired or replaced in the field, as required. Also the compressor crankcase heater may be replaced.

5. Standard oil acid test kit is not compatible with synthetic oil. See DB color chart for oil condition.

SLIDE VALVE
UNLOADING SYSTEM

The DB screw compressor capacity control system for infinite modulation consists of a slide valve and hydraulic piston/cylinder operator internal to the compressor, plus three hydraulic solenoid valves (UL-1, UL-2, & UL-3) piped externally.

The slide valve forms a portion of the chamber wall in which the rotors turn; thus, its position with respect to the rotors determines the effective rotor length and thereby the percent of full load capacity.

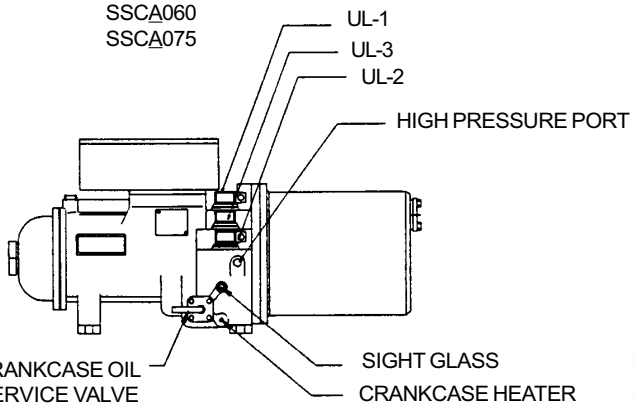
Upon compressor start-up, UL-3 is opened (energized). This allows oil pressure to act upon the hydraulic piston, holding it in the fully unloaded position. After 30 seconds, during which time full oil flow is established to all bearing surfaces, UL-3 is closed (de-energized). At this point, temperature controller is free to open or close UL-1 and UL-2 in response to the supply water temperature.

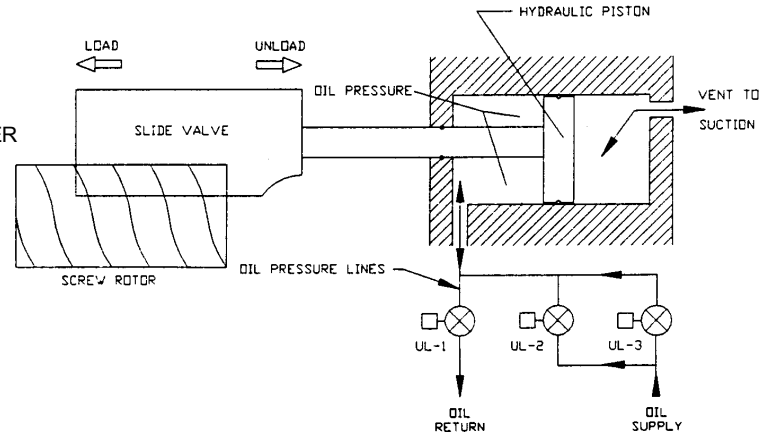
The slide valve will move to the left (loading) by force of discharge pressure, whenever UL-1 opens to permit flow to the oil return (low pressure) line. The slide valve will move to the right (unloading) whenever UL-2 opens the oil supply (high pressure) line, since the force of the oil exceeds that of the discharge gas.

The temperature controller sends a series of electrical "pulses" to the appropriate solenoid to adjust to load conditions. The further the supply water temperature is from the controller set point, the longer is the duration of the pulses. The series of pulses will continue until the controller is satisfied. As the water temperature approaches the set point, the pulses become quite brief to prevent overshooting the set point.

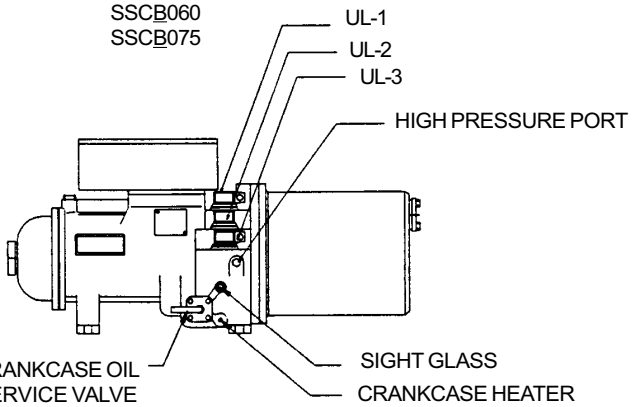
This method of compressor unloading, in conjunction with supply water sensing, minimizes action/reaction lag time and overshoot resulting in an exceptionally precise and stable control of supply water temperature.

COMPRESSOR MODEL
SSCA050
SSCA060
SSCA075





COMPRESSOR MODEL
SSCB050
SSCB060
SSCB075



The following table lists solenoid valve position for all three operating modes.

	UL-1	UL-2	UL-3
Starting	Close	Close	Open
Loading	Open	Close	Close
Unloading	Close	Open	Close

LOW AMBIENT OPERATION

Condenser Head Pressure Control

Outdoor air-cooled units required by application to start and run at ambients below normal summer conditions require some means to keep the condensing pressure high enough to insure adequate expansion valve feed to the cooler to prevent low side pressure trips, particularly during cold starts. Two types of condenser fan control are available to allow the units to operate at the ambients and loads indicated.

Standard Factory Installed Fan Cycling

This commonly applied scheme cycles condenser fans "on" and "off" in response to head pressure to maintain the head pressure within an acceptable range for proper system operation. This methods will permit starting and sustained running 20EF ambient.

The minimum ambient shown above reflect the performance of the condenser surface exposed to the operational fan(s) as well as that portion of the surface rejecting heat by natural convection with related fans "off". To further assist low ambient starts, all fans are held "off" until the head pressure reaches 190 psig. This alone cannot insure sustained operation if the system load is not high enough to produce the minimal pressures required.

Optional Variable Speed Fan Control

This scheme utilizes fan cycling but also adds speed control to the lead fan or fans. This feature not only serves to stabilize the head pressure between normal fan staging but also allows for virtually "no fan" operation down to 0EF ambient.

Cooler Freeze Protection - Low Ambient

Cooler freeze protection is a serious concern with outdoor packaged chillers and the responsibility for the proper implementation, monitoring and maintenance of both factory and field installed protective devices and procedures lies solely with the customer. The ACDX coolers are heat tape wrapped which utilize built-in 38EF thermostats and are insulated for protection down to about -20EF. However, this protection disappears if power fails, power to the heater circuit is switched off or left off by mistake, or the heater tapes burn out. In this regard, it is advisable to read and log the heater circuit amp draw at the first low ambient shut-down opportunity for future service and monitoring reference. In light of all the above, the following should be considered:

1) Drain the cooler and water piping thoroughly for long term shut-down at ambients below 32EF. Drain fittings are provided on the cooler for this purpose.

2) Add ethylene glycol to the chilled water system at a percent good for a freeze point at least 10EF below the minimum expected ambient.

3) The field installed cooler heater disconnect switch must be permanently tagged "**DO NOT OPEN THIS SWITCH**".

4) Make absolutely sure that responsible people know exactly how to react to general power failures.

ACDX AND AUDX FAN POSITION NUMBERS (See Fan Cycling Sequence Chart)

40

C1	1	3
	2	4

50

C1	1	3	5
	2	4	6

60

C1	1	3	5
	2	4	6

80

C1	1	3	5	7	
C2	2	4	6	8	

95

C1	1	3	5	7	9
C2	2	4	6	8	10

120

C1	1	3	5	7	9	11
C2	2	4	6	8	10	12

150-1,2

C1	1	3	5	7	9
C2	2	4	6	8	10

Front

150-3

C3	11	13	15
	12	14	16

Rear

170-1,2
185-1,2

C1	1	3	5	7	9	11
C2	2	4	6	8	10	12

Front

170-3
185-3

C3	13	15	17
	14	16	18

Rear

210-3,4
235-3,4
255-3,4

C3	11	13	15	17	19	
C4	12	14	16	18	20	

Front

210-1,2
235-1,2
255-1,2

C1	1	3	5	7	9	
C2	2	4	6	8	10	

Rear

T
* 7 Main Control Box End, all models
*

C = Circuit No.

ACDX FAN CYCLING SEQUENCE CHART

Model	Refrig Circuit	Fan Nos. "On" Per Step				
		1	2	3	4	
40	1 LH/RH	1, 2	3,4			
50	1 LH/RH	1, 2	3,4	5, 6		
60	1 LH/RH	1, 2	3,4	5, 6		
80	1 LH	1	3	5	7	
	2 RH	2	4	6	8	
95	1 LH	1	3	5	7, 9	
	2 RH	2	4	6	8, 10	
120	1 LH	1	3	5, 7	9, 11	
	2 RH	2	4	6, 8	10, 12	
150	1 LH	1	3, 5	7, 9		
	1 RH	2	4, 6	8, 10		
	2 LH/RH	11, 12	13, 14	15, 16		Rear Module
170	1 LH	1	3	5, 7	9, 11	
	1 RH	2	4	6, 8	10, 12	
	2 LH/RH	13, 14	15, 16	17, 18		Rear Module
185	1 LH	1	3	5, 7	9, 11	
	1 RH	2	4	6, 8	10, 12	
	2 LH/RH	13, 14	15, 16	17, 18		Rear Module
210	1 LH	1	3, 5	7, 9		Rear Module
	1 RH	2	4, 6	8, 10		Rear Module
	2 LH	11	13, 15	17, 19		
	2 RH	12	14, 16	18, 20		
235	1 LH	1	3, 5	7, 9		Rear Module
	1 RH	2	4, 6	8, 10		Rear Module
	2 LH	11	13, 15	17, 19		
	2 RH	12	14, 16	18, 20		
255	1 LH	1	3, 5	7, 9		Rear Module
	1 RH	2	4, 6	8, 10		Rear Module
	2 LH	11	13, 15	17, 19		
	2 RH	12	14, 16	18, 20		

NOTE: Refer to the unit wiring diagram for fan cycling pressure settings.

KEY TO WIRING DIAGRAM INDEXING SYSTEM

The wiring diagrams and sequence instructions on the following pages have been devised to simplify the understanding and tracing of circuit theory. The following key shows how the indexing system can be used.

9	Line number on wiring diagram
[9]	Line number in text
(1CR)	Component identification symbol in text (Control Relay #1)
(50)	Normally open contact -- line number location
(1)	Normally closed contact -- line number location

SEQUENCE OF OPERATION (TYPICAL)
MODELS ACDX40-120 A GENERATION
(Ref. Typical Wiring Diagrams on pages 26, 27 & 28)

The following sequence of operation is typical of all electromechanical ACDX Models. Refer to the wiring diagram furnished with the unit for specific information.

( )	Control Identification Symbol
[ ]	Circuit Line Number

Important Note!
With all the control circuit switches (S1-S3) in the "off" position, Terminals #1 and #2 on the Terminal Board (3TB) must have 115 volts supplied for a minimum of 24 hours to energize the compressor crankcase heaters (1HTR, 2HTR).

Preliminary Sequence
Close the main power disconnect switch. Check to see that the indicating light on the under voltage relay (UVR) is lit. **This light must be on to indicate proper phase rotation for the compressors.** If the light is not on, disconnect the main power and reverse any two phase legs at the Main Incoming Power Terminal Block. (WARNING! DO NOT REVERSE THE LEADS ON THE PHASE LOSS MONITOR FOR THIS WILL ALLOW THE COMPRESSORS TO RUN BACKWARDS, CAUSING SEVERE DAMAGE, AND WILL VOID THE COMPRESSOR WARRANTY!)

The crankcase heater relay contacts (1M1-1) and (2M1-1) are closed and are supplying power to the compressor crankcase heaters. Power must also be supplied to the chiller heater (CHR HTR) by the separate customer supplied 115 VAC supply.

Control power is turned on by the Control Power Switch (S1). UVR contacts must close to activate 1CR and temperature freezestat (2TAS) must also be satisfied to allow compressor operation.

Start up the chilled water pump. The water flow is confirmed when the water flow switch completes the electrical circuit across Terminals #8 and #9 and when chilled water pump auxiliary (CWP) closes between #9 and #10.

Check to make sure time clock contacts close during occupied modes and then set the thermostat (4TAS) to the desired leaving water temperature (e.g. 44EF). Set point adjustment is accomplished directly on the control. Initial control band setting is 4.0.

Place the two compressor control circuit switches (S2-S3) in the "On" position, thus energizing the balance of the control circuit. All safety controls must be satisfied and the system may be in a "Time-in" mode for five minutes before the first compressor will start.

Stage 1 Starting
Upon demand for cooling, the first step of the staging thermostat (4TAS) will close energizing relay (8CR). If all the safety controls and switches are closed, (see "Safety Controls" section for more detail) the contactors for Compressor No. 1 will energize and the compressor will start. The liquid line solenoid (1SOL) will also be energized and refrigerant flow starts.

Auxiliary switch (1M1-1) opens to de-energize oil sump heater (1HTR) and switch (1M1-2) closes to activate the fan control circuit.

The fan motors are controlled by fan cycling controls (10PS-1,2,3 & 4) and will cut in at the factory set condenser pressures shown on the wiring diagram.

If suction pressure is low, pressure switch (9PS-1) begins timing. If suction pressure does not rise above setpoint within 120 seconds, the compressor will be shut down.

Timer (7TR-1) contacts stay in the NC position to power the fast unloader solenoid (2SOL) which holds the compressor in the full unload position for 30 seconds. After (7TR-1) times out (30 seconds), the contacts for the fast unloader solenoid (2SOL) open and the NO contacts close, which energizes the relay (2CR).

Stage 1 Modulation
Upon energizing relay coil (2CR), the NO contacts of relay (2CR) are closed, allowing the thermostat (4TAS) to energize the load solenoid (3SOL) and the unload solenoid (7SOL) upon demand.

Stage 2 Starting
Subsequent to the start of Compressor No. 1 an approximate five minute time delay is incorporated into the microprocessor. After this time delay, and a further call for cooling, the second step of the staging thermostat (4TAS) will close. This will energize relay (9CR). If all the safety controls and switches are closed, (see "Safety Control" section for more details) the control circuit for Compressor No. 2 will energize, allowing the compressor start and energizing switches (1M1-1 and 2M1-2) open the oil heater and activate the fan control circuit. If suction pressure is low, pressure switch (9PS-2) begins timing. If suction pressure does not rise above setpoint within 120 seconds, the compressor will be shut down.

Timer (7TR-2) will energize the fast unload solenoid (6SOL) for 30 seconds then energize relay (3CR).

Upon energizing relay (3CR), the NO contacts are closed, allowing the thermostat (4TAS) to energize the load solenoid (4SOL) and the unload solenoid (8SOL) upon demand.

SHUTDOWN SEQUENCE

Stage 2 Shutdown
After both compressors have unloaded fully and the leaving water temperature is still lower than the setpoint, the second step of the thermostat (4TAS) will open and de-energize relay (9CR) providing an approximate three minute time delay integral with the microprocessor, has expired subsequent to the start of Compressor No. 2. This will close the liquid line solenoid (5SOL) and turn off Compressor No. 2. Compressor No. 1 will load and unload as required. Compressor No. 2 will not be able to restart for five minutes due to integral time delays.

Stage 1 Shutdown
If the leaving water temperature is still lower than the setpoint, the first step of the thermostat (4TAS) will open and de-energize relay (8CR). This will close the liquid line solenoid (1SOL) and turn off Compressor No. 1 as long as it has run for approximately three minutes. Compressor No. 1 will not be able to restart for five minutes.

SAFETY CONTROLS

The unit is protected by the following safety controls:
1. High Pressure (1PS)
2. Low Pressure (9PS)
3. High Discharge/Oil Temperature (12TAS)
4. Compressor Solid State Module (1TAS)
5. Low Water Temperature/Freeze (2TAS)
6. Compressor Starter Overloads (MOL) (200/230V only)
7. Under Voltage Relay (UVR)
8. Water Flow Switch (FLS)
9. Fan Circuit Breakers (CB)
10. Compressor Circuit Breakers (CB) (200/230V only)

If any of these devices should open due to abnormal conditions, the compressor(s) will automatically stop. All controls must be manually reset, except the Under Voltage Relay (UVR).

ELECTRICAL CONTROLS

Refer to pages 27 & 28 for A generation wiring diagram.

The following electrical controls that are used on A generation only are marked (A Gen).

S1 - *Power Switch (115V Control Circuit)*
This switch energizes the control circuit and must be left on (except for temporary control circuit service work) to allow normal on cycle operation. Compressor sump heaters are connected before this switch and are not affected by switch position.

S2, S3, S4 - Compressor Switch. This switch disconnects power from the corresponding compressor control circuit. This switch is S5 also used to reset the motor temperature protector 1TAS).

FLS - *Flow Switch*. For ACDX/AUDX units, a chilled water flow switch must be installed at the job site to ensure chilled water flow while the package is in operation. Wire the flow switch to the terminals shown on the wiring diagram.

CWP - *Chilled Water Pump Interlock*.
For ACDX/AUDX units, it is recommended that an interlock between the chilled water pump and the package be provided to prevent the unit from operating with the chilled water pump off. Connect the interlock to the terminals shown on the diagram.

1PS (A Gen) - *High Pressure Safety Switch (Manual Reset)*
This is a manual reset switch that stops the compressor in the event of excessive discharge pressure. This is possibly caused by fan failure or coil blockage.

ELECTRICAL CONTROLS (Cont'd)

12TAS - *High Oil Temperature Switch (Manual Reset)*
This switch stops the compressor in the event of excessive oil temperature (240EF). The bulb is mounted on the discharge line from the compressor.

MOL - *Compressor Overload (Manual Reset)*
On 208/230V systems, a compressor starter with overload relay is used for overload protection. If the current draw of the compressor exceeds the trip point of the overload, the compressor will be shut down.

9PS (A Gen) - *Low Pressure Switch (Manual Reset, Time Delay)*
This is a switch which stops the compressor in the event of sustained low suction pressure, possibly caused by inadequate refrigerant flow, chiller water flow, or refrigerant loss-of-charge. It is equipped with a 120 second time delay (unless otherwise listed) to avoid nuisance low pressure shutdown during transient conditions.

5TR
3TAS (A Gen)
Units with low ambient option have a 2 minutes timer (5TR) that extends the low pressure time delay to 4 minutes at the start of the compressor. This only occurs when ambient temperature is below 40EF. (3TAS is measuring ambient temperature and opens below 40EF).

10,11PS (A Gen) - *Fan Pressure Switch (Automatic*, Reverse *Acting)*
This switch (in multiples) is used to stage condenser fans on and off to maintain adequate high side pressures for proper system operation by controlling net air flow across the condenser coils (See Fan Cycling Control Section.)

2TAS (A Gen) - *Freeze Thermostat (Manual Reset)*
This thermostat, sensing water temperature leaving the cooler vessel, provides chiller vessel protection against freeze-up if the leaving water temperature drops dangerously low. Normally set to open at 38EF, this thermostat setpoint can be decreased for glycol systems as required.

7TR - *Fast Unload Timer*
This timer provides a 30 second fast unload signal at the start of a compressor. The normal load/unload solenoids are de-energized during this time delay.

10TR - *Wye-Delta Timer (Option)*
This timer is used for incremental start delay between Wye and Delta motor configurations. It is typically 5 seconds.

M - *Contactor (Compressor and Fan Motor)*
The contactor, operated by the control circuit, provides power individually to the compressor and fan motors. Contactors are used either singly or in parallel pairs for across-the-line and wye delta start. These devices are amp rated to handle both rated load amps and locked rotor amps.

C - *Shorting Contactor (Wye-Delta Option)*
This contactor is used for generating the Wye configuration of the motor windings at the start of a compressor.

CR - *Relays (Miscellaneous Control)*
These relays provide the necessary circuit logic for lock-in, lock-out and transfer functions.

HTR - *Crankcase Heater*
Energized continuously as long as control circuit power disconnect switch (not supplied with the unit) is closed and compressor is off. This heater maintains crankcase temperature above the system temperature during the compressor off cycle, preventing refrigerant migration in to the crankcase and consequent compressor damage.

Chiller Heater and Thermostat (ACDX only)
The chiller heater with integral thermostat is powered by a separate customer supplied 115VAC source. The heater turns on when the shell temperature drops to 38EF. This helps prevent a chiller freeze-up under low ambient conditions.

4TAS (A Gen) - *Operating Thermostat*
This microprocessor based temperature controller senses leaving chilled water temperature and cycles the compressor on/off and loads/unloads the compressor(s) as the system load changes. The desired leaving water temperature is set on the Setpoint dial using the "water" scale (10-60EF). The initial control band setting should be 4E. This may need to be increased if compressor cycling is observed.

SOL - *Liquid Line Solenoid Valve*
Closes when the compressor(s) is off to prevent any liquid refrigerant from accumulating in the chiller during the off cycle.

Load/Unload/Fast Unload Solenoid Valves
The load/unload solenoid valves modulate to the compressor slide valve during normal operation in response to commands from 4TAS or microcomputer controller.

The fast unload solenoid is activated during the first 30 seconds of compressor operation to insure that the compressor is fully unloaded.

Door Latch Solenoid (Optional)
The door latch solenoids are used to hold the control and power panel doors closed when power is applied to the unit. The control panel door solenoid can be temporarily de-energized with a key to allow opening of the door. This allows access to the microcomputer keyboard/ display or 4TAS temperature controller.

Hot Gas Bypass Solenoid (Optional)
This solenoid is energized under light load conditions. The hot gas reduces machine capacity to help prevent short cycling of the compressor.

CO - *Convenience Outlet (Optional)*
The convenience outlet is a 15 amp, 115 volt duplex outlet. This allows easy access to 115 VAC power by service personnel for small electrical tools.

1TAS - *Motor Overload Protection*
Compressor overload protection is provided by a solid state device (1TAS) that monitors internal motor temperature. If the maximum motor temperature is exceeded, the compressor will shutdown. To reset 1TAS, open the control switch for 5 seconds.

UVR - *Undervoltage Relay*
Protects the unit from the following electric supply malfunctions: under-voltage, phase reversal and single phasing. If the UVR trips, a control relay will de-energize and open the control circuit. A LED light, located on the UVR, will indicate a normal power supply.

SCR - *Fan Speed Control (Optional)*
The fan speed control varies the speed of the fan, depending on head pressure. With a discharge pressure of 140 psig or below, the fan is at minimum speed. As discharge pressure rises, the fan speed is increased proportionally until it reaches full speed at 200 psig. See fan cycling control section.

16TAS - *Load Limit Thermostat (Optional)*
(A Gen) This thermostat prevents loading of the compressor(s) when return water temperature is above the dial setting. The factory setpoint is 65EF.

LLC - *Lead/Lag Control (Optional)*
(A Gen) The lead/lag control helps equalize run time on the two compressors by alternating the compressor that starts first (lead compressor). When the unit is shut down because the load is satisfied or the customer control contacts are opened, the lead/lag control will alternate the lead compressor. Thus the lag compressor will be come lead and start first at the next call for cooling.

VM - *Voltmeter (Optional)*
The voltmeter along with the voltmeter transfer switch allows monitoring of the 3 phase voltages. The switch selects which phase voltage is shown on the meter.

NOTE: Refer to the unit wiring diagram for operation and safety control settings.

FIELD CONTROL WIRING

In addition to 3 phase power and 115 volt control power supplies, the following control interlock wiring is recommended. The "as built" control schematic, provided with the unit, provides detailed information. Typical control schematics are as shown on pages 27 thru 31.

1) Unit Control Contact - Unit on-off control should be done through the terminals shown on the wiring diagram. An open contact shuts down the unit. Time clock, night shut down, and energy management shut down should all be done from these terminals and contacts should be applied in series. Shielded wire should be used. Ground the shield at the control panel only.
2) Flow Switch - The flow switch contacts should be installed between the terminals shown on the wiring diagram for the flow switch.
3) Chilled Water Pump Interlock (CWP) - An auxiliary switch from the chilled water pump contactor should be installed between the terminals shown on the wiring diagram. This helps ensure chilled water pump operation before the unit is started.
4) Chilled Water Pump - The control of the chilled water pump must be worked out by the system designer. It is necessary for the pump to be on during any compressor operation. However, it is likely that the pump should remain on throughout all occupied operation or even at night for freeze protection.

   For microcomputer controlled units, the chilled water pump contacts shown on the wiring diagram should be used in the pump control circuit. These contacts stay closed whenever the unit is enabled (see item 1) and the internal schedule of operation

is set for the unit to operate. However, especially in cases of low ambient temperature, the contacts should not be the sole means of controlling pump operation.

5) Remote Chiller - On AUDX units with remote chiller, field wiring is required for liquid line solenoids, load limit option thermostat, and water temperature sensors. The 120VAC wiring should be run in a separate conduit from the sensor wiring. Also, shielded cable must be used for the sensor wiring with the shield grounded only to the main unit sub-panel.

STAR-DELTA STARTING
OPEN TRANSITION (OPTIONAL)

Typical For All Compressors

On call for cooling, the controller contacts close, energizing transition contactor (1C) and the five second transition timer (10TR). Transition contactor (1C) power contacts close, tying the center legs of the compressor motor windings together into "Star" (WYE) configuration. At the same time (1C-1) N.C. (Normally Closed) auxiliary contacts open preventing (1M-2) from closing. (1C-2) N.O. (Normally Open) auxiliary contacts then close, energizing contactor (1M1). The 1M1 power contacts close, applying power to the compressor winding. (1M1) N.O. (Normally Open) auxiliary contacts close locking 1M1 in the energized position. The compressor operates in the "Star" mode until 10TR transition timer times out (five seconds) at which time contacts N.C. open and de-energize (1C). Start contactor (1C) N.C. auxiliary contacts close, (10TR) timer N.O. contacts close, energizing compressor contactor, (1M2) power contacts close, thereby completing the "Delta" wiring configuration. Compressor contactor (1M2) N.C. auxiliary contacts open, preventing (1C) star contactor from energizing until the next starting sequence.

MICROCOMPUTER CONTROLLER

1. General Description

Your Dunham-Bush ACDX/AUDX is controlled by an NC25 microcomputer system. The computer system is composed of a main microcomputer board, several types of input/output (I/O) boards, and sensors. The I/O boards are connected to the microcomputer by ribbon cables. These hardware components are controlled by the software program in the microcomputer. The software determines the state of the output relays based on the input values.

There are two types of inputs to the computer system. A digital input indicates whether or not voltage is present at the input. This could be used to determine whether or not a contactor is pulled in, a water flow switch is made, or the status of other on/off devices. Another type of input is an analog input. An analog value is one that varies continuously, such as temperature, pressure, current, etc. An analog input must be converted to a digital value with an analog to digital (A/D) converter board before the computer can process the data.

The computer system outputs are relays that switch the 115 VAC control devices such as contactors and solenoids.

The software for the computer is stored in three different types of computer memory chips. The two EPROM chips (Electrically Programmable Read Only Memory) store general operating procedures (algorithms) and is the same for all packages. The EAROM chip (Electrically Alterable Read Only Memory) stores the program that defines the logic for a particular unit. This software is called the data base. Both of these chips retain their content when power is removed. The third type of memory is battery backed RAM (Random Access Memory) and is used for temporary storage.

Information can be retrieved from the NC25 and displayed on a video display terminal. The RS232 communications port is used. Refer to FORM 6372 for more information.

2. **Microcomputer Hardware Precautions**

The following precautions must be taken while working with the microcomputer system.

2.1. Do not lay the solder side of a computer board on a metallic surface. This may damage the battery on the board.

2.2. Cover the computer components completely when drilling sheet metal near the computer.

2.3. Strip wires away from microcomputer to prevent strands from falling on components.

2.4. Do not allow the component boards to get wet.

2.5. Disconnect power to the NC25 when plugging in or unplugging a ribbon cable connector.

3. **Operation of LCD Display NC25-4**
The following instructions are for operation of the NC25-4 microcomputer with 2 x 40 character LCD display.

3.1 To Display data from the menu

1. Press the MENU key.
2. Use the up or down arrow keys to select the type of information desired. The main menu items are:
   DATE & TIME SET DIGITAL SENSORS
   ALARMS CONTROL POINTS
   SETPOINTS A & B AUTHORIZATION
   ANALOG SENSORS
3. Press the ENTER key.
4. Use the up or down arrow keys to select the desired data. For control points, additional data can be viewed with the right and left arrow keys. Press the right arrow key to sequence through the following screens:

   A. LAST ON/OFF - RUN T/Y - CYC
   TIME TIME TIME TIME COUNT

   LAST ON/OFF gives the time of day that the control last turned on or off. The last on time is not updated if a screw compressor is started manually.

   RUN T/Y gives the accumulated time that the control point has been on today (T) since midnight and the accumulated run time during yesterdays(Y) twenty-four hour period.

   CYC gives the number of times that the control point cycled off since midnight. If a feedback digital input is associated with a control point (EX: compressor) the digital input cycles are recorded.

   B. TOTAL RUN TIME = COUNT
   TOTAL CYCLES = COUNT

   TOTAL RUN TIME gives the number of hours the control point has been on since memory clear was performed. This records up to 65,000 hours.

   TOTAL CYCLES gives the number of cycles since a memory clear was performed. This records up to 65,000 cycles.

2.6. Disconnect power to the NC25 when changing a chip on the board. Check to make sure that pin 1 of chip is in upper-left corner and that the chip is inserted fully before reconnecting power.

2.7. Route ribbon cable and sensor wires away from control and power wires.

2.8. Handle boards with care.

   C. -- CURRENT -- --- TARGET ---
   VALUE VALUE VALUE VALUE

   The values under CURRENT and TARGET give different operating analog input values and setpoints for different types of control points. Screw compressor control points give current and target leaving water temperature and percent full load capacity. Fan type control points give the current analog value and target turn on and turn off setpoints.

NOTE: When displaying analog sensors, the PAGE MODE key can be pressed to display two new analog inputs after each arrow key is pressed. Press PAGE MODE again to return to displaying one new analog input.

3.2 To Reset All Control Points to Computer control

1. Press the RESET key.The display will show RESET ALL CPs to COM MODE? N Y
2. Press the right arrow key to select Y.
3. Press the ENTER key. The reset will not be accepted if a lockout control point is active. Resolve the problem and reset again.

3.3 To Display Alarms

1. Press the MENU key.
2. Use the up or down arrow to select ALARMS.
3. Press ENTER.
4. The day, time, and alarm code is displayed. Alarm 1 is the most recent alarm.
5. Press the down arrow to view previous alarms.
6. Check the data label to obtain the name of the alarm. If the data label is not available, display the digital input that corresponds to the alarm number. If the digital input name is SPARE, then display the control point that corresponds to the alarm number. EX: If alarm code 29 has occurred then display digital input 29 or control point 29 to determine the failure.

3.4 To Become Authorized

1. Select AUTHORIZATION on the main menu. Press ENTER.
2. The current status will show VIEW, press the authorization code (64) on the number keys.

3. Press ENTER. The current status will change to PROG (program) if accepted. If no keys are pressed for five minutes, or if the Authorization screen is re-displayed, the authorization to change setpoints is removed and the above procedure must be repeated to log in.

3.5 To Alter Setpoint Data

1. You must be authorized and in the PROG mode. See section 3.4.
2. Select SETPOINTS A & B on the main menu. Press ENTER.
3. Use the up or down arrow keys to select the setpoint to be changed. Press ENTER. A cursor will flash over the setpoint A value.
4. a) If you want to change setpoint A, press in the desired new value and press ENTER. If the new value is within limits, it will be stored in memory. The cursor will then move to setpoint B.
   b) If you do not want to change setpoint A, press ENTER.
5. Repeat Step 4 for Setpoint B.

3.6 To Calibrate Temperature and Pressure Sensors

NOTE: Pressure calibration should only be done by a qualified refrigeration technician. Calibrate amps with potentiometer on filter board.

NOTE: For units with SI display option, the critical temperature and pressure calibration values are stored in the setpoints corresonding to the sensor names or numbers.

1. You must be authorized and in the PROG mode. See Section 3.4.
2. Display the analog sensor to be calibrated on the top line of the display.
3. Press ENTER to show ZERO CALIBRATION value.
4. Use an accurate gauge to measure the analog value when it is stable and near design conditions.
5. Determine the revised zero calibration required as follows: Meter Reading - AI Display + Zero Calibration = New Zero Calibration. The new zero calibration must be rounded to the nearest whole number.
6. Press ENTER to place the cursor on the zero calibration value.
7. Enter the new value from Step 5. Negative values are entered by pressing LOWER FUNCTION +/- before the number.
8. Press ENTER to store the revised zero calibration.

   For example, if a suction pressure gauge shows 58 psig and the computer displays 60.3 psig with a zero calibration of -1, then new calibration would be 58 - 60.3 + (-1) = -3.3 (-3). So the zero calibration should be changed to -3.

3.7 To Set Date and Time

1. You must be authorized. See Section 3.4.
2. Select DATE & TIME SET on the main menu. Press ENTER to display current date and time.
3. Press ENTER key to move cursor to each date/time item.
4. As each item flashes, use the number keys to enter revised data if necessary. The day of week, SUNday through SATurday, is selected by number keys 1 through 7, respectively.
5. Press ENTER to continue. The last ENTER will store the new date and time.

   WARNING: Setting the clock will cause a system reset. The entire unit will shut down and start over again. If the change was started inadvertently, press MENU key before completing the change.

3.8 To Display Data without Accessing Menu

1. Press LOWER FUNCTION.
2. Press function desired (blue sub-script)
3. Press item number to be displayed.
4. Press ENTER.
   EX: To display analog input #5, press LOWER FUNCTION, ANALOG INPUT, 5, ENTER.

3.9. To Revise Unit Schedule of Operation (Optional)

If a seven day time schedule of unit operation is desired, the internal real time clock of the microcomputer can be used. When the SCHEDULE control point is ON, the unit is allowed to operate. The following procedure is used to modify the operating schedule.

1. Perform the authorization procedure (See 3.4).
2. Press MENU key.
3. Use Up and Down to select CONTROL POINTS.
4. Press ENTER.
5. Use Up and Down to select SCHEDULE control point.
6. Use 6 to display the first schedule. The standard display screen would show:
   CP 17 SCHEDULE GRP:1 SCH:1 0000 2400 DAYS: *** ALL DAYS ***
   This indicates that control point 17 named SCHEDULE is controlled by schedule group (GRP) #1. The first schedule (SCH:1) turns on at 0000 hours and off at 2400 hours (military time) every day of the week. Thus it is on all the time.
7. To change this schedule, press ENTER. The cursor will flash over the turn-on time. To move to the next schedule, press the right arrow key.
8. Use the number keys (0-9) to enter the revised turn-on time using military format.
9. Press ENTER. The cursor will move over to the turn-off time.
10. Use the number keys to enter the turn-off time in military format.
11. Press ENTER. The cursor will move to DAYS during which this schedule is active.

12. To change the days for this schedule, press one or more of the following number keys: 0 - Clear all current days; 1 - Sunday(S); 2 - Monday(M); 3 - Tuesday(T); 4 - Wednesday(W); 5 - Thursday(R); 6 - Friday(F); 7 - Saturday(A); 8 - *** ALL DAYS***.
13. Press ENTER. The revised schedule number is now stored.
14. To add another schedule, press the right arrow key and repeat steps 7-13.
15. To delete a schedule, clear all of the days by pressing 0 at Step 12.

The schedule group turns on when any of the individual schedules turns on. The turn-on time does not have to be earlier than the turn off time. Schedules turn on by time and day, but turn off by time alone. For example, a schedule from 1900 to 0700 Saturdays would turn on at 7:00 PM Saturday (time and day) and turn off at 7:00 AM Sunday (time only).

Example: If a unit is to operate at all times except between the hours of 1:00 AM and 6:00 AM, the following schedule would be entered:
CP 17 SCHEDULE GRP:1 SCH:1 0600 0100 DAYS: *** ALL DAYS ***

Another example: A typical building may require cooling from 6:00 AM to 7:00 PM Monday - Friday and from 7:00 AM -3:00 PM on Saturdays. The schedules would be entered as follows:
CP 17 SCHEDULE GRP:1 SCH:1 0600 1900 DAYS: MTWRF
CP 17 SCHEDULE GRP:1 SCH:2 0700 1500 DAYS: A

4. **ACDX/AUDX Package Control**
In order to start a unit, the following conditions must be met:

- **S** chilled water pump running
- **S** chilled water flow switch made
- **S** customer control contact closed
- **S** control switch and compressor switch on
- **S** main unit power on
- **S** all safety conditions satisfied
- **S** reset pressed on microcomputer keypad
- **S** the compressor has not started within the last 15 minutes
- **S** leaving chilled water temperature 2EF or more above set point

The NC25 computer system performs the following functions on small screw compressor packages :

1. Capacity control of compressors
2. Staging of compressors
3. Compressor current limiting
4. Ramp control
5. Manual lead/lag
6. Compressor start delay
7. Power loss reset
8. Anti-recycle timing
9. Low pressure safety
10. High pressure safety
11. Freeze safety
12. High Oil Temp Safety
13. Alarm Output
14. Fan control
15. Chilled water reset and customer control interlock
16. Hot Gas Bypass option control
17. Compressor power control (No-stop alarm)
18. Sensor alarm shutdown
19. External shutdown indication (No-run alarm)
20. Fast Unload Solenoid Control (ACDX040-185B)
21. Low suction / discharge differential pressure alarm
22. High Motor temperature safety
23. Low chiller flow alarm
24. High discharge pressure unload
25. Low suction pressure unload

A description of each of the functions follows.

4.1. Capacity Control of Screw Compressors
The capacity of a compressor can be controlled manually or automatically.

The status of a compressor can be observed by displaying the compressor control point (1/CP, 4/CP, 7/CP or 10/CP). One of the following messages will be displayed where # is 1, 4, 7 or 10 for compressors 1, 2, 3 or 4:

CP# COMP	LOAD COM	Computer load
CP# COMP	CURRENT STATUS: LOAD	Manual load
CP# COMP	HOLD COM	Computer hold
CP# COMP	CURRENT STATUS: HOLD	Manual hold
CP# COMP	UNLD COM	Computer unload
CP# COMP	CURRENT STATUS: UNLD	Manual unload
CP# COMP	OFF COM	Off on a normal control shutdown
CP# COMP	COFF COM	Off on timer (clock off)
CP# COMP	LOFF MAN	Manual off or safety shutdown

4.1.1 Automatic Control
The computer calculates the operating percent capacity of a compressor by measuring discharge pressure and amps. This operating percent capacity is then compared to a target percent capacity. If the operating capacity is outside of a ± 3% deadband, the load or unload solenoids are pulsed to match the operating and target percent capacities. Since all compressors have the same target, their percent capacities are balanced.

The target percent capacity is given a fixed value when a compressor starts or stops. This value is then increased or decreased based on how far the leaving water temperature (TLW) is from setpoint and also on how fast the TLW is approaching setpoint. The target percent capacity will not change if the temperature is within a temperature deadband around the setpoint.

Some packages may have logic that prevents loading if the leaving water temperature is falling (negative derivative) at a certain rate.

The desired leaving water temperature is typically stored in setpoint 1A.

Calibrations of Amps Calculation at Full Load

The amps calculation is calibrated at the factory and does not normally need to be altered. If a compressor is replaced or improper operation is observed, the amps values can be calibrated as follows:

1. Check calibration of discharge pressure, and amps. NOTE: Calibrate amps with potentiometer on filter board.
2. Manually load the compressor(s) to full load. This can be done one compressor at a time if necessary.
3. Locate the amps and full load amps (FLA) analog locations from the analog input menu for the compressor being calibrated.
4. When the compressor(s) are at full load and conditions are close to design, record the amps and FLA analog values.
5. If the values do not match within 2-3 amps, do the following calculation: AMPS - FLA
6. Locate the amps calculation A setpoint for the compressor from the setpoint menu.

The setpoint is labeled FLA # CON, where # is 1 through 4 for each compressor number.

7. Add the value obtained in step 5 to the amps calculation A setpoint value from step 6.
8. Change the amps calculation setpoint to the new value.
9. Verify that amps and FLA now match closely.
10. Manually unload the compressor all the way.
11. Locate the percent full load capacity (%FLCP) for the compressor from the analog input menu and record the value.
12. If the value is 25% ±3%, no change is required. If the value is less than 22% or greater than 28%, locate the %FLA # CON setpoint B. If the setpoint is equal to 25.0, change it to the value observed in step 11 and proceed to step 13. If the setpoint is not equal to 25.0, change it to 25.0 and repeat steps 11 and 12.
13. Repeat this procedure for each compressor.

4.1.2. Manual Control

Screw compressors can be controlled manually with the keypad. A compressor can be turned on, off, or placed in computer control. When a compressor is controlled manually, it can be commanded to load, hold, or unload. If current limit is active, it will not accept a load command.

To place a compressor in manual control, which turns it on, the following procedure is used:

1. Log in for authorization.
2. Address desired compressor (1, 4, 7, or 10 control point).
3. Press ENTER to modify status.
4. Use up or down arrow keys to select ON MAN.
5. Press ENTER. The compressor will start or continue to run in hold state.
6. Press 0 to return to computer control, 1 to hold, 2 to load, 3 to unload. Note: Compressors will not load past amp limits.
7. Use menu key or arrows to access other data.

If a safety condition is exceeded while operating manually, the compressor will shutdown. To put all compressors back into computer control from a locked off state, press RESET.

CAUTION: Anti-recycle timer is bypassed by manual control. **DO NOT** start a compressor more than once every 15 minutes.

NOTE: All compressors will revert back to automatic control if the computer is not given a load, unload or hold command at least once every 15 minutes. A command can be repeated to meet the 15 minute requirement for manual control.

4.2. Staging of Compressors

The staging of compressors is based on leaving water temperature and the capacity calculations mentioned in section 4.1. When the percent capacity target gets up to full load and temperature is above deadband, a time delay of one or two minutes is initiated before starting the next compressor. When the capacity target falls below a stored setpoint and temperature is below the deadband, a compressor is turned off.

The percent capacity values that the computer is calculating can be displayed by addressing the analog input menu.

4.3. Compressor Current Limiting

The amp limit B setpoint on the unit control data sheet is the amp value at which the compressor will be prevented from loading. The amp limit A setpoint is the amp value at which the compressor will be given an unload command until the current drops below the A setpoint.

If the values are changed, the difference between the hold and unload points should not be decreased below 10% of compressor RLA so that oscillations will not occur.

4.4. Ramp Control

Ramp control can be implemented with the microcomputer. Whenever the unit starts with leaving water temperature greater than 5EF above setpoint, a ramp up is generated. The ramp start B setpoint specifies the percent capacity target at which the ramp begins on the first compressor. This can be set between 25 and 100 percent. The ramp rate A setpoint specifies the maximum amount that can be added to the target each compressor control interval. Thus a ramp rate of 0.1 produces the longest ramp rate. Table 1 gives sample ramp times for various ramp rate setpoints and start points for a two-compressor machine.

TABLE 1

Sample Ramp Times (Minutes) For a Two-Compressor Unit with a 2 Second Compressor Control Interval

Ramp Rate Setpoint	25% Start Pt. Setpoint	50% Start Pt. Setpoint	75% Start Pt. Setpoint
.1	58	50	42
.2	29	25	21
.3	19	17	14
.4	15	12	10

A formula for calculating ramp time in minutes is T = [(# compressors x 100) - start pt.] x Compressor Control Interval/(Ramp rate x 60)]

The compressor control interval can be determined by timing the frequency of load/unload pulses given to a compressor. It is typically 2 seconds.

4.5. Manual Lead/Lag Selection

The lead compressor can be selected by the lead B setpoint. The number stored in this setpoint should be one less than the desired compressor number. So a 0.0 in the setpoint specifies compressor 1 as the lead, a 1.0 puts compressor 2 as lead, etc. It is preferable to have compressor 1 as the lead. If a compressor is locked off, the next compressor will automatically take its place in the lead/lag sequence.

4.6. Compressor Start Delay

A compressor start delay of one or two minutes is incorporated into the computer to prevent two compressors from starting at the same time and insure that the system load requires another compressor. The compressor control point will display COFF ("clock off") during this timing.

4.7. Power Loss Reset

This function allows the customer the option of automatic or manual reset of the computer after a power loss to the computer. The power loss could be from the UVR or control switch. For automatic reset, a 0.0 is stored in the power loss B setpoint. For manual reset after power failure, a 1.0 is stored in the setpoint. A power loss alarm is also recorded by the computer.

4.8. Anti-Recycle Timing

At the start of a compressor, a 15 minute timer is initiated during which the compressor cannot start. If cooling is called for during this time, a COFF is displayed in the compressor control point.

CAUTION: This timer is bypassed by manual control of compressors. **DO NOT** manually start a compressor more than once every 15 minutes.

4.9. Low Pressure Safety

When the evaporator pressure of a given refrigeration circuit drops below the low pressure B setpoint, a time delay is initiated. If the pressure stays below the setpoint during the time period, all compressors on the circuit will be locked off and the low pressure alarm will be recorded by the computer.

For an air-cooled unit, the time delay is two minutes when ambient temperature is above 40EF. If ambient temperature drops below 40EF, the delay on compressor start up is extended to 4 minutes. After start-up, the low pressure delay is two minutes.

4.10 High Pressure Safety

If the condensing pressure of a refrigeration circuit exceeds the high pressure A setpoint, all compressors on the circuit are locked off. The high pressure alarm will be recorded by the computer. Typical setpoint value is 360 psig.

4.11 Freeze Safety

If the leaving water temperature of a chiller drops below the freeze B setpoint, all of the compressors will be locked off. The freeze alarm will be recorded by the computer. Press RESET to clear the lockout.

4.12 High Oil Temp Safety

If the oil temperature switch of a compressor opens, the oil temperature digital input turns ON. If the compressor is operating, the compressor will be locked off. The high oil temperature alarm will be recorded by the computer and RESET must be pressed after the problem is resolved.

4.13 Alarm Output

The alarm control point closes the digital output relay on all safety alarms. This relay is used to turn an alarm light on. After the problem is resolved, press RESET to reset the system and turn the alarm output off.

4.14 Fan Control

The fans are controlled by the microcomputer out put relays. The computer switches fans on or off based on the discharge pressure and the fan pressure setpoints. The high (A) setpoints are where the fans turn on and the low (B) setpoints are where the fans turn off.

4.15 Chilled Water Reset (Optional) and Customer Control Interlock

If an analog input is available, the chilled water temperature setpoint can be raised automatically by a 0-5 VDC signal provided by an external controller. The reset signal must be between 0VDC and 5VDC, with 0VDC being no reset and 5VDC being maximum reset. The maximum temperature reset (increase) desired must be stored in CWR max B setpoint. For example, to raise the chilled water setpoint from 44EF to 50EF (6.0EF) with a 5VDC input, a 6.0 is stored in CWR max setpoint.

CAUTION: The voltage input must never exceed 5.0VDC.

Control contacts from an external controller are used to enable or disable operation of compressors. The wiring diagram specifies the terminals to which the contacts must be wired removed. To enable the compressors, the contacts must be closed. To place the unit in stand-by mode, open the control contact.

Note: This control must be used for automatic control of the package. Do not use the flow switch to control the package.

4.16 Hot Gas Bypass Control (option)

When hot gas bypass has been supplied with the package, an output from the computer controls the solenoid. The solenoid is turned on if only one compressor is operating and the target percent capacity of the compressor drops below the hot gas bypass B setpoint. If the target percent capacity then climbs above the hot gas bypass A setpoint, the solenoid is turned off. Typical setpoints are 45% for the B setpoint and 80% for the A setpoint.

4.17 Compressor Power Control (No-Stop Alarm) and Unit Schedule

The control power/schedule feeds power to the compressor safety and control circuit and closes the chilled water pump contacts. (See Field Control Wiring). After power-up, the relay is held open for 15 seconds to allow for reset of the high motor temperature safety switch. The relay is then closed to allow normal compressor control if the unit schedule is calling for unit operation.

The computer will open this relay if it detects that a compressor auxiliary contact digital input stays ON for 15 seconds when the computer is commanding the compressor to be off. A No-Stop alarm would then be stored in the alarm history. This would indicate that either a hardware problem is forcing the compressor to run when it should not or that the digital input is staying on when the compressor is actually off. When the problem is resolved, press the RESET button to allow the machine to start.

During normal operation, this output turns ON/OFF based on the unit schedule of operation (see Section 3.9).

4.18 Sensor Alarm Shutdown

If the computer measures an analog sensor value that is outside of a given boundary, the associated compressors are shutdown. The computer then stores the alarm code corresponding to the sensor alarm. The boundary values are as follows:

	Low	High
1. Water temperature sensor	-	-190EF
2. Air temperature sensor	25EF	180EF
3. Suction pressure	-20 psig	See below
4. Discharge pressure	5 psig	-

The high setpoint for the suction pressure sensor will be triggered if the leaving water temperature is less than 60EF and suction pressure is greater than 150 psig.

If one of these sensor alarms occurs, it usually indicates a loose wire, blown fuse, defective sensor, or faulty analog board.

4.19 External Shutdown Indication (No-Run Alarm)

A No-Run control point error is generated if the computer tries to start (or run) a compressor but the compressor is held off by an external control. The computer determines that the compressor is not operating if the associated digital input from the compressor contactor does not indicate that the contactor is pulled in (digital input stays OFF), or if the amps of the compressor are less than about 12 amps. If a faulty No-run alarm occurs, monitor the digital input and amps to see which is producing the fault.

4.20 Fast Unload Solenoid Control

When a compressor starts, it's fast unload solenoid is energized for 30 seconds to ensure that the compressor unloads fully. The load and unload solenoids are de-energized during this time delay. After the time delay, normal control of the load/unload solenoids is restored.

4.21 Low Suction/Discharge Differential Alarm

If the difference between suction and discharge pressure is less than minimum differential pressure for 3 minutes while a compressor is operating, all the compressors on the affected refrigerant circuit are locked off. A low differential pressure alarm will be recorded by the computer and the alarm output will be turned on. Press RESET to clear the lockout.

4.22 High Motor Temperature Safety

If the high motor temperature switch of a compressor opens, the motor temperature digital input turns ON. If the compressor is operating, the compressor will be locked off. The high motor temperature alarm will be recorded by the computer and RESET must be pressed after the problem is resolved.

4.23 Low Chiller Flow Alarm

A low flow alarm will be generated if a compressor control point is ON and the flow switch digital input is OFF. All compressors will be locked off and the alarm light turned on. After resolving the problem, press RESET.

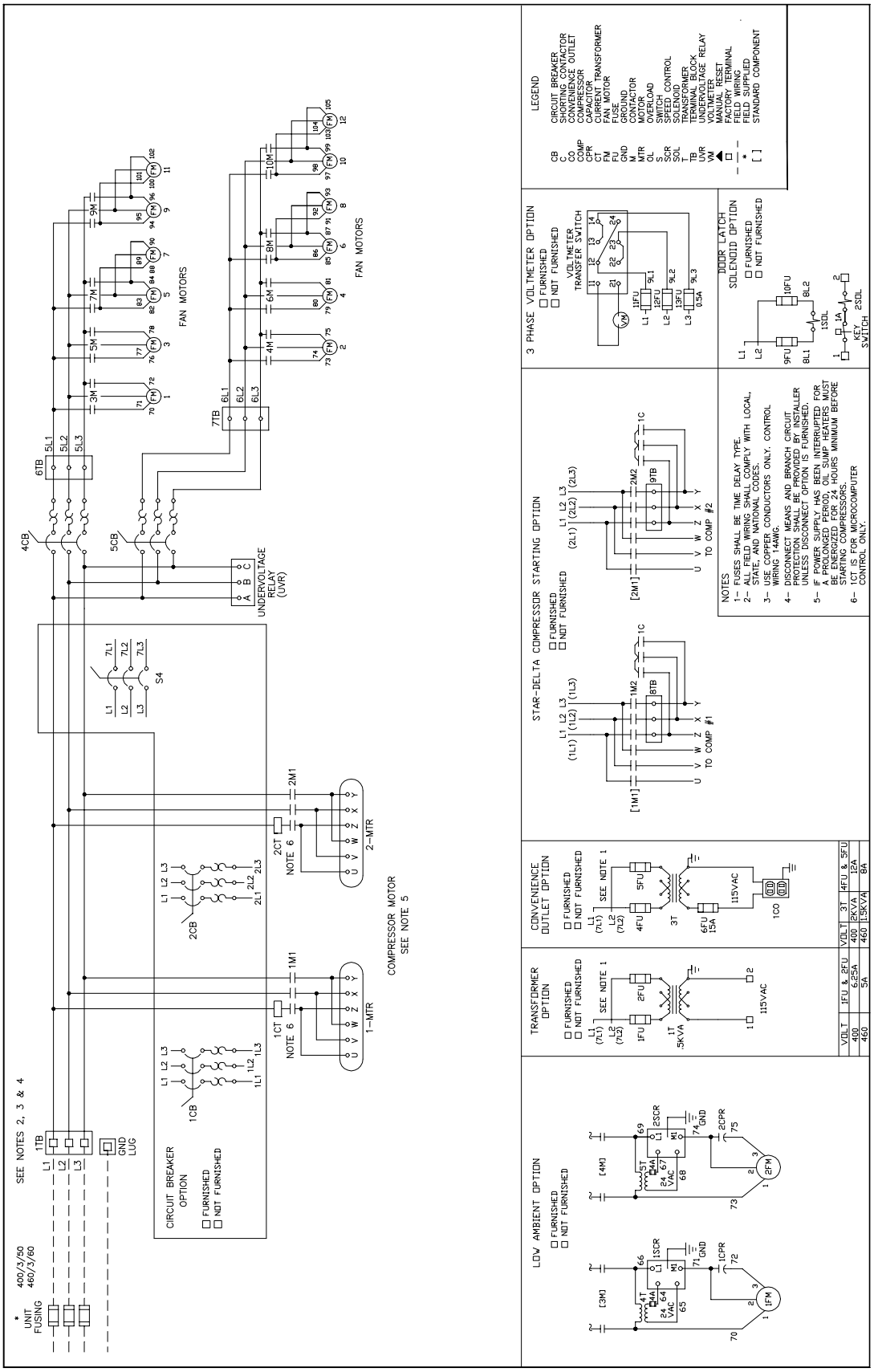
4.24 High Discharge Pressure Unload

This function unloads the compressor if discharge pressure is approaching the high pressure limit. If discharge pressure of an operating compressor reaches the high pressure setpoint minus 10 psi, the compressor will be prevented from loading (HOLD state). If the discharge pressure reaches the high pressure setpoint minus 5 psi, the compressor will begin unloading.

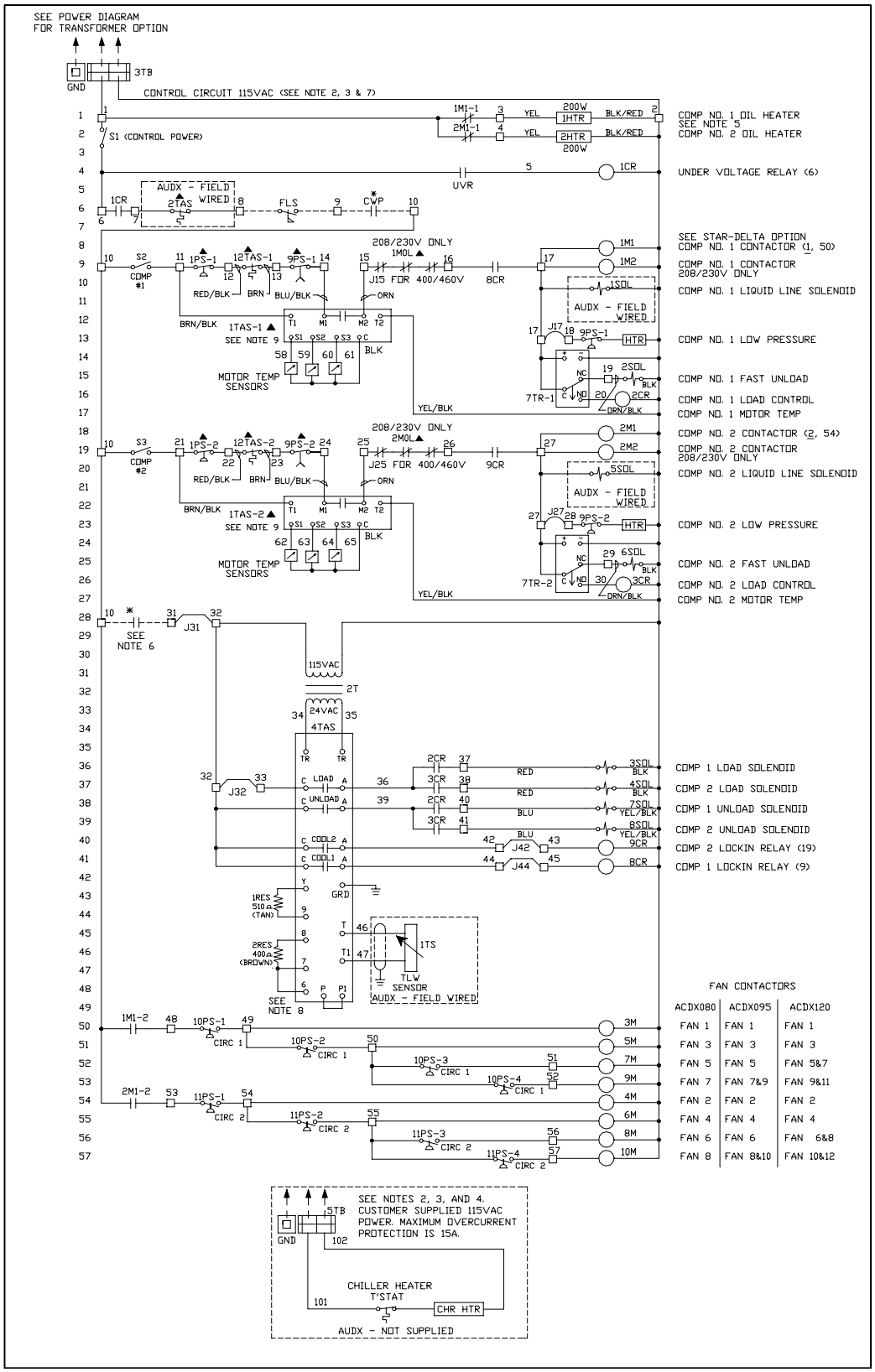
4.25 Low Suction Pressure Unload

This function unloads the compressor if suction pressure is approaching the low pressure limit. If suction pressure reaches the low pressure setpoint plus 4 psi, the compressor will be prevented from loading (HOLD state). If suction pressure falls to the suction pressure setpoint plus 2 psi, the compressor will begin unloading.

TYPICAL POWER WIRING (ACDX120A)



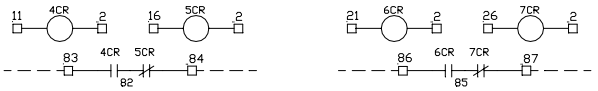
TYPICAL CONTROL WIRING (ACDX120A)



TYPICAL OPTIONS WIRING (ACDX120A)

ALARM CONTACT OPTION

☐ FURNISHED
☐ NOT FURNISHED



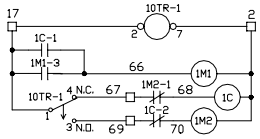
COMP #1 ALARM

COMP #2 ALARM

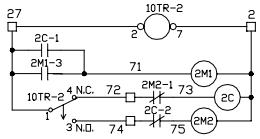
STAR-DELTA OPTION

☐ FURNISHED
☐ NOT FURNISHED

STAR-DELTA (REPLACES 1M1 & 1M2 IN CIRCUIT)

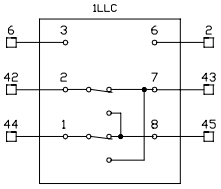


STAR-DELTA (REPLACES 2M1 & 2M2 IN CIRCUIT)



LEAD/LAG OPTION

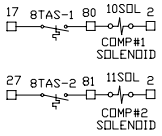
☐ FURNISHED
☐ NOT FURNISHED



REMOVE J42
REMOVE J44

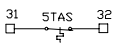
LIQUID INJECTION OPTION

☐ FURNISHED
☐ NOT FURNISHED



LOW AMBIENT LOCKOUT OPTION

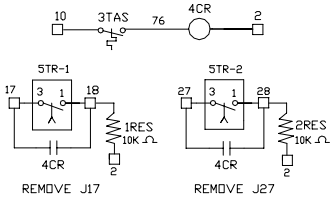
☐ FURNISHED
☐ NOT FURNISHED



REMOVE J31

LOW AMBIENT OPTION

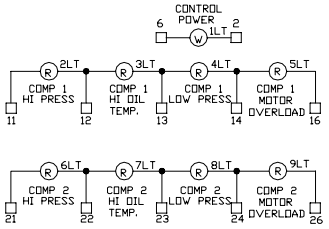
☐ FURNISHED
☐ NOT FURNISHED



REMOVE J17
REMOVE J27

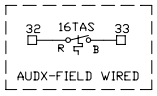
PILOT LIGHT OPTION

☐ FURNISHED
☐ NOT FURNISHED



LOAD LIMIT THERMOSTAT OPTION

☐ FURNISHED
☐ NOT FURNISHED



REMOVE J32

HOT GAS BYPASS OPT

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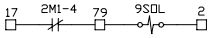
☐ NOT FURNISHED



WARNING

DO NOT SET 9PS OR 2TAS TO A VALUE LOWER THAN THAT INDICATED FOR YOUR GLYCOL CONCENTRATION. TO DO SO WILL VOID THE WARRANTY.

CONTROL SETTINGS

TIME

CNT	DELAY
5TR-1, 2	2 MIN.
7TR-1, 2	30 SEC.
9PS-1, 2	120 SEC.
10TR-1, 2	5 SEC.

PRESSURE(PSIG)

CNT	OPEN	CLOSE
1PS-1, 2	360	▲
10,11PS-1	140	190
10,11PS-2	150	210
10,11PS-3	160	220
10,11PS-4	170	230

TEMPERATURE

CNT	OPEN	CLOSE
3TAS	40°F	43°F
5TAS(STD AMB)	20°F	23°F
5TAS(LOW AMB)	0°F	3°F
8TAS-1,2	210°F	220°F
12TAS-1,2	240°F	▲
16TAS	65°F	60°F

SETPOINT TABLE

% ETHYLENE GLYCOL	MINIMUM AMBIENT (°F)	MINIMUM 9PS OPEN (PSIG)	MINIMUM 2TAS OPEN (°F)
0	32	55	38
10	27	49	33
20	18	39	24
30	3	33	9
40	-13	33	-7
50	-20	33	-14

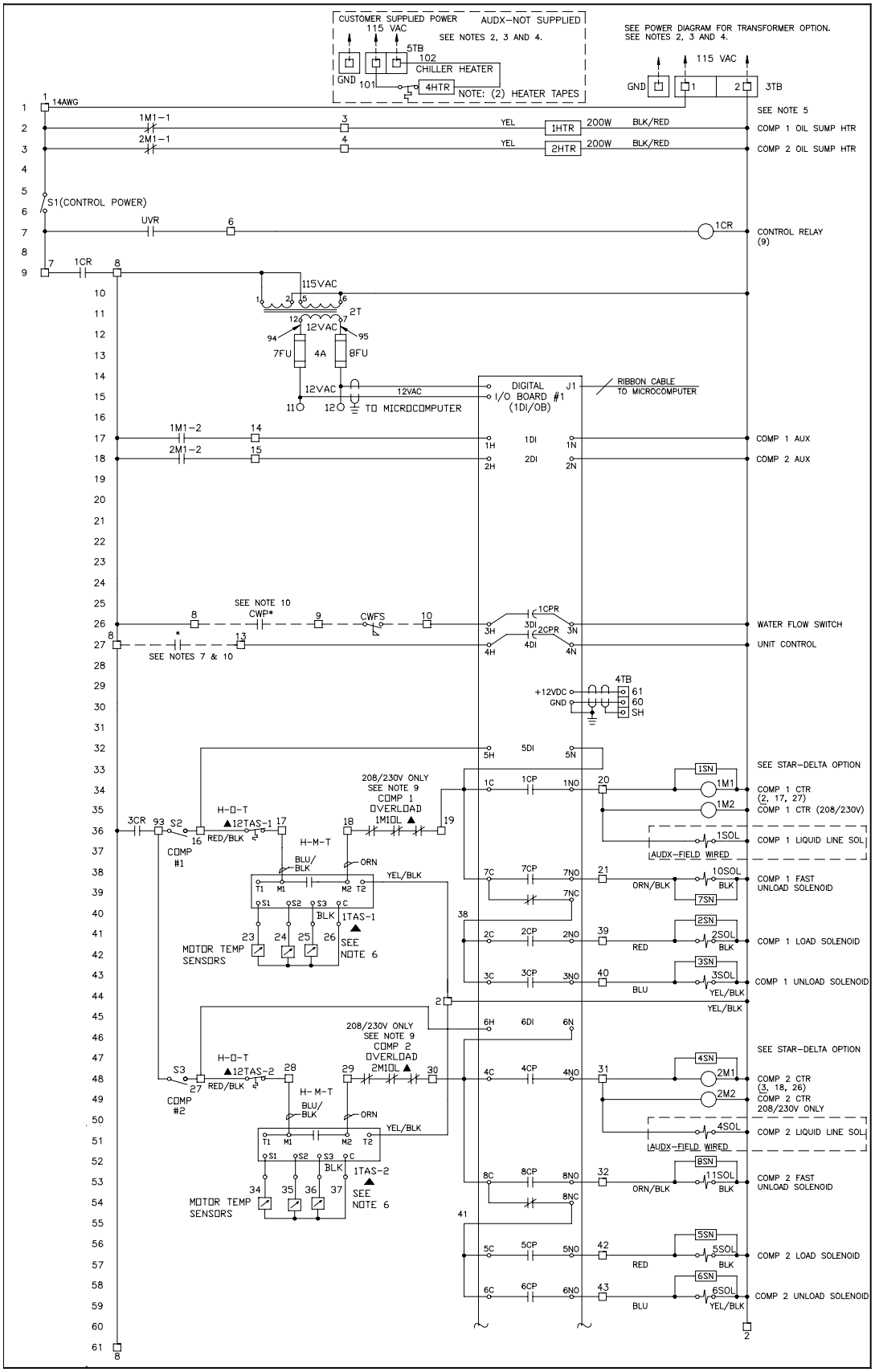
LEGEND

AMB	AMBIENT
COMP	COMPRESSOR
CR	CONTROL RELAY
CWP	CHILLED WATER PUMP
FLS	FLOW SWITCH
FU	FUSE
HTR	HEATER
J	JUMPER
LLC	LEAD/LAG CONTROL
LT	PILOT LIGHT
M	CONTACTOR
MIN	MINIMUM
1PS	HIGH PRESSURE
9PS	LOW PRESSURE
SOL	SOLENOID
T	TRANSFORMER
1TAS	MOTOR TEMP PROTECTOR
2TAS	FREEZE T'STAT
3TAS	AMBIENT T'STAT
4TAS	OPERATING T'STAT
5TAS	AMBIENT THERMOSTAT
8TAS	DISCHARGE THERMOSTAT
12TAS	COMP OIL THERMOSTAT
16TAS	RETURN WATER THERMOSTAT
TB	TERMINAL BOARD
TR	TIMER
TS	TEMP SENSOR
UVR	UNDERVOLTAGE RELAY
TRW	RETURN CHILLED WATER TEMP
TLW	LEAVING CHILLED WATER TEMP
R	CHILLED WATER RANGE (TRW - TLW)
☐	FACTORY TERMINAL
▲	MANUAL RESET
——	FACTORY WIRING
- - -	FIELD WIRING
*	FIELD SUPPLIED

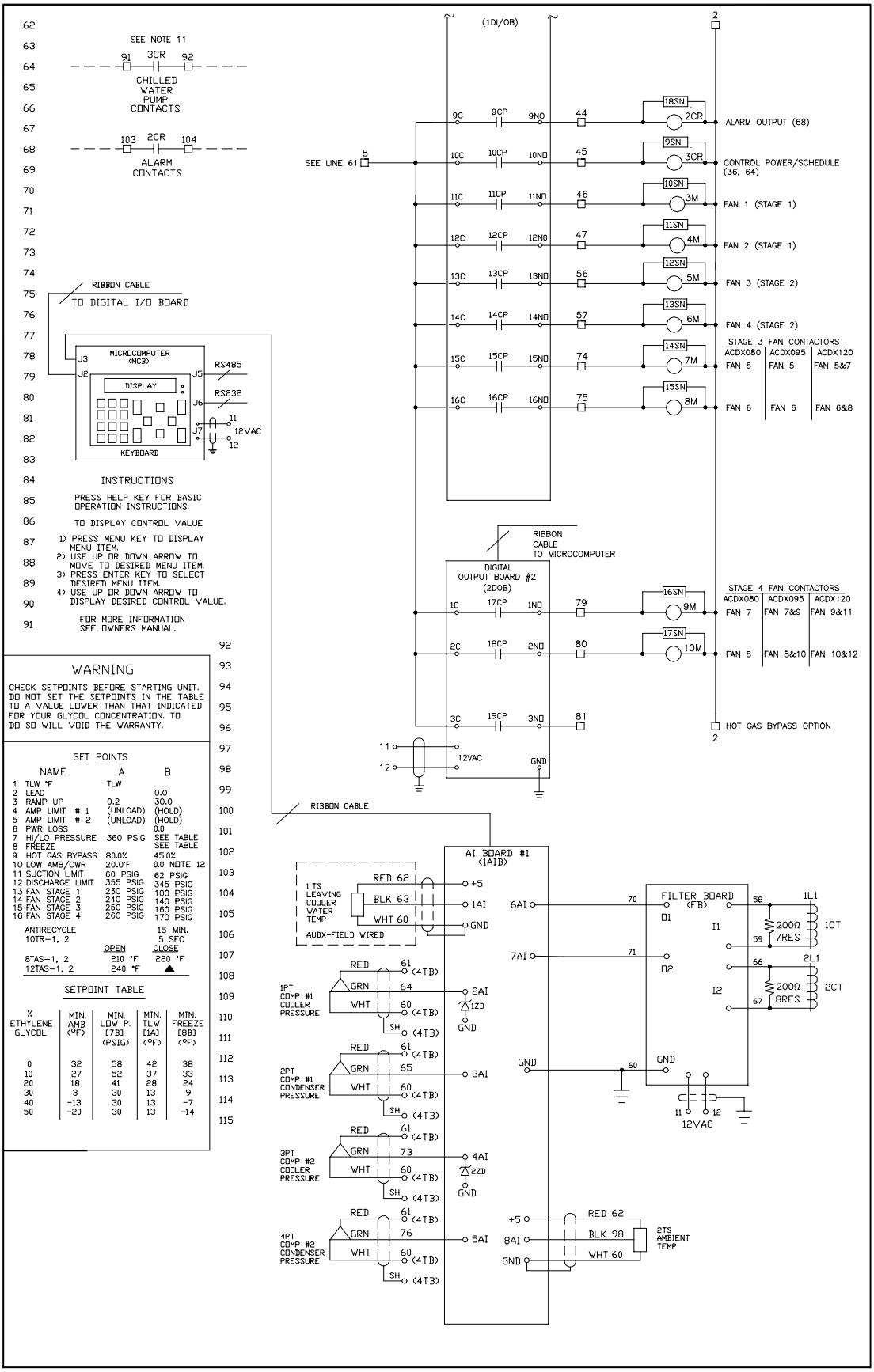
NOTES

1. FUSES TO BE DUAL ELEMENT TYPE
2. ALL FIELD WIRING TO COMPLY WITH LOCAL, STATE & NATIONAL CODES.
3. COPPER CONDUCTORS ONLY.
4. DISCONNECT MEANS & BRANCH CIRCUIT PROTECTION SHALL BE PROVIDED BY INSTALLER.
5. IF POWER SUPPLY HAS BEEN INTERRUPTED FOR A PROLONGED PERIOD, OIL SUMP HEATERS MUST BE ENERGIZED FOR 24HRS. MINIMUM BEFORE STARTING COMPRESSORS.
6. CUSTOMER CONTROL CONTACTS MUST BE WIRED BETWEEN TERMINALS 10 & 31.
7. WHEN TSF. OPT. IS NOT FACTORY SUPPLIED, A DIRECT CONNECTED 115VAC CONTROL CIRCUIT WITH OVERCURRENT PROTECTION AT 15A OR LESS(FIELD SUPPLIED) IS REQUIRED. USE #14AWG COPPER CONDUCTORS. WIRE TO TERMINAL BLOCK 3TB. USE TERMINAL #2 FOR CONNECTION OF THE NEUTRAL SUPPLY CONDUCTOR.
8. RECOMMENDED INITIAL CONTROL BAND SETTING IS 4.0.
9. TO RESET 1TAS, OPEN CORRESPONDING COMPRESSOR SWITCH FOR 5 SECONDS.

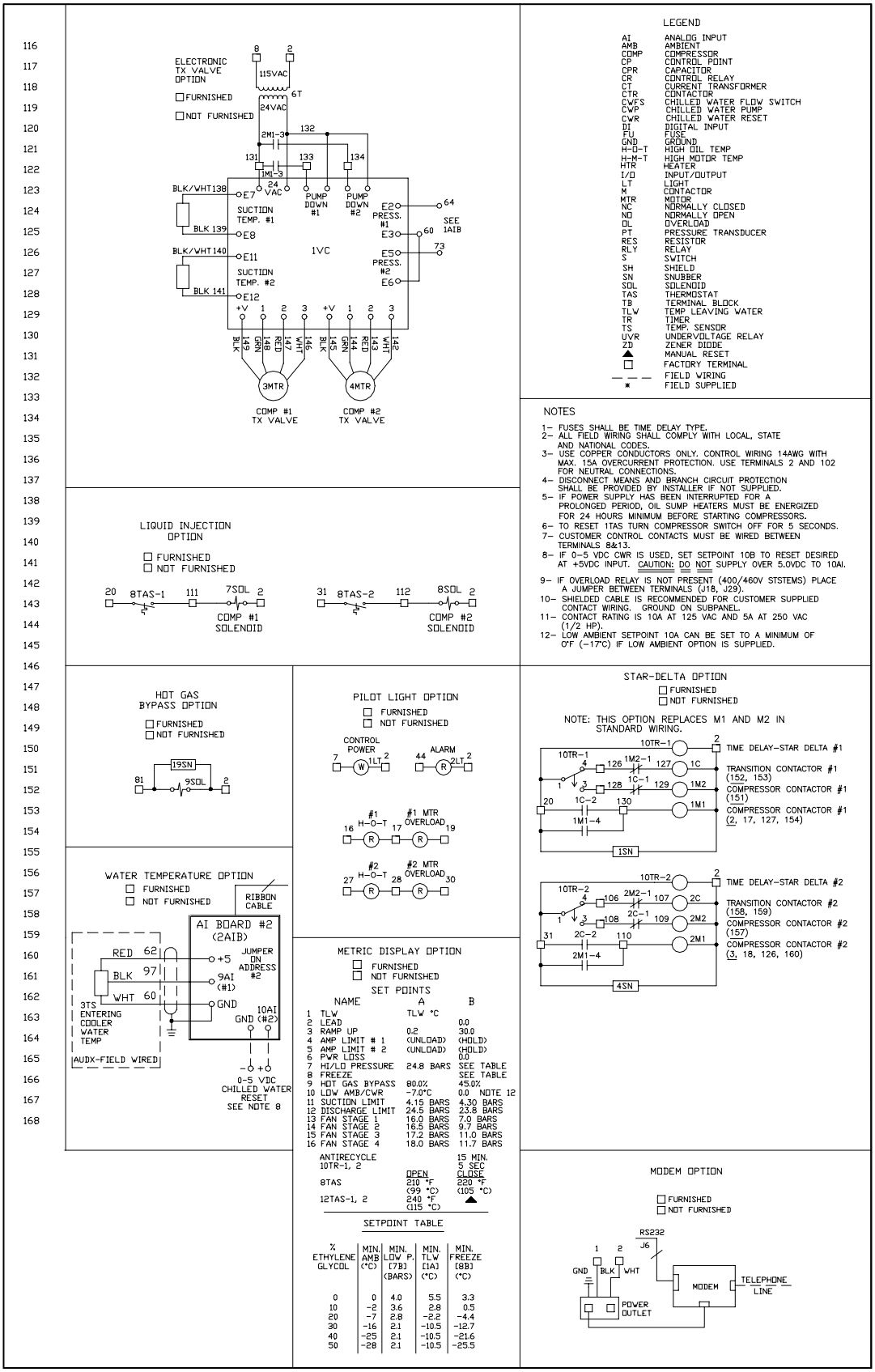
TYPICAL CONTROL WIRING (ACDX120B W/MICRO)



TYPICAL CONTROL WIRING (ACDX120B W/MICRO)



TYPICAL OPTIONS WIRING (ACDX120B W/MICRO)



NAME	A	B
1 TLW	TLW °C	
2 LEAD		0.0
3 RAMP UP	0.2	30.0
4 AMP LIMIT # 1	(UNLOAD)	(HOLD)
5 AMP LIMIT # 2	(UNLOAD)	(HOLD)
6 PWR LOSS		0.0
7 HI/LO PRESSURE	24.8 BARS	SEE TABLE
8 FREEZE		SEE TABLE
9 HOT GAS BYPASS	80.0%	45.0%
10 LOW AMB/CWR	-7.0°C	0.0 NOTE 12
11 SUCTION LIMIT	4.15 BARS	4.30 BARS
12 DISCHARGE LIMIT	24.5 BARS	23.8 BARS
13 FAN STAGE 1	16.0 BARS	7.0 BARS
14 FAN STAGE 2	16.5 BARS	9.7 BARS
15 FAN STAGE 3	17.2 BARS	11.0 BARS
16 FAN STAGE 4	18.0 BARS	11.7 BARS

	OPEN	15 MIN. 5 SEC CLOSE
8TAS	210 °F (99 °C)	220 °F (105 °C)
12TAS-1, 2	240 °F (115 °C)	▲

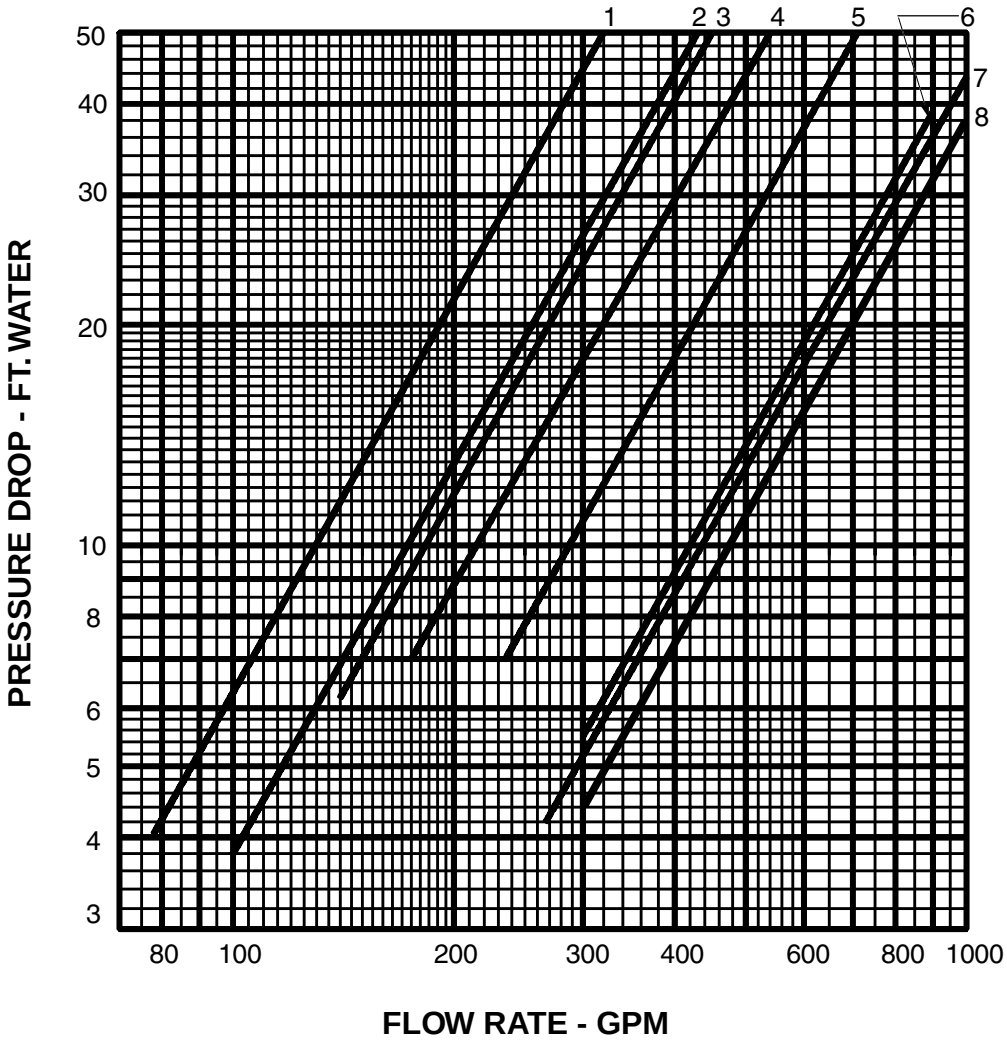
% ETHYLENE GLYCOL	MIN. AMB (°C)	MIN. LOW P. [7B] (BARS)	MIN. TLW [1A] (°C)	MIN. FREEZE [8B] (°C)
0	0	4.0	5.5	3.3
10	-2	3.6	2.8	0.5
20	-7	2.8	-2.2	-4.4
30	-16	2.1	-10.5	-12.7
40	-25	2.1	-10.5	-21.6
50	-28	2.1	-10.5	-25.5

ACDX ELECTRICAL DATA

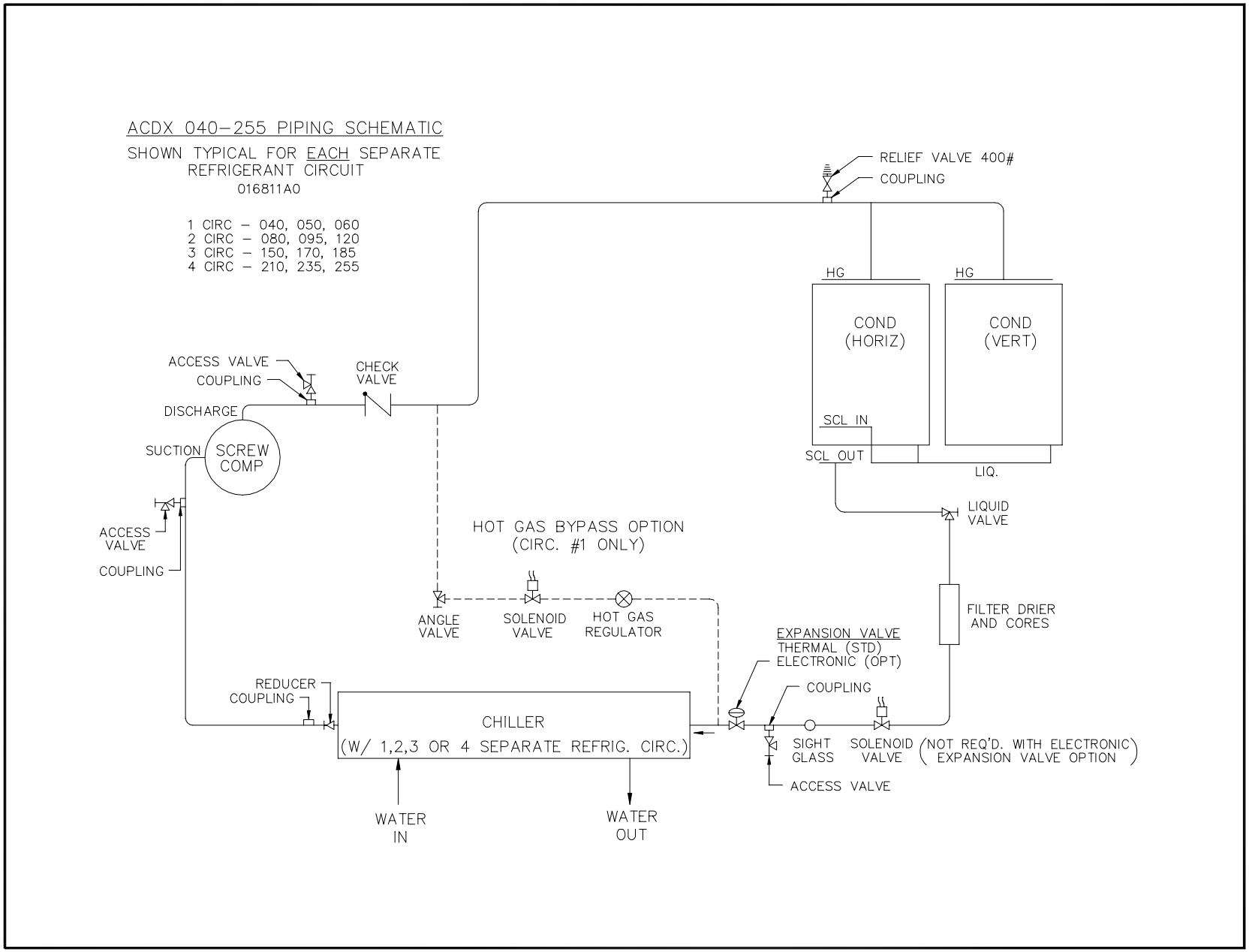
Model	Volts 3/60	MCA	MFS	Compressor				Fan Motor			Compr. Sump Htr.		CHR Htr Circuit	
				HP(qty)	RLA(ea)	LRA-XL(ea)	LRA-YD(ea)	Qty	Hp	FLA(ea)	Total Watts	Total Amps	Total Watts	Total Amps
040	208	189	300	50(1)	132	1040	347	4	1.5	5.9	200	1.7	420	3.5
	230	179	300	50(1)	124	1040	347	4	1.5	5.9	200	1.7	420	3.5
	460	105	175	50(1)	75	422	141	4	1.5	3.0	200	1.7	420	3.5
050	208	222	350	60(1)	164	1228	409	6	1.5	5.9	200	1.7	420	3.5
	230	207	350	60(1)	152	1228	409	6	1.5	5.9	200	1.7	420	3.5
	460	122	200	60(1)	91	485	162	6	1.5	3.0	200	1.7	420	3.5
060	208	287	450	75(1)	201	1415	472	6	1.5	5.9	200	1.7	560	4.7
	230	26	400	75(1)	184	1415	472	6	1.5	5.9	200	1.7	560	4.7
	460	141	225	75(1)	98	539	180	6	1.5	3.0	200	1.7	560	4.7
080	208	345	450	50(2)	132	1040	347	8	1.5	5.9	400	3.4	840	7.0
	230	327	450	50(2)	124	1040	347	8	1.5	5.9	400	3.4	840	7.0
	460	191	250	50(2)	74	422	141	8	1.5	3.0	400	3.4	840	7.0
095	208	428	500	60(2)	164	1228	409	10	1.5	5.9	400	3.4	1120	9.3
	230	401	500	60(2)	152	1228	409	10	1.5	5.9	400	3.4	1120	9.3
	460	235	300	60(2)	91	485	162	10	1.5	3.0	400	3.4	1120	9.3
120	208	524	700	75(2)	201	1415	472	12	1.5	5.9	400	3.4	1120	9.3
	230	485	600	75(2)	184	1415	472	12	1.5	5.9	400	3.4	1120	9.3
	460	257	350	75(2)	98	539	180	12	1.5	3.0	400	3.4	1120	9.3
150	208	632	800	60(3)	171	1228	409	16	1.5	5.9	600	5.0	1120	9.3
	230	570	700	60(3)	152	1228	409	16	1.5	5.9	600	5.0	1120	9.3
	460	334	400	60(3)	91	485	162	16	1.5	3.0	600	5.0	1120	9.3
170	208	772	1000	60(1) 75(2)	164	1228 1415	409 472	18	1.5	5.9	600	5.0	1120	9.3
	230	654	800	60(1) 75(2)	152	1228 1415	409 472	18	1.5	5.9	600	5.0	1120	9.3
	460	365	450	60(1) 75(2)	91	485 539	162 180	18	1.5	3.0	600	5.0	1120	9.3
185	208	792	1000	75(3)	211	1415	472	18	1.5	5.9	600	5.0	1260	10.5
	230	705	800	75(3)	184	1415	472	18	1.5	5.9	600	5.0	1260	10.5
	460	373	450	75(3)	98	539	180	18	1.5	3.0	600	5.0	1260	10.5
210	208	832	1000	60(4)	168	1228	429	20	1.5	5.9	800	6.7	1260	10.5
	230	832	1000	60(4)	168	1228	429	20	1.5	5.9	800	6.7	1260	10.5
	460	447	500	60(4)	91	485	162	20	1.5	3.0	800	6.7	1260	10.5
235	208	968	1200	60(2) 75(2)	164	1228 1415	409 472	20	1.5	5.9	800	6.7	1680	14.0
	230	836	1000	60(2) 75(2)	152	1228 1415	409 472	20	1.5	5.9	800	6.7	1680	14.0
	460	463	500	60(2) 75(2)	91	485 539	162 180	20	1.5	3.0	800	6.7	1680	14.0
255	208	998	1200	75(4)	207	1415	472	20	1.5	5.9	800	6.7	1680	14.0
	230	998	1200	75(4)	207	1415	472	20	1.5	5.9	800	6.7	1680	14.0
	460	498	600	75(4)	103	539	180	20	1.5	3.0	800	6.7	1680	14.0

NOTE: The above data is used for AUDX units except CHR heaters are not applicable.

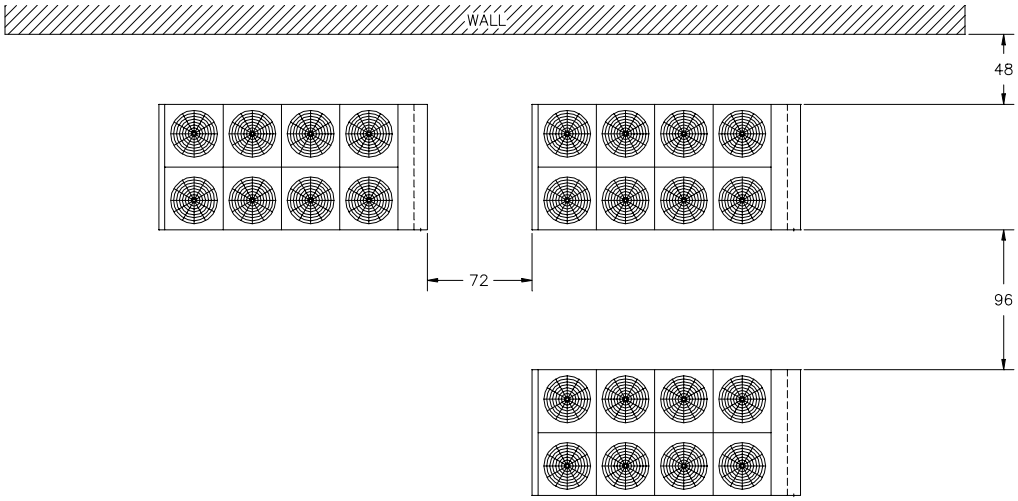
WATER SIDE PRESSURE DROP



ACDX Model Size	Cooler Model	Curve No.	Min. GPM	Max. GPM
040	CHSO10601B	1	78	315
050	CHS011601B	1	86	315
060	CHS013601B	2	101	420
080	EXD14102J09	3	140	440
095	EXD16112J09	4	175	519
120	EXD16122J07	5	236	697
150	EXT18122J07	7	267	1060
170	EXT18122J07	7	267	1060
185	EXT20122J07	6	298	881
210	EXF20122J07	8	298	1135
235	EXF20122J07	8	298	1135
255	EXF20122J07	8	298	1135


ACDX 040–255 PIPING SCHEMATIC
SHOWN TYPICAL FOR EACH SEPARATE REFRIGERANT CIRCUIT
016811A0
1 CIRC – 040, 050, 060
2 CIRC – 080, 095, 120
3 CIRC – 150, 170, 185
4 CIRC – 210, 235, 255
RELIEF VALVE 400#
COUPLING
HG
HG
COND (HORIZ)
COND (VERT)
SCL IN
SCL OUT
LIQ.
ACCESS VALVE
COUPLING
CHECK VALVE
DISCHARGE
SUCTION
SCREW COMP
ACCESS VALVE
COUPLING
LIQUID VALVE
HOT GAS BYPASS OPTION
(CIRC. #1 ONLY)
ANGLE VALVE
SOLENOID VALVE
HOT GAS REGULATOR
FILTER DRIER AND CORES
EXPANSION VALVE
THERMAL (STD)
ELECTRONIC (OPT)
REDUCER COUPLING
CHILLER
(W/ 1,2,3 OR 4 SEPARATE REFRIG. CIRC.)
COUPLING
SIGHT GLASS
SOLENOID VALVE
(NOT REQ'D. WITH ELECTRONIC EXPANSION VALVE OPTION)
ACCESS VALVE
WATER IN
WATER OUT

ACDX/AUDX CONDENSER CLEARANCE



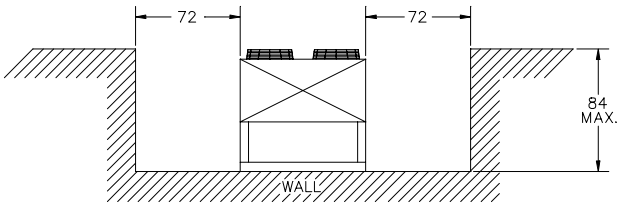


FIGURE #4
SINGLE PIT
(SEE NOTE 2)

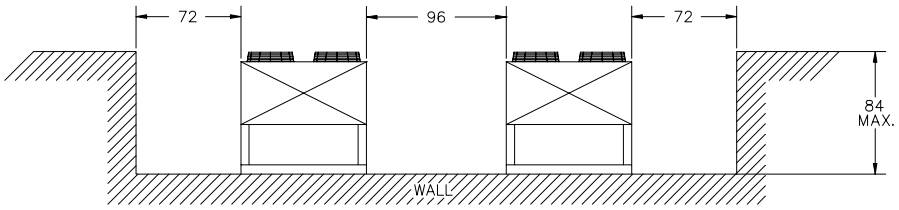


FIGURE #5
DOUBLE PIT
(SEE NOTE 2)

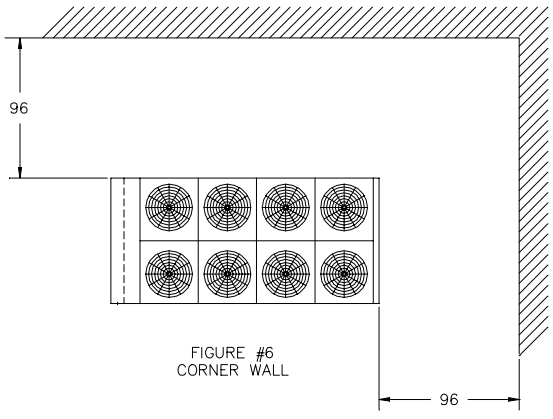
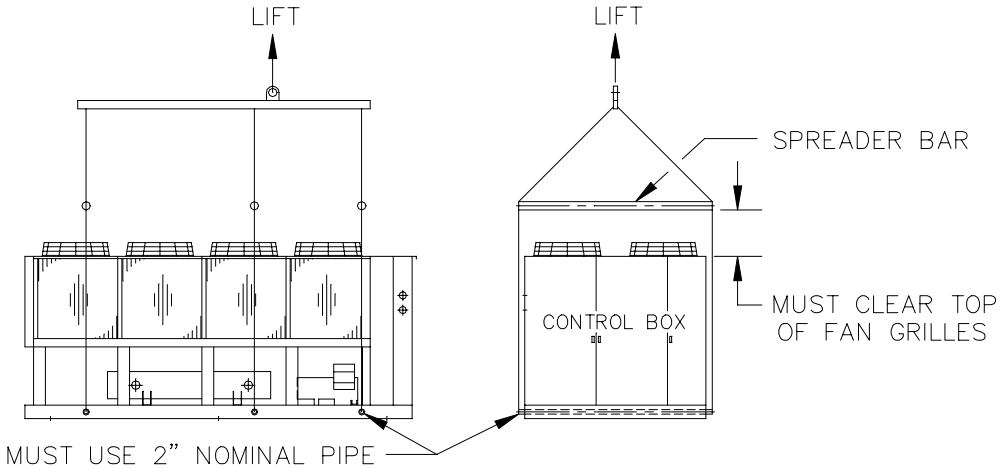


FIGURE #6
CORNER WALL

NOTE:

1) ALL DIMENSIONS ARE MINIMAL, UNLESS OTHERWISE NOTED.
2) PIT INSTALLATIONS ARE NOT RECOMMENDED. RE-CIRCULATION OF HOT CONDENSER AIR IN COMBINATION WITH SURFACE AIR TURBULENCE CANNOT BE PREDICTED. HOT AIR RE-CIRCULATION WILL SEVERELY AFFECT UNIT EFFICIENCY (EER) AND CAN CAUSE HI PRESSURE TRIPS OR FAN MOTOR TEMPERATURE TRIPS. DUNHAM-BUSH WILL NOT BE REPSONSIBLE FOR DUCTING FANS TO A HIGHER LEVEL TO ALLEVIATE THE ABOVE MENTIONED CONDITIONS.

RIGGING INSTRUCTIONS: ACDR/AUDR 080–135
ACDX/AUDX 080–255

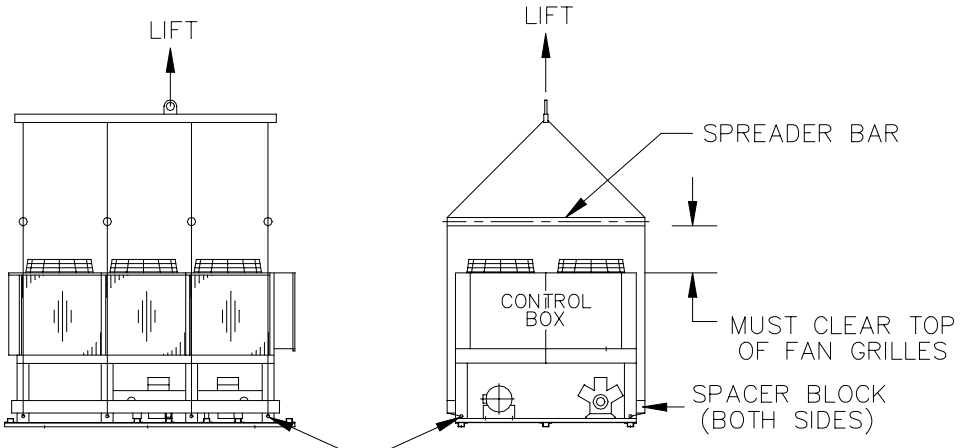


MUST USE 2" NOMINAL PIPE THRU UNIT FOR SLINGS TO AVOID BASE DAMAGE.

DO NOT USE SMALL HOLES IN LEGS FOR RIGGING THESE UNITS.

015729A2

RIGGING INSTRUCTIONS: ACDR/AUDR 015–070
ACDX/AUDX 040–060



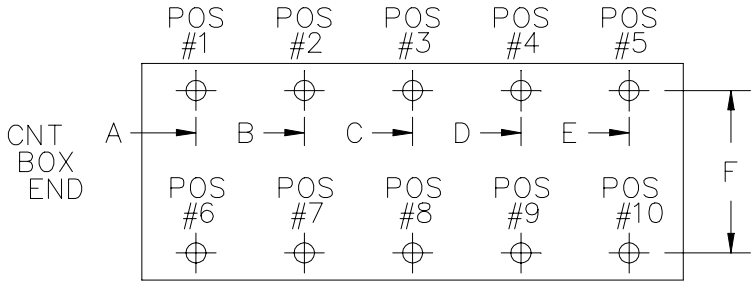
LOOP CHAIN THROUGH LEG HOLES

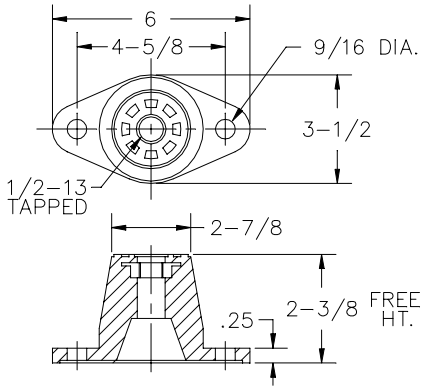
NOTE: SAME RIGGING FOR SINGLE UNITS.

015729A1

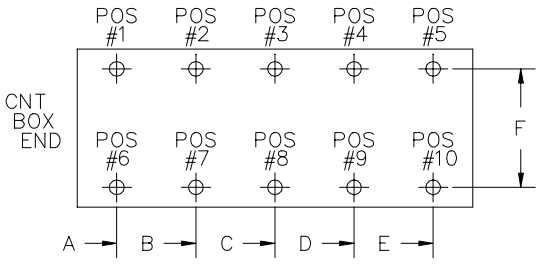
ACDX LOAD POINTS

UNIT MODEL ACDX	ISOLATOR WEIGHTS																TOTAL OPERATING WGT.(LBS.)
	DIMENSIONS–IN.						LOAD–LBS.										
	A DIM	B DIM	C DIM	D DIM	E DIM	F DIM	POS #1	POS #2	POS #3	POS #4	POS #5	POS #6	POS #7	POS #8	POS #9	POS #10	
040	20.0				84.0	80.3	994				752	1151				695	3592
050	20.0		70.0		120.0	80.3	835		903		562	822		1032		578	4732
060	20.0		70.0		120.0	80.3	919		1009		599	849		1075		593	5044
080	16.0		98.0		175.0	83.0	1187		1819		796	1275		1818		817	7712
095	16.0		98.0		183.0	83.0	1380		1907		1555	1380		1907		1555	9684
120	16.0	98.0		175.0	255.0	83.0	1334	1629		1493	907	1334	1629		1493	907	10,726
150	43.5	141.5		244.5	335.5	83.0	2136	1680		2063	1347	2171	2180		2063	1347	14,987
170	43.5	141.5	244.5	309.5	374.5	83.0	2173	1544	1107	1454	1418	2208	2045	1107	1454	1418	15,928
185	43.5	141.5	244.5	309.5	374.5	83.0	2180	1562	1175	1620	1572	2216	2086	1175	1620	1572	16,778
210	43.5	141.5	244.5	329.5	415.5	83.0	2212	2243	1452	2173	1192	2212	2243	1452	2173	1192	18,544
235	43.5	141.5	244.5	329.5	415.5	83.0	2263	2259	1460	2182	1201	2263	2259	1460	2182	1201	18,730
255	43.5	141.5	244.5	329.5	415.5	83.0	2271	2311	1466	2185	1205	2271	2311	1466	2185	1205	18,876



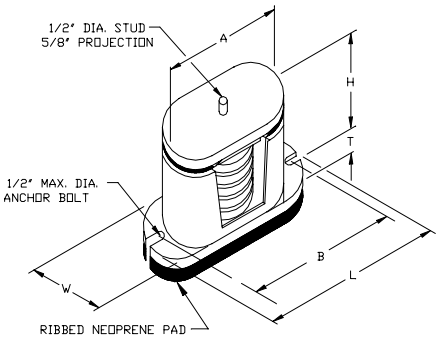


UNIT MODEL ACDX	SET ITEM	RUBBER–IN–SHEAR ISOLATOR																
		POS #1	POS #2	POS #3	POS #4	POS #5	POS #6	POS #7	POS #8	POS #9	POS #10	DIMENSION (INCHES)					
		DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	A DIM.	B DIM.	C DIM.	D DIM.	E DIM.	F DIM.
040	A1	RVD–3–C				RVD–3–B	RVD–3–C				RVD–3–B	20.0				84.0	80.3
050	A2	RVD–3–C		RVD–3–C		RVD–3–B	RVD–3–C		RVD–3–C		RVD–3–B	20.0		70.0		120.0	80.3
060	A3	RVD–3–C		RVD–3–C		RVD–3–B	RVD–3–C		RVD–3–C		RVD–3–B	20.0		70.0		120.0	80.3
080	A4	RVD–3–C		RVD–3–C(2)		RVD–3–C	RVD–3–C		RVD–3–C(2)		RVD–3–C	16.0		98.0		175.0	83.0
095	A5	RVD–3–D		RVD–3–C(2)		RVD–3–D	RVD–3–D		RVD–3–C(2)		RVD–3–D	16.0		98.0		183.0	83.0
120	A6	RVD–3–D	RVD–3–C(2)		RVD–3–D	RVD–3–C	RVD–3–D	RVD–3–C(2)		RVD–3–D	RVD–3–C	16.0	98.0		175.0	255.0	83.0
150	A7	RVD–3–C(2)	RVD–3–C(2)		RVD–3–C(2)	RVD–3–D	RVD–3–C(2)	RVD–3–C(2)		RVD–3–C(2)	RVD–3–D	43.5	141.5		244.5	335.5	83.0
170	A8	RVD–3–C(2)	RVD–3–D	RVD–3–C	RVD–3–D	RVD–3–D	RVD–3–C(2)	RVD–3–C(2)	RVD–3–C	RVD–3–D	RVD–3–D	43.5	141.5	244.5	309.5	374.5	83.0
185	A9	RVD–3–C(2)	RVD–3–D	RVD–3–C	RVD–3–C(2)	RVD–3–D	RVD–3–C(2)	RVD–3–C(2)	RVD–3–C	RVD–3–C(2)	RVD–3–D	43.5	141.5	244.5	309.5	374.5	83.0
210	B1	RVD–3–C(2)	RVD–3–C(2)	RVD–3–D	RVD–3–C(2)	RVD–3–C	RVD–3–C(2)	RVD–3–C(2)	RVD–3–D	RVD–3–C(2)	RVD–3–C	43.5	141.5	244.5	329.5	415.5	83.0
235	B2	RVD–3–C(2)	RVD–3–C(2)	RVD–3–D	RVD–3–C(2)	RVD–3–C	RVD–3–C(2)	RVD–3–C(2)	RVD–3–D	RVD–3–C(2)	RVD–3–C	43.5	141.5	244.5	329.5	415.5	83.0
255	B3	RVD–3–C(2)	RVD–3–C(2)	RVD–3–D	RVD–3–C(2)	RVD–3–C	RVD–3–C(2)	RVD–3–C(2)	RVD–3–D	RVD–3–C(2)	RVD–3–C	43.5	141.5	244.5	329.5	415.5	83.0



NOTE:
1) WHEN TWO ISOLATORS ARE CALLED OUT IN ANY ONE POSITION, THEN THE ISOLATORS ARE MOUNTING 6 INCHES ON EITHER SIDE OF THE CORRESPONDING DIMENSION.
2) QUANTITY OF ISOLATORS IS GIVEN IN ( ) WHEN MORE THAN ONE.

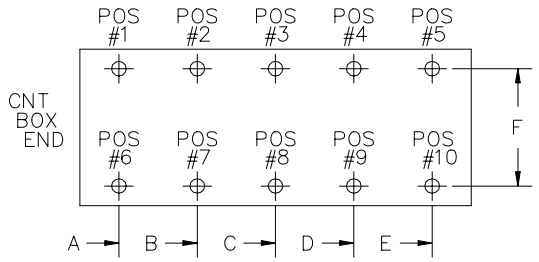
FIELD: INSTALL ISOLATORS AT THE CORRESPONDING LOAD POINTS.



DIMENSIONAL CHART							
DESC.	A	B	L	T	W	H (FREE HT.)	H (OPER. HT.)
XL	5-1/8	6-3/8	8	5/8	2-3/4	5-7/8	5-1/4
XLW	6-7/8	8-1/2	10	5/8	3-7/8	5-7/8	5-1/4

NOTE: TOP PLATE & LOWER HOUSING – CAST ALUMINUM

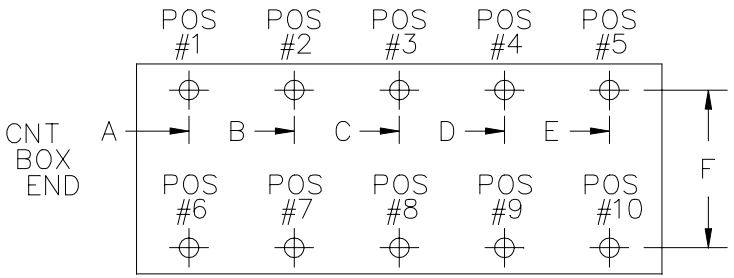
UNIT MODEL ACDX	SET ITEM	SPRING ISOLATOR															
		POS #1	POS #2	POS #3	POS #4	POS #5	POS #6	POS #7	POS #8	POS #9	POS #10	DIMENSIONS (INCHES)					
		DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	A DIM.	B DIM.	C DIM.	D DIM.	E DIM.	F DIM.
040	A1	XL-1200				XL-900	XL-1400				XL-900	20.0				84.0	80.3
050	A2	XL-1000		XL-1100		XL-700	XL-1000		XL-1300		XL-700	20.0		70.0		120.0	80.3
060	A3	XL-1200		XL-1300		XL-800	XL-1100		XL-1400		XL-800	20.0		70.0		120.0	80.3
080	A4	XL-1500		XLW-2300		XL-1000	XLW-1600		XLW-2300		XL-1000	16.0		98.0		175.0	83.0
095	A5	XLW-1700		XLW-2400		XLW-2000	XLW-1700		XLW-2400		XLW-2000	16.0		98.0		183.0	83.0
120	A6	XLW-1700	XLW-2100		XLW-1900	XL-1100	XLW-1700	XLW-2100		XLW-1900	XL-1100	16.0	98.0		175.0	255.0	83.0
150	A7	XLW-2700	XLW-2100		XLW-2600	XLW-1700	XLW-2700	XLW-2700		XLW-2600	XLW-1700	43.5	141.5		244.5	335.5	83.0
170	A8	XLW-2900	XLW-2000	XL-1400	XLW-1800	XLW-1800	XLW-2900	XLW-2600	XL-1400	XLW-1800	XLW-1800	43.5	141.5	244.5	309.5	374.5	83.0
185	A9	XLW-2900	XLW-2000	XL-1500	XLW-2100	XLW-2000	XLW-2900	XLW-2700	XL-1500	XLW-2100	XLW-2000	43.5	141.5	244.5	309.5	374.5	83.0
210	B1	XLW-2900	XLW-2900	XLW-1800	XLW-2700	XL-1500	XLW-2900	XLW-2900	XLW-1800	XLW-2700	XL-1500	43.5	141.5	244.5	329.5	415.5	83.0
235	B2	XLW-2900	XLW-2900	XLW-1800	XLW-2700	XL-1500	XLW-2900	XLW-2900	XLW-1800	XLW-2700	XL-1500	43.5	141.5	244.5	329.5	415.5	83.0
255	B3	XLW-2900	XLW-3000	XLW-1900	XLW-2700	XL-1500	XLW-2900	XLW-3000	XLW-1900	XLW-2700	XL-1500	43.5	141.5	244.5	329.5	415.5	83.0

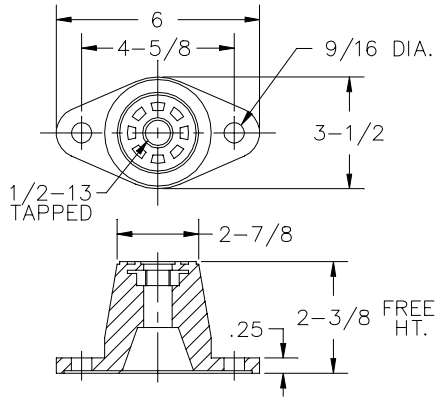


FIELD: INSTALL ISOLATORS AT THE CORRESPONDING LOAD POINTS.

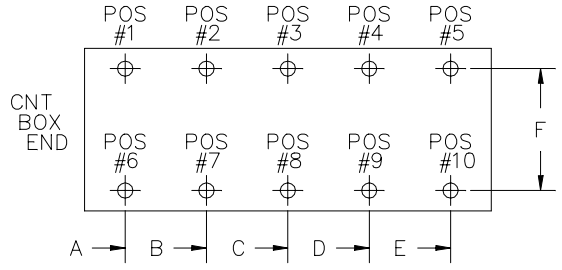
AUDX LOAD POINTS

UNIT MODEL AUDX	ISOLATOR WEIGHTS																TOTAL OPERATING WGT.(LBS.)
	DIMENSIONS–IN.						LOAD–LBS.										
	A DIM	B DIM	C DIM	D DIM	E DIM	F DIM	POS #1	POS #2	POS #3	POS #4	POS #5	POS #6	POS #7	POS #8	POS #9	POS #10	
040	20.0				84.0	80.3	764				517	1069				613	2963
050	20.0		70.0		120.0	80.3	622		641		465	755		947		535	3965
060	20.0		70.0		120.0	80.3	626		648		467	765		968		540	4014
080	16.0		98.0		175.0	83.0	869		1064		592	1118		1458		706	5807
095	16.0		98.0		183.0	83.0	1343		1290		880	1343		1290		880	7026
120	16.0	98.0		175.0	255.0	83.0	1307	1334		754	553	1307	1334		754	553	7896
150	43.5	141.5		244.5	335.5	83.0	2076	1425		924	817	2111	1926		924	817	11,020
170	43.5	141.5	244.5	309.5	374.5	83.0	2115	1458	743	654	721	2150	1959	743	654	721	11,918
185	43.5	141.5	244.5	309.5	374.5	83.0	2116	1470	743	654	721	2152	1994	743	654	721	11,968
210	43.5	141.5	244.5	329.5	415.5	83.0	2149	2152	859	889	781	2149	2152	859	889	781	13,660
235	43.5	141.5	244.5	329.5	415.5	83.0	2192	2159	859	889	781	2192	2159	859	889	781	13,760
255	43.5	141.5	244.5	329.5	415.5	83.0	2195	2206	859	889	781	2195	2206	859	889	781	13,860



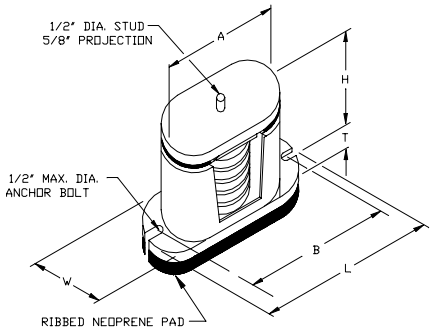


UNIT MODEL AUDX	SET ITEM	RUBBER-IN-SHEAR ISOLATOR															
		POS #1	POS #2	POS #3	POS #4	POS #5	POS #6	POS #7	POS #8	POS #9	POS #10	DIMENSION (INCHES)					
		DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	A DIM.	B DIM.	C DIM.	D DIM.	E DIM.	F DIM.
040	A1	RVD-3-B				RVD-3-B	RVD-3-C				RVD-3-B	20.0				84.0	80.3
050	A2	RVD-3-B		RVD-3-B		RVD-3-B	RVD-3-B		RVD-3-C		RVD-3-B	20.0		70.0		120.0	80.3
060	A3	RVD-3-B		RVD-3-B		RVD-3-B	RVD-3-B		RVD-3-C		RVD-3-B	20.0		70.0		120.0	80.3
080	A4	RVD-3-C		RVD-3-C		RVD-3-B	RVD-3-C		RVD-3-D		RVD-3-B	16.0		98.0		175.0	83.0
095	A5	RVD-3-D		RVD-3-D		RVD-3-C	RVD-3-D		RVD-3-D		RVD-3-C	16.0		98.0		183.0	83.0
120	A6	RVD-3-D	RVD-3-D		RVD-3-B	RVD-3-B	RVD-3-D	RVD-3-D		RVD-3-B	RVD-3-B	16.0	98.0		175.0	255.0	80.3
150	A7	RVD-3-C(2)	RVD-3-D		RVD-3-C	RVD-3-C	RVD-3-C(2)	RVD-3-C(2)		RVD-3-C	RVD-3-C	43.5	141.5		244.5	335.5	80.3
170	A8	RVD-3-C(2)	RVD-3-D	RVD-3-B	RVD-3-B	RVD-3-B	RVD-3-C(2)	RVD-3-C(2)	RVD-3-B	RVD-3-B	RVD-3-B	43.5	141.5	244.5	309.5	374.5	80.3
185	A9	RVD-3-C(2)	RVD-3-D	RVD-3-B	RVD-3-B	RVD-3-B	RVD-3-C(2)	RVD-3-C(2)	RVD-3-B	RVD-3-B	RVD-3-B	43.5	141.5	244.5	309.5	374.5	83.0
210	B1	RVD-3-C(2)	RVD-3-C(2)	RVD-3-C	RVD-3-C	RVD-3-C	RVD-3-C(2)	RVD-3-C(2)	RVD-3-C	RVD-3-C	RVD-3-C	43.5	141.5	244.5	329.5	415.5	83.0
235	B2	RVD-3-C(2)	RVD-3-C(2)	RVD-3-C	RVD-3-C	RVD-3-C	RVD-3-C(2)	RVD-3-C(2)	RVD-3-C	RVD-3-C	RVD-3-C	43.5	141.5	244.5	329.5	415.5	83.0
255	B3	RVD-3-C(2)	RVD-3-C(2)	RVD-3-C	RVD-3-C	RVD-3-C	RVD-3-C(2)	RVD-3-C(2)	RVD-3-C	RVD-3-C	RVD-3-C	43.5	141.5	244.5	329.5	415.5	83.0



NOTE:
1) WHEN TWO ISOLATORS ARE CALLED OUT IN ANY ONE POSITION, THEN THE ISOLATORS ARE MOUNTING 6 INCHES ON EITHER SIDE OF THE CORRESPONDING DIMENSION.
2) QUANTITY OF ISOLATORS IS GIVEN IN ( ) WHEN MORE THAN ONE.

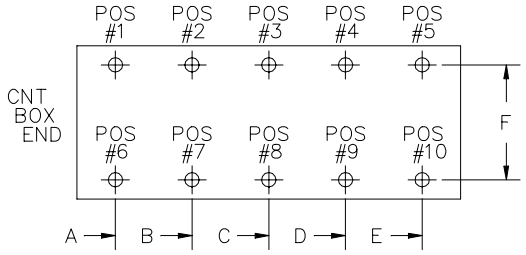
FIELD: INSTALL ISOLATORS AT THE CORRESPONDING LOAD POINTS.



DIMENSIONAL CHART							
DESC.	A	B	L	T	W	H (FREE HT.)	H (OPER. HT.)
XL	5–1/8	6–3/8	8	5/8	2–3/4	5–7/8	5–1/4
XLW	6–7/8	8–1/2	10	5/8	3–7/8	5–7/8	5–1/4

NOTE: TOP PLATE & LOWER HOUSING – CAST ALUMINUM

UNIT MODEL AUDX	SET ITEM	SPRING ISOLATOR															
		POS #1	POS #2	POS #3	POS #4	POS #5	POS #6	POS #7	POS #8	POS #9	POS #10	DIMENSIONS (INCHES)					
		DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	DESC.	A DIM.	B DIM.	C DIM.	D DIM.	E DIM.	F DIM.
040	A1	XL–1000				XL–700	XL–1300				XL–800	20.0				84.0	80.3
050	A2	XL–800		XL–800		XL–600	XL–1000		XL–1200		XL–700	20.0		70.0		120.0	80.3
060	A3	XL–800		XL–800		XL–600	XL–1000		XL–1200		XL–700	20.0		70.0		120.0	80.3
080	A4	XL–1100		XL–1300		XL–700	XL–1400		XLW–1800		XL–900	16.0		98.0		175.0	83.0
095	A5	XLW–1700		XLW–1600		XL–1100	XLW–1700		XLW–1600		XL–1100	16.0		98.0		183.0	83.0
120	A6	XLW–1600	XLW–1700		XL–1000	XL–700	XLW–1600	XLW–1700		XL–1000	XL–700	16.0	98.0		175.0	255.0	83.0
150	A7	XLW–2600	XLW–1800		XL–1200	XL–1000	XLW–2600	XLW–2400		XL–1200	XL–1000	43.5	141.5		244.5	335.5	83.0
170	A8	XLW–2600	XLW–1800	XL–900	XL–800	XL–900	XLW–2600	XLW–2400	XL–900	XL–800	XL–900	43.5	141.5	244.5	309.5	374.5	83.0
185	A9	XLW–2600	XLW–1800	XL–900	XL–800	XL–900	XLW–2600	XLW–2400	XL–900	XL–800	XL–900	43.5	141.5	244.5	309.5	374.5	83.0
210	B1	XLW–2700	XLW–2700	XL–1100	XL–1100	XL–1000	XLW–2700	XLW–2700	XL–1100	XL–1100	XL–1000	43.5	141.5	244.5	329.5	415.5	83.0
235	B2	XLW–2700	XLW–2700	XL–1100	XL–1100	XL–1000	XLW–2700	XLW–2700	XL–1100	XL–1100	XL–1000	43.5	141.5	244.5	329.5	415.5	83.0
255	B3	XLW–2700	XLW–2700	XL–1100	XL–1100	XL–1000	XLW–2700	XLW–2700	XL–1100	XL–1100	XL–1000	43.5	141.5	244.5	329.5	415.5	83.0



FIELD: INSTALL ISOLATORS AT THE CORRESPONDING LOAD POINTS.

TROUBLESHOOTING GUIDE

POSSIBLE CAUSE	REMEDY
CHILLER UNIT WILL NOT START	
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	4. Tighten all terminals
5. Control circuit open	5. Check phase loss monitor, flow switch, circuit breakers, temperature control, low ambient thermostat, low temperature, thermostat, remote switch, etc.
6. Time delay	6. Wait
COMPRESSOR HUMS BUT DOES NOT START	
1. Low Voltage	1a. Check at service and unit for loss b. Consult power company
COMPRESSOR CUTS OUT ON LOW PRESSURE SAFETY CONTROL	
1. Refrigerant shortage	1. Check for leaks -- add refrigerant
2. Restriction in liquid line	2a. Plugged strainer -- clean or replace b. Liquid line valve partially closed -- open valves fully c. Expansion valve clogged or inoperative -- clean or replace as required d. Solenoid valve partially open -- clean or replace as required
3. Low water flow thru cooler	3. Check water flow thru cooler and correct as required
COMPRESSOR CYCLES ON HIGH PRESSURE CONTROL	
1. Compressor discharge valve partially closed	1. Open valve fully
2. Non-condensible gases in system	2. Operate condenser fans with compressors off. If condenser pressure exceeds saturated pressure corresponding to condenser entering air temperature, then reclaim air from the top of hot gas header on the vertical header coil.
3. Overcharge of R-22	3. Reclaim refrigerant from system while in operation until head pressure reaches a normal level.
4. Dirty condenser	4. Clean the condenser
5. Compressor discharge check valve not operating properly	5. Replace if necessary
6. Fans not running	6. Check pressure control setting

CAUSES AND PREVENTION OF FREEZE-UP

CAUSES	PREVENTION
1. Improper charging	1. Charge per manufacturer's recommendation
2. Improperly set safety time delay	2. Check the safety time delay low pressure control for proper setting at the beginning of each season.
3. Improper chilled water circulation	3. Use an ample sized cleanable strainer in the chilled water circuit. Make certain 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.
4. Not draining for winter shutdown	4. When the system is shut down for the winter, remove the drain plugs and drain the cooler. Blow out any remaining water with air.
5. Improper pump shutdown	5. Make sure chiller barrel heater is working and flow switch is installed per wiring diagrams.
6. Low ambient during air conditioning season	6. Make sure chiller barrel heater is working.

NOTE:
If the ambient temperature is below 32EF, freezing can be completely prevented by one of two methods:
1. Drain all water from the equipment.
2. Add antifreeze to the water.

START-UP CHECK LIST Date _____

		YES	NO
Unit Model No.	_____		
Setting Unit:	a. Vibration isolator used	_____	_____
	b. Spring isolator adjusted for equal height	_____	_____
	c. If rubber-in-shear isolators are used, is unit leveled by shimming	_____	_____
Wiring:	a. Power wiring complete	_____	_____
	b. Control wiring complete	_____	_____
	c. Separate chiller heater wiring complete		
	d. Electric service adequate for load	_____	_____
	e. Power source voltage correct for motor(s) used	_____	_____
	f. Motor circuit has proper size fusetrons	_____	_____
	g. System wired per diagram	_____	_____
	h. All lead connections tight	_____	_____
	i. Wiring complies with local codes	_____	_____
	j. Flow switch operation	_____	_____
Piping:	a. Piping complies with applicable codes	_____	_____
	b. External piping independently supported	_____	_____
	c. Chilled water lines insulated	_____	_____
Before Start-Up:			
	a. Open compressor discharge service valve (if supplied)	_____	_____
	b. Open liquid valve(s)	_____	_____
	c. Open suction, and discharge valves to pressure gauges (if supplied)	_____	_____
	d. Check rotation of all fan motors	_____	_____
	e. Start auxiliary equipment (pumps, fans, etc.)	_____	_____
	f. Is crankcase heater operating? **Operate 24 hours prior to unit start-up.**	_____	_____
	g. Check the compressor oil level through the crankcase sight glass. The oil level should be 1/2 of the glass. If the level is low, add oil in accordance with the directions in the maintenance instructions	_____	_____
	h. Check all control settings as specified on unit wiring diagram	_____	_____
	i. Air purged from chilled water system	_____	_____
After Start-up:	a. Check high pressure control	_____	_____
	b. Check oil temperature safety switch	_____	_____
	c. Check and adjust low temperature freeze control	_____	_____
	d. Check and adjust unit controller	_____	_____
	e. Check and adjust low pressure control	_____	_____
	f. Check and adjust expansion valve superheat	_____	_____

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