

Air Cooled Rotary Screw **Flooded** Chillers

203 through 522 Tons

60Hz



DUNHAM-BUSH®

Products That Perform...By People Who Care

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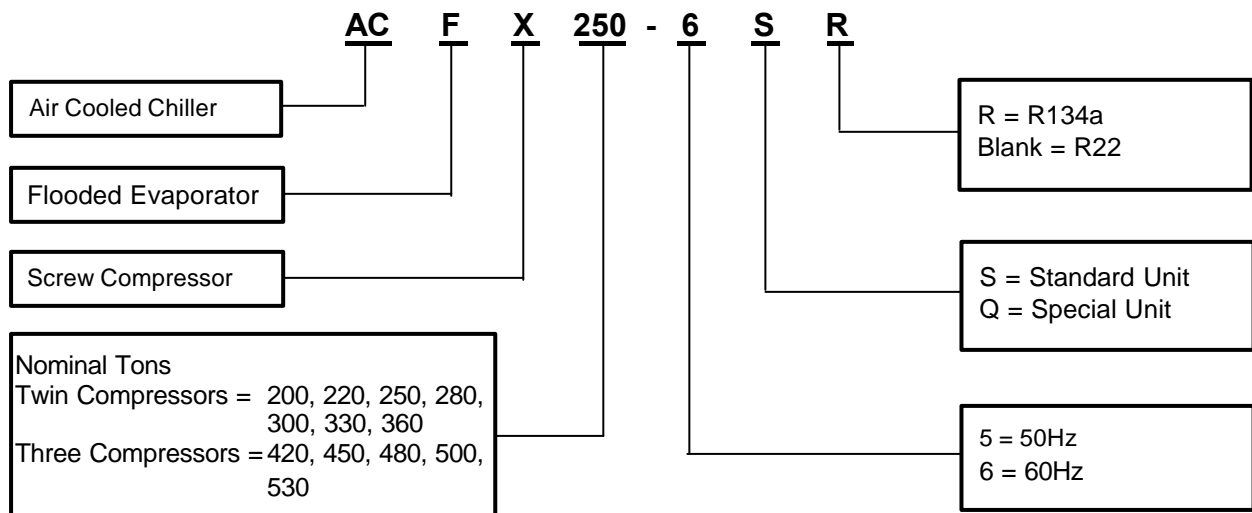
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INTRODUCTION

The **Dunham-Bush name** is synonymous worldwide with the **Rotary Screw Compressor Chiller technology**; with over 35 years of proven experience and track record in the manufacture and installation of Rotary Screw Compressors and chillers. There is no doubt that many of our major competitors who initially specialized in the manufacturing of high maintenance cost centrifugal compressor chillers are now producing Rotary Screw Chillers. Today, thousands of Dunham-Bush Rotary Screw Compressor chillers have clocked more than **100,000 operating hours without any compressor tear-out or overhaul!**

As a pioneer and industry leader in the Rotary Screw compressor technology for refrigeration systems, Dunham-Bush now introduces the **Air Cooled Rotary Screw Flooded Chillers** with unsurpassed performance and reliability.

NOMENCLATURE



ADVANTAGES OF FLOODED CHILLER

In a flooded cooler the refrigerant surrounds the tubes in the shell and the water to be cooled flows through the tubes. The level of liquid refrigerant in the shell is maintained by the combined action of an electronic level controller and a mod-motor actuated ball valve which modulates the subcooled liquid refrigerant into the cooler. This ensures that all the cooler tubes are completely immersed in the liquid refrigerant for better heat transfer efficiency.

For a Direct Expansion (DX) cooler the refrigerant is expanded into the tubes while the chilled water is circulated through the shell. Thermostatic expansion valve is used to throttle the refrigerant in maintaining constant superheat of suction gas to the compressor.

The following are the advantages of using flooded chiller:

1. Higher Capacity and Higher EER Achievable with the Same Compressor

The flooded cooler with all the copper tubes immersed in the “boiling” liquid refrigerant enables a small approach temperature between the “boiling” liquid refrigerant temperature in the shell and the outlet chilled water temperature in the cooler tubes to be achieved. This approach temperature or temperature difference between the evaporating temperature of the boiling liquid refrigerant and the chilled water outlet temperature, for a flooded cooler, is typically less than 3°F.

On the contrary, for a DX or Direct Expansion Cooler, the typical approach temperature is between 8°F to 10°F. This simply means that the same compressor in a flooded cooler system will operate at a higher saturated evaporating temperature when compared to the same compressor in a DX-Cooler system, when outlet chilled water temperatures in both cases are set at the same temperature.

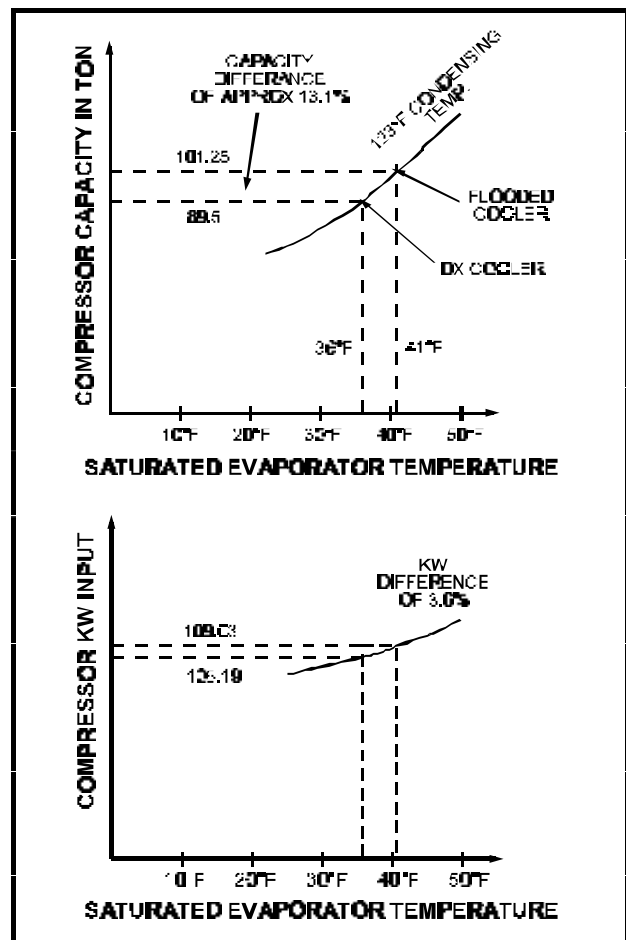
Figure 1 shows the typical Dunham-Bush screw compressor capacity performance curve at a particular condensing temperature over saturated evaporating temperature of between 30°F to 50°F, and the typical power input curve over the same conditions. It can be noted that the same compressor when operating with a flooded cooler will generate approximately 13.1% more cooling capacity while kw input increases negligibly by less than 3.6%. Therefore, the same compressor when coupled to a flooded cooler will typically achieved

higher cooling capacity performance with correspondingly higher Energy Efficiency Ratio (EER) i.e. (Btu/watt) or lower kw/Ton.

A DX cooler uses TXV throttling to maintain about 10 to 15°F suction superheat to prevent liquid flood back to the compressor. In a flooded cooler, the refrigerant boils off in the shell and gas can be sucked out from the top of cooler back to compressor. The suction superheat is usually about 3 to 5°F. Reduction in suction superheat will further increase the capacity performance of the compressor.

DX coolers are typically designed with higher tube velocities to ensure proper oil return to compressor both at full load and at reduced load. This will contribute to higher refrigerant pressure drop through the cooler. On the contrary, there is very little shell side pressure losses for a flooded cooler. Therefore, lower suction pressure drop in the flooded design will impose less capacity penalty on the compressor and this will further enable the compressor in a flooded cooler to generate more capacity than one with a DX Cooler.

FIGURE 1



ADVANTAGES OF FLOODED CHILLER

2. Better Part Load Performance

The Dunham-Bush Air Cooled Flooded Chiller with its sophisticated microcomputer control and patented oil management system has all cooler tubes completely immersed in the "boiling" liquid refrigerant to achieve superior heat transfer efficiency while ensuring adequate oil return to the compressor(s). This ensures superior full-load efficiency and even better part-load efficiency as the full heat transfer surface areas of the cooler tubes are utilized even at part-load conditions. On the contrary, in the Direct Expansion Cooler, because of the need to maintain adequate refrigerant gas velocities in the cooler tubes for proper oil return, it is typical for certain bundle of cooler tubes to be "blocked" or "baffled off" at part-load conditions. Thus not utilizing the full heat transfer surface areas of the cooler tubes and therefore have a lower efficiency when compared with a flooded cooler chiller at part-load conditions.

3. Flash Economizer/ Vapor Injection Cycle for Increase Capacity and Higher EER

The renowned Dunham-Bush vertical screw compressor allows for **flash economizer vapor injection cycle** to be incorporated, **increasing** capacity by as much as **25% with marginal 10% to 15% increase in kw-input**. Most of Dunham-Bush's competitors who produce Rotary Screw Chillers do not incorporate flash-economizer vapor injection cycle – not to mention flooded cooler!

4. Excellent Capacity Modulation in Response to Building Loads

Dunham-Bush utilizes its state-of-the-art NC25-4 microcomputer controller in combination with the electronic level controller and mod-motor actuated ball valve to ensure instantaneous and precise feeding of liquid refrigerant to the flooded cooler in response to changes in building demand; and maintains precise ($\pm 1/2^\circ\text{F}$) preset outlet chilled water temperatures even at very low load conditions; whereas most of Dunham-Bush's competitors, in screw chillers, still utilizes the conventional "centrifugal chiller" method of using orifice plates to modulate refrigerant feed to the cooler; and as such their machines do not

function efficiently at low-load conditions and can encounter oil return problem!

5. Maximum Reliability and Redundancy

Today, the Dunham-Bush vertical screw compressors are increasingly accepted for its reliability. For the two compressors and four compressors models, each individual compressor is provided with suction stop valve, suction check valve, discharge check valve and other isolating valves in the oil management system to allow complete isolation in the unlikely event of a faulty compressor without contaminating the refrigerant system and further allows other compressors to continue to operate - thus ensuring maximum redundancy

6. Cleanable Cooler

For a single pass cooler, the end plates at both ends of the water boxes (2 pass only at return end) can be removed easily without dismantling the chilled water piping connections, for inspection and for mechanical tubes cleaning with brushes or auto-brush. This will enable low tube fouling factor in the cooler to be ensured, thus maintaining system efficiency.

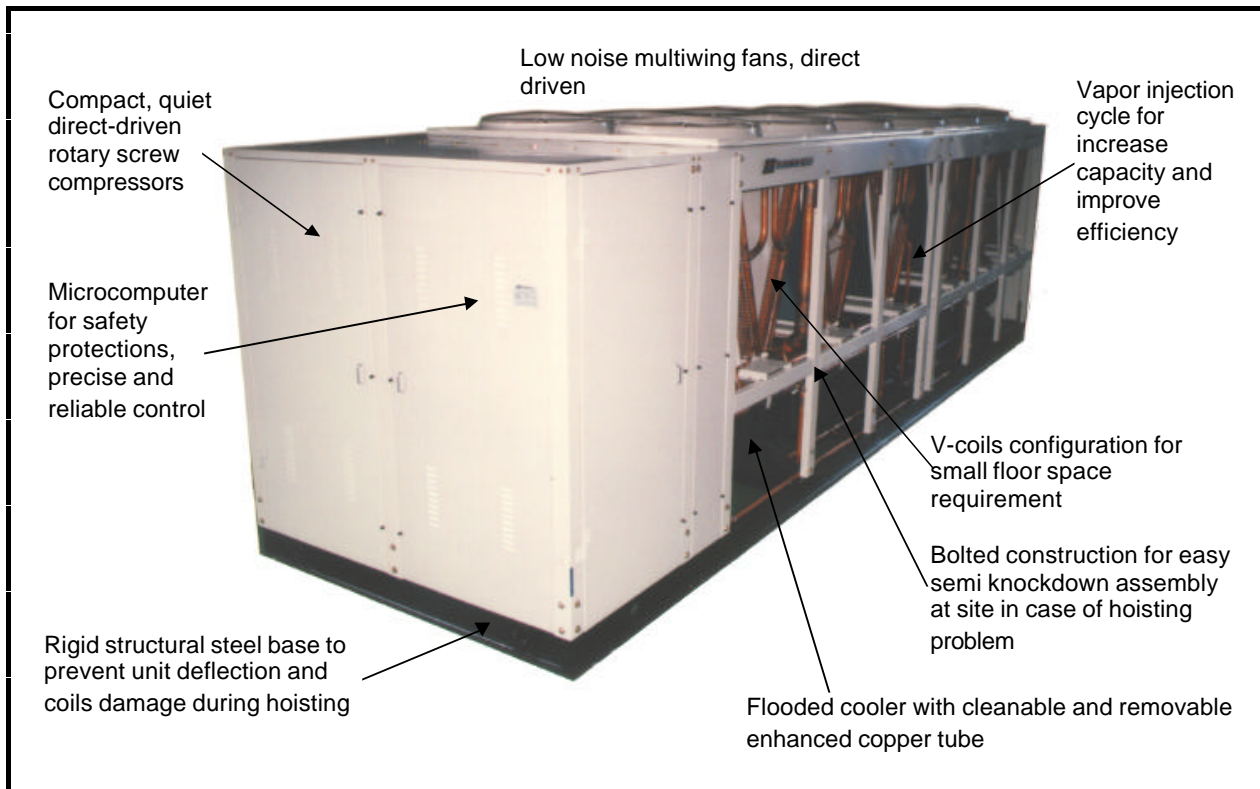
7. Lower Water Side Pressure Drop

In a DX cooler, the water flows transversely over the outside of the tubes. The water flow is guided with vertical baffles. This will have a higher-pressure drop as compared with the water flow in the tubes of a flooded cooler. In other words, the equivalent flooded chiller will require smaller water pump to operate at lower power consumption.

8. Commonly Used In Large Tonnage Chillers Where Efficiency Is Critical

As a general rule, DX-cooler are typically used in small and medium tonnage chillers where efficiency is not important and the low initial cost is the main consideration! However, with increasing energy cost and the drive to reduce **global warming, flooded cooler chillers will increasingly become more popular not only in the large tonnage but also in the small and medium tonnage chillers. Dunham-Bush, again, leads the industry in this respect!**

COMPONENTS



STANDARD FEATURES

Size / Range

- ✿ 12 models from 203 to 522 tons at ARI standard conditions.
- ✿ Multiple compressor units provide redundancy, and superior part load efficiency.

Compressor(s)

- ✿ Quiet, reliable MSC Vertical Rotary Screw Compressors with integral oil separator.
- ✿ Compartmentalized to reduce noise breakout.
- ✿ Multiple rotary screw compressors designed for better reliability and redundancy.
- ✿ Welded hermetic design with no requirement for internal parts service, no periodic compressor tear down and overhaul, and eliminates casing leakages.
- ✿ Consistent loading and unloading with dependable slide valve mechanism.
- ✿ No external oil pump required.
- ✿ Double-delta motor winding with 1/3 lock-rotor amps at start-up. Faulty or damaged

compressors reworkable at minimal cost at various Dunham-Bush's authorized compressors rework facilities.

- ✿ Vapor injection cycle to increase capacity and improve efficiency.

Evaporator

- ✿ One pass for 2 and 4 compressors and 2 pass for 3 compressors units.
- ✿ Cleanable and removable integral fin copper tubes for easy serviceability.
- ✿ For a wide variety of applications.
- ✿ Removable water heads for service.
- ✿ Flange water connections for quick installation and/ or service.
- ✿ Built according to ASME code.
- ✿ JKKP approved.
- ✿ Relief valve(s) standard – 3/4" FPT.
- ✿ Full pump-down capacity in condenser, therefore, pump out unit not required.

STANDARD FEATURES

Microcomputer/Factory Packaged Power Panel

- ✦ Proactive microcomputer controller adapts to any abnormal operating conditions and safety protections.
- ✦ Tolerant and accommodating of extreme conditions at start-up.
- ✦ Capable of controlling multiple chillers, pumps, etc.
- ✦ Circuit breaker on each multiple compressors unit.
- ✦ Unit mounted step-start contactors and delay for reduced inrush starting current.
- ✦ Current and voltage transformers.
- ✦ Under and voltage phase protection relay.

- ✦ Indicator lights for compressor overloads, micro alarm, control power, compressor control circuit, etc.

Condenser Coil/ Fans

- ✦ Constructed with seamless inner-grooved copper tubes expanded into die-formed aluminum fins in staggered configuration. Leak and pressure tested to 450 psig.
- ✦ High efficiency low-noise multi-wings condenser fan.
- ✦ "V" coil design to increase condensing surface area.
- ✦ "V" coil with internal baffle for fan cycling and fan staging.

UNIT FEATURES

Microcomputer Control

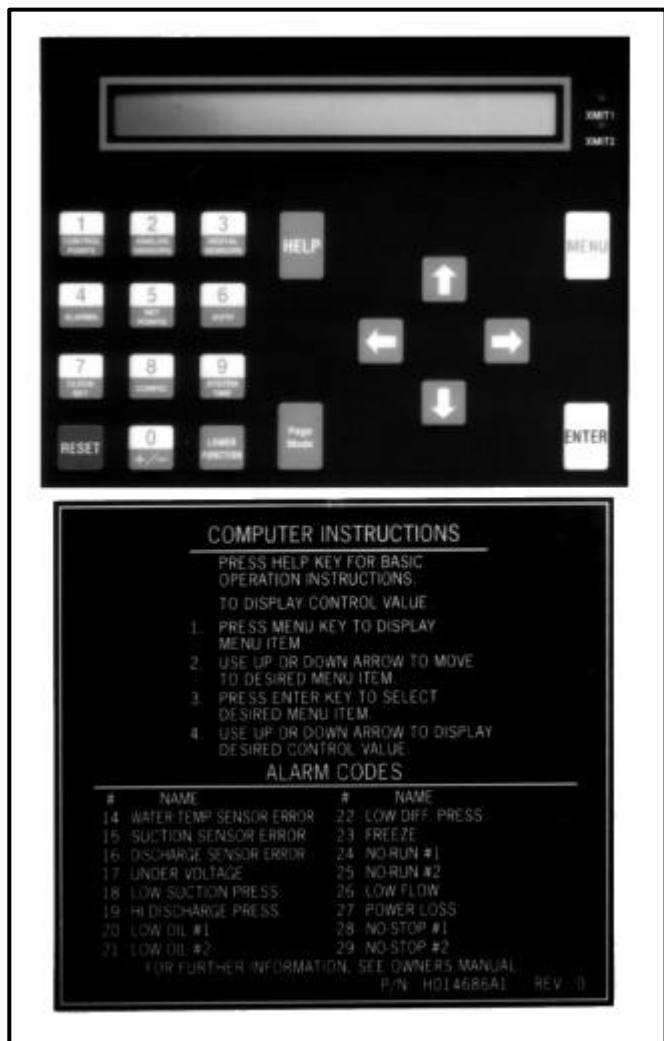
Advanced Microcomputer control is a standard feature for all Dunham-Bush rotary screw air cooled chillers monitoring analog and digital inputs to achieve precise control of the major operational and protective functions of the unit.

Direct Digital Control (DDC) allows fingertip user interaction. Its simple-to-use push button keyboard and menu-driven software provide access to operating conditions, control setpoints and alarm history clearly displayed on a prominent multi-line 80 character alphanumeric display.

An easy-to-install, inexpensive modem option allows remote reading of operating parameter updates. The Dunham-Bush microcomputer insures its owner state-of-the-art efficiency and reliability.

Display Information

The 80 character alphanumeric liquid crystal display utilizes easy to understand menu-driven software. Inexperienced operators can quickly work through these menus to obtain the information they require or to modify control parameters. More experienced operators can bypass the menu systems, if desired, and move directly to their requested control function. At all times, assistance is available to the operator by simply pressing the help key. Easily accessible measurements include:



UNIT FEATURES

- ✿ Leaving chilled water temperature.
- ✿ Evaporator pressure.
- ✿ Condenser pressure.
- ✿ System voltage.
- ✿ Compressor amp draw of each compressor.
- ✿ Compressor elapsed run time of each compressor.
- ✿ Number of compressor starts.
- ✿ Compressor contactor status.
- ✿ Optical oil float switch status.
- ✿ Water temperature reset value.
- ✿ Water flow switch status.
- ✿ External start/ stop command status.

Optional entering chilled water temperature is available. With this option the operator can quickly and accurately read all significant water temperatures and eliminate the need for often-inaccurate thermometers.

Capacity Control

Leaving chilled water temperature control is accomplished by entering the water temperature setpoint and placing the microcomputer in automatic control. The unit will monitor all control functions and move the slide valve to the required operating position. The compressor ramp (loading) cycle is programmable and may be set for specific building requirements. Remote adjustment of the leaving chilled water setpoint is accomplished through either direct connection of other DB control packages to the microcomputer through either the RS485 long distance differential communications port, via terminal or modem connected to the RS232 communication port, or from an external Building Automation System supplying a simple 0 to 5VDC signal. Remote reset of compressor current limit may be accomplished in a similar fashion.

System Control

The unit may be started or stopped manually, or through the use of an external signal from a Building Automation System. In addition, the microcomputer may be programmed with seven-

day operating cycle or other DB control packages may start and stop the system through inter-connecting wiring.

System Protection

The following system protection controls will automatically act to insure system reliability:

- ✿ Low suction pressure
- ✿ High discharge pressure
- ✿ High oil temperature
- ✿ Freeze protection
- ✿ Low differential pressure
- ✿ Low oil level
- ✿ Compressor run error
- ✿ Power loss
- ✿ Chilled water flow loss
- ✿ Sensor error
- ✿ Compressor over current
- ✿ Anti-recycle

The microcomputer will retain the latest eight alarm conditions complete with time of failure in an alarm history. This tool will aid service technicians in troubleshooting tasks enabling downtime and nuisance trip-outs to be minimized.

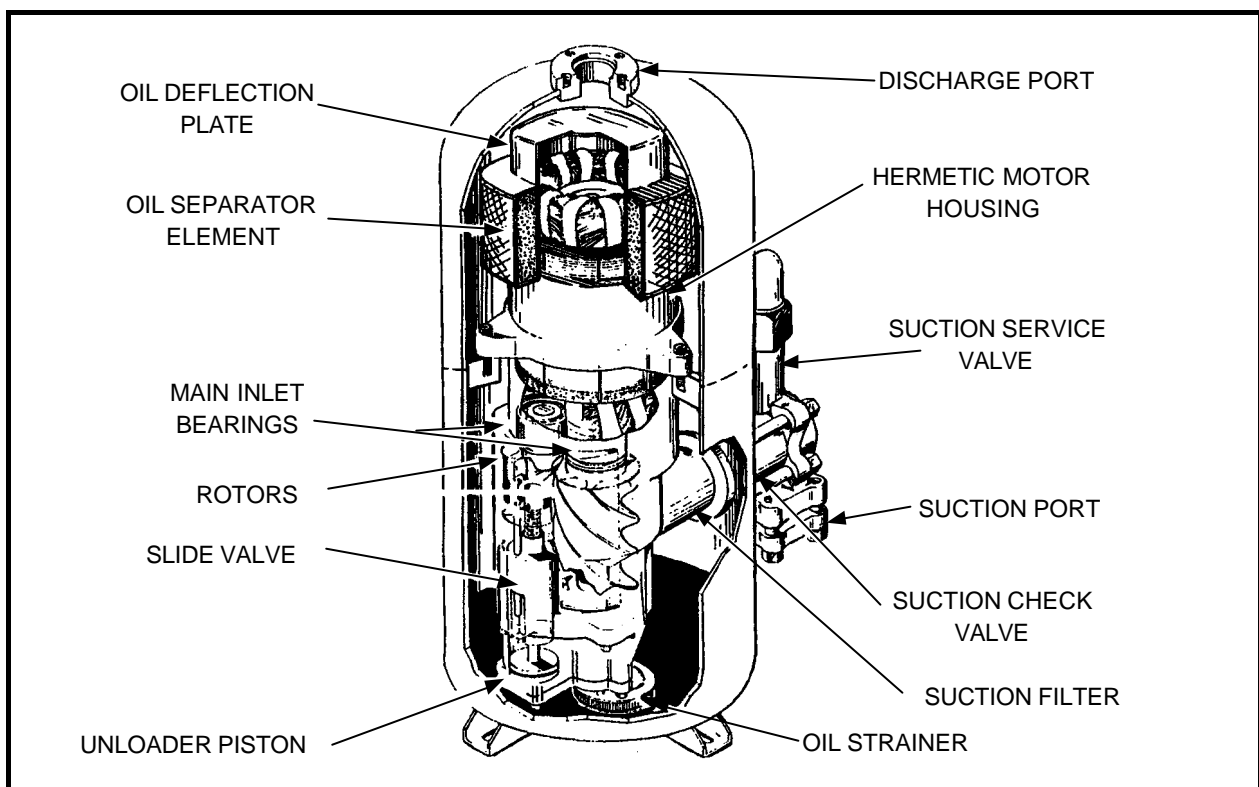
Remote Monitoring

The microcomputer is complete with an RS232 communications port and all hardware or software necessary to be remotely monitored and controlled from a simple terminal and optional phone modem. This valuable enhancement to the refrigeration system allows the ultimate in serviceability. The microcomputer as standard is additionally equipped with history files which may be used to take logs which may be retrieved via the phone modem periodically. Now owners of multiple buildings have a simple and inexpensive method of investigating potential problems quickly and in a highly cost effective manner. Dunham-Bush has an open protocol on its microcomputer to allow direct interface with Building Management Systems.

UNIT FEATURES

The Revolutionary Dunham-Bush Vertical Screw Compressor

Dunham-Bush introduced the revolutionary Vertical Screw Compressors in the early 1970's. Since then, the compressor has undergone several design changes to improve efficiency, and reliability! Today, The Dunham-Bush vertical screw compressor is not only the most efficient and reliable screw compressor in its capacity range; but it is the most completely "packaged" rotary Screw Compressor for use in flooded chillers! The Dunham-Bush vertical screw compressor and motor assembly is completely housed in an integral oil separator heavy-duty steel casing -- therefore eliminating the need for an external oil separator and its associated piping connections. The compressor does not require an external oil pump as it lubricates the bearing and rotors by use of the pressure differential between the discharge and suction cavities of the compressor. Thus, there is also no need for an external compressor oil cooler and its associated piping connections. The compressor is completely sealed to prevent leakage and there is no need to service the few internal moving parts of the compressor.



Compressor Assembly

The Dunham-Bush rotary screw compressor is a positive displacement helical-axial design for use with high-pressure refrigerants.

- ✿ The compressor consists of two intermeshing helical grooved rotors, a female drive rotor and a male driven rotor, in a stationary housing with suction and discharge gas ports.
- ✿ Uniform gas flow, even torque and positive displacement, all provided by pure rotary motion contributes to vibration-free operation over a wide range of operating conditions. Intake and discharge cycles overlap, effectively producing a smooth, continuous flow of gas.
- ✿ No oil pump is required for lubrication or sealing purposes. Oil is distributed throughout the

compressor by the pressure differential between the suction and the discharge cavities.

Simplified Capacity Control

The slide valve mechanism for capacity modulation and part load operation is an outstanding feature:

- ✿ The moving parts are simple, rugged and trouble-free. The slide mechanism is hydraulically actuated.
- ✿ Package capacity reduction can be down to as low as 10% without HGBP by progressive movement of slide valves away from their stops.
- ✿ Capacity reduction is programmed by an exclusive electronically initiated, hydraulically actuated control arrangement.

UNIT FEATURES

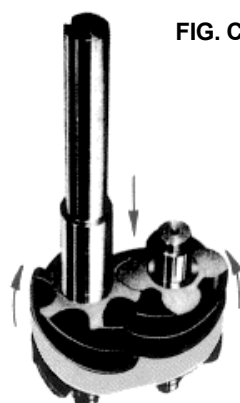
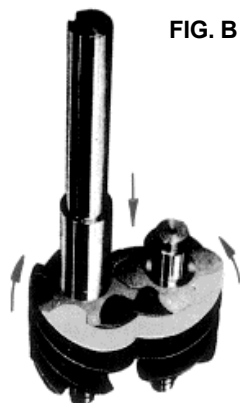
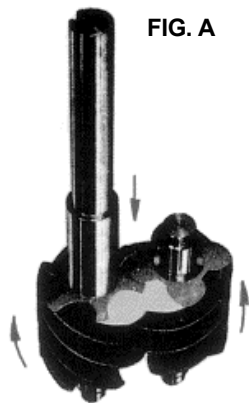
Positive Displacement Direct Connected

The compressor is directly connected to the motor without any complicated gear systems to speed up the compressor and thus detract from the overall unit reliability.

Oil Separation

Each compressor is provided with an integral oil separator/impingement plate located below the discharge gas port.

- ✿ The separator is a multi-layered mesh element which effectively separates oil from the gas stream.
- ✿ The oil drains into the sump and the discharge gas passes around the deflection plate. An oil drain valve is located near the bottom of the oil sump.



Compressor Operation

Note: For clarity reasons, the following account of the compressor operation will be limited to one lobe on the male rotor and one interlobe space of the female rotor. In actual operation, as the rotors revolve, all of the male lobes and female interlobe spaces interact similarly with resulting uniform, non-pulsating gas flow.

Suction Phase

As a lobe of the male rotor begins to unmesh from an interlobe space in the female rotor, a void is created and gas is drawn in tangentially through the inlet port-- Fig. A. --as the rotors continue to turn the interlobe space increases in size-- Fig. B. --and gas flows continuously into the compressor. Just prior to the point at which the interlobe space leaves the inlet port, the entire length of the interlobe space is completely filled with drawn in gas -- Fig. C.

Main Bearings

Each rotor is fitted with a set of anti-friction tapered roller bearings. They carry both radial and thrust loads.

Rotors

The latest asymmetrical rotor profiles of patented Dunham-Bush design assure operation at highest efficiencies. Rotors are precision machined from AISI 1141 bar stock and case hardened.

Castings

All housings are manufactured of high grade and low porosity, cast iron.

Warranty

The entire compressor(s) is covered by a 2-years part warranty as standard when started up and maintained by Dunham-Bush Service.

Compression Phase

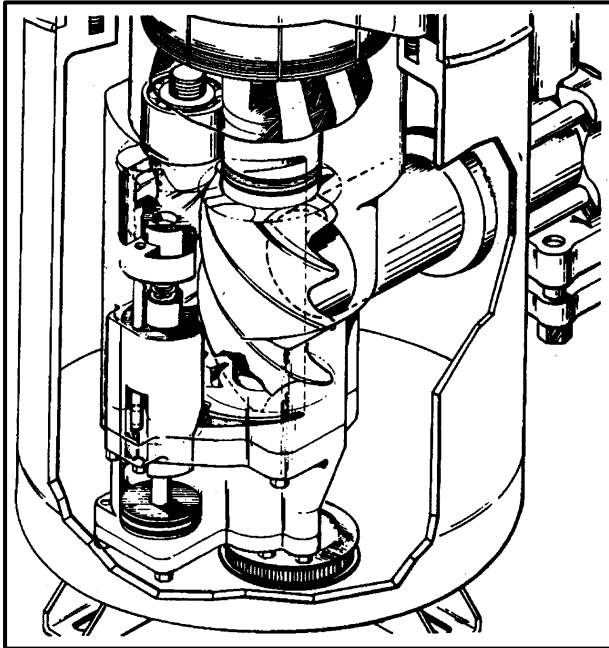
As rotation continues, the gas in the interlobe space is carried circumferentially around the compressor housing. Further rotation meshes a male lobe with the interlobe space on the suction end and squeezes (compresses) the gas in the direction of the discharge port. Thus the occupied volume of the trapped gas within the interlobe space is decreased and the gas pressure consequently increased.

Discharge Phase

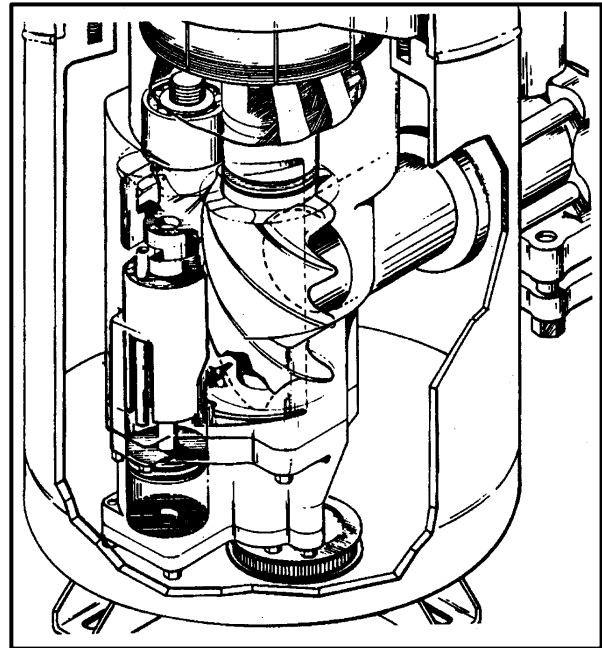
At a point determined by the designed "built-in" compression ratio, the discharge port is covered and the compressed gas is discharged by further meshing of the lobe and interlobe space--Fig D. While the meshing point of a pair of lobes is moving axially, the next charge is being drawn into the unmeshed portion and the working phases of the compressor cycle are repeated.

UNIT FEATURES

Compressor Fully Unloaded



Compressor Fully Loaded



Slide Valve Control

Movement of the slide valve is programmed by an exclusive Dunham-Bush electrically initiated (by variations in leaving chilled water temperature) hydraulically actuated control arrangement. When the compressor is fully loaded, the slide valve is in the closed position. Unloading starts when the slide valve is moved back away from the valve stop. Movement of the valve creates an opening in the side of the rotor housing.

Suction gas can then pass back from the rotor housing to the inlet port area before it has been compressed. Since no significant work has been done on this return gas, no appreciable power losses are incurred. Reduced compressor capacity is obtained from the gas remaining in the rotors which is compressed in the ordinary manner. Enlarging the opening in the rotor housing effectively reduces compressor displacement.

Refrigerating Cycle

Dunham-Bush rotary screw air-cooled chillers are designed for efficiency and reliability. The rotary screw compressor is a positive displacement, variable capacity compressor that will allow operation over a wide variety of conditions.

Even at high head and low capacity, a difficult condition for centrifugal compressors, the rotary screw performs easily. **It is impossible for this positive displacement compressor to surge.**

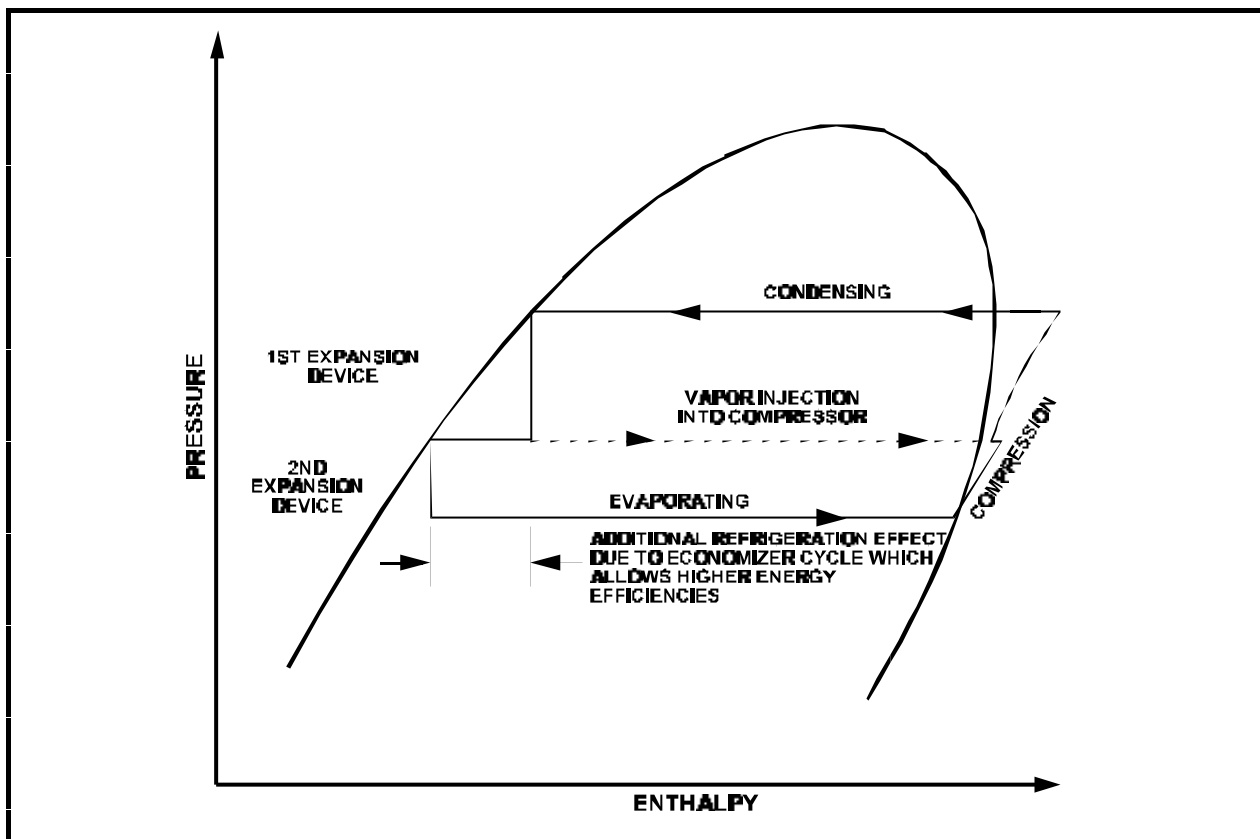
The refrigerant management system, however, is very similar to centrifugal water chillers and is shown in the refrigerant cycle diagram below.

Liquid refrigerant enters the flooded evaporator uniformly where it absorbs heat from water flowing through the evaporator tubes. The vaporized refrigerant is then drawn into the suction port of the compressor where the positive displacement compression begins.

This partially compressed gas is then joined by additional gas from the flash economizer as the rotors rotate past the vapor injection port at an intermediate pressure. Compressed gaseous refrigerant is then discharged into the integral oil separator where oil, which is contained in the refrigerant vapor, is removed and returned to the oil sump.

Fully compressed and superheated refrigerant is then discharged into the condenser, where air is being drawn through the condenser tube by the propeller fan cools and condenses the refrigerant. Liquid refrigerant then passes through the first expansion device and into the flash economizer where flash gas and liquid refrigerant are separated.

UNIT FEATURES



The gaseous refrigerant is then drawn out of the flash economizer and into the vapor injection port of the compressor. The remaining liquid refrigerant then passes through a second expansion device which reduces refrigerant pressure to evaporator levels where it is then distributed evenly into the evaporator.

By removing the flash gas from the flash economizer at an intermediate pressure, the enthalpy of the refrigerant flowing into the evaporator is reduced which increases the refrigeration effect and improves the efficiency of the refrigeration cycle.

Refrigerant flow into and out of the flash economizer is controlled by modulating valves which eliminate the energy wasting hot gas bypass effect inherent with fixed orifices.

Part-Load Performance

Through the use of flash economizer modulating flow control and multiple compressors, Dunham-

Bush rotary screw air-cooled chillers have best part-load performance characteristics in the industry.

In most cases, actual building system loads are significantly less than full load design conditions, therefore chillers operate at part load most of the time.

Dunham-Bush rotary screw air-cooled chillers combine the efficient operation of multiple rotary screw compressors with an economizer cycle and microprocessor control to yield the best total energy efficiency and significant operating saving under any load.

When specifying air conditioning equipment, it is important to consider the system load characteristics for the building application. In a typical city, the air conditioning load will vary according to changes in the ambient temperature. Weather data compiled over many years will predict the number of hours that equipment will operate at various load percentages.

OPERATING BENEFITS

Efficiency and Reliability

COMPRESSOR EXPERIENCE

- ✿ Over 35 years of rotary screw experience and dedicated technological advancements.
- ✿ Simply designed for high reliability with only two rotating parts. No gears to fail.
- ✿ Two year warranty on entire compressor at no extra costs.
- ✿ Insured continuous oil flow to each compressor through integral high efficiency oil separation for each compressor.
- ✿ Chillers use multiple rotary screw compressors for fail-safe reliability and redundancy.

ENERGY EFFICIENCY

- ✿ Designed to provide the greatest amount of cooling for the least kilowatt input over the entire operating range of your building.
- ✿ Delivers outstanding efficiency and total energy savings through the utilization of economizer cycle and microcomputer-controlled staging producing greater capacity with fewer compressors.
- ✿ Maximized performance through computer-matched components and multiple compressors on a single refrigerant circuit.
- ✿ High efficiency oil recovery system guarantees removal of oil carried over in the refrigerant and maintains the heat exchangers at their maximum efficiency at both full and part load.

INSTALLATION EASE

- ✿ Dramatic payback in reduced maintenance and overhaul costs both in down time and in labor expenditures.
- ✿ Ease of troubleshooting through microprocessor retention of monitored functions.
- ✿ Factory run tested.

SAFETY CODE

- ✿ ASME Boiler and Pressure Vessel Code, Section VIII Division 1 "Unfired Pressure Vessels".
- ✿ JKPP Code.
- ✿ ASME Standard B31.5 Refrigeration Piping.
- ✿ ASHRAE Standard 15 Safety Code for Mechanical Refrigeration.
- ✿ IEEE.
- ✿ Safety quality license for import boiler and pressure vessel, China.
- ✿ UL 508 / ETL Listed.

REFRIGERANT COMPATIBILITY

- ✿ Designed to operate with environmentally safe and economically smart HCFC-22 with proven efficiency and reliability.
- ✿ Consult Factory for use of other HFC refrigerants.

CONTROL FLEXIBILITY

- ✿ Microcomputer-based with DDC (direct digital control) features precise push button control over every aspect of operation with built-in standard features that allow extra energy savings on start-up and throughout the life of your equipment.
- ✿ Insured uniform compressor loading and optimal energy efficiency through microcomputer controls which utilize pressure transducers to measure evaporator and condenser pressure.
- ✿ Lower energy costs resulting from automatic load monitoring and increased accuracy and efficiency in compressor staging.
- ✿ Monitor your chiller's key functions from a remote location with a simple, low cost, phone modem option.
- ✿ Proactive control by microcomputer that anticipates problems and takes corrective action before they occur. Controls will unload compressor(s) if head or suction pressure approach limits. This will enable unit to stay on the line while warning operator of potential problems.

TYPICAL SEQUENCE OF OPERATION

The Dunham-Bush rotary screw air-cooled water chiller depends mainly on its on-board microcomputer for control. Operation described is for a two-compressor units and is very similar for single, three or four-compressor units.

For initial start-up, the following conditions must be met:

- ✿ Power supply to unit energized.
- ✿ Unit circuit breakers in the "on" position.
- ✿ Control power switch on for at least 15 minutes. Compressor switches on.
- ✿ Reset pressed on microcomputer keypad.
- ✿ Chilled water pump running and chilled water flow switch made.
- ✿ Leaving chilled water temperature at least 2°F above setpoint.
- ✿ All safety conditions satisfied.

After all above conditions are met, the microcomputer will call for the lead compressor to start. After a one-minute delay, the first contactor (e.g. 1M-1) is energized followed by the second contactor (e.g. 1M-2) after one-second-time delay. This provides reduced inrush stepped start. The compressor 15-minute anti-recycle timer is initiated at compressor start.

The microcomputer monitors compressor amps, volts, leaving water temperature and suction and discharge pressures. The compressor and cooling capacity is controlled by pulsed signals to load and unload solenoid valves on the compressor. When the compressor starts, it is fully unloaded, yielding about 25% of its full load capacity. As the computer gives it load signals, capacity gradually increases. The rate of compressor loading is governed by ramp control which is adjustable in the computer.

The computer responds to leaving chilled water temperature and its rate of change which is proportional and derivative control. If leaving chilled water temperature is within the deadband ($\pm 0.8^\circ\text{F}$ from setpoint), no load or unload commands are given. If chilled water temperature is above deadband, the computer will continue loading the compressor until a satisfactory rate of decline is observed. If leaving chilled water temperature is below the deadband, the

compressor is commanded to unload. Thus the compressor capacity is continuously modulated to match applied load and hold leaving chilled water temperature at setpoint.

If the applied load is greater than one compressor can handle, it will load fully and then the microcomputer will call for a second compressor. After one minute, the second compressor will start in the same manner as the first. Then both compressors will be commanded to adjust load to 50%. They are gradually loaded up together until the applied load is satisfied. In this way the two compressors share the load equally.

If the applied load decreases to the point that both compressors are running at about 40% capacity, the computer shuts down the lag compressor and loads the remaining compressor to about 80%. If applied load decreases further, the remaining compressor unloads proportionately. If applied load decreases to less than the minimum capacity of one compressor, the leaving chilled water temperature will decline to 2°F below setpoint, at which time the lead compressor will shut down. It will restart automatically if leaving chilled water temperature rises to 2°F above setpoint and both 15 minute anti-recycle and one minute start delay timers are satisfied.

During start-up operation, the computer monitors the difference between discharge and suction pressures to insure that minimum of 30 psi differential is available for compressor lubrication. If the difference falls below a minimum of 30 psi, the computer closes refrigerant flow control valves, starving the evaporator, causing evaporator pressure to drop, increasing differential pressure. This is especially helpful at startup, when warm chilled water and low ambient temperature would cause a low head situation. This feature is called EPCAS: Evaporator Pressure Control at Startup. It is one of several proactive control features of the microcomputer which overcome potential problems while continuing operation.

Two additional proactive features are low suction and high discharge pressure override. If operating pressures approach trip level, compressors are unloaded as necessary to continue operation.

PERFORMANCE DATA

Air Cooled Rotary Screw Flooded Chiller

60Hz

LWT °F	Model ACFX	Ambient Air Temperature, °F														
		85			95			105			115			120		
		TR	KW	EER	TR	KW	EER	TR	KW	EER	TR	KW	EER	TR	KW	EER
40	ACFX 200-6	196.6	192.6	10.96	191.0	212.7	9.73	185.1	236.6	8.56	179.0	265.2	7.46	151.9	241.2	6.90
	ACFX 220-6	215.0	212.0	10.81	208.8	234.1	9.61	202.4	260.4	8.46	195.8	291.6	7.38	170.0	272.6	6.82
	ACFX 250-6	239.9	230.9	11.02	233.0	254.9	9.80	225.9	283.3	8.64	218.5	316.8	7.55	196.6	308.8	6.96
	ACFX 280-6	265.8	250.9	11.34	258.3	276.9	10.09	250.4	307.6	8.89	242.3	344.1	7.76	218.7	330.6	7.27
	ACFX 300-6	291.5	272.4	11.55	283.1	300.8	10.26	274.2	334.1	9.03	265.2	373.7	7.88	236.4	345.1	7.55
	ACFX 330-6	316.3	300.9	11.33	307.3	332.2	10.06	297.6	369.5	8.85	287.9	413.6	7.71	251.8	369.7	7.48
	ACFX 360-6	344.1	331.7	11.29	334.2	366.5	10.01	323.8	407.8	8.79	312.7	456.5	7.65	265.2	395.5	7.41
	ACFX 420-6	403.8	386.2	11.01	392.3	426.7	9.79	380.4	474.5	8.64	368.0	530.8	7.55	326.8	509.3	6.96
	ACFX 450-6	432.6	406.8	11.27	420.2	449.5	10.02	407.4	499.9	8.83	394.2	559.1	7.71	346.6	530.5	7.11
	ACFX 480-6	457.4	438.5	11.01	444.3	484.6	9.79	430.7	539.2	8.63	414.3	606.9	7.45	354.1	549.4	6.97
	ACFX 500-6	481.2	469.9	10.78	467.5	519.5	9.58	453.2	578.3	8.44	433.7	653.7	7.23	361.1	567.6	6.84
ACFX 530-6	505.4	500.8	10.59	491.0	554.1	9.41	475.2	616.4	8.28	459.0	700.6	7.13	379.5	586.0	6.92	
42	ACFX 200-6	202.8	194.4	11.20	197.0	214.7	9.95	191.1	238.9	8.76	184.1	266.8	7.63	152.9	235.9	7.09
	ACFX 220-6	221.8	214.0	11.06	215.5	236.4	9.84	209.0	262.9	8.66	202.2	294.5	7.56	172.1	268.7	6.99
	ACFX 250-6	247.5	233.0	11.27	240.5	257.2	10.03	233.2	285.9	8.85	225.7	319.8	7.73	198.2	303.3	7.13
	ACFX 280-6	274.1	253.3	11.59	266.5	279.6	10.32	258.5	310.6	9.10	250.3	347.3	7.95	219.1	323.8	7.42
	ACFX 300-6	300.6	275.0	11.81	292.1	303.7	10.49	283.1	337.3	9.24	273.8	377.5	8.05	238.6	338.7	7.76
	ACFX 330-6	326.2	304.0	11.57	317.0	335.7	10.28	307.3	373.4	9.05	297.0	417.6	7.89	254.2	364.9	7.64
	ACFX 360-6	354.8	335.2	11.52	344.7	370.3	10.23	333.9	412.0	8.98	319.3	453.8	7.85	267.7	390.0	7.57
	ACFX 420-6	416.3	389.8	11.26	404.6	430.6	10.02	392.4	478.9	8.84	379.9	535.8	7.73	328.5	498.6	7.13
	ACFX 450-6	446.0	410.7	11.52	433.4	453.7	10.24	420.3	504.6	9.03	406.9	564.5	7.89	350.8	523.2	7.29
	ACFX 480-6	471.5	442.7	11.26	458.1	489.4	10.01	444.4	544.3	8.82	424.9	607.2	7.64	355.5	536.2	7.16
	ACFX 500-6	496.1	474.4	11.02	482.0	524.9	9.79	467.5	583.8	8.63	438.7	645.7	7.40	363.2	555.0	7.02
ACFX 530-6	520.6	506.2	10.80	506.1	559.6	9.61	490.0	622.6	8.47	463.4	685.9	7.34	383.1	573.8	7.12	
44	ACFX 200-6	209.1	196.3	11.45	203.3	216.8	10.18	197.2	241.4	8.96	188.4	267.4	7.79	153.7	230.3	7.29
	ACFX 220-6	228.8	216.1	11.31	222.4	238.7	10.06	215.7	265.6	8.86	206.4	294.2	7.72	173.2	262.9	7.18
	ACFX 250-6	255.4	235.3	11.54	250.2	259.7	10.35	240.8	288.7	9.06	233.2	323.0	7.92	199.7	297.4	7.31
	ACFX 280-6	282.8	255.7	11.86	274.9	282.3	10.55	266.8	313.6	9.31	258.4	350.8	8.13	220.9	318.8	7.59
	ACFX 300-6	310.0	277.9	12.07	301.1	306.6	10.72	292.1	340.8	9.44	282.7	381.3	8.24	240.8	333.5	7.94
	ACFX 330-6	336.4	306.9	11.83	326.7	339.1	10.50	316.9	377.1	9.25	306.4	421.8	8.06	256.6	357.9	7.85
	ACFX 360-6	365.9	338.6	11.78	355.4	373.9	10.45	344.6	416.2	9.18	325.6	450.7	8.06	270.3	382.6	7.78
	ACFX 420-6	429.1	393.5	11.51	417.2	434.7	10.24	404.8	483.5	9.04	392.0	541.1	7.91	331.4	489.4	7.32
	ACFX 450-6	459.7	414.6	11.77	446.9	458.0	10.47	433.6	509.5	9.23	419.9	570.1	8.07	351.2	509.1	7.48
	ACFX 480-6	486.0	447.1	11.50	472.5	494.1	10.23	458.4	549.7	9.02	434.0	605.7	7.82	359.1	526.6	7.35
	ACFX 500-6	511.3	479.3	11.25	500.1	530.0	10.47	482.3	589.6	8.83	447.1	640.3	7.60	366.3	543.8	7.21
ACFX 530-6	536.5	511.1	11.04	521.7	565.1	9.83	505.1	629.6	8.64	467.8	674.9	7.52	386.8	560.8	7.33	

- Notes:
- 1.) Ratings based on 10°F water range in evaporator and .0001 fouling factor.
 - 2.) Interpolation between ratings is permissible but extrapolation is NOT.
 - 3.) KW is for compressor only.
 - 4.) EER is for entire unit.
 - 5.) For 50 Hz operation, consult factory.
 - 6.) Unit is running on part load on the shaded area due to the current limiter.

PERFORMANCE DATA

Air Cooled Rotary Screw Flooded Chiller

60Hz

LWT °F	Model ACFX	Ambient Air Temperature, °F														
		85			95			105			115			120		
		TR	KW	EER	TR	KW	EER	TR	KW	EER	TR	KW	EER	TR	KW	EER
46	ACFX 200-6	215.7	198.3	11.71	209.7	219.0	10.41	203.5	243.9	9.16	192.0	266.6	7.96	155.3	226.1	7.49
	ACFX 220-6	236.0	218.2	11.57	229.5	241.0	10.29	222.7	268.3	9.06	210.5	293.6	7.89	174.2	256.9	7.37
	ACFX 250-6	263.5	237.5	11.80	256.2	262.2	10.51	248.6	291.6	9.27	240.9	326.3	8.10	201.0	291.1	7.50
	ACFX 280-6	291.6	258.2	12.13	283.7	285.0	10.79	275.4	316.8	9.52	266.9	354.2	8.33	222.4	313.2	7.77
	ACFX 300-6	319.7	280.5	12.34	310.6	309.8	10.96	301.1	344.4	9.64	288.9	380.0	8.45	243.1	326.2	8.18
	ACFX 330-6	346.7	310.0	12.09	336.9	342.2	10.74	327.0	380.9	9.46	313.4	420.6	8.27	259.1	352.3	8.04
	ACFX 360-6	377.3	342.2	12.03	366.6	377.7	10.68	355.5	420.8	9.38	329.8	442.6	8.30	272.7	374.5	8.01
	ACFX 420-6	442.3	397.2	11.76	430.2	438.9	10.47	417.6	488.2	9.24	404.6	546.5	8.09	332.6	477.2	7.51
	ACFX 450-6	473.9	418.6	12.03	460.8	462.5	10.71	447.3	514.5	9.44	433.4	575.8	8.26	355.0	500.6	7.68
	ACFX 480-6	501.0	451.6	11.75	487.1	499.2	10.45	472.8	555.4	9.22	444.8	605.9	8.02	362.5	516.8	7.54
	ACFX 500-6	526.9	484.3	11.49	512.3	535.6	10.22	497.4	596.0	9.02	455.2	634.9	7.79	369.2	532.6	7.40
ACFX 530-6	552.8	516.5	11.27	537.6	571.1	10.03	520.9	635.9	8.83	472.1	664.0	7.70	390.3	548.4	7.55	
48	ACFX 200-6	222.4	200.3	11.97	216.3	221.3	10.64	210.0	246.4	9.36	193.8	263.3	8.13	156.8	221.8	7.69
	ACFX 220-6	243.5	220.4	11.83	236.8	243.5	10.52	229.9	271.0	9.27	214.7	292.7	8.07	176.0	252.3	7.57
	ACFX 250-6	271.9	239.9	12.07	264.4	264.8	10.75	256.7	294.5	9.48	248.8	329.6	8.29	203.3	286.3	7.70
	ACFX 280-6	300.8	260.7	12.40	292.6	287.8	11.03	284.2	320.0	9.73	275.5	358.0	8.51	224.1	306.7	7.97
	ACFX 300-6	329.5	283.4	12.60	320.3	312.7	11.20	310.8	348.0	9.86	294.8	377.6	8.67	245.2	321.6	8.36
	ACFX 330-6	357.6	313.3	12.35	347.5	345.9	10.97	337.3	384.8	9.66	316.1	410.7	8.53	261.3	345.1	8.27
	ACFX 360-6	388.9	345.7	12.28	377.9	381.8	10.90	366.6	425.2	9.58	332.7	432.0	8.56	275.2	366.0	8.25
	ACFX 420-6	455.9	401.1	12.02	443.5	443.1	10.71	430.7	493.1	9.45	414.9	549.3	8.25	336.1	468.9	7.71
	ACFX 450-6	488.4	422.7	12.30	475.1	467.0	10.94	461.4	519.7	9.65	443.3	577.5	8.42	358.7	491.8	7.89
	ACFX 480-6	516.3	456.2	12.00	502.3	504.2	10.68	487.7	561.3	9.42	449.0	597.8	8.19	364.8	504.4	7.76
	ACFX 500-6	542.9	489.4	11.73	528.3	541.0	10.44	512.9	602.6	9.21	457.2	622.3	7.97	374.1	523.4	7.62
ACFX 530-6	569.6	521.9	11.51	554.1	577.2	10.24	537.0	642.9	9.01	476.3	646.6	7.95	393.8	542.3	7.69	
50	ACFX 200-6	229.4	202.3	12.23	223.2	223.6	10.87	216.7	249.1	9.56	194.6	258.3	8.31	158.3	217.3	7.91
	ACFX 220-6	251.2	222.7	12.09	244.3	246.0	10.76	237.3	274.0	9.47	219.0	291.6	8.26	177.8	247.6	7.78
	ACFX 250-6	280.5	242.3	12.34	272.9	267.5	10.99	265.0	297.6	9.70	252.5	328.0	8.45	205.5	281.3	7.91
	ACFX 280-6	310.2	263.4	12.67	301.9	290.7	11.29	293.3	323.4	9.95	280.8	356.4	8.71	225.3	300.3	8.18
	ACFX 300-6	339.6	286.3	12.87	330.2	315.7	11.45	320.8	351.9	10.07	299.0	372.3	8.91	247.4	315.1	8.59
	ACFX 330-6	368.5	316.6	12.61	358.3	349.4	11.21	347.8	389.1	9.86	318.7	401.3	8.78	263.7	338.7	8.48
	ACFX 360-6	400.8	349.3	12.54	389.9	386.1	11.13	378.4	430.0	9.78	335.5	421.5	8.84	277.6	359.4	8.46
	ACFX 420-6	469.9	405.0	12.28	457.3	447.6	10.94	444.2	498.1	9.66	419.8	544.7	8.41	339.5	460.2	7.92
	ACFX 450-6	503.5	426.9	12.56	489.9	471.8	11.18	475.9	525.1	9.86	445.7	569.0	8.58	362.3	482.6	8.10
	ACFX 480-6	532.2	460.8	12.26	517.9	509.5	10.91	503.1	567.2	9.62	452.1	587.8	8.37	367.7	494.1	7.96
	ACFX 500-6	559.6	494.3	11.98	544.5	547.0	10.66	529.0	609.1	9.40	461.3	611.2	8.17	376.6	512.0	7.82
ACFX 530-6	587.0	527.4	11.75	571.2	583.4	10.46	553.7	650.1	9.20	480.6	634.4	8.17	397.2	529.8	7.92	

- Notes:
- 1.) Ratings based on 10°F water range in evaporator and .0001 fouling factor.
 - 2.) Interpolation between ratings is permissible but extrapolation is NOT.
 - 3.) KW is for compressor only.
 - 4.) EER is for entire unit.
 - 5.) For 50 Hz operation, consult factory.
 - 6.) Unit is running on part load on the shaded area due to the current limiter.

PHYSICAL DATA

Air Cooled Rotary Screw Flooded Chiller

60Hz

MODEL	ACFX 200-6	ACFX 220-6	ACFX 250-6	ACFX 280-6	ACFX 300-6	ACFX 330-6
COMPRESSOR						
MODEL (QTY)	MSC1210(2)	MSC 1210(1) MSC 1212(1)	MSC 1212(2)	MSC 1212(1) MSC 1215(1)	MSC 1215(2)	MSC 1215(1) MSC 1218(1)
RPM	3500	3500	3500	3500	3500	3500
NOMINAL CAPACITY TR	203.3	222.4	250.2	274.9	301.1	326.7
COMPRESSOR KWI	216.8	238.7	259.7	282.3	306.6	339.1
FAN KWI	22.8	26.6	30.4	30.4	30.4	34.2
UNIT EER	10.18	10.06	10.35	10.55	10.72	10.50
MIN. % UNIT CAPACITY REDUCTION	12.50%	13.30%	12.50%	13.20%	12.50%	13.00%
EVAPORATOR						
MODEL (QTY)	EF14102M 076KAG (2)	EF16102M 098KAG (2)	EF18102M 128KAG (2)	EF18102M 128KAG (2)	EF18102M 128KAG (2)	EF18102M 144KAG(2)
WATER CONNECTOR INCH	6	6	8	8	8	8
NOM. WATER FLOW (GPM)/ PD (FT IN WG)	501 / (7.9 X 2)	556 / (6.2 X 2)	617 / (4.4 X 2)	684 / (5.3 X 2)	760 / (6.5 X 2)	828 / (6.2 X 2)
MIN/MAX WATER FLOW (GPM)	222 / 886	288 / 1150	378 / 1500	378 / 1500	378 / 1500	425 / 1680
MIN/MAX WATER PD (FT IN WG)	(1.8/ 22.0) X 2	(1.9/ 24.0) X 2	(1.8/ 22.2) X 2	(1.8/ 22.2) X 2	(1.8/ 22.2) X 2	(1.8/ 22.5) X 2
CONDENSER						
COIL ROWS DEEP/ TOTAL FA FT ²	3 / 282.3	3 / 329.4	3 / 376.4	3 / 188.2 4 / 188.2	4 / 376.4	4/423.5
NO OF FAN	12	14	16	16	16	18
FAN DIA MM	800	800	800	800	800	800 (9), 800 (9)
FLA , AMP (QTY)	3.6 (12)	3.6 (14)	3.6 (16)	3.6 (16)	3.6 (16)	3.6 (18)
*MIN. AMBIENT TEMPERATURE (°F) AT MIN. LOAD	65	65	65	65	65	65
ELECTRICAL						
NOM. VOLTAGE	460/3/60	460/3/60	460/3/60	460/3/60	460/3/60	460/3/60
UNIT RLA	154 (1), 158(1)	158(1), 189(1)	189(1), 191(1)	190(1), 223(1)	228(1), 223(1)	227(1), 279(1)
UNIT MAX. INRUSH	599A	637A	695A	729A	801A	864A
GENERAL						
UNIT LENGTH INCH	322.5	365	402	402	402	444
UNIT WIDTH INCH	88	88	88	88	88	88
UNIT HEIGHT INCH	96	96	96	96	96	96
SHIPPING WEIGHT LBS	16035	18623	20713	21596	22522	23080
OPERATING WEIGHT LBS	16494	19218	21479	22362	23288	23900
OPERATING CHARGE R-22 LBS	471.4	523.8	581.5	644.1	716.0	779.5

* 45°F WITH SOLENOID CONTROL AND FAN CYCLING.

PHYSICAL DATA

Air Cooled Rotary Screw Flooded Chiller

60Hz

MODEL	ACFX 360-6	ACFX 420-6	ACFX 450-6	ACFX 480-6	ACFX 500-6	ACFX 530-6
COMPRESSOR						
MODEL (QTY)	MSC 1218(2)	MSC 1212(1) MSC 1215(2)	MSC 1215(3)	MSC 1215(2) MSC 1218(1)	MSC 1215(1) MSC 1218(2)	MSC 1218(3)
RPM	3500	3500	3500	3500	3500	3500
NOMINAL CAPACITY TR	355.4	417.2	446.9	472.5	500.1	521.7
COMPRESSOR KWI	373.9	434.7	458.0	494.1	530.0	565.1
FAN KWI	34.2	54.0	54.0	60.0	66.0	72.0
UNIT EER	10.45	10.24	10.47	10.23	10.47	9.83
MIN. % UNIT CAPACITY REDUCTION	12.50%	5.90%	8.33%	7.80%	7.40%	8.33%
EVAPORATOR						
MODEL	EF20102M 180KAG(2)	EF24125H 298KAJ	EF26125H 336KAJ	EF28125H 358KAJ	EF28125H 378KAJ	EF28125H 395KAJ
WATER CONNECTOR INCH	8	8	10	10	10	10
NOM. WATER FLOW (GPM)/ PD (FT IN WG)	898/ (5.2 X 2)	1022/ 18.5	1089/ 17.0	1156/ 17.3	1224/ 17.3	1291/ 17.6
MIN/MAX WATER FLOW (GPM)	525/ 2100	299/ 1496	329/ 1643	350/ 1750	370/ 1848	387/ 1931
MIN/MAX WATER PD (FT IN WG)	(1.9/ 24.2) X 2	2.0/ 37.0	1.9/ 36.0	2.0/ 36.5	2.0/ 36.5	2.0/ 36.5
CONDENSER						
COIL ROWS DEEP/ TOTAL FA FT ²	4/423.5	3/192.5, 4/385.0	4/577.5	4/577.5	4/577.5	4/577.5
NO OF FAN	18	18	18	18	18	18
FAN DIA. (QTY) MM	800 (18)	800 (6), 860 (12)	860(18)	860(18)	860(18)	860(18)
FLA , AMP (QTY)	3.6 (18)	4.3 (18)	4.3(18)	4.3(12), 5.7(6)	4.3(6), 5.7(12)	5.7(18)
*MIN. AMBIENT TEMPERATURE (°F) AT MIN. LOAD	65	65	65	65	65	65
ELECTRICAL						
NOM. VOLTAGE	460/3/60	460/3/60	460/3/60	460/3/60	460/3/60	460/3/60
UNIT RLA	279(1), 286(1)	188(1), 223(1)	223(3)	223(2), 282(1)	223(1), 282(2)	282(3)
UNIT MAX. INRUSH	944A	1008A	1043A	1132A	1199A	1267A
GENERAL						
UNIT LENGTH INCH	444	473	473	473	473	473
UNIT WIDTH INCH	88	88	88	88	88	88
UNIT HEIGHT INCH	96	118	118	118	118	118
SHIPPING WEIGHT LBS	24595	28858	29991	32036	33179	34308
OPERATING WEIGHT LBS	25610	29767	31032	33178	34362	35527
OPERATING CHARGE R-22 LBS	845.5	962.5	1025.1	1088.6	1152.1	1215.7

* 45°F WITH SOLENOID CONTROL AND FAN CYCLING.

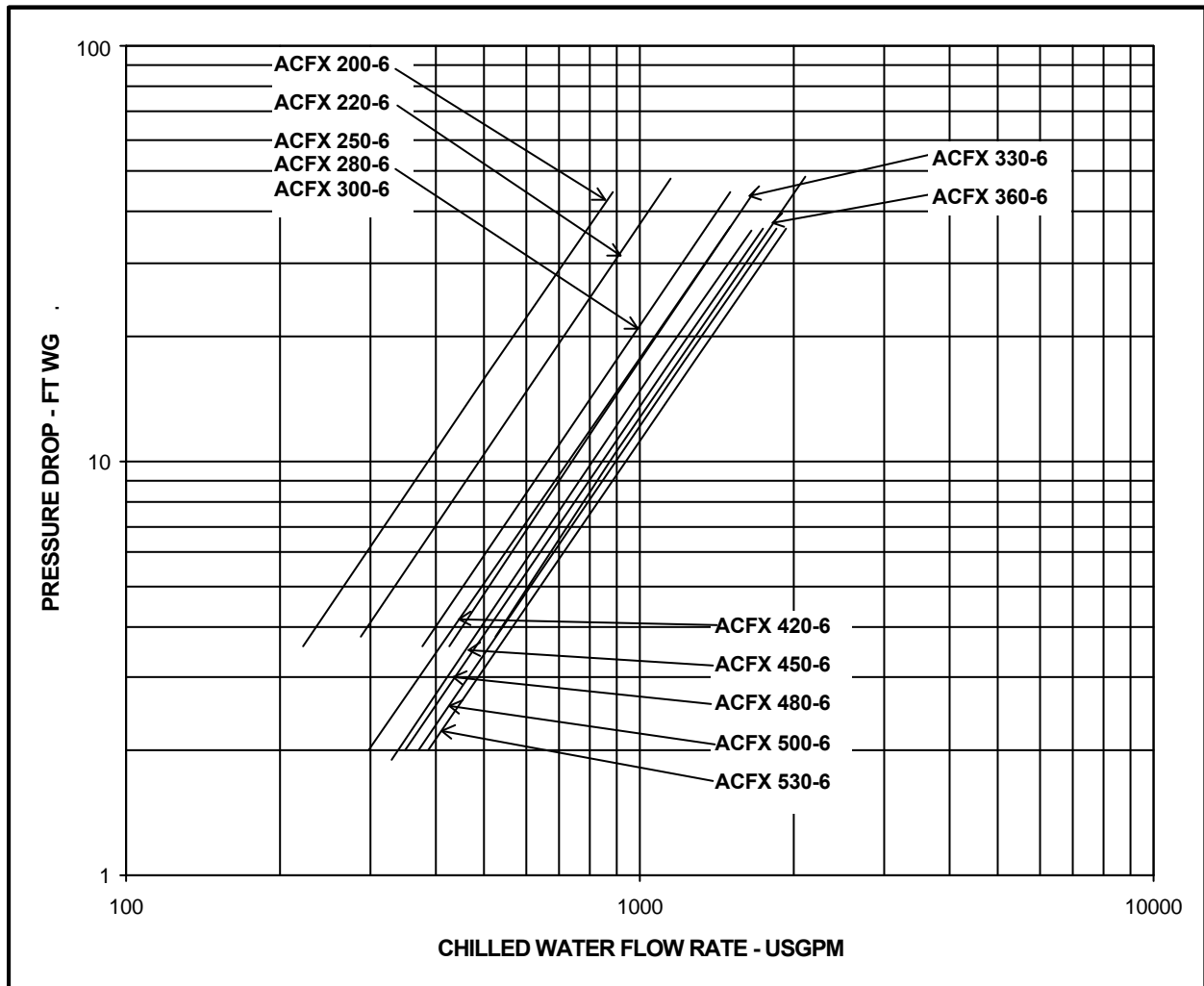
SOUND DATA

Sound Pressure Level in dB(A) For ACFX at 10 Meters 60Hz

Model	SPL dB (A)	OCTAVE BAND (Hz)								TOTAL	NC
		63	125	250	500	1K	2K	4K	8K		
ACFX 200-6	39	43	53	58	64	62	55	48	67	63	
ACFX 220-6	40	43	53	58	64	62	55	48	67	63	
ACFX 250-6	40	43	53	58	64	63	55	49	68	64	
ACFX 280-6	41	44	54	59	66	64	57	50	69	65	
ACFX 300-6	42	46	55	61	67	65	58	51	70	66	
ACFX 330-6	40	44	53	60	67	65	57	50	70	66	
ACFX 360-6	40	44	53	60	68	66	57	50	71	67	
ACFX 420-6	42	45	55	61	68	66	58	51	71	67	
ACFX 450-6	42	46	55	61	69	67	59	52	72	68	
ACFX 480-6	42	52	57	63	69	67	60	53	72	68	
ACFX 500-6	41	54	58	64	70	68	61	54	73	69	
ACFX 530-6	41	56	59	64	70	68	61	55	74	69	

PRESSURE DROP

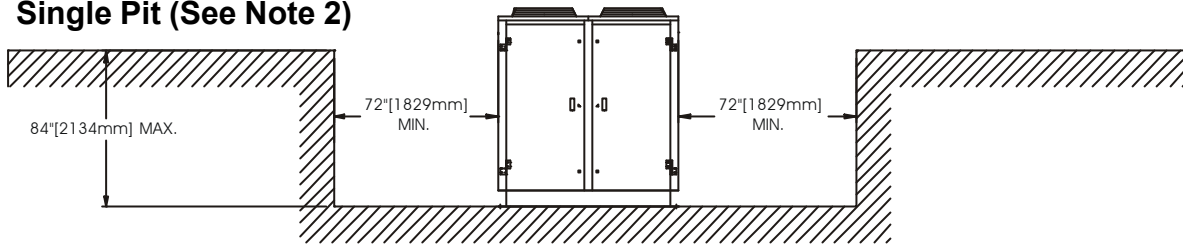
Evaporator Cooler Water Pressure



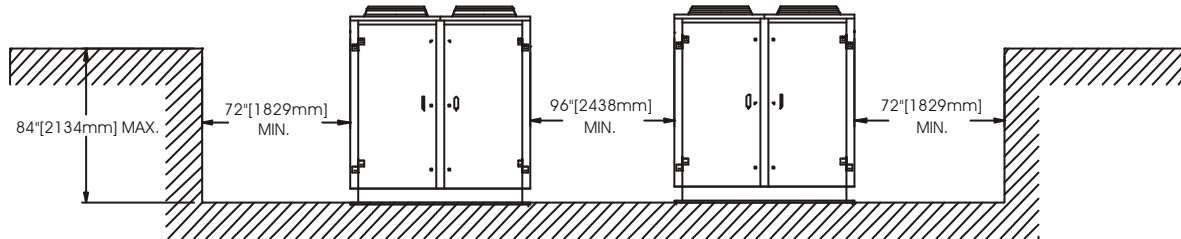
DIMENSIONAL CLEARANCE

Air Cooled Rotary Screw Flooded Chiller

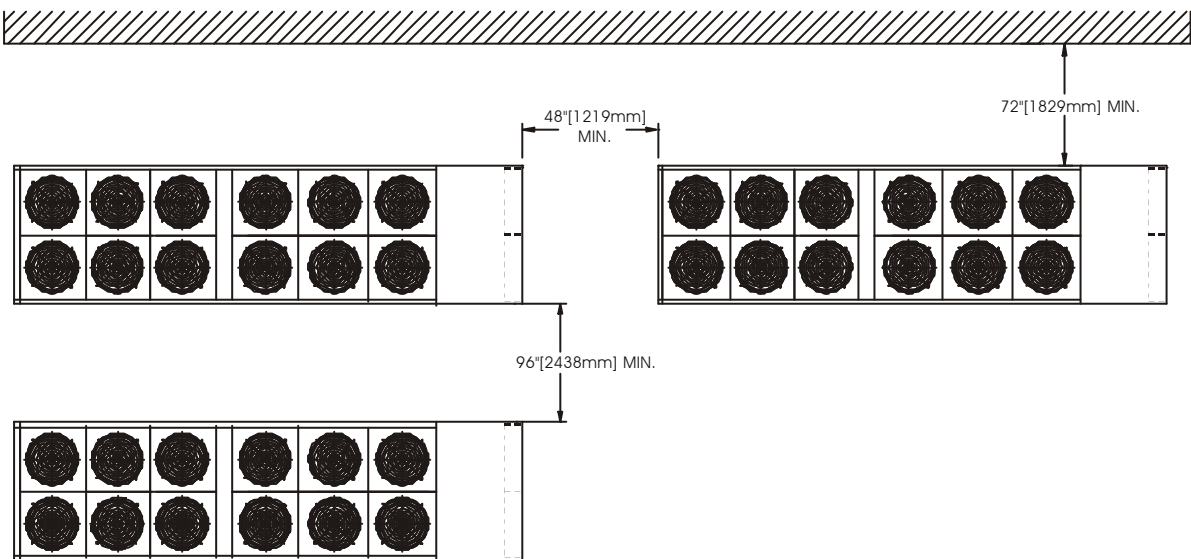
Single Pit (See Note 2)



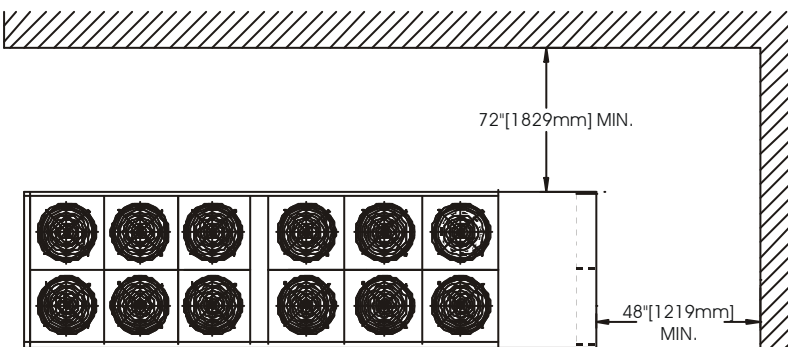
Double Pit (See Note 2)



Multi Pit



Corner Wall

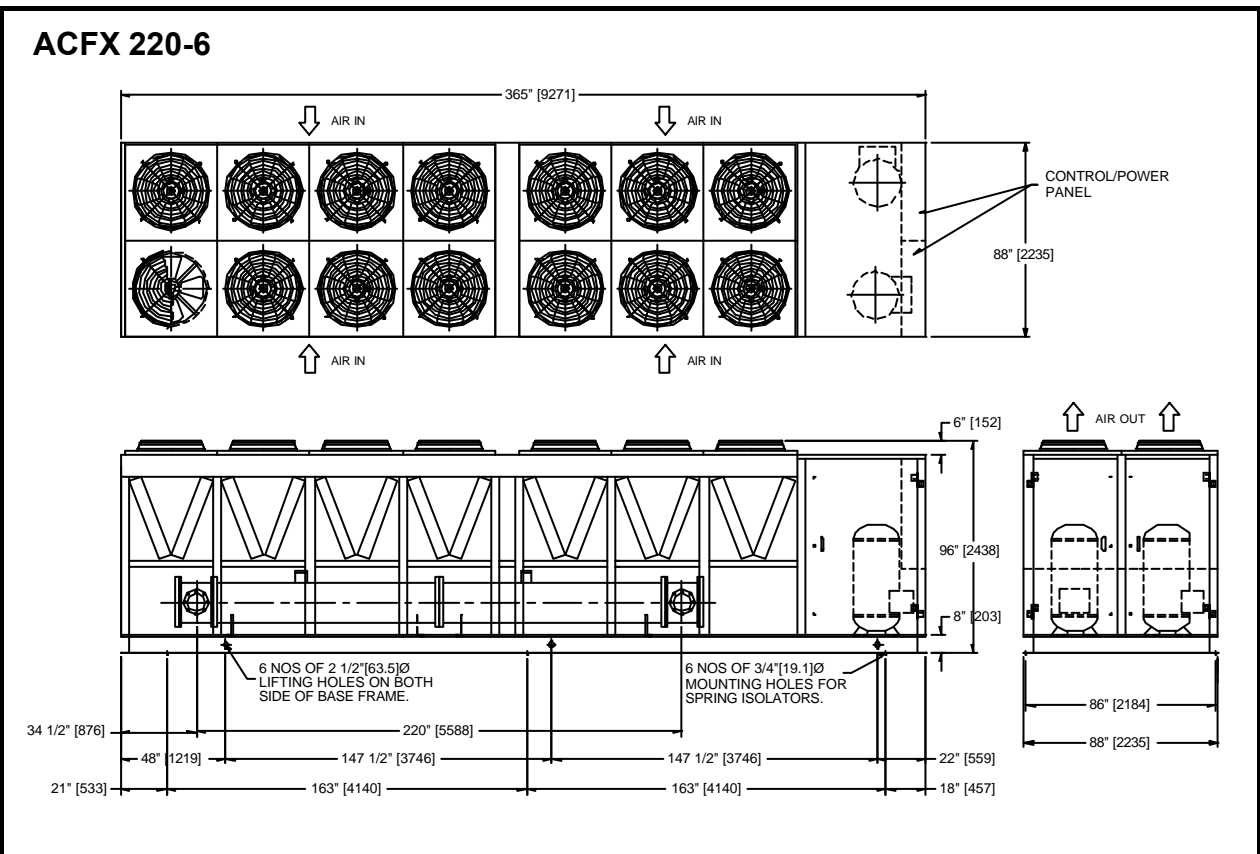
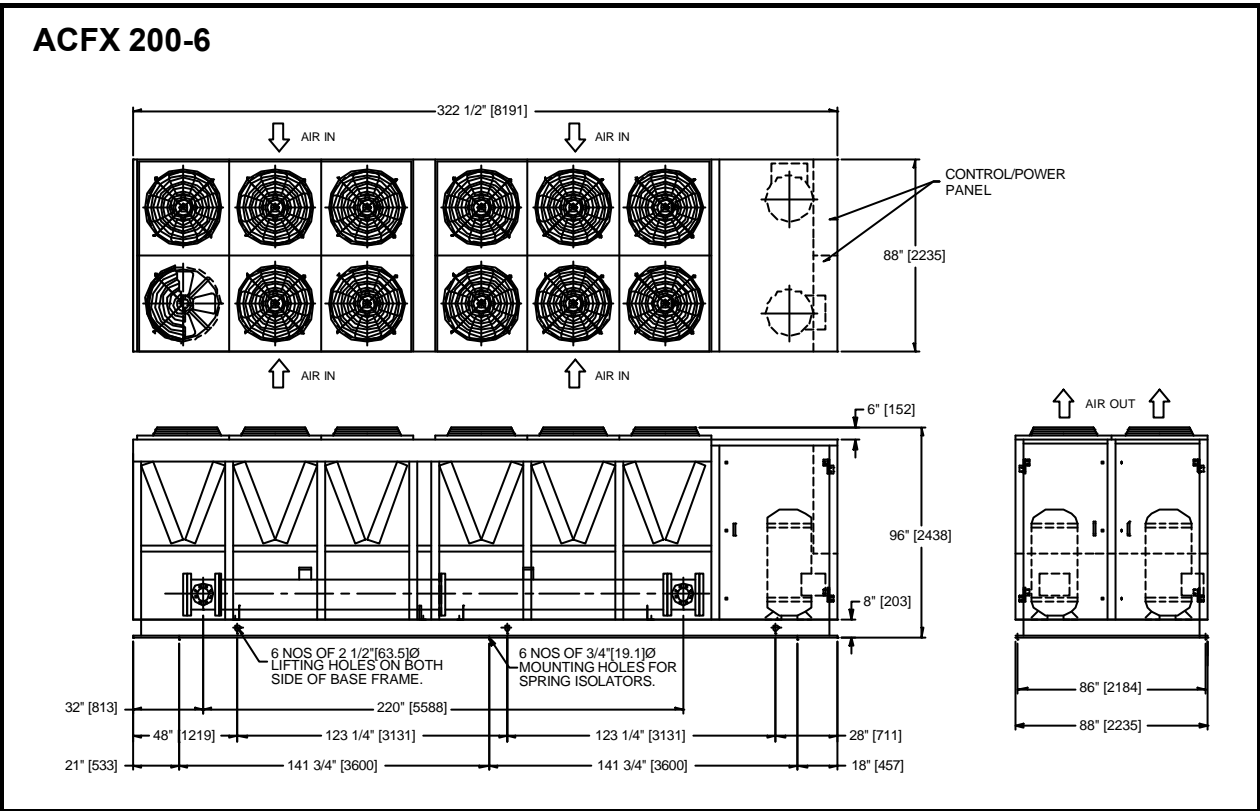


Notes:

- 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 high pressure or fan motor temperature trips. Dunham-Bush will not be responsible for ducting fans to a higher level to alleviate the above mentioned conditions.

DIMENSIONAL DATA

Air Cooled Rotary Screw Flooded Chiller

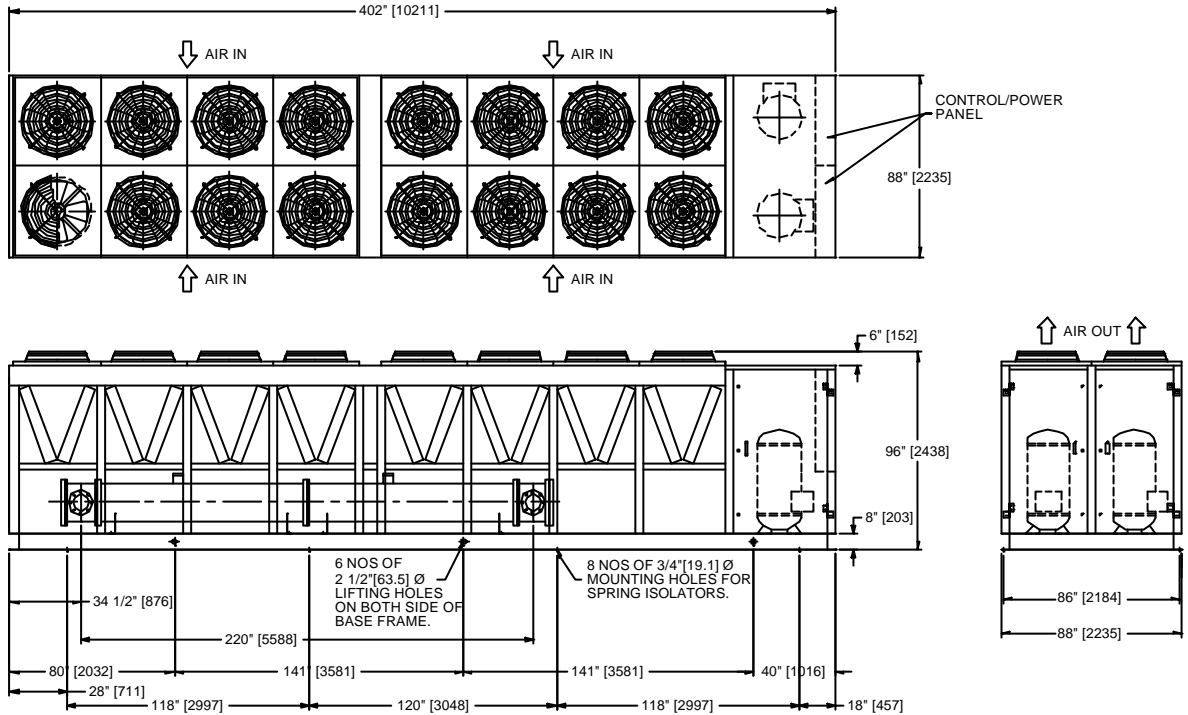


NOTE : ALL DIMENSIONS ARE IN INCHES [MM].

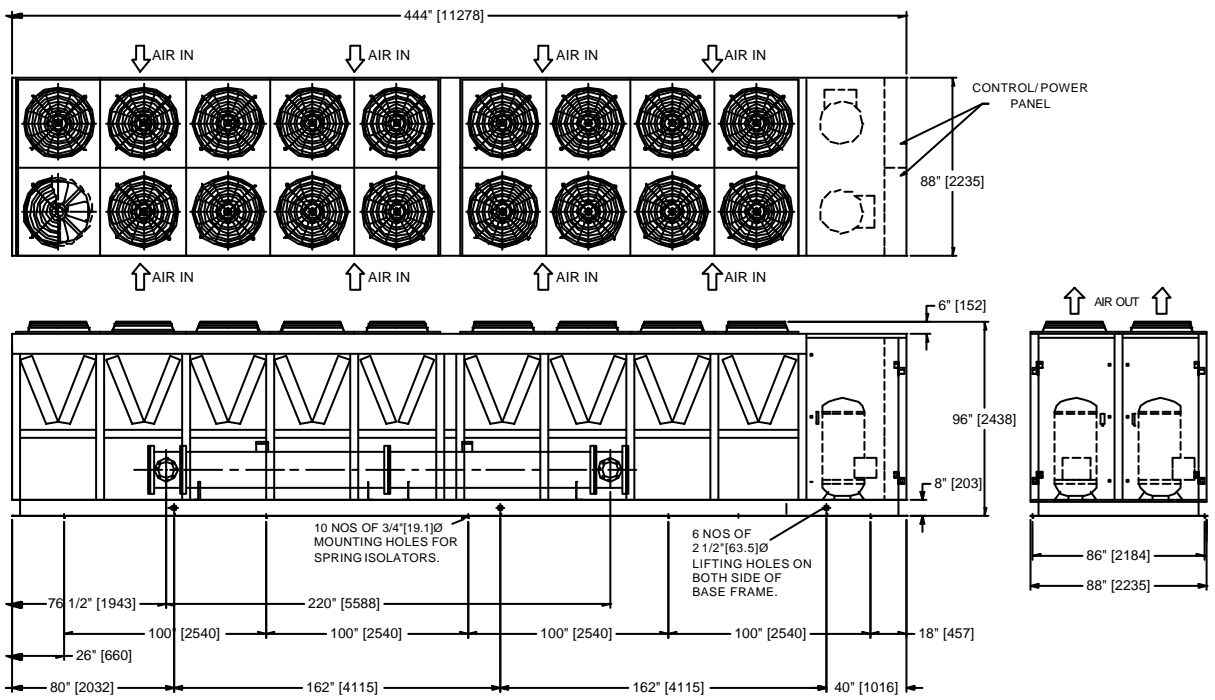
DIMENSIONAL DATA

Air Cooled Rotary Screw Flooded Chiller

ACFX 250-6, 280-6, 300-6



330-6, 360-6



NOTE : ALL DIMENSIONS ARE IN INCHES [MM].

CONDENSER FAN

Fan Position Number & Cycling Sequence

ACFX 200-6				ACFX 220-6			
		SYSTEM 1	SYSTEM 2			SYSTEM 1	SYSTEM 2
BASE FANS		8, 10 & 12	2, 4 & 6	BASE FANS		8, 10, 12 & 14	2, 4 & 6
STAGE 2		7	1	STAGE 2		7	1
STAGE 3		11	5	STAGE 3		11	5
STAGE 4		9	3	STAGE 4		9	3
				STAGE 5		13	-

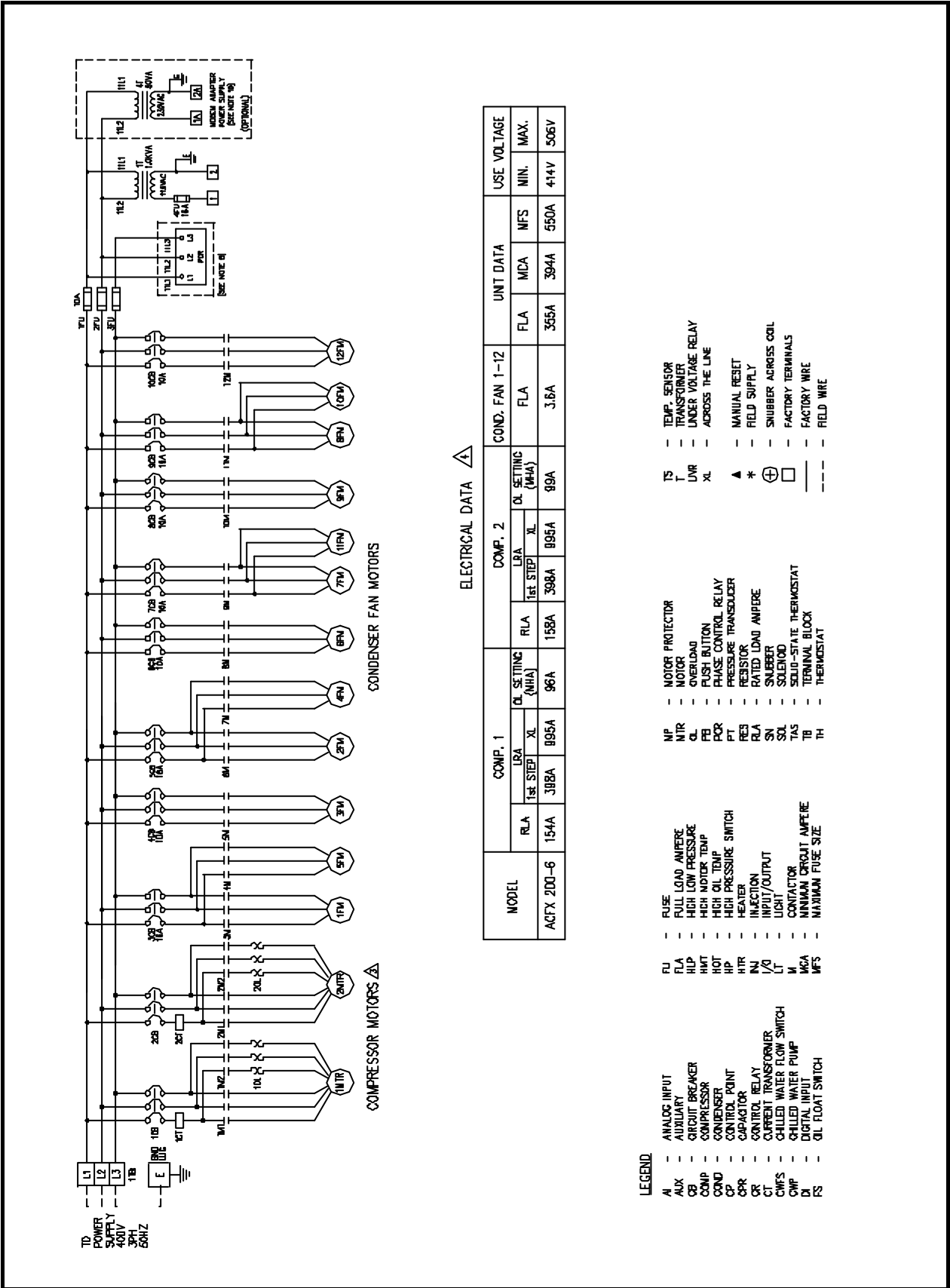
ACFX 250, 280-6, 300-6			
		SYSTEM 1	SYSTEM 2
BASE FANS		10, 12, 14 & 16	2, 4, 6 & 8
STAGE 2		9	1
STAGE 3		13	5
STAGE 4		11	3
STAGE 5		15	7

ACFX 330-6, 360-6			
		SYSTEM 1	SYSTEM 2
BASE FANS		9, 10, 12, 14, 16 & 18	2, 4, 6 & 8
STAGE 2		13	1
STAGE 3		17	5
STAGE 4		11	3
STAGE 5		15	7

ACFX 420-6, 450-6, 480-6, 500-6, 530-6				
		SYSTEM 1	SYSTEM 2	SYSTEM 3
BASE FANS		14, 16 & 18	8, 10 & 12	2, 4 & 6
STAGE 2		13	7	1
STAGE 3		17	11	5
STAGE 4		15	9	3

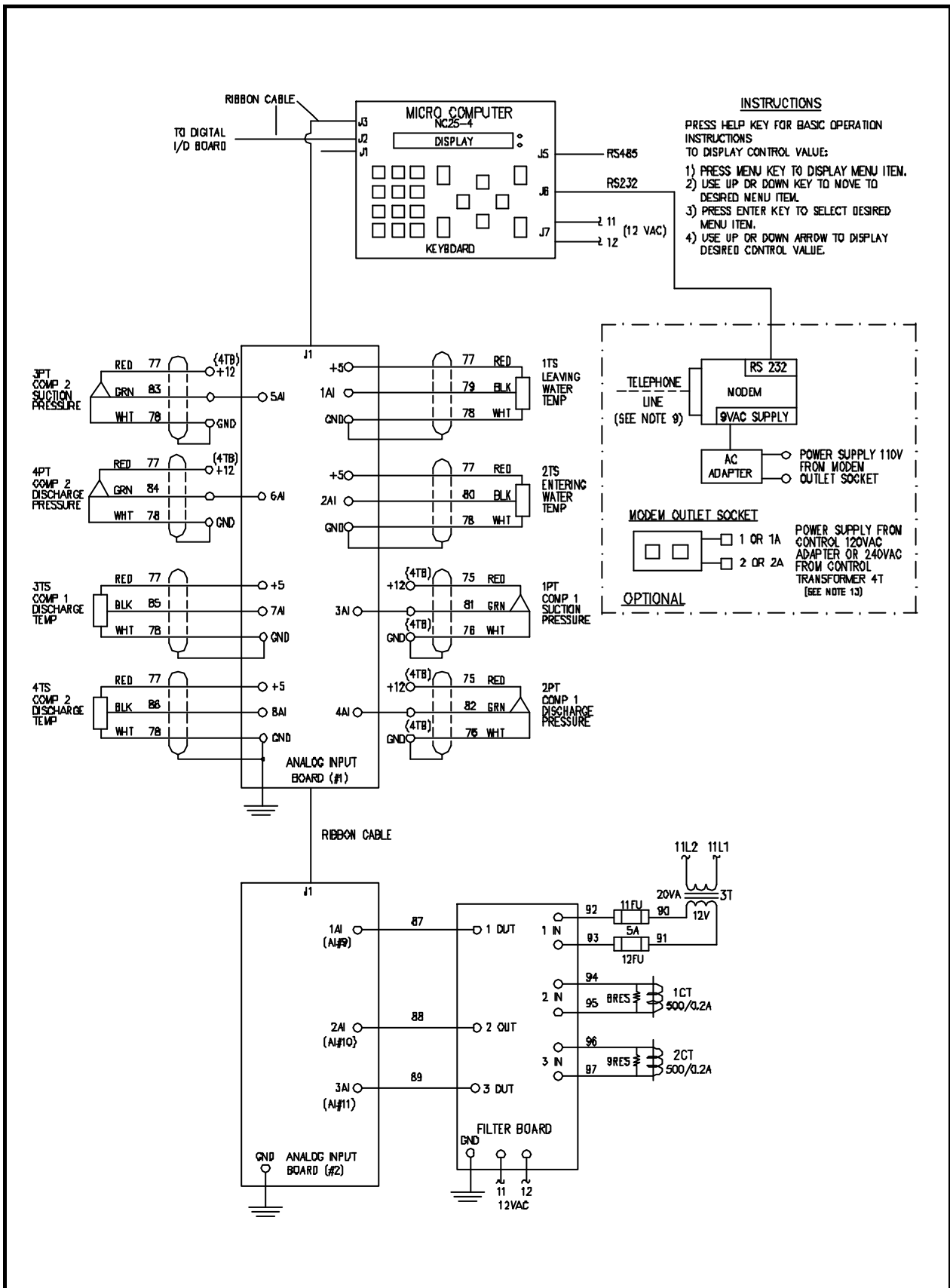
TYPICAL WIRING SCHEMATIC

Air Cooled Rotary Screw Flooded Chiller



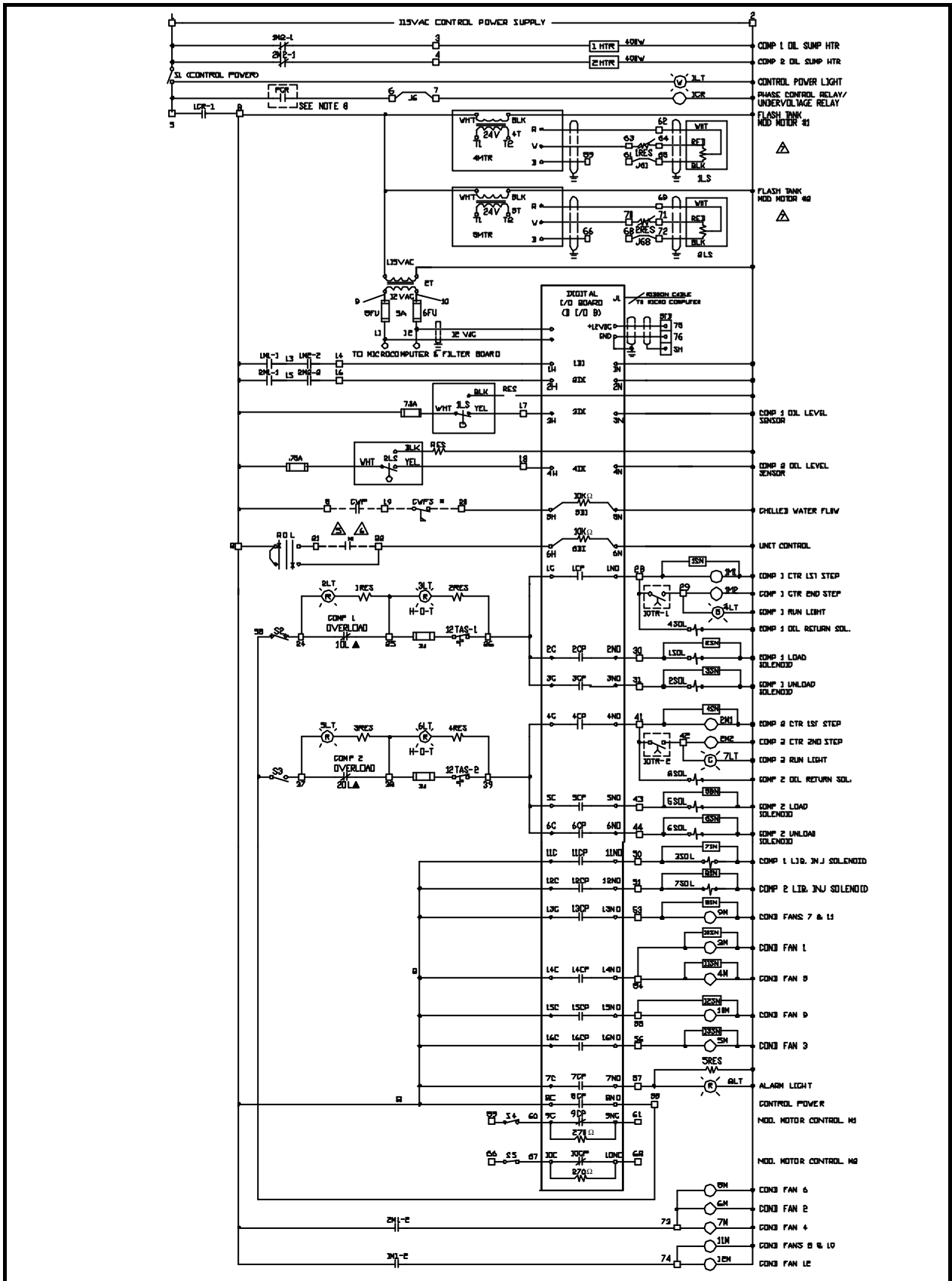
TYPICAL WIRING SCHEMATIC

Air Cooled Rotary Screw Flooded Chiller



TYPICAL WIRING SCHEMATIC

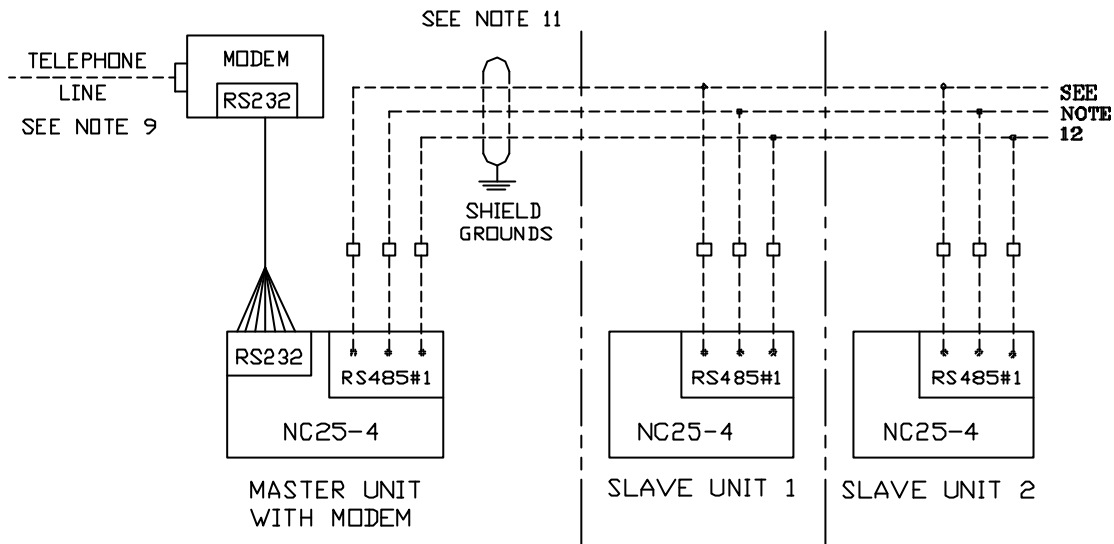
Air Cooled Rotary Screw Flooded Chiller



TYPICAL WIRING SCHEMATIC

Air Cooled Rotary Screw Flooded Chiller

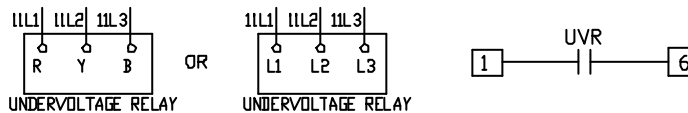
MODEM COMMUNICATIONS WIRING CONNECTION DIAGRAM



OPTIONAL

NOTES:

1. DISCONNECT MEANS & BRANCH CIRCUIT PROTECTION SHALL BE PROVIDED BY OTHERS
2. USE COPPER CONDUCTOR ONLY.
3. IF POWER SUPPLY HAS BEEN INTERRUPTED FOR A PROLONGED PERIOD, OIL SUMP HEATERS MUST BE ENERGIZED FOR 24 HOURS MINIMUM BEFORE STARTING COMPRESSOR.
4. BASED ON 400V-3PH-50Hz POWER SUPPLY, 44°F LWT/55°F EWT AND 95°F AMBIENT CONDITIONS
5. CUSTOMER CONTROL CONTACTS MUST BE WIRE BETWEEN 21 & 22. SELECT POSITION 'R' FOR REMOTE START, POSITION 'O' FOR UNIT SHUT DOWN AND POSITION 'L' FOR LOCAL START.
6. SHIELDED CABLES ARE RECOMMENDED FOR FIELD INSTALLED CONTROL & SIGNAL WIRING, CONNECT ONE END OF SHIELD TO GROUND.
7. 1RES AND 2RES CAN BE WIRED BETWEEN TERMINAL 63 & 64 AND 61 & 65 OR BETWEEN TERMINALS 71 & 72 AND 68 & 72 IF 1RES AND 2 RES ARE WIRED BETWEEN 63 & 64 AND 70 & 71, J63 AND J70 MUST BE REMOVED AND A JUMPER J61 & J68 MUST BE ADDED BETWEEN TERMINAL 61 & 65 AND 68 & 72
8. IF UNDER VOLTAGE RELAY (UVR) IS USED INSTEAD OF PHASE CONTROL RELAY THE CONNECTION DIAGRAM WILL BE AS BELOW :



9. INSERT THE SUPPLIED PHONE CORD INTO THE LINE JACK ON THE REAR OF THE MODEM, REFER TO OPERATION MANUAL FOR MORE INFORMATION. THE MODEM AND SOCKET OUTLET ARE INSTALLED IN UNIT ONE ONLY (OPTIONAL)
10. IF POWER SUPPLY 230V FOR MODEM OUTLET SOCKET IS IN NEED, THEN THE STEP DOWN CONTROL TRANSFORMER TO 230VAC CIRCUITRY MUST BE USED IN ORDER TO GENERATE THE MODEM. (OPTIONAL)
11. THE RS485 PORT OF EACH NC25-4 MUST BE INTERCONNECTED WITH A THREE-CONDUCTOR SHIELDED CABLE AND SHIELD MUST BE GROUNDED AT THE MASTER NC25-4 ONLY. IF AN RS485 JUNCTION IS MADE AT A SLAVE NC25-4, THE SHIELDS SHOULD BE JUMPED BETWEEN THE SHIELDED CABLE (OPTIONAL)
12. IF THE NUMBER OF SLAVE UNITS ARE MORE THAN 2, THEN FOLLOW THE ADDITIONAL RS485 CONNECTIONS AS SAME AS SLAVE UNITS 1 AND 2. THE MAXIMUM NUMBER OF SLAVE UNITS ARE 8. (OPTIONAL)

TYPICAL WIRING SCHEMATIC

Air Cooled Rotary Screw Flooded Chiller

Point No	Control points { CP }	Digital In (DI)	Analog In (AI)	Set Point B	Set Point A	Alarm Codes	Item No
1	Comp 1	Comp 1	Lvg. Wtr. Temp		Lvg. Wtr. Temp		1
2	Load 1	Comp 2	Ent. Wtr. Temp.	Lead			2
3	Unload 1	Oil Level 1	C1 Suct. Pressure	Ramp Start	Ramp Rate		3
4	Comp 2	Oil Level 2	C1 Disch. Pressure	Amp Limit 1 (Hold)	Amp Limit 1 (Unld)		4
5	Load 2	Flow Switch	C2 Suct. Pressure	Amp Limit 2 (Hold)	Amp Limit 2 (Unld)		5
6	Unload 2	Unit Control	C2 Disch. Pressure	Power Loss			6
7	Alarm		C1 Disch. Temp.	Low Pressure	High Pressure		7
8	Control Power		C2 Disch. Temp.	Freeze			8
9	SDD CNT 1		Volts	Fan Stage 2 (Off)	Fan Stage 2 (On)		9
10	SDD CNT 2		C1 Amps	Fan Stage 3 (Off)	Fan Stage 3 (On)	No Run 1	10
11	Liquid Inj. 1		C2 Amps	Liquid Inj. (off)	Liquid Inj. (on)	Low Suct. Press 1	11
12	Liquid Inj. 2			High Volt	Low Volt	High Disch. Press 1	12
13	Cond. Fans 7 & 11			SDD		Low Different Press 1	13
14	Cond. Fans 1 & 5					Low Oil 1	14
15	Cond. Fan 9					Sensor Press Error 1	15
16	Cond. Fan 3					High Disch. Temp. 1	16
17						No Run 2	17
18						Low Suction Press. 2	18
19						High Disch. Press 2	19
20			Target %			Low Different 2	20
21			% FLCF C1			Low Oil 2	21
22			% FLCF C2			Sensor Press Error 2	22
23			KW 1			High Disch. Temp. 2	23
24			KW 2			No Stop 1	24
25			Full Load KW 1			No Stop 2	25
26			Full Load KW 2			Freeze	26
27						Temp. Error	27
28						Power Loss	28
29						Hi/Low Volt	29
30						Low Flow	30
31							31
32							32
33							33

MANUFACTURER RESERVES THE RIGHT TO CHANGE SPECIFICATION OR DESIGN AT ANY TIME WITHOUT PRIOR NOTICE.

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