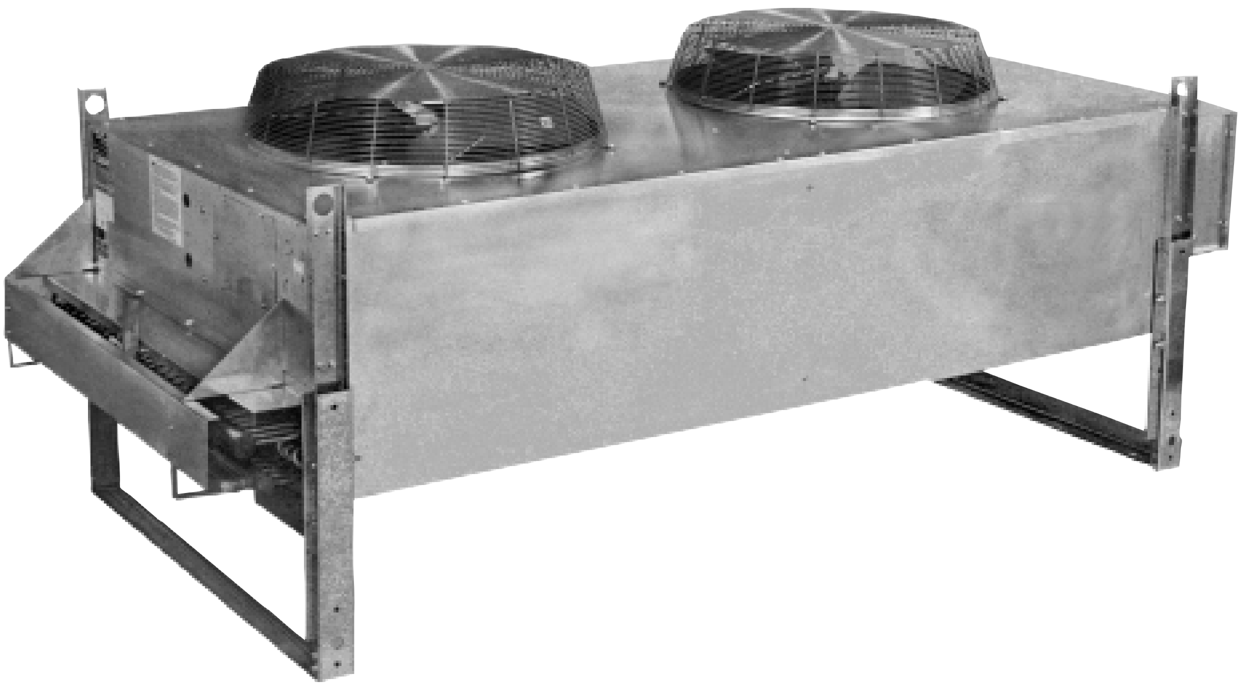
HEATCRAFT®

Refrigeration Products

Bulletin H-IM-43B **June 1998** **Part Number 2500018**

Replaces H-IM-43A (5/92)



AIR-COOLED CONDENSERS

Models WSS 024 through 160

Installation and Maintenance Data

Table of Contents

Inspection

Responsibility should be assigned to a dependable individual at the job site to receive material. Each shipment should be carefully checked against the bill of lading. The shipping receipt should not be signed until all items listed on the bill of lading have been accounted for.

Check carefully for concealed damage. Any shortage or damages should be reported to the delivering carrier.

Damaged material becomes the delivering carrier's responsibility, and should not be returned to the manufacturer unless prior approval is given to do so. When uncrating, care should be taken to prevent damage. Heavy equipment should be left on its shipping base until it has been moved to the final location.

System Warranty

This equipment is designed to operate properly and produce rated capacity when installed in accordance with accepted industry standards. Failure to meet the following conditions may result in voiding of the system warranty:

1. System piping must be installed following industry standards for good piping practices.
2. Inert gas must be charged into piping during welding.
3. System must be thoroughly leak checked and evacuated before initial charging. High vacuum gauge capable of reading microns is mandatory. Dial indicating pressure gauges are not acceptable.
4. Power supply to system must meet following conditions:
   a. Voltage for 208/230 motors not less than 195 volts or more than 253 volts.
   b. All other voltages must not exceed $\pm$10% of nameplate ratings.
   c. Phase imbalance not to exceed 2%.
5. All controls and safety switch circuits properly connected per wiring diagram.
6. Factory installed wiring must not be changed without written factory approval.

Installation

NOTE: Installation and maintenance to be performed only by qualified personnel who are familiar with local codes and regulations, and experienced with this type of equipment.

CAUTION: Sharp edges and coil surfaces are a potential injury hazard. Avoid contact with them.

Unit Location

Units are designed for outdoor application and may be mounted on a roof or concrete slab (ground level installation). Roof mounted units should be installed level on steel channels or an I-beam frame to support the unit above the roof. Use of vibration pads or isolators is recommended. The roof must be strong enough to support the weight of the unit. See Table 6 for unit weights. Concrete slabs used for unit mounting should be installed level and be properly supported to prevent settling. A one-piece concrete slab with footings extending below the frost line is recommended.

The condenser should be located no closer than four feet from any wall or other obstruction to provide sufficient clearance for air entrance. Do not attach ductwork to the coil inlet or fan outlet. Care should be taken to avoid air recirculation conditions that can be caused by sight screening, walls, etc. Also keep unit fan discharge away from any building air intakes. See page 5 for space and location requirements.

WARNING: This equipment may contain a substance which harms the public health and environment by destroying ozone in the upper atmosphere. Venting of certain refrigerants to the atmosphere may be illegal in your location. Refrigerant recovery devices should be used when installing or servicing this product. Consult your local codes for requirements in your location.

Sound Vibration

Units should be installed away from occupied spaces and above or outside of utility areas, corridors and auxiliary spaceds to reduce the transmission of sound and vibraton to occupied spaces. The refrigerant piping should be flexible enough to prevent the transmission of noise and vibration from the unit into the building. If the refrigerant lines are to be suspended from the structure of the building, isolation hangers should be used to prevent the transmission of vibration. Where piping passes through a wall, it is advisable to pack fiberglass and sealing compound around the lines to minimize vibration and retain flexibility in the lines.

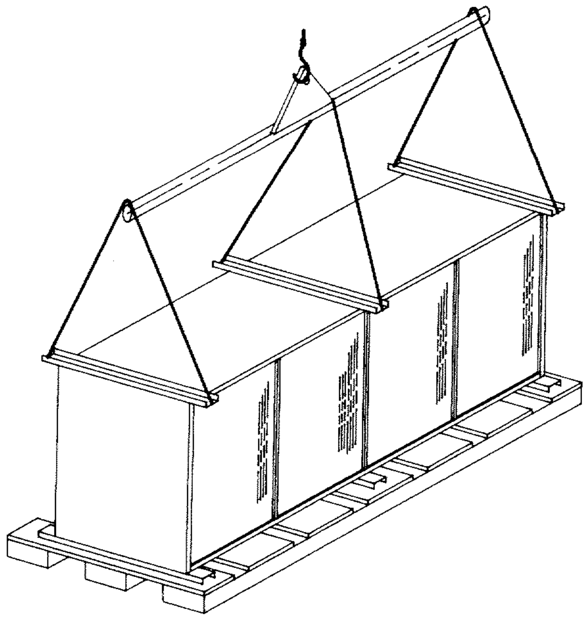
The unit needs to be secured in its final location. Holes are provided in the base runner for this purpose.

WARNING: There may be more than one source of electrical current in this unit. Do not service before disconnecting all power supplies.

Rigging and Moving Units

The exact method of handling and setting the unit depends on available equipment, size of unit, final location, and other variables. It is therefore up to the judgement of the riggers and movers to determine the specific method of handling each unit. All units are shipped on heavy skids and enclosed in open crating. Generally, it is advisable to bring the unit as close to its final location as possible before removing crating.

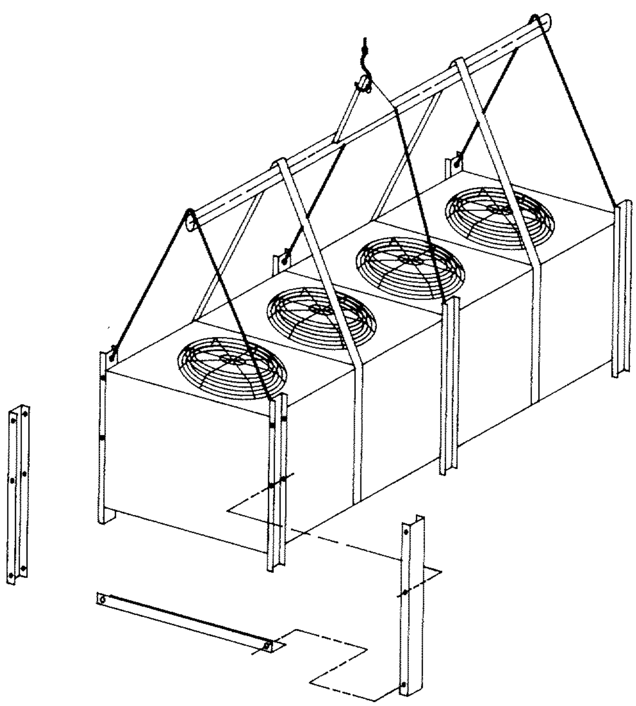
Units are provided with lifting ears near the four corners. Under no circumstances should the coil headers or return bends be used for moving these units.



NOTE FOR ALL MODELS:

1. **Spreader Bars Must Be Used. (Contractor Supplied)**

2. **Safety Sling Should Be Usd When Making Lift.**



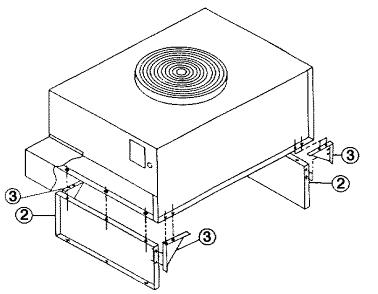
Horizontal Condenser

Horizontal airflow type units should be installed with the coil (inlet air side) facing the prevailing winds. Where strong winds are common, it is recommended that a wind deflector (Wind deflector by others) be used to discharge the air vertically from the unit, so as to prevent loss of capacity during varying wind conditions. The wind deflector should be installed on the fan side of the unit. If horizontal airflow units are installed with coil facing a wall, a distance of at least 48 inches should be maintained between unti and wall. If it is absolutely necessary to have the unit positioned so that the air discharge is toward a wall, it should be spaced from the wall a distance of not less than $1^1/_2$ times the coil face heights.

Vertical Condenser

Vertical airflow type units should be located no closer than the width of the unit from a wall or other obstruction. If two or more units are to be positioned in the same area, a similar distance should be maintained between adjacent units. Sufficient free area should be left around and below unit to avoid air restriction to coil.

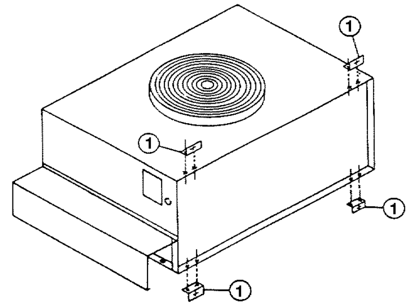
Figure 1. Leg Assembly (Vertical Airflow)



Leg Assembly for Vertical Airflow Installation (Models WSS 008 - 016)

1. Assemble to the unit two legs, item 2 as shown in figure 1, using three each 1/4 - 20 x 3/4" long bolts per leg. Captive nuts are provided on unit for this assembly.
2. Four gussets, item 3, are provided for leg support as shown in figure 1.
3. Assemble the gusset in each corner with 1/4 - 20 x 3/4" long bolts and 1/4" nuts.
4. Discard the four mounting angles, item 1.

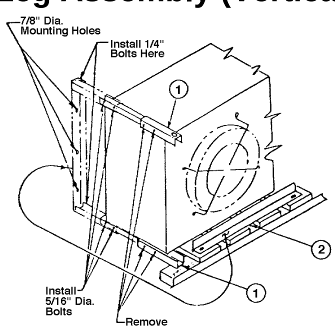
Figure 1. Leg Assembly (Horizontal Airflow)



Leg Assembly for Horizontal Airflow Installation (Models WSS 008 - 016)

1. Attach to the units four mounting angles, items 1 as shown in figure 2, using two each of the 1/4 - 20 x 3/4" long bolts and 1/4" nuts per mounting angle.
2. Discard the two legs, items 2, and four gussets, item 3, in figure 1.

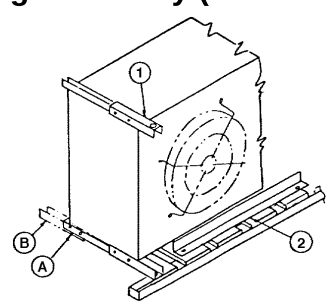
Figure 3. Leg Assembly (Vertical Airflow)



Leg Assembly for Vertical Airflow Installation (Models WSS 024 - 160)

1. Remove fasteners securing condenser to skid.
2. Remove leg extensions (item 1) by removing four 5/16" x 3-1/2" bolts.
3. Install as shown in dotted lines with same four bolts.
4. Install mounting angle (2) as shown (dotted lines) with four 1/4 - 20 x 3/4" bolts provided.
5. Condenser can be hoisted by attaching hooks into 1-1/2" holes in leg assemblies.
6. Attach condenser to base using 7/8" diameter holes in the base angle.

Figure 4. Leg Assembly (Horizontal Airflow)



Leg Assembly for Horizontal Airflow Installation (Models WSS 008 - 160)

1. Remove bolts securing condenser to skid.
2. Remove item 1 and attach to rear of bottom leg "A" to complete mounting base. Item 2 is not required in the horizontal discharge application and may be discarded.
3. Condenser can be hoisted by the 1-1/2" holes in leg assemblies.
4. Attach unit to base using mounting holes on leg extensions at "B".

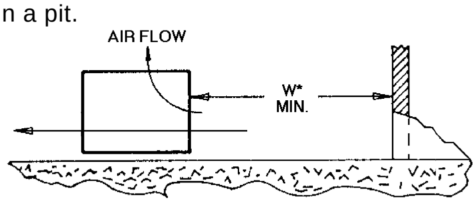
Space and Location Requirements

The most important consideration which must be taken into account when deciding upon the location of air cooled equipment is the provision for a supply of ambient air to the condenser, and removal of heated air from the condenser area. Where this essential requirement is not adhered to, it will result in higher head pressures, which cause poor operation and possible eventual failure of equipment. Units must not be located in the vicinity of steam, hot air or fume exhausts.

Another consideration which must be taken 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 and other auxiliary areas where high levels of sound are not an important factor. Sound and structural consultants should be retained fo recommendations.

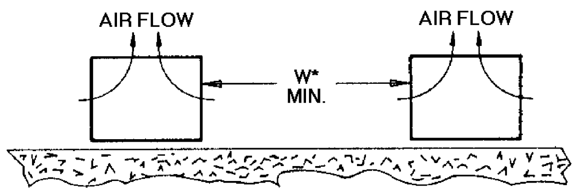
Walls or Obstructions

The unit should belocated so that air may circulate freely and not be recirculated. For proper air flow and access all sides of the unit should be a minimum of "W" away from any wall or obstruction. It is preferred that this distance be increased whenever possible. Care should be taken to see that ample room is left for maintenance work through access doors and panels. Overhead obstructions are not poermitted. When the unit is in an area where it is enclosed by three walls the unit must be installed as indicated for units in a pit.



Multiple Units

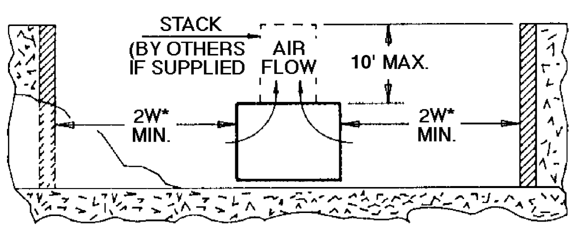
For units placed side by side, the minimum distance between units is the width of the largest unit. If units are placed end to end, the minimum distance between units is four feet.



Units In Pits

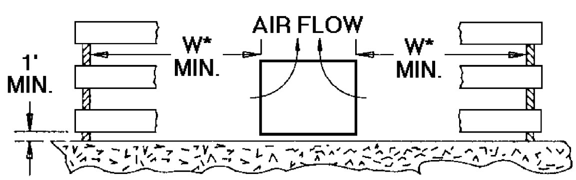
The top of the unit should be level with the top of the pit, and side distance increased to "2W".

If the top of the unit is not level with the top of pit, discharge cones or stacks must be used to raise discharge air to the top of the pit. This is a minimum requirement.



Decorative Fences

Fences must have 50% free area, with one-foot undercut, a "W" minimum clearance, and must not exceed the top of the unit. If these requirements are not met, unit must be installed as indicated for "Units in pits".



W = Total width of the condenser. See Dimensional Data, pages 6 and 7 for this information.

Dimensions

Figure 5. WSS 008-016

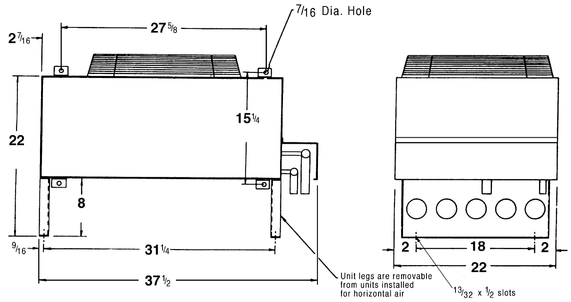


Figure 6. WSS 024-133 Vertical Air Flow

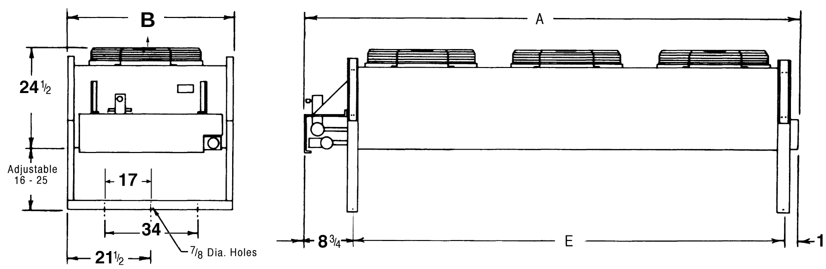


Table 1. WSS 024-133 Vertical Air Flow Dimensional Data

Models	Vertical Air Flow Dimensions (Inches)								
	A	B	C	D	E	F	G	H. min	H. max
WSS 024	39-3/4	43	24-1/2	21-1/2	30	8-3/4	1	16	25
WSS 040	49-3/4	43	24-1/2	21-1/2	40	8-3/4	1	16	25
WSS 049	69-3/4	43	24-1/2	21-1/2	60	8-3/4	1	16	25
WSS 061	69-3/4	43	24-1/2	21-1/2	60	8-3/4	1	16	25
WSS 070	89-3/4	43	24-1/2	21-1/2	80	8-3/4	1	16	25
WSS 080	89-3/4	43	24-1/2	21-1/2	80	8-3/4	1	16	25
WSS 105	129-3/4	43	24-1/2	21-1/2	120	8-3/4	1	16	25
WSS 113	129-3/4	43	24-1/2	21-1/2	120	8-3/4	1	16	25
WSS 133	129-3/4	43	24-1/2	21-1/2	120	8-3/4	1	16	25

Figure 7. WSS 024-133 Horizontal Air Flow

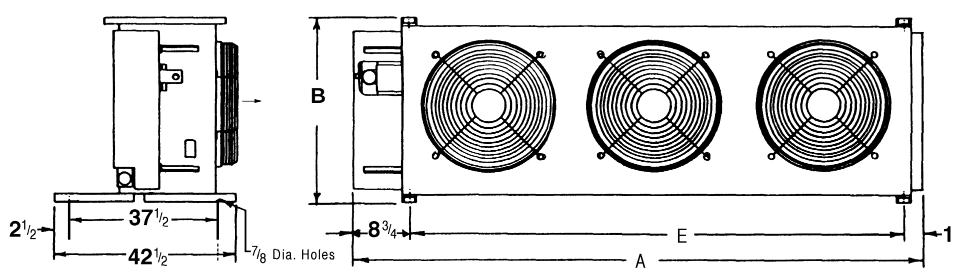


Table 2. WSS 024-133 Horizontal Air Flow Dimensional Data

Models	Vertical Air Flow Dimensions (Inches)							
	A	B	C	E	F	G	H	J
WSS 024	39-3/4	43	42-1/2	30	8-3/4	1	37-1/2	2-1/2
WSS 040	49-3/4	43	42-1/2	40	8-3/4	1	37-1/2	2-1/2
WSS 049	69-3/4	43	42-1/2	60	8-3/4	1	37-1/2	2-1/2
WSS 061	69-3/4	43	42-1/2	60	8-3/4	1	37-1/2	2-1/2
WSS 070	89-3/4	43	42-1/2	80	8-3/4	1	37-1/2	2-1/2
WSS 080	89-3/4	43	42-1/2	80	8-3/4	1	37-1/2	2-1/2
WSS 105	129-3/4	43	42-1/2	120	8-3/4	1	37-1/2	2-1/2
WSS 113	129-3/4	43	42-1/2	120	8-3/4	1	37-1/2	2-1/2
WSS 133	129-3/4	43	42-1/2	120	8-3/4	1	37-1/2	2-1/2

Dimensions

Figure 8. WSS 140-160 Vertical Air Flow

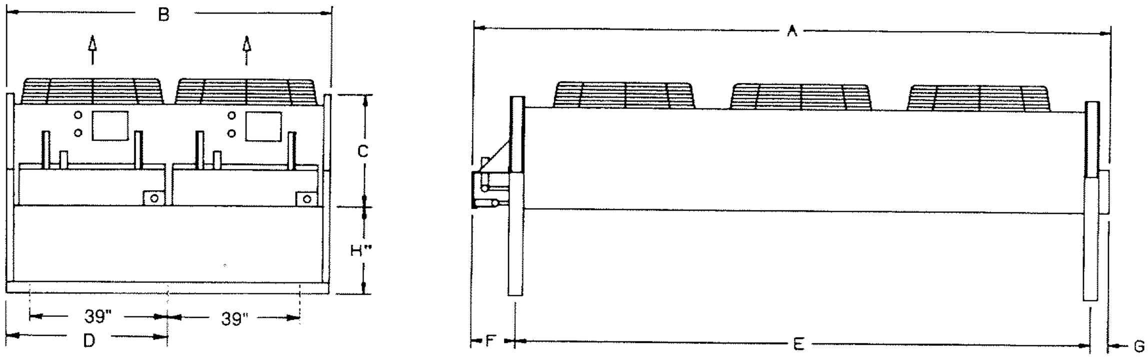


Table 3. WSS 140-160 Vertical Air Flow Dimensional Data

Models	Vertical Air Flow Dimensions (Inches)							
	A	B	C	D	E	F	G	H min/max
WSS 140	89-3/4	83-5/8	22-1/4	41-13/16	80	8-3/4	1	16/20
WSS 160	89-3/4	83-5/8	22-1/4	41-13/16	80	8-3/4	1	16/20

Figure 9. WSS 140-160 Horizontal Air Flow

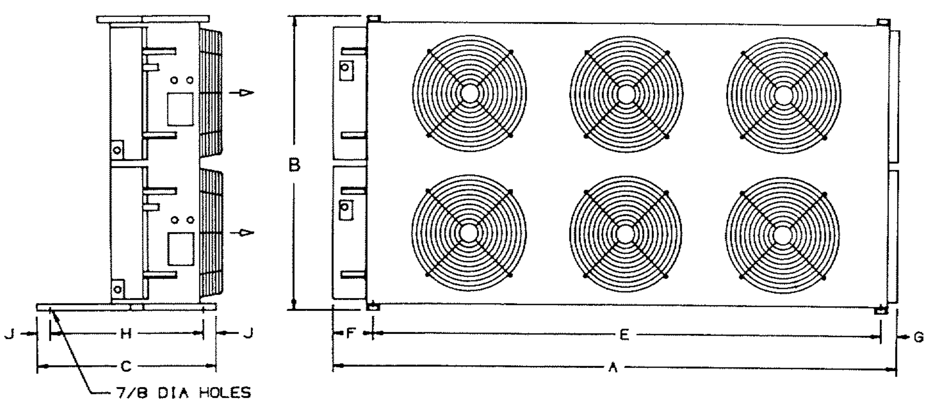


Table 4. WSS 140-160 Horizontal Air Flow Dimensional Data

Models	Vertical Air Flow Dimensions (Inches)							
	A	B	C	E	F	G	H	J
WSS 140	89-3/4	83-5/8	42-1/4	80	8-3/4	1	37-1/2	2-1/2
WSS 160	89-3/4	83-5/8	42-1/4	80	8-3/4	1	37-1/2	2-1/2

Unit Specifications

Table 5. WSS Unit Specifications

		Fan		Motor Data					Standard Connections ODS		Approx. Net
Models	CFM	No.	Dia.	No.	HP(1)	FLA (1)	HP(2)	FLA (2)	Inlet	Outlet	Wt. (Lbs.)
WSS 008	2,400	1	18	1	1/4	2.0	---	---	3/8	3/8	96
WSS 009	2,400	1	18	1	1/4	2.0	---	---	5/8	5/8	96
WSS 010	2,400	1	18	1	1/4	2.0	---	---	7/8	5/8	96
WSS 016	2,100	1	18	1	1/4	2.0	---	---	7/8	5/8	114
WSS 024	5,050	1	24	1	1/3	3.5	1/3	2.6 / 1.3	1-1/8	7/8	180
WSS 040	6,450	1	26	1	1/2	4.1	1/3	2.6 / 1.3	1-1/8	7/8	260
WSS 049	10,100	2	24	2	1/3	7.0	1/3	5.2 / 2.6	2@1-1/8	2@7/8	450
WSS 061	12,400	2	26	2	1/2	8.2	1/3	5.2 / 2.6	2@1-1/8	2@7/8	470
WSS 070	13,700	2	26	2	1/2	8.2	1/3	5.2 / 2.6	2@1-1/8	2@7/8	510
WSS 080	12,900	2	26	2	1/2	8.2	1/3	5.2 / 2.6	2@1-3/8	2@1-1/8	530
WSS 105	20,500	3	26	3	1/2	12.3	1/3	7.8 / 3.9	2@1-5/8	2@1-1/8	550
WSS 113	19,900	3	26	3	1/2	12.3	1/3	7.8 / 3.9	2@1-5/8	2@1-1/8	580
WSS 133	19,400	3	26	3	1/2	12.3	1/3	7.8 / 3.9	2@1-5/8	2@1-1/8	625
WSS 140	27,400	4**	26	4	1/2	15.6	1/3	10.4 / 5.2	2@1-3/8	2@1-1/8	1,020
WSS 160	25,800	4**	26	4	1/2	15.6	1/3	10.4 / 5.2	2@1-3/8	2@1-1/8	1,060

* Not including operating charge.(1) Motor voltage 208-230/1/60; 1075 RPM
** Two rows of fans.(2) Motor voltage 208-230-460/3/60; 1140 RPM

General Fan Layouts

Figure 16. Models 008, 009, 010, 024, 040

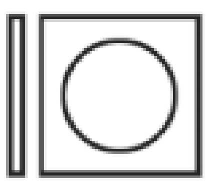


Figure 17. Models 049, 061, 070, 080

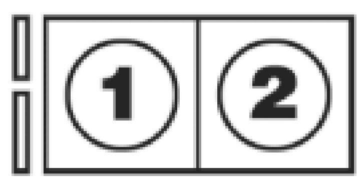


Figure 18. Models 105, 113, 133

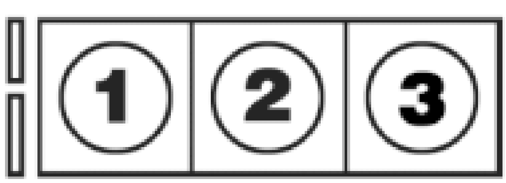
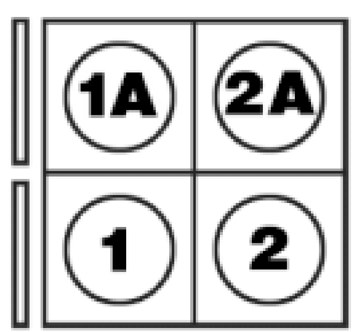


Figure 19.



Electrical junction box is located on header end of units unless optional FAN CYCLING is ordered on 230 and 460 volt. In which case, three phase units electrical junction box is located on unit end opposite header end.

Piping

General

The design of refrigerant piping for air cooled condensers involves a number of considerations not commonlyh associated with other types of condensing equipment. The following text is intended for use as a general guide to sound, economical and trouble-free piping of air cooled condensers.

Discharge Lines

The proper design of discharge lines involves two objectives:

1. To minimize refrigerant pressure drop, since high pressure losses cause increased compressor horsepower per ton of refrigerant.
2. To maintain sufficiently high gas velocity to carry oil through to the condenser coil and receiver at all loading conditions.

Liquid Lines

The liquid lines must be designed to allow free drainage of refrigerant from the condenser coil to the receiver. If this is not done, the liquid will build up in the bottom of the condenser coil, reduce the effective surface and cause increased operating head pressure. This line should be free of any traps or loops which may cause gas binding in the receiver. The liquid line should be sized so the liquid velocity from the condenser coil to the receiver does not exceed 100 feet per minute. Above this velocity the flow of liquid may prevent air or other noncondensibles from passing back through the liquid line into the condenser coil.

A check valve must be installed in the lqiud line in all applications where the ambient temperature can get below the equipment room temperature. This prevents liquid migration to the condenser, helps maintain a supply of refrigerant in the receiver for initial start-up.

On systems as described with a liquid line check valve, a relief valve or relief-type check valve must be used on the liquid line to relieve dangerous hydraulic pressures that could be created as cooled liquid refrigerants (in the line between the check valve and expansion or shut-off valve) warm up.

Line Sizing

Table 7, page 11, may be used as a guid for proerly sizing discharge and liquid lines. The discharge line capacities are based on tons of refrigerant resulting in a line pressure drop per 100 feet of equivalent pipe length corresponding to 2°F change in saturation temperature. The liquid line capacities shown are based on a maximum of 300 feet per minute condenser to receiver liquid velocity. For more complete information, refer to the ASHRAE Handbook of Fundamentals.

Typical Arrangements

Figure 10, page 10, illustrates a typical piping arrangement involving a remote condenser located at a higher elevation, as commonly encountered when the condenser is on a roof and the compressor and receiver are on grade level or in a basement equipment room.

In this case, the design of the discharge line is very critical. If properly sized for full load condition, the gas velocity might be too low at reduced loads to carry oil up through the discharge line size would increase the gas velocity sufficiently at reduced load conditons; however, when operating at full load, the line would be greatly undersized, and thereby create an excessive refrigerant pressure drop. This condition can be overcome in one of two following ways:

1. The discharge line may be properly sized for the desired pressure drop at full load conditions and an oil separator installed at the bottom of the trap in the discharge line from the compressor.
2. A double riser discharge line may be used as shown in Figure 11, page 10. Line "A" should be sized to carry the oil at minimum load conditions and the line "B" should be sized so that at the full load conditions both lines would have sufficient flow velocity to carry the oil to the condenser.

Figure 12, page 10, illustrates another very common application where the condenser is located on essentially the same level as the compressor and receiver. The principal problem encountered with this arrangement is that there is frequently insufficient vertical distance to allow free drainage of liquid refrigerant from the condenser coil to the receiver.

Figure 13, page 10, illustrates a third very common application where two or more separate condensers are piped together to a single compressor. Multiple units may be connected in parallel to produce a condensing system of almost unlimited capacity. When units are connected in parallel, the piping should be equivalent for equal pressure drop to each. It is best if the two units have the same capacity so that the refrigerant pressure drop through each unit is equal. If not, a drop leg should be included between each liquid manifold of sufficient height to prevent back-up of liquid into the coil of the unit with the lower pressure drop. The pressure drop through each unit should be essentially the same to distribute the load equally.

This is particularly important in applications where the refrigerant receiver is directly beneath the air cooled condensers. If two unlike air cooled condensers or unequal piping is used, the resultant unequal refrigerant pressure drop may cause liquid to build up in one of the condenser coils, thereby reducing its effective capacity.

Notice that in all illustrations the discharge line is looped at the bottom and the top of the vertical run. This is done to prevent oil and condensed refrigerant from flowing back into the compressor and causing damage. The highest point in the discharge line should always be above the high point in the condenser coil, and it is recommended that a means be provided to remove noncondensibles from the system as per local codes.

It is also very important that the piping be arranged such that no excessive strain on the piping or unit components can result. There seems to be a general disregard for this factor. Typical expamples are the connecting of two condensers in parallel, connected header-to-header without any offset in the interconnecting line, or running of a line directly from a coil connection through a wall or floor and then sealing tightly between the line and the opening. Provide sufficient flexibility to allow for vibration, thermal expansion, and gradual base or building movement.

The discharge line should include a loop to a level above the header of the condenser coil. When the condensers are locatted above the compressor, the discharge line should loop to the floor near the compressor before rising to the condenser coil. This reduces the possibility of refrigerant condensing in the line during the off cycle, and draining back to the head of the compressor. Also, any oil traveling up the pipe wall will not drain back to the head of the compressor during off periods.

Maintain gravity drainage in the liquid line from the condenser coil to the receiver.

Gas binding is a condition usually caused by an undersized liquid line between the condenser and the receiver, or because of traps in this same line. Air or other condensibles also may cause binding.

For more complete information, refer to the ASHRAE Handbook on Systems.

Subcooler

Figures 10 and 11 show typical subcooler piping. Figure 10 is the preferred connection with receiver as it provides maximum subcooling. Figure 11 may be used if the receiver is located far from the condenser.

Figure 10.

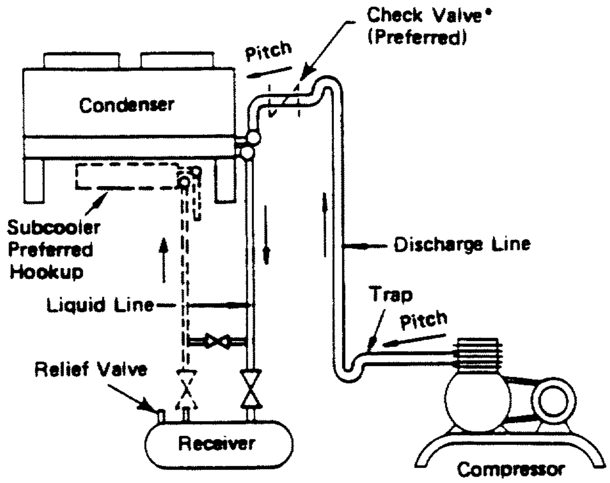


Figure 11.

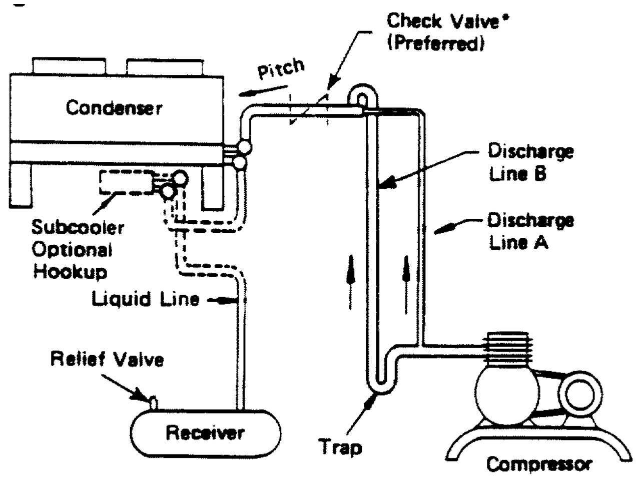


Figure 12.

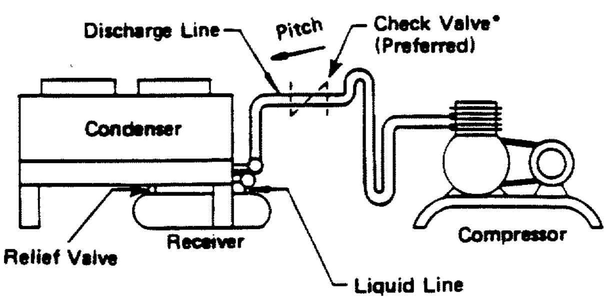
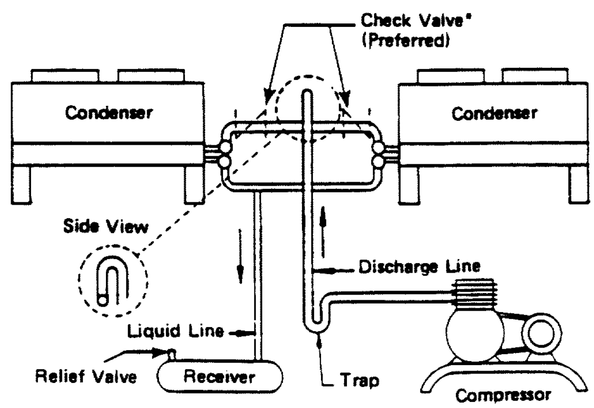


Figure 13.



NOTES:
1. All oil traps to be as short radius as possible. Common practice is to fabricate trap using two 90-degree street ells.
2. Pressure relief valves are recommended at the condenser for protection of the coil.
3. A valve at the high point in the discharge line is recommended to aid in removing noncondensibles.
4. The placement of a subcooler should be such that it does not interfere with normal airflow of the condenser. Increased static of the unit could cause decrease in system capacity and fan motor damage.

• Refer to ASHRAE Handbook.

When a refrigerant receiver is used, it should preferably be installed in a warm location to insure sufficient refrigerant pressure for proper expansion valve operation immediately upon start of system. This is particularly important where systems are required to operate in low ambient temperatures; otherwise, special controls for low ambielt start may be required. The receiver should not be installed in a space ordinarily warmer than where the compressor is located. Otherwise, there is a danger of migration of refrigerant to the compressor during extended off periods. The sizing of the receiver should be determined by totalling the refrigerant charge required for each component in the system: i.e., evaporator, piping, condenser coil and receiver operating charge. The total volume of the condenser and the receiver should be at least 20 percent greater than this calculated total charge.

When the condenser is operating at full capacity, at ambient temperature above 75°F, there should be no liquid refrigerant flooded back in the condenser coil. The additional refrigerant introduced into the system with the use of a Flooded Head Pressure (FHP) valve system must be stored in the receiver during summer operation. Therefore, the receiver must be sized accordingly.

Because of the rather large refrigerant charge required in an air cooled condenser system, especially when using the FHP Valve system, it is usually necessary to put additional oil into the system. The amount of oil to be added varies considerably with the make of compressor used, and whether the system is furnished with an oil separator. The compressor oil level should be watched carefully on initial start-up until the system has stabilized.

Table 6. Refrigerant Line Capacities (Tons)

Line Size Type L Copper Tubing O.D.	Discharge Line (1)		Liquid Line Liquid Refrigerant Velocity			
	40°F Sat. Suction Temperature		100 FPM		300 FPM	
	R-22	R-502	R-22	R-502	R-22	R-502
5/8	2.34	1.90	3.7	2.3	11.1	6.9
7/8	6.15	4.98	7.8	4.9	23.4	14.7
1-1/8	12.44	10.25	13.2	8.3	39.6	24.9
1-3/8	21.67	17.72	20.2	12.6	60.6	37.8
1-5/8	34.26	27.96	28.5	17.9	85.5	53.7
2-1/8	71.01	57.83	49.6	31.1	148.8	93.3
2-5/8	125.03	101.75	76.5	48.0	229.5	144.0
3-1/8	199.41	161.78	109.2	68.4	327.6	205.2
3-5/8	295.89	240.11	147.8	92.6	443.4	205.2
4-1/8	416.39	338.06	192.1	120.3	576.3	360.9

* Line sizes based on pressure drop equivalent to 2°F per 100 equivalent feet. For 1°F per 100 equivalent feet, use table value x 0.683.

Electrical Wiring

The electrical installation should be in accordance with National Electrical Code, local codes and regulations. Proper overcurrent protection should be provided for the fan motors. Wiring diagrams shown are only basic and do not show fuses, disconnect switches, etc., which must be provided in the field.

All standard motors have internal inherent overload protectors. Therefore, contactors can be used instead of starters requiring thermal protectors, eliminating the problem of furnishing the proper heating elements.

All air cooled condensers are furnished with either single phase of three phase fan motors which are identified by the unit dataplate.

Electrical leads from each motor terminate at the unit junction box. Field connections must be made from these leads through a contactor, fuse and disconnect in accordance with local, state and national codes.

Three phase motors must be connected to three phase power of voltage to agree with motor and unit dataplate.

The motors are wired into a common junction box. Where fan cycling is furnished and factory installed, the motors are completely wired through the control and to the contactors. The motors must be checked for proper rotation. Be sure to check that motor voltage and control connection agree with electric services furnished.

Warning: There may be more than one source of electrical current in this unit. Do not service before disconnecting all power supplies.

Diagram 1. Typical Wiring Diagram for 208-230/1/60

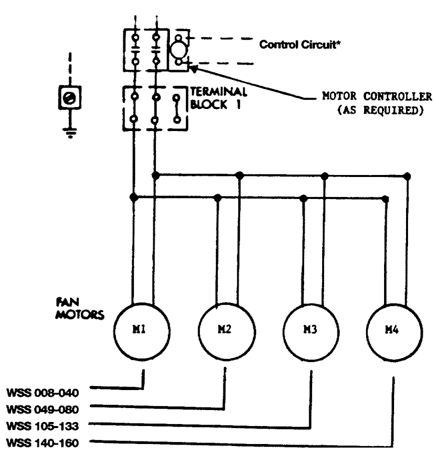
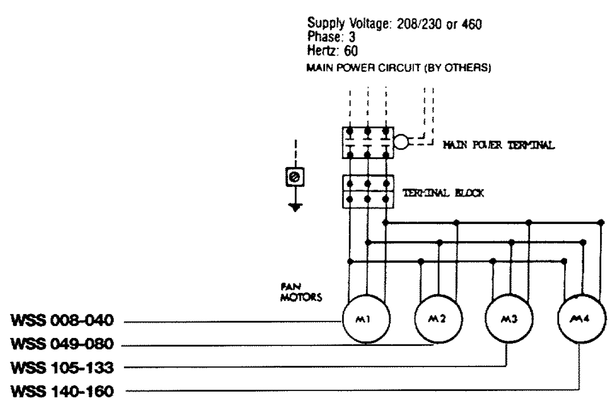


Diagram 2. Typical Wiring Diagram for 208-230-460/3/60



*** CONTROL CIRCUIT: May be 24 volt, 120 volt, or 230 volt (as specified).**

Diagram 3. Typical Wiring Diagram for 208-230/1/60 with Fan Cycling.

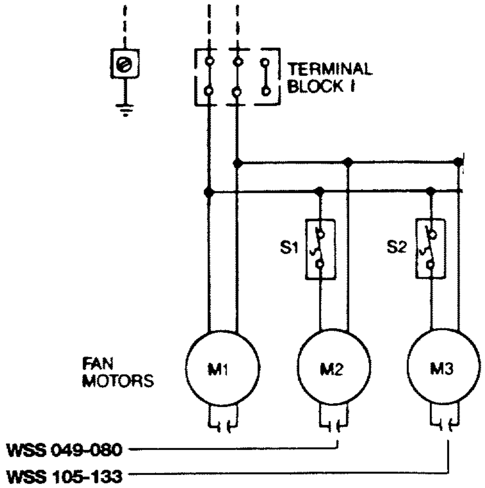


Diagram 4. Typical Wiring Diagram for 208-230/1/60

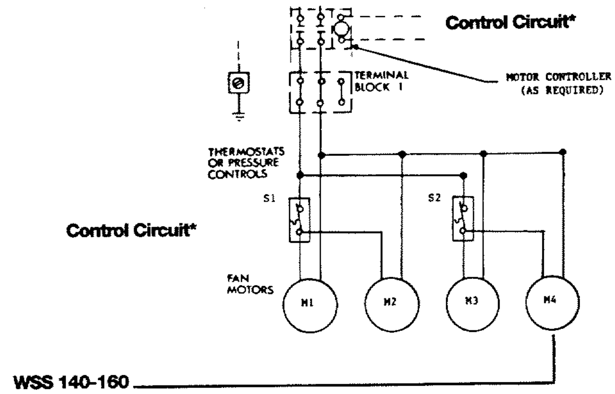


Diagram 5. Typical Wiring Diagram for 208-230-460/3/60 with Fan Cycling.

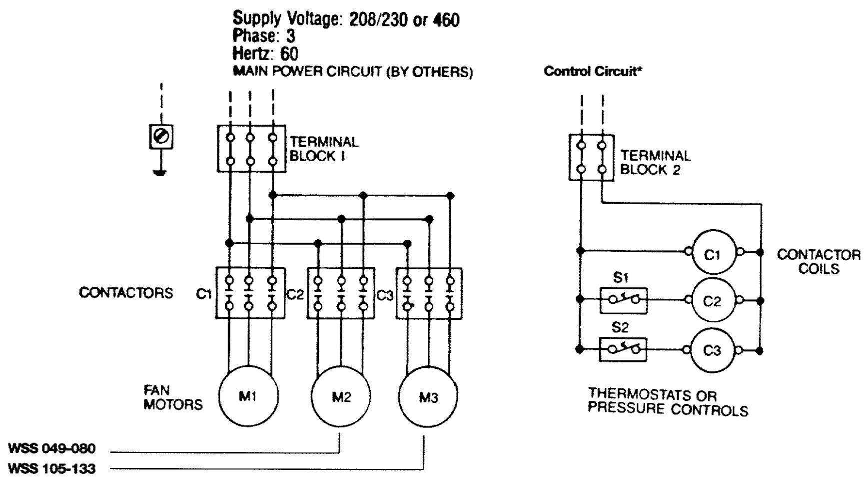
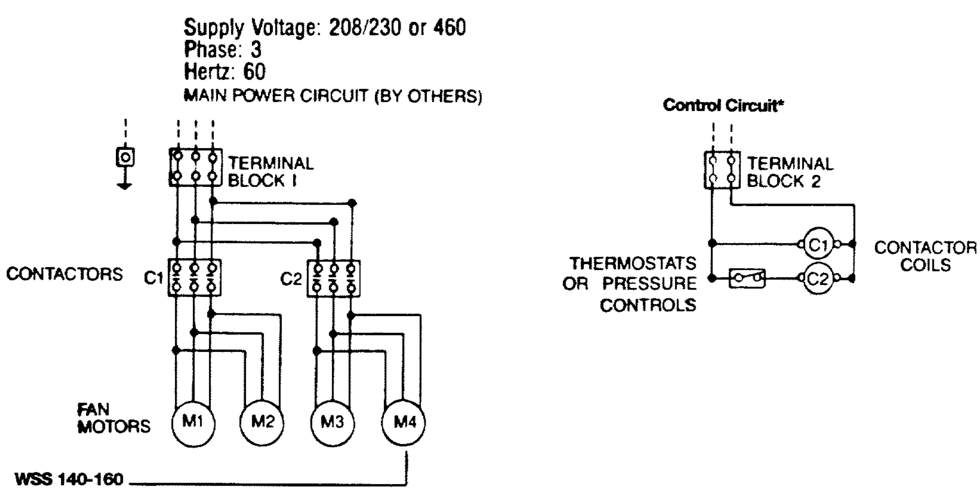


Diagram 6. Typical Wiring Diagram for 208-230-460/3/60 with Fan Cycling.



*** CONTROL CIRCUIT: May be 24 volt, 120 volt, or 230 volt (as specified).**

Start Up

Check for proper fan rotation. Air is drawn through the coil on all units. Be sure the fans turn freely.

Rotation of the motors and blades should be in a "CW" direction looking at the unit from the blade side. On three phase units, it may be necessary to reverse two of the three power leads to the unit.

NOTE: The manifold assembly is not designed to support field piping. Any damages to the condenser due to excessive weight, pressure or vibration will not be covered by our standard warranty.

Operation

Winter Operation Head Pressure Control

The capacity of an air cooled condenser varies with the difference between the entering air dry bulb temperature and the condensing temperature of the refrigerant. Since air temperature in some regions varies as much as 100 degrees from summer to winter, some means must be employed to keep the condensing temperature sufficiently high to insure proper operation of the refrigerant expansion valve during low ambient operation, and also allow sufficient capacity so that excessively high condensing temperatures do not result diring high ambient conditions.

The low limit of the head pressure is dependent upon the required pressure drop across the thermostatic expansion valve. For normal air conditioning applications, head pressure should be maintained above a condensing temperature corresponding to 90°F. This, in effect, corresponds to a normal lower limit of about 60°F ambient air. Since air conditioning is not normally required at these lower ambient temperatures, condenser head pressure control may not always be necessary. However, for those applications which are of such a nature that operation is required below 60°F ambient air temperature, two methods of condenser head pressure control are available to meet specific job requirements and engineer/owner preference: **FAN CYCLING** and **FLOODED HEAD PRESSURE CONTROL (FHP)**.

Fan Cycling Method

This is an automatic winter control method and will maintain a condensing pressure within reasonable limits by cycling fan motors in response to outside air temperature entering the condensing coil. When voltage other than 230/208 is supplied to the unit, a transformer will be provided for field installation. Electrical protection must be provided for this transformer.

Fan Cycling Operation and Installation

The fan cycling control package consists of a weather-tight enclosure with motor starting contactor(s) as required and thermostat(s). The contactor coil is 24 volts, 115 volts or 240 volts as ordered. The thermostats and contactors are wired within the panel and the factory as shown on Diagrams 1 through 6.

Factory installed packages are mounted on the unit and have all motor connections completed. Field wiring consists of connecting this panel to a power supply and fused disconnect(s) together with the control circuit to the contactor coils.

It is suitable for outside temperatures above those shown in Table 8. The thermostat should be field set to shut off the fan when the condensing temperature is reduced to approximately 90°F. Table 9 lists approximate settings for several system T.D.'s. These settings are approximate as they do not take into account variations in load.

Where operation at ambients below the range shown on Table 8 were required, FHP must be added.

Flooded Head Pressure Control Valve (FHP)

The FHP system of head pressure control is a completely automatic control that maintains a preset condenser pressure without need of seasonal adjustment. The control maintains head pressure by backing liquid into the leaving side of the condenser, decreasing the effective condenser surface and therefore maintaining a constant head pressure upon a drop in ambient temperature.

Operation:

During normal ambient operation, the valve allows liquid refrigerant to flow through "C" port (see Figure 14) and "R" port to the liquid receiver. As the pressure drops with a drop in ambient temperature, the valve opens to allow high pressure discharge gas to enter "B" port, pass through the valve and pressurize the receiver to provide adequate liquid flow to the expansion valve (see Figure 15). This action raises the pressure on the discharge side of the condenser, redicing flow and flooding the leaving side of the condenser until the pressure rises to a proper level to close "B" port. The liquid receiver size is important in this type of control and must be large enough to hold the total system charge. If the receiver is not large enough, the liquid will be stored in the condenser causing high head pressure at normal ambient temperatures.

The refrigerant charge required will often be about two times the normal charge for cold weather operation. The amount of refrigerant that must be added to a system for winter or cold weather operation is determined by Tables 10 and 11.

Piping:

As on all systems, refrigerant migration must be prevented when using FHP. If the receiver is in a warm location, a check valve should be placed in the line between the FHP valve and the receiver. Good piping practice suggests a trap in the compressor discharge line and an inverted trap at the condenser outlet. Multiple valve applications must have valves piped in parallel.

Figure 14.

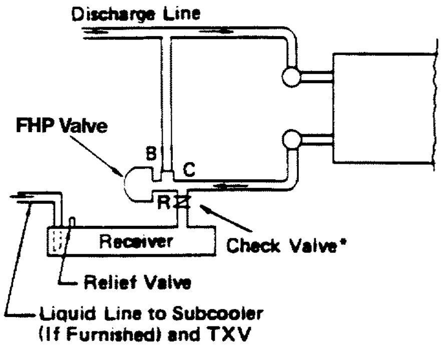
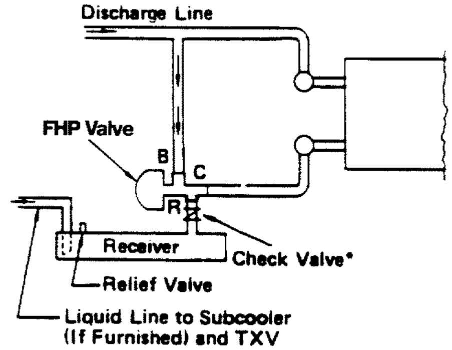


Figure 15.



* If receiver is located in a warm ambient, a check valve in this locatino may be required to prevent receiver gas from migrating into the condenser during the off cycle.

Table 7. Minimum Ambient for FANTROL

Models	Design T.D.			
	30°F	25°F	20°F	15°F
2-fan units: 049, 061, 070, 080	45	55	65	70
4-fan units: 140,160	45	55	65	70
3-fan units: 105, 113, 133	30	40	50	60

Table 8. FANTROL Thermostat Settings

Models	Design T.D. T.D.	Thermostat Settings T1	T2
2-fan units: 049, 061, 070, 080 4-fan units: 140,160	30 25 20 15	55 60 65 75	
3-fan units: 105, 113, 133	30 25 20 15	60 65 75 75	45 50 55 65

NOTE: Fans closest to the headers should not be cycled on standard temperature or pressure controls. Dramatic temperature and pressure changes at the headers as a result of fan action can result in possible tube failure. Fan motors are designed for continuous duty operation. Fan cycling controls should be adjusted to maintain a minimum of five (5) minutes on and five (5) minutes off. Short cycling of fans may result in a premature failure of motor and/or fan blade.

Table 9. Refrigerant Charge, Lbs. for R-22

WSS Model	Standard R-22 Charge	Additional Lbs. R-22 Charge for FHP at 20° T.D. °F Minimum Ambient at Condenser*				
		+50°F	+40°F	+20°F	0°F	-20°F
008	.064	1.4	2.2	2.5	2.8	3
009	.73	1.7	2.7	3.3	3.5	3.8
010	.82	2.2	3.4	4	4.5	4.7
016	1.1	3.2	4.9	5.8	6.4	6.9
024	1.8	5.4	8.3	9.7	10.8	11.6
040	3.6	9.1	13.6	17.3	19.1	20
049	3.6	10	15.5	18.2	20	21.8
061	3.6	10	15.5	18.2	20	21.8
070	4.5	13.6	20.9	24.6	27.3	29.1
080	6.4	18.2	27.3	32.8	36.4	39.1
105	6.4	20	30.9	36.4	40	42.8
113	6.4	20	30.9	36.4	40	42.8
133	9.1	26.4	41	48.2	53.7	57.3
140	9.0	27.3	41.8	49.1	54.6	58.2
160	12.8	36.4	54.6	65.5	72.8	78.3

Multiply all R-22 values by 1.06 for Lbs. of R-502/404A.
* See charge factor chart, Table 12 for 25 and 30 T.D.

Table 10. Additional Lbs. R-22 Charge for FHP and FAN CYCLING Combination

WSS Model	Additional Lbs. R-22 Charge for FHP and FAN CYCLING Combination											
	25 T.D.				20 T.D.				15 T.D.			
	+40	+20	+0	-20	+40	+20	+0	-20	+40	+20	+0	-20
049	4.5	10	13.6	16.3	8.1	12.7	16.3	18.2	12.7	16.3	18.2	20
061	4.5	10	13.6	16.3	8.1	12.7	16.3	18.2	12.7	16.3	18.2	20
070	5.5	12.7	18.2	21.8	10.9	17.2	21	23.6	16.3	21.8	24.5	27.3
080	7.3	17.2	23.6	28.2	13.6	22.7	28.2	31.8	21.8	28.2	32.7	36.4
105	0	7.3	17.2	23.6	4.5	16.3	23.6	30	15.5	24.5	31	34.5
113	0	7.3	17.2	23.6	4.5	16.3	23.6	30	15.5	24.5	31	34.5
140	11	25.4	36.4	43.6	21.8	34.5	41.8	47.3	32.7	43.6	49	54.6
160	14.5	34.5	47.3	56.4	27.3	45.5	56.4	63.7	43.6	56.4	65.5	72.8

Multiply all R-22 values by 1.06 for Lbs. of R-502/404A.

Table 11. FHP Charge Factor for 25 T.D. and 30 T.D.

Minimum Ambient	Additional Charge Factor	
	25 T.D.	30 T.D.
+60°F	.66	.33
+40°F	.85	.71
+20°F	.91	.81
0°F	.93	.86
-20°F	.95	.90

In-Warranty Return Material Procedure

Material may not be returned except by permission of authorized factory service personnel of Heatcraft Inc. Refrigeration Products Division in Stone Mountain, Georgia. A "Return Goods" tag will be sent to be included with the returned material. Enter the information as called for on the tag in order to expedite handling at our factories and prompt issuance of credits. All parts shall be returned to the factory designated on the "Return Goods" tag, transportation charges prepaid.

The return of a part does not constitute an order for replacement. Therefore, a purchase order must be entered through your nearest Heatcraft Refrigeration Products representative. The order should include part number, model number and serial number of the unit involved.

Replacement Parts

When writing to the factory for service or replacement parts, Refer to the model number and serial number of the unit as stamped on the serial plate attached to the unit. If replacement parts are required, mention the date of installation of unit and date of failure, along with an explanation of the malfunctions and a description of the replacement parts requred.

Table 12. Replacement Parts List

WSS Models	Motors			Fan Blades	Fan Guards
	Qty.	1 ph motor	3 ph motor		
008	1	2537974	—	2291820	2318491
009	1	2537974	—	2291820	2318491
010	1	2537974	—	2291820	2318491
016	1	2537974	—	2291836	2318491
024	1	2530355	2531193	2292422	23111026
040	1	2531191	2531193	2292625	23111026
049	2	2530355	2531193	2292422	23111026
061	2	2530355	2531193	2292625	23111026
070	2	2531191	2531193	2292625	23111026
080	2	2531191	2531193	2292625	23111026
105	3	2531191	2531193	2292625	23111026
113	3	2531191	2531193	2292625	23111026
133	3	2531191	2531193	2292625	23111026
140	4	2531191	2531193	2292625	23111026
160	4	2531191	2531193	2292625	23111026

Maintenance

Air cooled condensing units require a minimum of maintenance. the unit coil will require a periodic cleaning and this can be accomplished by a brush, vacuum cleaner, pressurized airstream or a commercially available coil cleaning foam. All of the other condenser fan motors have sealed ball bearings. The only acceptable service to these bearings is replacement.

Cleaning Instructions

Heatcraft recommends that the finned surface of this unit be cleaned approximately every six (6) months; more frequent cleaning may be required if extreme conditions cause clogging or fouling of air passages through the finned surface.

Calgon Corporation's CalClean 41352 (or equal) should be acceptable for cleaning this unit. CalClean should be applied liberally to entering air and leaving air surfaces of the finned area in accordance with the label directions.

CAUTION: Under no circumstances should this unit be cleaned with an acid-based cleaner.

INSTALLATION CHECK LIST

Condenser

Start Up Date ________________________________

Model Number ________________________________

Serial Number ________________________________

Electrical

Voltage ________________________________

Amperage ________________________________

Installer: Name & Address

____

____

____

Please retain this information with the condenser.

HEATCRAFT®

Refrigeration Products

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